The Rise of the Universal Bank: Financial Architecture and Firm Volatility in the United States*

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Abstract

This paper relates increases in firm-level volatility of publicly traded companies in the United States to the rise of universal banking following the repeal of the Glass-Steagall Act. On the theoretical side, we argue that economies of scope in the provision of concurrent lending and underwriting improve the access to finance for risky enterprises. Empirically, we distinguish between financial intermediaries that become universal banks through mergers with investment banks and those that establish securities affiliates (Section 20 subsidiaries). We then exploit deregulatory shocks to the scope of their banking activities to identify the effect on firm risk. Using transaction-level data, we document a run-up in sales-growth volatility and idiosyncratic risk not just across but also within public firms that obtain financing from universal banks. Characterizing the risk-return relationship, we find that firms funded by universal banks exhibit lasting increases in total factor productivity of up to 7%, especially in the presence of close relationship banking and cross-selling. Our evidence points to increased efficiency of financial intermediation by universal banks, thereby constituting a novel link between financial development and growth. By enabling firms to invest in riskier projects with higher return prospects, universal-bank finance is a key contributor, which we estimate to account for up to three-quarters of the increases in firm-level volatility and productivity since the late 1980s.

JEL classification: E20, G20, G21

Keywords: universal banking, firm volatility, financial deregulation, firewalls, loans, underwriting

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1 Introduction

Since the 1980s, multiple episodes of financial deregulation in the United States have significantly changed the architecture of the U.S. banking sector. These developments have sparked a strong interest in the aggregate implications of financial deregulation. Our analysis focuses on the step-wise repeal of the Glass-Steagall Act from 1989 to 1999. In this paper, we argue that financial deregulation in the U.S. – and the subsequent rise of universal banking – is a key contributor to the observed increase in firm-level risk over the same period.

The Glass-Steagall Act of 1933 imposed a strict separation between commercial banking, such as borrowing and lending, and investment banking, such as securities underwriting. Since 1989, however, commercial banks were allowed to gradually expand into investment banking and to develop into *universal banks* that offer a broad range of financial services. To identify the effect of this evolution on the characteristics of externally financed firms in the economy, we use data on lending relationships between banks and firms. In doing so, we exploit deregulatory shocks to the scope of universal banks' activities to estimate changes in the volatility of firms upon contracting with universal rather than commercial banks.

In evaluating the repeal of the Glass-Steagall Act, we focus on firm-level outcomes, and document an efficiency-increasing impact of universal banking. In particular, we find that higher volatility is accompanied by increases in total factor productivity (TFP) of universal-bank-financed firms. Our results thus point towards efficiency gains from universal banking as a potential source of economy-wide benefits. These benefits are to be contrasted with previously established drawbacks of universal banking, most notably the possibility for banks to become too big to fail.

Figure 1 plots market-value-weighted firm-level sales-growth volatility and TFP versus the fraction of total loans provided by universal banks. The graph shows the comovement between all three time series from 1989 onwards. Furthermore, apart from the oil-price shocks of the early 1980s, firm-level volatility and TFP are approximately constant from 1970 to 1990, before increasing sharply during the 1990s and early 2000s. Our hypothesis is that the efficiency-increasing impact of universal banking plays a crucial role in the rise of firm-level volatility and productivity among public firms. Firms enter into more sophisticated financing relationships with universal banks than they would under separated banking. The simultaneity of lending and underwriting provided by a single institution can be considered a contract-technological advance, allowing universal banks to finance riskier enterprises that offer higher return prospects. The time series in Figure 1 is consistent with this narrative especially for TFP, while we observe the strongest surge in firm risk during the 1990s. There were increases in firm risk leading up to the late 1980s, which coincided with preceding acts of financial deregulation, e.g., the Garn-St. Germain Depository Institutions Act (as scrutinized in Saunders, Strock, and Travlos (1990)). However, this episode of financial deregulation – unlike the repeal of the Glass-Steagall Act – did not affect the scope of banking, which is the centerpiece of our explanation for the simultaneous movements in firm-level volatility and TFP.

The rise of universal banking offers a unique setting for investigating the firm-level real effects of financial development: using transaction data, we are able to determine the transmission of deregulatory shocks from banks to firms. We provide empirical support for our hypotheses by analyzing the sales-growth volatility and idiosyncratic risk of public firms that obtain financing in the form of loans from universal banks. To identify the effect on firm volatility, we exploit different stages of financial deregulation towards full-scale universal banking. While banks were first allowed to expand into investment banking in 1989, their (timing of the) decision to do so might not be exogenous to our outcome variables of interest. Commercial banks can become universal banks either by opening a securities affiliate – a so-called Section 20 subsidiary, which engages only in

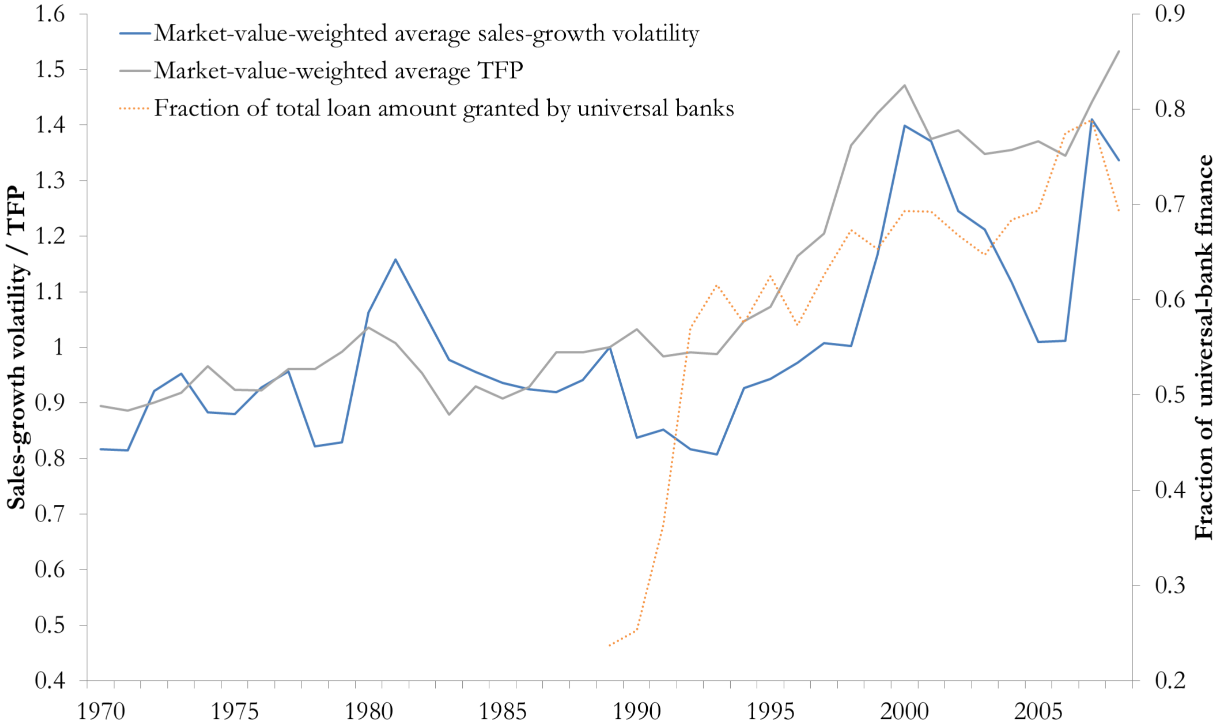


Figure 1: **Market-value-weighted Average 6y [t-3,t+2] Sales-growth Volatility and Market-value-weighted Average TFP versus Fraction of Universal-bank Finance (1970-2008).** Sources: own analysis based on Compustat and data from Imrohoroglu and Tuzel (2011). Sales-growth volatility and TFP are normalized to 1 in 1989.

underwriting – or by acquiring an investment bank. To strengthen our causal interpretation that firm risk increases as a result of universal banking, we use shocks to the degree of expansion of extant universal banks. In this regard, the Federal Reserve Board took an important step in 1996, which affected universal banks differently depending on their mode of establishment. By 1996, commercial banks that had expanded into investment banking through M&A were no longer burdened with regulatory firewalls, which previously limited information and financial flows between securities and commercial-bank divisions. Simultaneously, the revenue limit on underwriting corporate debt and equity was raised from 10 to 25%, which affected mainly Section 20 subsidiaries.

Against this background, we define two different treatment groups, for which the 1996 deregulation constituted an exogenous shock to the scope of universal banking and, thus, the capacity for risk taking: universal banks established through M&A before 1996 and Section 20 subsidiaries for which the revenue limit was likely binding prior to 1996. For loans extended by both types of treated universal banks, we document a significant run-up in sales-growth volatility and idiosyncratic risk of debtor firms.

Our empirical findings support the idea that the increased scope of universal banking enables riskier lending. However, it is not clear to what extent this shift in firm risk in the loan portfolios of universal banks contributes to the overall increase in volatility of public firms in the U.S. In order to investigate this, we translate the increases in firm risk after universal-bank financing events into *within-firm* effects of roughly 10% higher sales-growth volatility. The effects reach up to 15% for firms with deeper cross-selling relationships with universal banks – in the form of multiple loans, M&A advisory services, or an initial public offering (IPO). Similarly, we find that for firms funded by universal banks, firm-level TFP increases by up to 7%, and does not decline shortly thereafter.

The within-firm estimates indicate that universal-bank financing enables firms to invest in riskier projects, rather than universal banks reallocating funds towards generally riskier firms that may have been unable to obtain financing prior to the reform. This validates the possibility that universal-bank financing can account for a significant fraction of the observed rise in volatility and TFP among U.S. public firms. Using the aforementioned estimates, we calculate that fraction to be between one-quarter and three-quarters of the increases in sales-growth volatility and TFP since 1989.

To complement our analysis based on loans issued by mature, public firms with evidence on firms early in their life cycle, we examine whether universal banks, as compared to investment banks, serve as bookrunners for IPOs of younger and, thus, potentially riskier firms. We find that, as a response to the 1996 deregulation, universal banks take public firms that are up to six years younger. Strikingly, in this regard, universal banks established through M&A and Section 20 subsidiaries behave in the same fashion as our analysis has shown they do when granting loans to firms that exhibit higher (sales-growth or idiosyncratic) volatility.

Why might business practices change so dramatically as banks transition to universal banking? It is plausible to think that a given firm requires a large number of differentiated financial services over its life cycle, ranging from pure loan contracts to more complex debt-for-equity swaps involving third-party investors. This implies that economies of scope across different financial products are a salient feature of financing relationships. We argue that the advent of universal banking – and the associated cross-selling opportunities – allow financial intermediaries and their clients to fully realize these economies of scope. Crucially, as banks become more efficient at providing financial services, financial constraints that previously prevented firms from investing in relatively risky projects may no longer bind under universal banking.

One source of efficiency gains from cross-selling loans and non-loan products may be informational economies of scope. Alternatively, concurrent lending and underwriting may enable universal banks to use capital structure to provide managerial incentives when the type of incentive problem evolves over time. This is a likely scenario for large public firms. We capture this idea in a stylized model of a dynamic financing relationship between an entrepreneur and a bank. Our setup gives rise to a dynamic trade-off between two conflicting sources of moral hazard on the part of the entrepreneur. The associated moral-hazard costs are increasing in the risk of the project that the entrepreneur seeks to finance by borrowing directly from the bank or by accessing capital markets through the (same or another) intermediary. We then contrast the equilibrium outcome under separated banking with that under universal banking. Under separated banking, the firm has little capital-structure flexibility to balance both types of moral hazard because it can receive only one type of financing per bank, and there is no coordination between commercial and investment banks. Conversely, universal banks can offer capital-structure flexibility by combining debt and equity issues over multiple periods. Finally, we find that a system of universal banking enables firms to invest in riskier projects than under separated banking, which also results in higher expected productivity.

In sum, our results point strongly to increased efficiency in financial intermediation by universal banks, and we estimate this efficiency gain to be largest for relatively risky firms. Thus, the rise of universal banking constitutes an important contributing factor in the observed comovement of firm-level volatility and productivity among publicly traded firms since the late 1980s.

2 Related Literature

Our analysis focuses on the evolution of firm-level volatility of publicly traded U.S. firms in the era of universal banking. In an important contribution, based on earlier observations by Campbell, Lettau, Malkiel, and Xu (2001), Comin and Philippon (2006) document empirically that idiosyncratic firm risk has been rising over the past thirty years. In contrast to our paper, the authors' explanations are disconnected from financial history and development. They assert that increased product-market competition (potentially driven by deregulation in product markets) led to more turnover in the ranks of firms. Also, the authors claim that increased R&D-based competition induced higher firm-level volatility and simultaneously reduced comovement with the rest of the economy. Similarly, Comin and Mulani (2009) aim to explain increases in firm volatility through changes in the R&D behavior of large firms. In particular, they argue that as markets become more competitive, industry leaders invest less in general-purpose technologies but more in firm-specific technologies. Their model is successful in matching the divergent trends in idiosyncratic and aggregate volatility, but it cannot account for the increases in firm-level TFP shown in Figure 1.

Based on the analysis by Comin and Philippon (2006), Davis, Haltiwanger, Jarmin, and Miranda (2007) report a large upsurge in the number of newly listed firms after 1979, and show that the rise in firm-level volatility is due to publicly traded, and not private, firms. The authors also find that much of the volatility and dispersion rise among public firms reflects a strong influx of more volatile firms in later cohorts, even after controlling for size, age, and industry effects. This is in line with our assertion that the stepwise repeal of the Glass-Steagall Act has led to a riskier composition of firms financed by universal banks. Our universal-bank explanation can also accommodate the dichotomy between public and private firms, as equity underwriting is a major cross-selling product, so universal banking affects primarily firms that eventually go, or already are, public. To the best of our knowledge, the only other paper on the impact of financial deregulation on firm-level volatility is by Correa and Suarez (2009), who consider a different facet of financial deregulation in the U.S. – namely, interstate banking deregulation – and find a stabilizing effect on firm volatility. Thus, while we are not the first to analyze the relationship between the industrial organization of financial services and firm-level volatility, we provide the first evidence of a *risk-increasing* impact of financial deregulation, in the form of universal banking. Furthermore, while other authors have analyzed bank behavior under universal banking, our approach towards analyzing bank risk taking differs from that of Saunders, Strock, and Travlos (1990) and Cornett, Ors, and Tehranian (2002), for example. The difference is that we focus on universal-bank-financed firms and firm-level volatility rather than on risk indicators at the bank level.

Similar to Cornett, Ors, and Tehranian (2002), our analysis focuses on the differences between universal banking and separated banking. Ang and Richardson (1994), Kroszner and Rajan (1994), and Puri (1996) provide evidence that, in the pre-Glass-Steagall era, investors were willing to pay higher prices for securities underwritten by universal rather than investment banks. Also, the price differential between universal-bank and investment-bank underwritings, both pre-Glass-Steagall and post-1989, is greater for securities with high information costs, such as non-investment-grade securities (see, for instance, Gande, Puri, Saunders, and Walter (1997)). However, it is important to note that these securities may combine, almost by definition, both opaqueness and risk *divorced* from pure informational asymmetries. Hence, a selection effect governing the *types* of projects funded by universal or investment banks may also be at work.

Last, Drucker and Puri (2005) present evidence that issuers derive benefits from concurrent lending and underwriting, which may also mean lending and underwriting in quick succession. In particular, their view is that both universal banks and investment banks compete for such deals, but through different channels: while universal banks are more likely to offer discounted yield spreads on concurrent loans, investment banks are more likely to discount the underwriter spread for a seasoned equity offering. Regarding the former, the authors report that, unlike investment-grade borrowers, non-investment-grade borrowers receive significantly lower yield spreads on concurrent loans relative to matched non-concurrent loan yield spreads.

3 Theoretical Framework

In this section, we describe a model of financial intermediation by universal banks. Our model is similar in spirit to that of Greenwood, Sanchez, and Wang (2010), who use a costly-state-verification framework based on Townsend (1979). More specifically, we focus on the impact of universal banking, as opposed to separated banking, on the characteristics of firms financed in equilibrium. Informational economies of scope of simultaneous lending and underwriting are a defining feature of universal banking. This gives rise to the competitive effects of tying, as analyzed by Laux and Walz (2009) as well as Lóránth and Morrison (2012). More related to our paper, Kanatas and Qi (1998) and Kanatas and Qi (2003) discuss information spillovers as potential conflicts of interest, adversely affecting the bank's performance in underwriting securities. While Kanatas and Qi (2003) consider the characteristics of firms that are more likely to benefit from universal banking, they do not yield any predictions for risk. Conversely, we center our analysis on the effects of the most basic economies of scope for bank risk taking.

Before setting up the model and characterizing the optimal contracts under separated and universal banking, we revisit the empirical motivation for our model. As noted by Davis, Haltiwanger, Jarmin, and Miranda (2007), firm risk has been increasing for public, but not for private, firms. While public firms are most likely to have been affected by the rise of universal banking (even if mechanically so through the cross-selling of IPOs), they also constitute a class of large firms that realistically face *multiple sources of moral hazard*, especially in a dynamic context.

In our model, there are two main frictions. First, the entrepreneur has hidden information about the state of the cash flows in the first period, and he must be incentivized to reveal it truthfully. Second, the entrepreneur can take a non-contractible action that changes the payoff structure of the firm in an inefficient way in the second period. However, if he is not sufficiently exposed to the downside risk, he may have incentives to take this inefficient gamble.

Thus, we consider two types of moral hazard: the entrepreneur's truth telling in the first period and the inefficient gamble in the second period. As in Dewatripont and Tirole (1994), the optimal financing contract determines both the capital structure and the compensation of the entrepreneur. This setup gives rise to a major trade-off between dealing with these sources of moral hazard: viewed in isolation, the optimal incentive scheme to deal with one type of moral hazard may conflict with the optimal scheme to deal with the other. This is particularly true in our setup because the two moral-hazard problems are timed separately.

Under separated banking, the entrepreneur contracts for debt and equity separately with commercial and investment banks, between which we assume no coordination. This forces the entrepreneur to fix the capital structure ex ante, rendering him unable to balance out both types of moral hazard despite their different timing. Conversely, under universal banking, the tools of relationship banking allow for designing a more flexible capital structure that tackles the entrepreneur's truth telling by issuing more debt at date one, and avoids the inefficient gamble by swapping debt for equity before date two. More precisely, we allow universal banks to commit to state-contingent equity issues, while separated banks can make use of the latter only if the issue is individually rational for the entrepreneur.

Basic Environment and Technology

Time is discrete and runs for two periods, $t = 1, 2$. We consider the problem of an entrepreneur who has access to a single project and does not own any capital endowment. He must borrow to be able to invest in the project, for which he contracts with a financial intermediary. For simplicity, we assume that all parties are risk neutral, and that there is no discounting. We also assume that the entrepreneur may not save and consumes all per-period surplus immediately.[1]

At the beginning of the first period, the entrepreneur can invest k units of capital in a project. At the end of each period, one of two outcomes is realized: the project either fails or succeeds. Let $\theta \in \{S, F\}$ denote the state of the project; $\theta_t = S$ if the project is a success in period t, and $\theta_t = F$ if the project is a failure in period t. The project returns in each state θ are given by a function $R^\theta(k)$ that is strictly increasing and concave in k. Furthermore, $R^\theta(\cdot)$ satisfies $R^S(k) > k > R^F(k)$ for all k. The state of the project is i.i.d over time: in each period, the project is a success with probability p, and is a failure with the complementary probability $(1-p)$. Capital does not depreciate over time: when k is invested in period 1, the project also operates with k units of capital in period 2.

Information Structure and the Entrepreneur's Moral Hazard

At date 1, project returns are observable only to the entrepreneur. As such, the entrepreneur can potentially steal the first-period returns, and must be given incentives to truthfully reveal the state. There is no hidden-action problem. Other than that, we assume that all elements of the intermediation agreement between the bank and the entrepreneur are public information at each date: they are observed by bank, entrepreneur, equity and debt holders at $t = 1, 2$.

Prior to date 2, we allow the entrepreneur to take a non-contractible action $A \in \{G, S\}$, where G denotes a *gamble* and S denotes a *safe action*. The gamble increases the payoff given second-period success by $\Delta^S(k) > 0$, and reduces the payoff given failure by $\Delta^F(k) = \frac{p}{1-p}\Delta^S(k)$. Additionally, the gamble reduces the probability of success by q with $0 < q < p$. That is, the gamble induces a mean-preserving spread of size $\Delta^S(k)$ with respect to the measure p (and not $p - q$, for the gamble is inefficient). The gamble is inefficient in the sense that:

$$(p-q)(R^S(k) + \Delta^S(k)) + (1-p+q)(R^F(k) - \Delta^F(k)) < pR^S(k) + (1-p)R^F(k) \qquad \forall k > 0.$$

Accordingly, the *inefficiency* induced by the gamble is given by:

$$I(k) \equiv q\left(R^S(k) - R^F(k)\right) + \left(\frac{q}{1-p}\right)\Delta^S(k)$$

and $I(k) > 0$ for all $k > 0$.

Contracts

The entrepreneur contracts with banks to finance the investment. A bank can provide access to equity markets or issue a loan (equivalently: by providing access to debt markets). For simplicity, the net risk-free rate in the economy is assumed to be zero, and the price of capital is normalized to one. Funds from equity markets are obtained by selling a stake in the firm. To summarize, with the help of the bank, the entrepreneur can:

1. Issue standard debt and/or equity at the beginning of period 1. Debt is either (i) short-term debt with face value d that becomes due at the end of period 1; or (ii) long-term debt with face value D that becomes due at the end of period 2. Equity shares issued in period 1 are denoted s_1. As is standard, we assume that debt is senior to equity; that is, when a firm cannot service its debt obligations, debt holders claim the entire cash flow of the firm. In addition, any unserviced debt at $t = 1$ is rolled over to $t = 2$.

[1] As argued in Clementi and Hopenhayn (2006), this assumption is equivalent to assuming that savings are observable.

2. Issue additional equity shares s_2 prior to period 2.

Given $\theta_t \in \{S, F\}$, the project's status in period t, let superscript $\theta_1\theta_2$ denote the two-period history detailing the project's status at each date. Then, the loan repayments in periods 1 and 2 can be denoted by $\tau_1^{\theta_1}$ and $\tau_2^{\theta_1\theta_2}$, respectively. Financial intermediation is subject to limited liability: loan repayments in any given period must not exceed the achieved cash flow in that period.

Debt Overhang

Consider a firm saddled with outstanding debt of face value $D \geq R^F(k)$ at the beginning of period 2. The entrepreneur chooses to gamble whenever

$$(p-q)\left(R^S(k) + \Delta^S(k) - D\right) \geq p\left(R^S(k) - D\right).$$

Hence, the entrepreneur does *not* gamble whenever

$$D \leq \bar{D}(k) \equiv R^S(k) - \left(\frac{p-q}{q}\right)\Delta^S(k).$$

An entrepreneur saddled with debt such that $R^F(k) \geq D \geq R^F(k) - \Delta^F(k)$ does not gamble whenever

$$D \leq R^S(k) - \left(\frac{p-q}{1-p+q}\right)\Delta^S(k).$$

An entrepreneur saddled with $D \leq R^F(k) - \Delta^F(k)$ never gambles. For simplicity, we assume $\Delta^S(k)$ is such that $\bar{D}(k) \geq R^F(k)$. The relevant upper bound for debt is then given by $\bar{D}(k)$.

Value of the Firm

Fix a contract with short-term debt d and long-term debt D. We define as the *value of the firm* the expected present value of all future cash flows, net of the required debt repayment to the bank. Define $\tau_1^{\theta_1} = \min(d, R^{\theta_1}(k))$. The total face value of outstanding debt in period 2 after a realization of θ_1 in period 1 is then given by $D'_{\theta_1} = D + d - \tau_1^{\theta_1}$. Loan repayments in period 2 after history $\theta_1\theta_2$ – e.g., if $\theta_2 = S$ – are $\tau_2^{\theta_1\theta_2} = \min(R^{\theta_2}(k) + \Delta^{\theta_2}(k)\mathbb{1}_{\{A^{\theta_1}=G,\theta_2=S\}}, D'_{\theta_1})$. Finally, define $p_2^{\theta_1}$ as the endogenous second-period probability of success, after first-period history θ_1, with $p_2^{\theta_1} = p - q$ if $A^{\theta_1} = G$ and $p_2^{\theta_1} = p$ otherwise. Hence, the value of the firm V_t^θ in history node θ and at the beginning of period t is defined recursively as:

$$V_2^S = p_2^S(R^S(k) + \Delta^S(k)\mathbb{1}_{\{A^S=G\}} - \tau_2^{SS}) + (1-p_2^S)(R^F(k) - \Delta^F(k)\mathbb{1}_{\{A^S=G\}} - \tau_2^{SF})$$

$$V_2^F = p_2^F(R^S(k) + \Delta^S(k)\mathbb{1}_{\{A^F=G\}} - \tau_2^{FS}) + (1-p_2^F)(R^F(k) - \Delta^F(k)\mathbb{1}_{\{A^F=G\}} - \tau_2^{FF})$$

$$V_1 = p(R^S(k) - \tau_1^S) + (1-p)(R^F(k) - \tau_1^F) + pV_2^S + (1-p)V_2^F.$$

Since there are no informational asymmetries between the firm and outside investors, the value per share of an equity issue is precisely the proportionate value of the firm. Therefore, an equity issue of size s_t at time t in history node θ generates revenues Π_t^θ according to

$$\Pi_t^\theta = s_t V_t^\theta.$$

Accordingly, the residual value of the firm to the entrepreneur after the equity issue is $(1-s_t)V_t^\theta$.

Lender's Participation Constraint

The combined creditor and shareholder participation constraint is given by:

$$
\begin{aligned}
k \leq\ & p \left[\tau_1^S + p_2^S \tau_2^{SS} + (1-p_2^S)\tau_2^{SF} + (s_2^S - s_1)V_2^S\right] \\
& + (1-p) \left[\tau_1^F + p_2^F \tau_2^{FS} + (1-p_2^F)\tau_2^{FF} + (s_2^F - s_1)V_2^F\right] + s_1 V_1.
\end{aligned} \tag{PC}
$$

In equilibrium, this constraint will bind with equality.

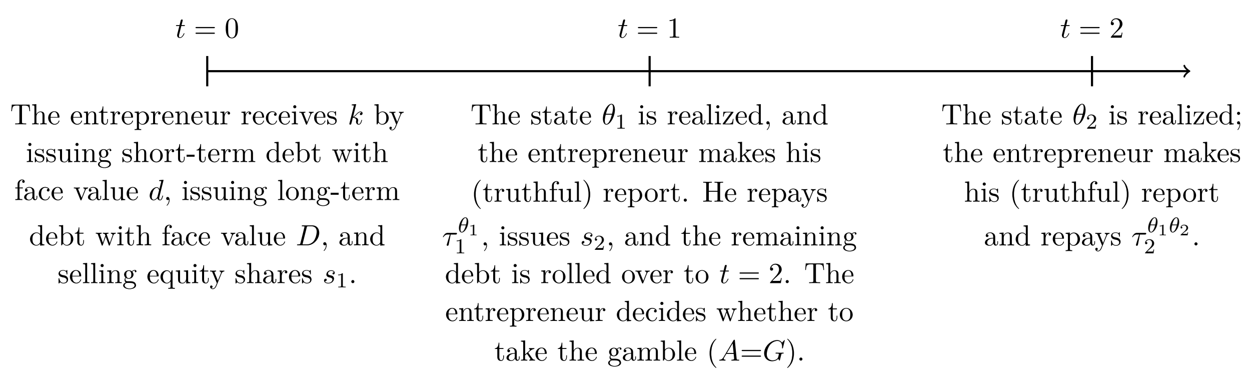
Entrepreneur's Incentive Constraint

Let U_2^θ denote the value of the firm *to the entrepreneur* at the beginning of date 2 if the project's state in the first period is θ. Let $\tau_1^\theta = \min(d, R^\theta(k))$ denote the payments to debt holders at the end of period 1. If the entrepreneur privately observes state S at date 1, he needs to be incentivized to truthfully reveal this state. Then, the entrepreneur's incentive constraint at date 1, given an intermediation agreement (k, d, D, s_1, s_2), is:

$$
(1-s_1)(\tau_1^S - \tau_1^F) + s_1(R^S(k) - R^F(k)) \leq U_2^S - U_2^F. \tag{IC}
$$

Optimal Contracts under Separated vs. Universal Banking

We now consider the differences in financial intermediation between a system of separated banking – i.e., distinct commercial and investment banks, so the entrepreneur receives debt and equity from separate intermediaries – and one of universal banking. The general timeline of the model is as follows.



We continue by establishing the first-best benchmark without financial constraints.

First-best Benchmark

The first-best value of the firm is given by:

$$
V_1^{FB} = \max_k 2\left[pR^S(k) + (1-p)R^F(k)\right] - k. \tag{1}
$$

We denote the associated first-best level of capital by k^*.

Separated Banking

Under separated banking, the only instruments available to commercial and investment banks (summarized as *the bank* in the following) are capital k, equity shares s_1, short-term debt d, and long-term debt D. There will be no second-period equity issues (i.e., $s_2 = 0$), which is reflected by the following lemma and proved in the Appendix.

Lemma 1 (No equity issues to pay down debt) *Suppose that the firm has debt obligations $D > \bar{D}(k)$ at the beginning of period two with $D \in [R^F(k), R^S(k)]$, and a fraction s_1 of shares outstanding to outside shareholders. Then, the entrepreneur will never choose to issue equity to pay down debt from D to $\bar{D}(k)$.*

It follows that the entrepreneur will never have an incentive to sell equity shares at date 1, as he cannot commit to doing so ex ante. We now turn to characterizing the optimal contract under separated banking. There are three classes of contracts to consider:

1. The contract prevents a gamble in all states of the world (class 1).
2. The contract induces a gamble in all states of the world (class 2).
3. The contract prevents a gamble after success, and induces a gamble after failure (class 3).

The following proposition, the proof of which can be found in the Appendix, summarizes the analysis.

Proposition 1 (Optimal contract under separated banking) *Suppose that the production technology satisfies*

$$R^F(k^*) + pR^S(k^*) + (1-p)R^F(k^*) \geq k^* + \frac{p}{q}(p-q)\Delta^S(k^*).$$

Then, the firm achieves the first best under separated banking. The optimal contract under separated banking that delivers the first best to sufficiently productive firms is given by: $s_1 = 0$, $d = R^F(k^*)$, and $D = \bar{D}(k^*)$.

Next, suppose that the production technology satisfies

$$R^F(k^*) + pR^S(k^*) + (1-p)R^F(k^*) < k^* + \frac{p}{q}(p-q)\Delta^S(k^*).$$

Let k_i^* be the capital amount under the optimal contract of class i, given that the firm is not sufficiently productive so as to achieve the first best. The three classes of contracts are given by:

1. *$s_1 = 0$, $d = R^F(k_1^*)$, and $D = \bar{D}(k_1^*)$ (class 1).*
2. *$s_1 = 0$, $d = R^F(k_2^*)$, and $D = R^S(k_2^*) + \Delta^S(k_2^*)$ (class 2).*
3. *$s_1 = 0$, $d = R^F(k_3^*) + \frac{p}{q}\Delta^S(k_3^*)$, and $D = \bar{D}(k_3^*)$ (class 3).*

Then, the optimal contract among these three contracts is the second-best contract under separated banking. Furthermore, $k_3^* > k_2^*$, but k_3^* is not necessarily larger than k_1^*.

Universal Banking

We model the distinction between separated and universal banking by allowing the entrepreneur to enter a two-period contract over debt and/or equity from the same bank under universal banking. This enables universal banks to commit to conducting debt-for-equity swaps after project returns have been realized and debt repayments have been made in period 1, but prior to period 2. The capital-structure flexibility provided by debt-for-equity swaps maximizes pledgeable income even while preserving truth-telling incentives, which, in turn, increases capital k for the financing of risky projects (under which the truth-telling constraint is more likely to bind).

Note that any contract with state-contingent debt-for-equity swaps and full commitment can be replicated by a contract without swaps and state-contingent equity issues. As such, we can write the participation constraint as

$$\begin{aligned} k \leq\, & p\left[\tau_1^S + p_2^S\tau_2^{SS} + (1-p_2^S)\tau_2^{SF} + (s_2^S - s_1)V_2^S\right] \\ & + (1-p)\left[\tau_1^F + p_2^F\tau_2^{FS} + (1-p_2^F)\tau_2^{FF} + (s_2^F - s_1)V_2^F\right] + s_1V_1, \end{aligned} \tag{2}$$

and the entrepreneur's IC constraint under hidden information is given by

$$(1-s_1)(\tau_1^S - \tau_1^F) + s_1(R^S(k) - R^F(k)) \leq (1-s_2^S)V_2^S - (1-s_2^F)V_2^F. \tag{3}$$

Given these preliminaries, the following proposition characterizes the optimal contract under universal banking.

Proposition 2 (Optimal contract under universal banking) *Suppose that the production technology satisfies*

$$pR^S(k^*) + (1-p)R^F(k^*) + R^F(k^*) \geq k^*.$$

Then, the firm achieves the first best under universal banking (with commitment).

Next, suppose that the production technology satisfies

$$pR^S(k^*) + (1-p)R^F(k^*) + R^F(k^*) < k^*.$$

Then, the optimal contract under universal banking prevents a gamble in all states of the world, and has the following properties:

1. *k_{UB}^* is the largest k such that $pR^S(k) + (1-p)R^F(k) + R^F(k) = k$.*
2. *Post-swap state-contingent debt levels satisfy $D'_F, D'_S \in [0, \bar{D}(k_{UB}^*)]$.*
3. *Short-run debt d satisfies $d \in [R^F(k_{UB}^*), R^S(k_{UB}^*)]$.*
4. *The sizes of the equity issues satisfy $s_1 = 0$, $s_2^F = 1$, $s_2^S = \frac{V_2^S - (d - R^F(k_{UB}^*))}{V_2^S}$.*

The next proposition formalizes the efficiency gains from universal banking. In particular, it shows that firms that obtain financing from a universal bank always do at least as well as under separated banking. Furthermore, there exists a level of risk, as proxied by the payoff spread $S(k) = R^S(k) - R^F(k)$, such that for any given level of mean productivity, relatively risky firms do *strictly* better under universal banking than under separated banking.

Proposition 3 (Comparison of separated and universal banking) *Let k^*_{SB} and k^*_{UBC} define the equilibrium levels of capital obtained under separated banking and universal banking, respectively. Let U^*_{SB} and U^*_{UB} denote the associated values of the optimal contracts to the entrepreneur. Finally, let $S(k) = R^S(k) - R^F(k)$ denote the payoff spread between success and failure returns, and let $\bar{Z}(k) \equiv pR^S(k) + (1-p)R^S(k)$ be the associated mean productivity. Then, $k^*_{SB} \leq k^*_{UB}$ and $U^*_{SB} \leq U^*_{UB}$ for any $S(\cdot)$ and $\bar{Z}(\cdot)$. Furthermore, for each $\bar{Z}(k)$, there exists an $S(k)$ such that $k^*_{SB} < k^*_{UB}$ and $U^*_{SB} < U^*_{UB}$.*

Proposition 3 translates into our main empirical predictions. First, the value of a firm is decreasing in risk, and particularly so under separated banking. For a given level of productivity, we then expect universal banks to be able to finance firms that would not have obtained financing otherwise, owing purely to the ability of universal banks to effectively intermediate relatively risky projects. Therefore, universal-bank-financed projects are, on average, riskier. Second, as long as project risk and return are positively correlated, the pool of universal-bank-financed projects, on average, exhibits higher productivity than the pool of projects financed under separated banking.

More than that, an outcome of the model is that firms do not use equity under separated banking, as opposed to firms that enter into financing relationships with universal banks. Taking into account the stylized nature of the model, one can interpret this as suggesting earlier IPO timing under universal banking, for which we present evidence in Section 5.4.

Equity Underwriting vs. Investment

The use of equity instruments is crucial for avoiding the debt-overhang problem at date 2. Thus, the modeling of equity should be treated with special care. The concurrent provision of debt and equity is a specific feature of universal banking that enables the accommodation of higher-risk projects. In our model, equity underwriting is equivalent to the bank investing its own funds in the form of equity. Our choice for modeling equity can be motivated by the fact that a so-called *bought deal* is a common method for the sale of shares in an IPO. While, under other methods, banks serve only as intermediaries in the underwriting process, in bought deals, underwriters do *purchase* shares directly from the issuer before placing them with outside investors.

Still, if commercial banks indeed had the same ability as universal banks to invest equity in firms, then our modeling of the equity contract would fail to capture the distinct essence of universal banking. This is, however, not the case. The Bank Holding Company Amendment Act of 1970 enabled bank-holding companies to participate in commercial activities: they may acquire up to 5% of the voting stock of a firm, as well as non-voting stock as long as the total holdings do not exceed 24.9% of the commercial firm's capital (cf. Barth, Brumbaugh, and Wilcox (2000)). The latter regulation speaks to our model insofar as it limits the amount of equity that commercial banks and universal banks alike can invest in firms. However, only universal banks can serve as a pure intermediary in the equity-underwriting process, thereby leaving our conclusions in the model regarding the different outcomes under separated and universal banking unaltered.

Numerical Example

We now provide a numerical example to illustrate the main mechanism of the model. We specialize the setup to the following specification.

- The production function satisfies $R^\theta(k) = Z^\theta k^\alpha$ with $\alpha \in (0, 1)$. Z^θ is a constant for each θ and $Z^S > Z^F$. The firm's *idiosyncratic risk* is given by the payoff spread $(Z^S - Z^F)$.

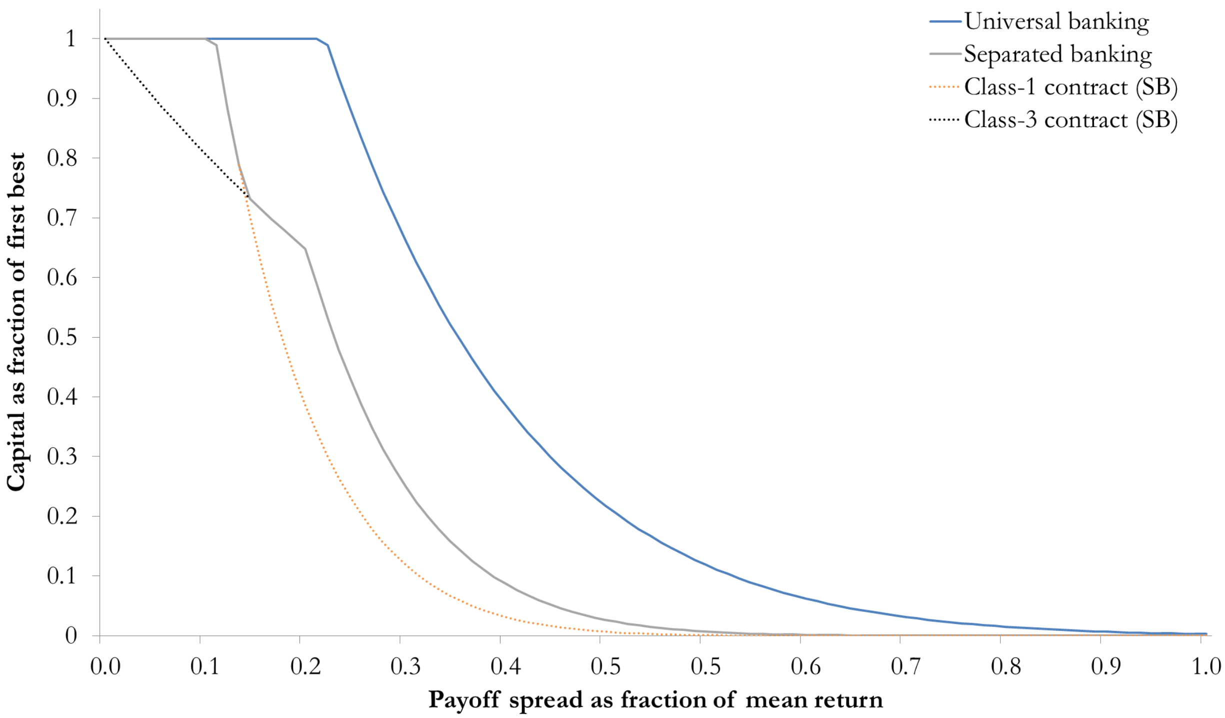


Figure 2: **Equilibrium Capital Stock under Universal and Separated Banking as a Function of the Payoff Spread** $(Z^S - Z^F)$**.** Parameter values fixed at $p = 0.5$, $q = 0.2$, $\alpha = 0.9$, $\bar{Z} = 1$, $\phi = \bar{\phi}$.

- The additional output after a success induced by a gamble is given by $\Delta^S = \phi(Z^S - Z^F)$ for some $\phi > 0$. ϕ satisfies $\phi \leq \bar{\phi} \equiv \frac{p}{p-q}$.

The second part of this specification guarantees that $\bar{D}(k) \geq R^F(k)$ for all $k \geq 0$. More substantially, it also implies that the size of the gamble is increasing in the idiosyncratic risk of the firm, namely the spread between the success and failure payoffs. The qualitative behavior of the model is robust to variations in this assumption. Figures 2 and B.1 (in the Appendix, alongside corresponding figures for three more specifications as robustness checks) show the impact of a mean-preserving spread in Z^S and Z^F on equilibrium capital. In particular, we hold $\bar{Z} \equiv pZ^S + (1-p)Z^F$ fixed at unity, and we trace out equilibrium capital and the value of the firm as we vary idiosyncratic risk. The figures show that universal banking is particularly attractive for risky firms: as the payoff spread increases, the value of the firm under separated banking decreases sharply, as does equilibrium capital. The underlying mechanism works directly through the IC constraint: any increase in the payoff spread tightens the IC constraint for any $k > 0$. This creates a need to provide incentives by increasing the difference in firm value after success and failure. Under separated banking, this can be accomplished only by inducing high levels of residual debt after failure. As soon as the level of debt crosses $\bar{D}$, however, this comes at the cost of simultaneously inducing the inefficient gamble in period two. Under universal banking, in contrast, the appropriate incentives can be provided to the agent through debt-for-equity swaps after failure, thereby avoiding the inefficient gamble.

Universal Banking and Firm Risk

Our argument for an increase in both productivity and risk is related to Greenwood, Sanchez, and Wang (2010), and proceeds in two steps. First, for a given level of productivity, idiosyncratic risk is a bigger impediment to obtaining financing under separated banking than it is under universal banking. In particular, under separated banking, firm risk tightens the IC constraint, and decreases the amount of capital that can be obtained from financial intermediaries. Since the value of the firm is increasing in its installed capital, a relatively risky firm is thus less valuable under separated than under universal banking, holding average productivity constant. This mechanism is highlighted in the numerical example presented in the previous section.

Second, suppose that the set of potential projects in an economy is described by a distribution along a risk-return frontier such that higher returns are associated with higher risk. In the absence of moral-hazard frictions, it would be preferable to finance high-return projects since they offer higher ex-ante value. However, under separated banking, any associated increase in risk drags down the value of the firm by rationing the available capital. In turn, the lower the value of the firm, the less likely it is that the entrepreneur will invest in the respective project. Under universal banking, the equilibrium trade-off along the risk-return frontier is biased towards productivity: firms with high expected returns can be sustained in equilibrium even if their cash flows are risky.

This argument generates clear empirical predictions. In particular, we expect high-return, high-risk firms to contract with universal banks, while relatively safe firms are content to receive financing from a separated-banking system. We now turn to establishing such a pattern in the data.

4 Empirical Methodology and Identification

4.1 Institutional Background

In this paper, we consider a crucial facet of financial deregulation in the U.S.: the gradual dismantling of the Glass-Steagall Act, which separated commercial and investment banking, and the rise of universal banking, culminating in the Gramm-Leach-Bliley Act in November 1999. Under Section 20 of the Glass-Steagall Act, commercial banks were prohibited from engaging in any kind of underwriting or securities business, which was subsequently entirely in the hands of investment banks and other investment houses. The Glass-Steagall Act characterized the financial-architectural landscape in the U.S. until 1987. Starting April 30, 1987, commercial banks were allowed to open so-called Section 20 subsidiaries and generate up to 5% of gross revenues from underwriting and dealing in certain securities, namely municipal revenue bonds, mortgage-related securities, consumer-receivable-related securities, and commercial paper. Two years later – on January 18, 1989 – banks were allowed to engage in veritable investment-banking activities, most notably corporate debt and equity underwriting. On September 13, 1989, the revenue limit was raised to 10%. These measures gave rise to cross-selling opportunities for commercial banks that decided to become universal banks.

A major expansion of universal-banking deregulation took place on August 1, 1996, when the revenue limit on underwriting securities was raised to 25%. Besides the possibility of becoming a universal bank by opening a Section 20 subsidiary, commercial banks could also purchase or merge with an investment bank. Such universal banks established through M&A were also affected by the 1996 deregulation in that the Federal Reserve Board eliminated prudential limits or firewalls within bank-holding companies. This reduction of the regulatory firewalls, which limit information and financial flows between securities and commercial-bank divisions, was instrumental for cross-selling strategies of large, diversified universal banks, many of which were formed through M&A.

To identify the impact of universal banking on the composition of firms that received financing, we use transaction-level data – mostly loans – to determine whether a bank was a universal bank at the time of the transaction. We delineate this by comparing the opening date of the respective bank's first Section 20 subsidiary or the completion date of a banking-scope-expanding (from commercial to investment banking) acquisition to the transaction date.

As an example, consider the historical anatomy of Citigroup. Citicorp, a commercial bank with a Section 20 subsidiary, was acquired by Travelers Group on October 8, 1998. Before that, Travelers, typically focused on insurance business and some lending, merged with Smith Barney – an investment bank owned by conglomerate Primerica since June 21, 1987 – on December 31, 1993, and with Salomon Brothers on November 26, 1997. Thus, Travelers Group became a universal bank through M&A in 1993, and any loan granted by Travelers Group before December 31, 1993 is labeled as a loan provided by a commercial bank that eventually became a universal bank, but was not a universal bank at the time of the transaction. Similarly, any loan *after* this date is labeled as a loan provided by a universal bank (Citigroup).

Note that we also have international banks in our sample. International banks are special cases in that, before the International Banking Act of 1978, these banks were not subject to the Glass-Steagall Act. As a consequence, international banks that were active in the U.S. before 1978 and established as universal banks outside the U.S. were allowed to continue their business model in the U.S. (as long as they would not expand their activities further). None of the banks in our sample were subject to the International Banking Act. For instance, Deutsche Bank became a universal bank only after acquiring Morgan Grenfall, a London-based investment bank, in 1990. Similarly, Crédit Suisse acquired a controlling stake in the American investment bank First Boston Corporation in December 1988.

To motivate our identification strategy, consider, first, the deregulation of restrictions on branching and interstate banking in the U.S. between 1970 and 1994, which is widely studied in the literature. Exploiting the staggered timing of branch deregulation across states, Jayaratne and Strahan (1996) find a positive effect on state-level growth rates following the reform. Note that this episode of deregulation is unlikely to explain the rise in firm volatility, as Morgan, Rime, and Strahan (2004) find a stabilizing effect on state-level growth, which is confirmed by Correa and Suarez (2009) at the firm level.[2] To shed light on the underlying mechanism, recent studies aim to relate financial development to firm outcomes, such as innovation. In doing so, the identification strategy relies on the distinction between bank-dependent and non-bank-dependent firms in treated states (see Amore, Schneider, and Zaldokas (2012) and, using Italian data, Benfratello, Schiantarelli, and Sembenelli (2008)). However, this approach uses a state-level treatment and, thus, does not precisely account for *if and when* individual firms are affected by an increase in credit supply.

In contrast, we use lending relationships with banks to identify the impact of financial deregulation on firm-level outcomes.[3] Starting in 1989, commercial banks have selectively converted into universal banks and, as such, experience banking-scope-expanding deregulatory shocks. Transaction dates – e.g., of loans – then determine the timing of the transmission of the banks' treatment to firms, thereby refining the measurement of firm-level changes made possible by the contract technology of universal banks.

The two treatments differ along multiple dimensions, and these differences determine the boundaries for identifying firm-level real effects of financial deregulation. Intra- and interstate banking deregulation impacts firms' financing decisions through an increase in credit supply, while leaving the nature of financial intermediation unaltered. This renders it difficult to use loan data to assign any firm-level effects to increased credit supply *due to* branch deregulation without specifying a

[2] The finding in Kerr and Nanda (2009) as well as Kerr and Nanda (2010) that there has been large-scale entry at the *extensive margin* following branch deregulation appears to be instrumental in explaining the negative effects on the median firm volatility of publicly listed firms (unlike small entering firms) and on state-level volatility (namely, through diversification).

[3] While this idea is similar in spirit to that pursued by Herrera and Minetti (2007), the authors, using data from Italy, cannot make use of any natural experiment to identify the impact of informed lending on firm outcomes.

structural model that dictates a counterfactual level of loan provision in the absence of deregulation.

Conversely, the nature of financial intermediation changes significantly under universal banking. Conditional on receiving financing, our treatment is defined at the bank level, and affects the scope of activities engaged in by universal banks, rather than a mere expansion of the geographical scope, as is the case under branch deregulation. This enables us to use transaction-level data to (i) scrutinize the depth of bank-firm relationships and (ii) assess whether firm-level volatility increases after contracting with universal banks rather than commercial banks.

4.2 Identification Strategy

Our main set of results is based on the analysis of loan data from the DealScan database. In DealScan, firms are typically publicly listed. When scrutinizing the impact of universal banking on firm characteristics such as risk, we elucidate what kinds of relatively mature firms receive financing and how this contributes to their (investment) behavior and performance in the market. Note that while public firms differ from private firms along manifold dimensions (Farre-Mensa (2011)), we compare public firms to public firms. Therefore, to generalize our results to private firms, we require only that the effect of the banking-organization form on firm risk not be different for public vs. private firms. However, there are reasons, stemming from our motivating evidence, for why one would not want to do so. As seen in Davis, Haltiwanger, Jarmin, and Miranda (2007), firm risk has been increasing only for publicly listed firms. We assert that the rise of universal banking has potentially contributed to a shift in firm-level risk. The underlying mechanism would be in line with the observation that firm risk has been increasing only among publicly listed firms, because the expansion of banking activities engaged in by universal banks typically involves underwriting. Thus, universal banks can cater to riskier firms through cross-selling products, so public firms are more likely than private firms to be affected by the kind of financial deregulation under consideration.

Our identification strategy is based on a deregulatory shock in 1996 that affected the scope of banking activities engaged in by pre-existing universal banks differently, depending on how they were established. To test our claim that universal banks finance riskier firms, we turn to the loan data. We wish to estimate the average firm risk associated with loans provided by commercial banks before and after they became universal banks, as opposed to those that remained commercial banks. That is, treated firms receive financing from universal banks that offer concurrent lending and underwriting. The control group consists of commercial banks that never became universal banks and, therefore, never changed the scope of their business.

We face the following identification challenges. First, the ideal data for this test would comprise repeated observations of firm i with the same bank j, before and after the bank *randomly* becomes a universal bank. Second, even if the bank's timing to expand into universal banking were exogenous, bank-firm pairs are not always observed under both commercial- and universal-banking structures. This, in turn, forces us to use other universal banks' observations as counterfactuals for commercial banks that eventually become universal banks but never appear as such in the data, and vice versa. Given these prerequisites, consider the following difference-in-differences specification:

$$\begin{aligned} risk_{ijt} \quad = \quad & \beta_1 UB\ through\ M\&A_{jt} + \beta_2 Eventually\ UB\ through\ M\&A_j \\ & + \beta_3 UB\ through\ Section\ 20_{jt} + \beta_4 Eventually\ UB\ through\ Section\ 20_j \\ & + \beta_5 X_{ijt} + \beta_6 industry_i + \mu_t + \epsilon_{ijt} \end{aligned} \tag{4}$$

or, after including bank fixed effects,

$$\begin{aligned} risk_{ijt} &= \beta_1 UB\ through\ M\&A_{jt} + \beta_2 UB\ through\ Section\ 20_{jt} \\ &+ \beta_3 X_{ijt} + \beta_4 industry_i + \mu_t + \lambda_j + \epsilon_{ijt}, \end{aligned} \tag{5}$$

where $UB\ through\ M\&A_{jt}$ and $UB\ through\ Section\ 20_{jt}$ are indicator variables for whether at the time t of transaction j any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary, $Eventually\ UB\ through\ M\&A_j$ and $Eventually\ UB\ through\ Section\ 20_j$ are indicator variables for whether, at *any point in time*, any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary, X_{ijt} denotes time-varying characteristics of the borrowing entity i and of the originated loan j, $industry_i$ and μ_t are industry and year fixed effects, respectively, and λ_j denotes bank fixed effects, which we include for lead arrangers of loan j that are or eventually become universal banks (whereas all remaining commercial banks are grouped together).

We hypothesize the difference-in-differences estimates β_1 and β_3 in (4) – or, equivalently, β_1 and β_2 in (5) – to be positive. For these coefficients to be identified, one would require the following assumptions:

1. Any bank's timing to become a universal bank is orthogonal to the risk properties of its client base.
2. There is no structural change in the client base other than through the contracting (e.g., cross-selling) possibilities for universal banks, compared to commercial banks that only later become universal banks.
3. Commercial banks that eventually become universal banks and those that do not exhibit similar behavior prior to deregulation – i.e., prior to the former's actually becoming a universal bank either through M&A or through opening a Section 20 subsidiary.

What kinds of biases might one expect according to these identification assumptions? First, commercial banks choose when to become universal banks, so reverse causality may be at work. For example, after an increase in firm risk, banks may be more likely to opt to become universal banks for diversification purposes.

Second, it is possible that firms self-sort into contracting with universal banks based on characteristics that may be correlated with risk. To control for this, we include firm characteristics such as proxies for firm size, namely sales and the number of employees. However, even after doing this, it is not clear that receiving financing from a universal rather than a commercial bank is related only to the universal bank's increased capacity to finance riskier projects, as made possible by the additional contracting possibilities, e.g., cross-selling.

The third requirement is the typical parallel-trend assumption that would allow us to use the coefficients β_2 and β_4 in (4) or the bank fixed effects λ_j in (5) to capture any structural differences between commercial banks that eventually become universal banks and those that do not. The complications associated with this assumption are linked to the endogeneity of the bank's decision to expand into universal banking, in that universal banks established through M&A might pursue a more aggressive lending strategy than universal banks established through Section 20 subsidiaries.

To address these issues, we focus on already existing universal banks. For these banks, we use deregulatory shocks to the scope of banking – and, thus, the capacity to finance riskier projects – that are tailored to universal banks depending on their mode of establishment. On August 1, 1996 the Federal Reserve Board eliminated firewalls within bank-holding companies, thereby

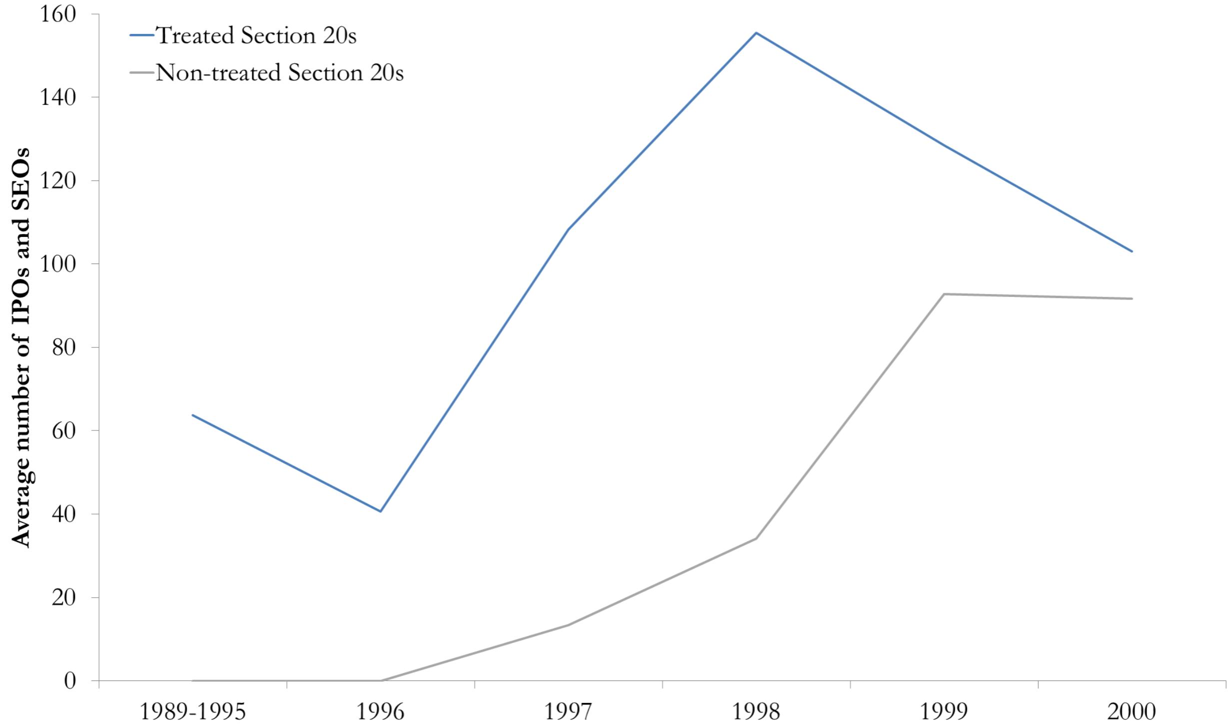


Figure 3: **Average Number of IPOs and SEOs Run by Universal Banks Established through Section 20 Subsidiaries before August 1, 1996 – Treated vs. Non-treated Group.** Source: own analysis based on SDC IPO and SEO data.

enhancing the ability of universal banks to engage in cross-selling, while raising the revenue limit on underwriting securities from 10 to 25%. In particular, we exploit the fact that this deregulation affects universal banks formed through M&A and Section 20 subsidiaries differently. While the elimination of firewalls affects all universal banks established through M&A, the elevation of the limit on revenues from underwriting corporate securities is naturally relevant only for those Section 20 subsidiaries for which the former revenue limit of 10% was binding prior to 1996. To capture this, we consider a Section 20 subsidiary as treated if it, in any capacity (not just as a bookrunner), fulfills two criteria. First, the universal bank had non-zero IPOs and seasoned equity offerings (SEOs) recorded in SDC prior to August 1, 1996. Second, its underwriting activity increased in 1996 and 1997, i.e., right after the elevation of the revenue limit.

Figure 3 visualizes the difference in IPO and SEO turnover between the treated and the non-treated group of Section 20 subsidiaries established prior to August 1, 1996. All of the banks in the non-treated group have zero underwriting activity recorded in SDC prior to 1997, whereas the treated group's activity in 1996 almost amounts to the cumulative turnover from 1989 to 1995. Then, the treated group's underwriting activity increases sharply between 1996 and 1997. The treated group experiences the bulk of increased IPO/SEO turnover until 1998, whereas the non-treated group's underwriting activity picks up right after 1998. The two groups' underwriting activities converge towards 2000, which is plausible given the conclusion of the deregulatory process with the Gramm-Leach-Bliley Act in November 1999.

The figure documents the distinct behavior of the two groups, and justifies our presumption that the previous revenue limit of 10% was binding for the treated group of Section 20 subsidiaries. Given that the non-treated group has no recorded equity-underwriting activity before 1997, there is greater flexibility in interpreting the 1996 deregulatory shock. Even if there were no revenue limits, then clearly the elimination of firewalls could matter only for Section 20 subsidiaries that were active in both lending and underwriting prior to the deregulation. Thus, we identify a group whose scope of banking activities – as captured by underwriting and other cross-selling possibilities – increased exogenously due to the 1996 deregulation.

If economies of scope across financial products are the driving force behind the universal banks' ability to finance riskier firms, then the graph indicates that the treated group should finance a greater number of riskier firms after 1996 than before 1996, one reason for which is that the revenue limit is likely to bind for this group before 1996. Note, however, that the non-treated group exhibits hardly any increase in underwriting activity before 1998/1999. Any such increase after 1996 is very likely endogenous, e.g., due to mergers with investment banks with a proven track record in underwriting. Indeed, while we cannot exclude the possibility that the non-treated group's surge in IPOs/SEOs was driven by mergers with investment banks after 1996, none of the treated Section 20 subsidiaries engaged in any mergers before 2000, most notably J.P. Morgan. As another example, Bankers Trust won more underwriting mandates in the second half of 1996 and in 1997, before the completion of its acquisition of Alex. Brown & Sons on September 1, 1997, and was acquired by Deutsche Bank (i.e., the bank vanishes from our data set) shortly thereafter.

We use the organizational-form-specific treatment groups to strengthen our causal interpretation that firm risk increases as a result of universal banking. In particular – as noted by, among others, Bhargava and Fraser (1998) – the initiation of universal-banking deregulation from 1987 to 1989 was based on the Federal Reserve's responses to specific requests from large banks (Bankers Trust, Citicorp, and J.P. Morgan), so the 1996 deregulation is more likely to constitute an exogenous shock to universal banks' ability to finance riskier projects. The control group consists of banks whose scope of banking activities was not affected by the 1996 deregulation, namely commercial banks that never become universal banks in our data. To test the contingency of increased risk taking by universal banks on being treated under the 1996 deregulation, we extend regression specification (5) as follows:

$$
\begin{aligned}
risk_{ijt} \;=\; & \beta_1 UB\ through\ M\&A_{jt} + \beta_2 UB\ through\ M\&A_{jt} \times Est.(1996)_j \\
& \times\ After(1996)_t + \beta_3 UB\ through\ M\&A_{jt} \times Est.(1996)_j \\
& + \beta_4 UB\ through\ Section\ 20_{jt} + \beta_5 UB\ through\ Section\ 20_{jt} \times Treated(1996)_j \\
& \times\ After(1996)_t + \beta_6 UB\ through\ Section\ 20_{jt} \times Treated(1996)_j \\
& + \beta_7 UB\ through\ Section\ 20_{jt} \times Est.(1996)_j \times After(1996)_t \\
& + \beta_8 UB\ through\ Section\ 20_{jt} \times Est.(1996)_j + \beta_9 After(1996)_t \\
& + \beta_{10} X_{ijt} + \beta_{11} industry_i + \mu_t + \lambda_j + \epsilon_{ijt}, \qquad (6)
\end{aligned}
$$

where $After(1996)_t$ is an indicator variable for whether the loan-issue date was on or after August 1, 1996, $Est.(1996)_j$ is an indicator variable for whether a universal bank (through M&A or Section 20) was established prior to August 1, 1996, $Treated(1996)_j$ is an indicator variable denoting whether a universal bank established through a Section 20 subsidiary and actively underwriting securities prior to August 1, 1996 experienced a run-up in the number of IPOs and SEOs after that date, and the remaining variables are defined as above (cf. equation 5).

We cluster standard errors at the bank-parent level in the following way. Whenever one of the lead arrangers is a universal bank (note that we focus on transactions with at most one lead arranger that eventually becomes, or already is, a universal bank), we use the universal bank's identifier. When there is no universal-bank lead arranger but a commercial bank that becomes a universal bank only after the respective loan transaction, then we use that bank's identifier. Similarly, when a deal is financed only by commercial banks, we cluster standard errors at the syndicate level by using unique identifiers for all lead-arranger constellations.

If the 1996 deregulation did, indeed, lead to greater risk taking by universal banks through a reduction of barriers to cross-selling for Section 20 subsidiaries and universal banks established through mergers with investment banks, then we would expect β_2, $\beta_5 > 0$. We will show that this holds across various risk measures, not just limited to corporate lending, but also in terms of risk associated with younger firms taken public by universal banks. For β_2 and β_5 to represent the population difference-in-differences, we effectively assume that risk trends would be the same among non-treated universal banks, which we cannot observe in the case of universal banks established through M&A, and commercial banks that never become universal banks. This reflects the notion that the endogenous decision to become a universal bank leads to a one-time increase in risk taking, which is followed by a common trend for universal banks and commercial banks that never become universal banks.

The test based on the 1996 deregulation helps preclude that our results are spurious, for it appears that firm risk increases as a response to universal-bank financing, particularly following the reduction of the regulatory firewalls and the elevation of the revenue limit. Even if one suspected that public firms changed before commercial banks expanded into investment banking, but the shift in firm risk does not show in our outcome variables before 1996, then our results still imply that any such change is less likely to have taken place in the absence of universal banking.

4.3 Data Description

The focus of our analysis will be on estimating the impact of universal banking on different firm-level outcomes, most notably firm risk. To this end, we use as our main data sources Compustat accounting data, CRSP stock prices, DealScan loan data,[4] and SDC IPO (as well as M&A and SEO) data, complemented with further data sources to be described in the empirical analysis. As is customary, we drop energy companies, public-service firms, and financial institutions from our analysis. On the transaction level, we focus on loans issued to public firms in the U.S. in the DealScan database since 1982, as well as on U.S. IPOs listed in the SDC database since 1970. While for IPOs we consider the bookrunners (i.e., lead underwriters), the loans in the DealScan database often constitute syndicate loans. To simplify matters, we focus on loans with at most one lead arranger that eventually becomes, or already is, a universal bank, comprising 91% of the transactions in DealScan, for which that bank's organizational structure (commercial bank, eventually universal bank, or universal bank at the time of the transaction) determines the value of the indicator variables (*Eventually*) *UB through M&A/Section* 20.[5]

Outcome Variables

The most important outcome variables considered in this paper are firm-level risk measures. We focus primarily on six-year volatilities of the sales-growth rates γ_{it} of firm i in year t.[6] For n-year volatilities, we follow Davis, Haltiwanger, Jarmin, and Miranda (2007) in constructing annual growth rates that accommodate entry and exit:[7]

$$\gamma_{it} = \frac{x_{it} - x_{i,t-1}}{\frac{1}{2}\left(x_{it} + x_{i,t-1}\right)}, \tag{7}$$

where x_{it} denotes sales from Compustat.

[4] We match DealScan with Compustat data using the link provided by Chava and Roberts (2008).

[5] All results are robust to including the remaining transactions with multiple (up to three) lead arrangers, where the indicator variables are set to one if at least one bank was (or would later become) a universal bank.

[6] Throughout the paper, we use six-year volatilities to keep as many firms as possible in our sample.

[7] All results in this paper are robust to using standard growth rates.

Furthermore, we also consider (six-year) idiosyncratic volatility, which is estimated as the standard deviation of the residuals from a Fama and French (1993) three-factor model using monthly CRSP data. Note that, in adopting these outcome variables to test our theory, we effectively assume the distribution of project returns to be stationary. This allows us to use the time-series volatility of sales growth rather than the cross-sectional volatility for our transaction- and firm-level analyses.

Given that public firms in DealScan are typically mature, we use another outcome measure to capture firm risk earlier in the firm's life cycle: the firm's age at the time of its IPO. This is a well-established proxy for firm risk in the corporate-finance literature. To calculate the latter, we use the founding dates of firms with IPOs recorded in SDC until 2006, collected by Loughran and Ritter (2004) and Fink, Fink, Grullon, and Weston (2010).[8]

Besides the above-mentioned risk measures, we also analyze effects on firm-level TFP, for which we use data estimated by Imrohoroglu and Tuzel (2011), who employ the semiparametric estimation procedure suggested by Olley and Pakes (1996), for the panel of Compustat firms.[9]

Summary Statistics

In Table 1, we present summary statistics of firm-specific and transaction-level variables for all regression samples used in the paper. In doing so, we preserve the chronology of the tables: DealScan is the foundation for Tables 2 and 3, Compustat for Tables 4 to 6, where SDC M&A data are also used (besides in Tables C.1 and C.2), and SDC IPO data for Table 7. For all samples, we use the actual regression sample, i.e., the sample that comprises all variables used in any of the specifications of the respective tables.

First, note that the unit of observation in the M&A sample is the bank-firm level, thereby summarizing the entire relationship between the two entities. Next, as mentioned before, the loans sample is limited to transactions with at most one lead arranger that eventually becomes, or already is, a universal bank. The respective regression sample comprises 3,054 observations when using the six-year sales-growth volatility $\sigma(\widehat{sales_i})^{t,t+5}$, and drops to 2,473 observations when using the six-year idiosyncratic volatility $\sigma^{t,t+5}_{idiosyncratic,i}$. For the former risk measure, the "total" regression sample, including deals with more than one non-commercial-bank lead arranger, has 3,443 observations. The summary statistics also reveal a couple of features about universal-banking deregulation. We distinguish by whether a universal bank is established through opening a Section 20 subsidiary or through M&A, and we find that at the bank-firm level, both types of universal banks interact equally often with their clients when it comes to loan financing. That is, although the scope of investment-banking activities is wider for universal banks established through M&A, the higher number of cross-selling products does not lead to less cross-selling of multiple loans.

As we use the 1996 deregulation as an exogenous shock to the scope of investment-banking activities engaged in by universal banks, we also review the number of universal banks established prior to that date. This is relevant for the DealScan and SDC IPO data sets. In DealScan, 5 out of 7 universal banks established through M&A existed before August 1, 1996 and were, thus, affected by the deregulation. In the SDC IPO data, 3 out of 5 universal banks established through M&A existed before that date. For Section 20 subsidiaries, the elevation of the revenue limit on underwriting securities (the relevant part of the 1996 deregulation) did not affect all of them equally. Against this background, we identify the *treated* group of Section 20 subsidiaries established prior to August 1, 1996 as universal banks that had significantly fewer (but not zero) IPOs recorded in SDC prior to that date than they did immediately after. While in both DealScan and SDC IPO data sets, most of the Section 20 subsidiaries were founded before August 1, 1996, only 4 out of 25

[8] We thank Jason Fink for sharing the data with us.
[9] We thank the authors for sharing their data with us.

and 2 out of 10 are labeled as treated universal banks in the loan and the IPO data, respectively. In total, based on the DealScan data, we have 43 universal banks.

The empirical analysis will proceed in three stages. First, we discuss evidence that cross-selling loans and non-loan products is prevalent among universal banks. Then, the core of our analysis will exploit the different stages of financial deregulation towards full-scale universal banking to identify the effect on different measures of firm-level volatility and TFP, using data on loan transactions and IPOs. Last, we discuss the explanatory power of universal-bank finance, using our transaction-based estimates, for the total rise in firm-level volatility and TFP among U.S. public firms.

5 Results

5.1 Cross-selling by Universal Banks

A crucial assumption of our model in Section 3 is that the option of universal banks to cross-sell financial products supports their capacity to finance riskier firms. Cross-selling is typically organized as follows. Bank managers cover different firms, and are responsible for placing not only standard investment-banking services (such as M&A advisory) or capital-market products, but also large hedging positions, event-driven hedging, and pension- or tax-related structured products. Conversely, loans are granted upon approval by a credit committee that weighs the costs and benefits. Credit costs amount to refinancing costs for the bank, which possibly exceed interest-rate payments under loan agreements. In order to render the loan a positive-NPV project for the bank, the credit committee evaluates the cross-selling potential for the loan-seeking firm. Loans are, thus, often granted on the basis of high expected depth of cross-selling.

Bharath, Dahiya, Saunders, and Srinivasan (2007) provide ample evidence of cross-selling of loans and non-loan products (fee-generating services) such as debt and equity underwriting.[10] We complement their findings with evidence of universal banks' cross-selling not only loans and underwriting, but also M&A advisory services. The latter can be understood to be less functionally related to loan financing (than debt and equity underwriting), while potentially refining the bank's information on the firm with which it has a lending relationship.

We discuss the detailed evidence in the Appendix, alongside supplementary tables. Our results can be summarized as follows. First, there is cross-selling of loans and M&A advisory. Second, contingent on receiving a loan from a universal bank, a firm is at least 20% more likely to have run its IPO through the same universal bank if that universal bank also serves as an M&A advisor at some point during the bank-firm relationship. We conclude by noting that the extant empirical evidence (e.g., Bharath, Dahiya, Saunders, and Srinivasan (2007)) in conjunction with our findings attests to the broad scope of cross-selling by universal banks. That finding supports this paper's underlying rationale that the moral-hazard cost advantages across financial products boost risk taking in lending relationships.

5.2 Impact of Universal Banking on Firm Risk: Evidence from Loan Data

We now turn to the estimation results using the DealScan data. In Table 2, we use as a firm-level measure of risk the six-year sales-growth volatility $\sigma(\widehat{sales_i})^{t,t+5}$ starting in the year of the loan transaction, t. In the first and second columns, we estimate specifications (4) and (6) without bank fixed effects, respectively. While in the first column, we find a risk-increasing effect only for firms

[10] Somewhat more specialized in the scope of their analysis, Drucker and Puri (2005) and Yasuda (2005) examine the relationship between past lending relationships and seasoned equity offerings and debt underwriting, respectively.

financed by universal banks established through M&A – amounting to over one-fifth of a standard deviation – the decomposition according to the 1996 deregulation in the second column reveals that both treatment groups, universal banks formed through M&A and Section 20 subsidiaries alike, respond in the hypothesized manner.

The estimates for universal banks formed through M&A in the second column indicate that for those banks established before August 1, 1996, firm risk did not go up until the firewalls were reduced. Overall, the effect of these treated universal banks and those formed through M&A after 1996 on firm risk is not significantly different from zero, as can be inferred from the sum of the coefficients on $UB\ through\ M\&A_{jt} \times Est.(1996)_j \times After(1996)_t$ and $UB\ through\ M\&A_{jt} \times Est.(1996)_j$. The (negative) sum of these coefficients can be interpreted as the potential bias of estimated risk for firms financed by universal banks that are active after August 1, 1996, i.e., whose risk taking is (more) likely to be endogenous to the respective financial deregulation.

Turning to Section 20 subsidiaries, we find an almost identical intercept effect for $UB\ through\ Section\ 20_{jt}$ as for $UB\ through\ M\&A_{jt}$. Additionally, the 1996 deregulation has a strikingly similar effect on risk taking by universal banks established through Section 20 subsidiaries prior to August 1, 1996. For Section 20 subsidiaries, the potential bias is measured by the sum of all four coefficients on the interaction effects, which is – again – insignificantly different from zero. Most importantly, we find that only the treated group, which we characterize by their IPO activity before and after August 1, 1996, responded to the deregulation: the coefficient on $UB\ through\ Section\ 20_{jt} \times Treated(1996)_j \times After(1996)_t$ is significantly positive, whereas that on $UB\ through\ Section\ 20_{jt} \times Est.(1996)_j \times After(1996)_t$ is indistinguishable from zero. That is, universal banks established through Section 20 subsidiaries financed riskier firms following the 1996 deregulation only if they were active in both lending and equity underwriting prior to and immediately after that date. This strengthens the evidence for our alleged mechanism that the 1996 deregulation constituted an exogenous shock to the universal banks' ability to realize economies of scope across loans and underwriting, thereby enabling them to finance riskier firms.

Increased risk taking as a response to the 1996 deregulation by universal banks established before 1996 need not be inconsistent with the behavior of banks that are *too big to fail.* To disentangle the two explanations, there are two considerations that may affect our results. Banks either grow in size – e.g., through M&A – to become too big to fail, or at the time that they are already large universal banks – and, thus, too big to fail – insurance may be strengthened, inducing higher risk taking by universal banks. The former explanation is precluded by the fact that the last universal bank to be established through a merger or an acquisition prior to August 1, 1996 in our data set (cf. Table 1) is Travelers Group (now Citigroup), through its merger with Smith Barney on December 31, 1993 – almost three years prior to the reduction of firewalls. Thus, it is unlikely that the treated banks acted in anticipation of the deregulation, or that we capture increased risk taking around the year 1996 by banks that actually did merge in order to become too big to fail. In this regard, note that we distinguish universal banks by their *mode of establishment* (Section 20 subsidiary or M&A). There was, however, a wave of mergers after 1996, not many of which (only two in our loan data) marked a widening of the banking scope for the parties involved, because already established universal banks engaged in these mergers.

This leaves us with the possibility that existing universal banks, particularly the largest ones, increased their risk taking after 1996 due to reasons unrelated to the expanding scope of banking activities. To scrutinize this, we re-run the regressions from the first, second, and fourth columns of Table 2 for all transactions except for those by the five and ten largest universal banks. The results are reported in the first and last three columns, respectively, of Table C.4, and indicate that our findings are clearly robust.

Finally, one may argue that bank size approximates for lower interest rates charged by banks that are too big to fail. That is, borrowers potentially experience benefits in the form of lower cost of borrowing from (large) universal banks. As a consequence, firms would receive debt in a manner that is risk-insensitive. While risk should be positively correlated with charged interest rates under loan contracts with both commercial and universal banks, the too-big-to-fail hypothesis implies that lower interest rates affect firm risk differentially for commercial vs. universal banks. Then, if we limit the sample to firms that receive lower interest rates, the difference in firm risk associated with loans granted by universal banks as opposed to commercial banks should *increase*.

What constitutes a lower interest rate should be defined at the firm level. As a first pass, we use the average loan spread charged to each firm by both universal and commercial banks.[11] Then, we limit the sample to loans for which firms are charged spreads that are below or equal to their (firm-level) average spread on loans provided by universal and commercial banks. In Table C.5, we re-run all regressions from Table 2 on this new subsample. The estimates are virtually unchanged. This runs counter to the too-big-to-fail hypothesis, under which we would have expected the coefficients on the universal-bank indicators to increase.

Another way of controlling for such stories as banks trying to become too big to fail is to include bank-year fixed effects, which absorb the variation in the size of universal banks. However, including bank-year fixed effects in our regressions would force the identification of our treatment effects to come from within-year rather than between-year variation in firm risk associated with loans provided by universal banks. For this reason, we typically include bank fixed effects in our regressions, but also run specifications with bank-year fixed effects as a robustness check. After including bank(-year) fixed effects, $Eventually\ UB\ through\ M\&A_{jt}$ and $Eventually\ UB\ through\ Section\ 20_{jt}$ drop out. In the third column of Table 2, we include bank-year fixed effects, and while the risk-increasing effect for Section 20 subsidiaries is imprecisely estimated, it is not significantly different from that for universal banks established through M&A, which is significant and larger than the respective coefficients in the first two columns.

In the fourth column of Table 2, we estimate regression specification (6) with bank fixed effects. All insights from the second column carry over, including any insignificance of the two biases. That is, the average post-1996 sales-growth volatility of firms associated with loans granted by treated universal banks established through M&A or through a Section 20 subsidiary before 1996 is not significantly different from that of firms associated with loans granted by universal banks established after 1996.

Given that our model ties universal-bank contracting to a firm's investment opportunities, we also run specification (6) on the subset of loans that are most likely related to investments affecting sales. In the last column of Table 2, we limit the sample to loans that are not associated with any corporate financial restructuring (e.g., recapitalization).[12] The estimates are very similar to those in the fourth column, except that the firm risk associated with transactions of universal banks established through M&A before August 1, 1996 is higher than that associated with transactions of universal banks established through M&A thereafter. Indeed, the sum of the coefficients on $UB\ through\ M\&A_{jt} \times Est.(1996)_j \times After(1996)_t$ and $UB\ through\ M\&A_{jt} \times Est.(1996)_j$ is *positive* and significant at the 8% level. In this manner, the total risk-increasing effect for universal banks established through M&A before August 1, 1996 amounts to over one-quarter and over one-half of a standard deviation before and after the deregulatory shock, respectively.

Using these estimates, we can validate our identification strategy. To this effect, we can illustrate

[11] The corresponding variable in DealScan is "All in Spread Drawn" (Ivashina (2009)).

[12] We restrict the sample to loans with the following purposes in DealScan: "Acquis. line," "Aircraft finance," "Capital expend.," "Corp. purposes," "CP backup," "Cred Enhanc," "Debt Repay.," "Equip. Purch.," "ESOP," "Lease finance," "Merger," "Project finance," "Purch. Hardware," "Real estate," "Securities Purchase," "Ship finance," "Spinoff," "Takeover," "TelcomBuildout," and "Trade finance."

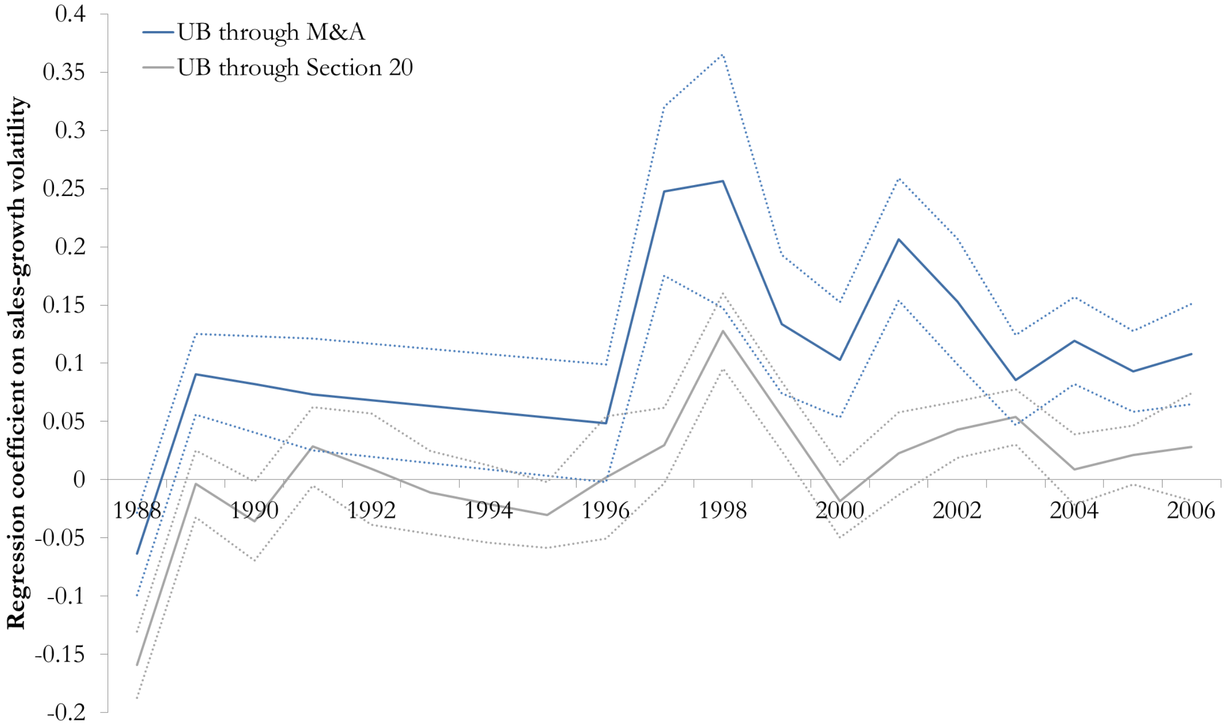


Figure 4: **Impact of Financing by Treated Universal Banks Established Before August 1, 1996 on 6y [t,t+5] Sales-growth Volatility over Time (1988-2006).** Regression coefficients are based on the specification in the fourth column of Table 2, and error bars correspond to one standard error.

that treated universal banks increase their risk taking only after the 1996 deregulation. Figure 4 plots the year-dependent total effects of all *treated* universal banks from the fourth column of Table 2 (with sales-growth volatility as the dependent variable).[13] That is, the omitted category comprises only commercial banks. Until 1996, most coefficients hover around zero, but are relatively stable starting in 1989. Thereafter, we note a surge in coefficients between 1996 and 1997 for Section 20 subsidiaries, and more clearly so for universal banks formed through M&A. Our estimates drop in or after 2000, and the gap to the pre-1996 estimates closes, at least for the Section 20 subsidiaries. Note that the sales-growth volatility in any given year t is calculated based on the sales data from years t to $t+5$, so even with a drop in coefficients since 2000, the contribution of universal banking to the rise in idiosyncratic risk is not short-lived overall.

Our identification assumption is that risk trends would be the same among non-treated universal banks and commercial banks that never become universal banks. The stability of the coefficients between 1989 and 1996 for treated universal banks in Figure 4 attests to this assumption. While in the case of universal banks established through M&A, we cannot observe their non-treated universal-bank counterparts, we do distinguish between treated and non-treated Section 20 subsidiaries based on equity-underwriting activity before the 1996 deregulation. Given their striking differences in the underwriting market, a potential concern may be that these Section 20 subsidiaries also differ in their lending behavior prior to 1996. To investigate this, in Figure 5 we plot the year-dependent total effects of both treated and non-treated Section 20 subsidiaries from the fourth column of Table 2 *up to the deregulation year 1996.* Except for 1988, in which non-treated Section 20 subsidiaries financed riskier firms, the pre-1996 trends for both groups are virtually overlapping.

[13] Note that due to the lower number of loans by universal banks established through M&A before 1996, we interpolate the coefficients for the years 1990 and 1992-1995.

Figure 5: **Impact of Financing by Section 20 Subsidiaries Established Before August 1, 1996 on 6y [t,t+5] Sales-growth Volatility over Time (1988-1996).** Regression coefficients are based on the specification in the fourth column of Table 2, and error bars correspond to one standard error.

Despite this supporting evidence, a relative weakness of our 1996-deregulation test for universal banks established through Section 20 subsidiaries is that the respective event is associated with two events, namely the removal of firewalls and the elevation of the revenue limit. We hypothesize the former to be of much less relevance for Section 20 subsidiaries than the latter. To strengthen this aspect of our identification, we can make use of the 1989 deregulation. On September 13, 1989, Section 20 subsidiaries were first allowed to generate 10% in revenues from underwriting corporate debt and equity. Until 1989, they could not underwrite corporate debt and equity, and the revenue limit was set at 5%. Section 20 subsidiaries treated under this deregulation are a subset – all but one – of the ones treated under the 1996 deregulation, as used in the previous regressions. In Table C.6, we re-run the regressions from the second, fourth, and fifth columns of Table 2 with both sets of interaction effects for the 1989 and 1996 deregulations and for different sets of transactions (excluding transactions since August 1, 1996 in the last two columns). The results unanimously point towards an increase in risk taking by Section 20 subsidiaries after 1989, as long as the respective universal banks indeed engaged in underwriting thereafter (cf. Figure 3). The parallel effects for Section 20 subsidiaries in 1989 and 1996 support our causal interpretation of the impact of the banking scope, as restrained by the revenue limits, on the banks' capacity to finance riskier projects.

Next, we scrutinize a more market-based measure of risk: six-year idiosyncratic risk as estimated from a Fama and French (1993) three-factor model, $\sigma^{t,t+5}_{idiosyncratic,i}$, for which we re-run all regression specifications from Table 2. The results are in Table 3, and are fairly similar to those for sales-growth volatility.

It appears that the bulk of increased risk taking in terms of idiosyncratic volatility is due to universal banks established before August 1, 1996. This holds particularly for Section 20 subsidiaries (cf. the significantly positive coefficient on $UB\ through\ Section\ 20_{jt} \times Est.(1996)_j$ in the fifth column of Table 3 and the general negativity of the coefficient on $UB\ through\ Section\ 20_{jt}$). Most importantly, universal banks that we characterize as treated under the 1996 deregulation according to their organizational form financed significantly riskier firms after August 1, 1996. Across the estimates in the second, fourth, and fifth columns, the economic magnitudes of the respective interaction effects $UB\ through\ M\&A_{jt} \times Est.(1996)_j \times After(1996)_t$ and $UB\ through\ Section\ 20_{jt} \times Treated(1996)_j \times After(1996)_t$ correspond to at least one-quarter of a standard deviation.

Overall, our estimates in Tables 2 and 3 lend support to the idea that universal-bank financing has a positive impact on firm risk, irrespective of whether we measure the latter as sales-growth or idiosyncratic volatility. The risk-increasing effect is economically significant, and responds to variations in the scope of banking activities, such as cross-selling, as was the case under the 1996 deregulation.

To show that cross-selling opportunities, which are correlated with the size of the bank's operations, are the primary characteristic distinguishing Section 20 subsidiaries from universal banks established through M&A, we collected key summary statistics for the respective bank-holding companies a year before to a year after becoming universal banks. As Table C.3 shows, universal banks established through M&A are typically larger than Section 20 subsidiaries. Such mergers constitute one-time increases in total assets, net income, cash flow (approximated by EBIT), and the number of employees, whereas Section 20 subsidiaries grow more continuously over time.[14] Most importantly, both types of universal banks are strikingly similar in their equity-to-assets and cash-to-assets ratios. That is, higher risk taking by universal banks established through M&A cannot be readily explained by a different leverage position or excess cash. Loan-to-assets ratios are somewhat higher for universal banks formed through Section 20 subsidiaries, as investment-banking operations are a smaller portion of the business model.

So far, we have limited our analysis to loan-transaction-level data, thereby measuring average increases in firm risk *in the (total) portfolio of all universal banks.* However, our motivational evidence stemming from Figure 1 is chiefly based on the observation that the average volatility across *all* public firms has increased in the U.S., particularly during the 1990s.

In order to evaluate how the shift in firm risk in the portfolios of universal banks documented so far can account for the overall increase in volatility of public firms in the U.S., we estimate the *within-firm* effects of universal-bank financing, to which we turn next.

5.3 Contribution of Universal-bank Financing to Increasing Firm Risk in the U.S.

In Tables 2 and 3, we have calculated our risk measures – sales-growth and idiosyncratic volatility – based on post-loan data. Yet, this does not preclude that what is driving the increase in average risk taking by universal banks is simply a reallocation of funds towards *generally riskier* firms, rather than firms that receive universal-bank financing embarking on riskier projects. To scrutinize whether firms actually become riskier through universal-bank financing, regardless of how risk-taking they are at the outset, we merge our loan data with the Compustat panel, and include firm fixed effects in our extant specifications:

[14] Note that two universal banks established through M&A are missing because their bank-holding companies are international. Furthermore, we did not include Section 20 subsidiaries for which the data do not cover all three time periods; i.e., we dropped Section 20 subsidiaries that were established right when the data are available (1987) or that were eventually acquired by other banks.

$$
\begin{aligned}
outcome_{it} \quad = \quad & \beta_1 UB\ through\ M\&A_{jt} + \beta_2 Eventually\ UB\ through\ M\&A_j \\
& + \beta_3 UB\ through\ Section\ 20_{jt} + \beta_4 Eventually\ UB\ through\ Section\ 20_j \\
& + \beta_5 Only\ CB\ Financing_{jt} + \beta_6 X_{ijt} + \psi_i + \mu_t + \epsilon_{ijt} \qquad (8)
\end{aligned}
$$

or, after including bank fixed effects,

$$
\begin{aligned}
outcome_{it} \quad = \quad & \beta_1 UB\ through\ M\&A_{jt} + \beta_2 UB\ through\ Section\ 20_{jt} + \beta_3 X_{ijt} \\
& + \psi_i + \mu_t + \lambda_j + \epsilon_{ijt}, \qquad (9)
\end{aligned}
$$

where $outcome_{it}$ is the natural log of an outcome variable (e.g., sales-growth volatility) at the firm-year level, $UB\ through\ M\&A_{jt}$ and $UB\ through\ Section\ 20_{jt}$ are indicator variables for whether in any transaction j during year t any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary, $Eventually\ UB\ through\ M\&A_j$ and $Eventually\ UB\ through\ Section\ 20_j$ are indicator variables for whether in any transaction j during year t any one of the lead arrangers at *any point in time* is a universal bank formed through a merger or through opening a Section 20 subsidiary, $Only\ CB\ Financing\ 20_{jt}$ is an indicator variable for whether, given any loan transactions in year t, none of them are arranged by commercial banks that eventually become, or already are, universal banks, X_{ijt} denotes time-varying characteristics of the borrowing entity i and of the originated loan j, ψ_i and μ_t are firm and year fixed effects, respectively, and λ_j denotes bank fixed effects, which we include for *all* lead arrangers of loans j in year t that are or eventually become universal banks (whereas all remaining commercial banks are grouped together).

In Table 4, we run specifications (8) and (9), and use as the dependent variable the natural logarithm of the firm's six-year sales-growth volatility $\sigma(\widehat{sales_i})^{t,t+5}$. Throughout the first three columns, universal-bank financing is generally associated with substantial within-firm increases in sales-growth volatility ranging from 7 to 11%, which tend to be larger for years in which a firm receives financing from universal banks established through M&A rather than through opening a Section 20 subsidiary. A potential rationale for the differential effect might be the very reason why we hypothesize that universal banks can finance riskier firms: the scope of banking activities increases more as a consequence of M&A – e.g., when a commercial bank acquires a full-service investment bank – than it does through Section 20 subsidiaries, as the latter typically engage exclusively in underwriting. Underwriting is only one of many facets of investment-banking business, however.

The estimates in Table 4 confirm that, after controlling for firm fixed effects, firms embark on riskier projects after receiving universal-bank financing. We argue that the bank's increased capacity to finance riskier projects is a consequence of its expansion into investment-banking services, aiding the bank's cross-selling strategy. The latter is subject to exogenous shocks, such as the 1996 deregulation. To use the resulting variation in the intensity of bank-firm relationships, we can determine whether – at least within the scope of the data sets employed in this paper – a bank is in a cross-selling relationship with a firm, which we incorporate in the following specification:

$$
\begin{aligned}
outcome_{it} \quad = \quad & \beta_1 UB\ through\ M\&A_{jt} + \beta_2 UB\ through\ M\&A_{jt} \times Cross-selling_{ij} \\
& + \beta_3 UB\ through\ Section\ 20_{jt} + \beta_4 UB\ through\ Section\ 20_{jt} \\
& \times Cross-selling_{ij} + \beta_5 X_{ijt} + \psi_i + \mu_t + \lambda_j + \epsilon_{ijt}, \qquad (10)
\end{aligned}
$$

where $Cross-selling_{ij}$ is an indicator variable for whether, during the entire bank-firm relationship, the firm receives another loan, M&A advisory services, or its IPO from the same universal bank that is a lead arranger for any loan in year t, and the remaining variables are defined as above (cf. equation 9).

We run the respective regressions in the last two columns of Table 4, and find that the risk-increasing impact is contingent on cross-selling for universal banks established through M&A, but not for Section 20 subsidiaries. The effect for the former category of universal banks amounts to an increase in sales-growth volatility by up to 15% – i.e., roughly 50% larger than in the first three columns – whereas the total effect for Section 20 subsidiaries remains robust in magnitude. The fact that $\beta_3 + \beta_4$ in the last two columns is roughly equal to the coefficient on $UB\ through\ Section\ 20_{jt}$ in the second and third columns of Table 4 hints at the idea that cross-selling is very prevalent even among Section 20 subsidiaries. Furthermore, we include firm age on the right-hand side of the specification in the last column in order to control for the time span during which a universal bank could establish a cross-selling relationship with the firm (whereas in our regressions, the lower risk associated with more mature firms appears to be captured entirely by the firm's sales).

Up to this point, we have considered only risk measures as outcome variables. We next turn to the question as to whether the additional risk is rewarded by higher productivity of universal-bank-financed firms. To test this, we use the regression specifications from Table 4, with the natural logarithm of firm-level TFP one year after loan issuance as the dependent variable. The results in Table 5, across all columns, attest to the idea that universal-bank finance, regardless of how the universal bank is formed, has a positive impact on TFP. In the first three columns, financing from universal banks established through M&A is associated with 4 to 7% higher TFP levels one year after loan issuance, and financing from Section 20 subsidiaries is associated with up to 3% higher TFP levels. As before, the effect for universal banks established through M&A ranks higher than that for Section 20 subsidiaries.

Most notably, the interaction effects with cross-selling in the last two columns of Table 5 are significant for both forms of universal banks, implying up to 7% higher TFP levels after years in which a firm receives financing from a universal bank established through M&A or through opening a Section 20 subsidiary. While it is less of a concern for the firm's sales-growth volatility, one might argue that cross-selling of M&A advisory services leads to higher TFP levels through the sole fact of the firm's participation in a merger. Our cross-selling measure precludes this for two reasons. First, we pool all M&A events – whether a firm is the acquirer or the target, whether the deal goes through or fails, and despite the potentially differential effects on firm-level outcomes. Second, $Cross-selling_{ij}$ is a time-invariant measure characterizing the *entire* bank-firm relationship, whereas one would expect mergers to impact firm-level outcomes only around the time of the execution. If firms making use of many loans and M&A advisory services are generally riskier or more productive, then this should be absorbed by the firm fixed effects. To account for the possibility that a related effect occurs only in the year of the respective transaction, we include cumulative loan and M&A transaction volumes for firm i on the right-hand side of the specifications in Table C.7. The cross-selling interaction effects remain robust.

Furthermore, to demonstrate that the documented TFP growth is not temporary, we re-run the regressions from Table 5 for $\ln(TFP_i^{t+4})$ rather than $\ln(TFP_i^{t+1})$, and we witness in Table C.8 that the TFP-increasing effect of financing from universal banks established through Section 20 subsidiaries is even stronger in the longer run. However, the respective effect for universal banks established through M&A becomes weaker and is imprecisely estimated, while the signs are preserved.

Altogether, our results suggest that higher sales-growth and idiosyncratic volatilities are compensated for by higher productivity of firms that receive loans from universal banks, indicating that universal-bank-financed projects are positive NPV albeit riskier. That is, within the scope of our loan data, we have established a positive risk-return relationship by exploiting the shift in firm-level risk induced by the rise of universal banking.

The evidence discussed so far indicates that universal-bank finance can, in general, contribute to the overall rise in firm risk and productivity, because we have shown that financing from universal rather than commercial banks is associated with within-firm increases in sales-growth volatility and TFP. This renders it unlikely that our results in the loan data (cf. Tables 2 and 3) are driven exclusively by universal banks reallocating funds to previously less heavily funded (or even unfunded) riskier firms. Pure reallocation of funds towards riskier (public) firms would severely dampen the explanatory power of universal-bank finance for the observed rise in firm-level volatility and TFP in the U.S. during the 1990s: those firms could have been public for many years, which would also contribute to the level of firm risk *before* the rise of universal banking.

To further solidify this point, we limit the Compustat sample to: (i) firms that never receive universal-bank financing; and (ii) firms that receive loans from universal banks, but only from banks that they also interacted with when those were still commercial banks. That is, we drop all firms from the sample that receive loans from a bank only when it is a universal bank but not when it was still a commercial bank. This sample has two main characteristics. First, the universal-bank-financed firms in the sample are clients of commercial banks before they become universal banks and, thus, take the change in the banks' organizational form as given, which aids our identification. In this sample, 21% of the firms receive loans from *a single universal bank*, which attests to the depth of relationship banking. Second, we conservatively drop all firms that obtain financing only from universal banks (beyond trivial reasons such as their founding date), which form the core of the firms affected by a potential reallocation of funds through universal banking.

In Table 6, we re-run the regressions from the second, third, and fifth columns of Tables 4 and 5 on the new subsample of firms. On the one hand, the coefficients on $UB\ through\ M\&A_{jt}$ and $UB\ through\ Section\ 20_{jt}$ are somewhat larger than in Tables 4 and 5, and remarkably so for the impact of $UB\ through\ M\&A_{jt}$ on sales-growth volatility. On the other hand, the interaction effects with $Cross-selling_{ij}$ are, in part, smaller than in Tables 4 and 5. Taken together, we find no clear evidence that dropping firms that were potentially excluded from financing prior to the era of universal banking increases our estimates. This would imply that the risk-increasing impact of universal-bank financing is weaker for those firms. In that case, the generally risky nature of their business could have kept them from contracting with commercial banks. The findings in Table 6 do not warrant such a conclusion and, therefore, lend support to our hypothesis that universal-bank finance enables firms – old and new clients of (eventual) universal banks alike – to invest in riskier projects.

Development of Firm-level Volatility since 2000

The previous analysis substantiates the relevance of universal-bank finance for the overall rise in firm-level volatility in the U.S.: firms increased their risk through universal-bank finance, and we have accumulated evidence that this change in the nature of operations would not have been possible in the absence of universal banking. Moreover, universal banks appear to nurture their existing client base, and do not primarily reallocate funds towards generally riskier firms. These observations may imply that universal-bank finance can explain a significant portion of the overall rise in firm volatility, as depicted in Figure 1.

As the figure shows, sales-growth volatility – unlike TFP – drops after 2000, before it resurges in the wake of the subprime crisis. The continuous rise in firm volatility prior to 2000, documented by Campbell, Lettau, Malkiel, and Xu (2001), has been attributed to different causes, many of which are consistent with our observations about universal banking – e.g., increased institutional ownership (Bennett, Sias, and Starks (2003); Xu and Malkiel (2003)) or the higher risk of newly listed companies (Brown and Kapadia (2007)[15]). However, using more recent stock-price data, Brandt, Brav, Graham, and Kumar (2010) point out that idiosyncratic volatility has fallen since the late-1990s surge, with a breakpoint around April 2000. Furthermore, the authors argue that both the increase in idiosyncratic volatility through the 1990s and the more recent reversal are partly due to retail trading. Zhang (2010) challenges this view, attributing the reversal to fundamentals-based variables rather than trading activity.

Our explanation, the rise of universal banking, should be held against the standard of explaining the different time-series behavior of firm volatility before and after 2000. As witnessed in Figure 4, the risk-increasing impact of universal-bank financing dampened after 2000. We next provide evidence that this development can be explained, in part, by life-cycle characteristics of firms in extant universal-bank relationships rather than just by a (negative) supply shock of risky projects in the economy.

The results based on the loan data can be driven by a composition effect – i.e., if universal banks lend to less risky firms over time, or if the projects in which firms can invest become less risky (negative supply shock of risky projects). As before, we turn to the merged Compustat-DealScan data to include firm fixed effects and, thus, measure the within-firm effects of universal-bank financing on sales-growth volatility. In Tables 4 to 6, we found a risk-increasing effect even after controlling for firm fixed effects, which runs counter to the idea of a composition effect driving our cross-sectional evidence. Our alternative hypothesis – as opposed to a negative supply shock of risky projects – for a weaker risk-increasing effect over time is that many loans since 2000 are not the first kind of universal-bank interaction that firms experience. Following a concavity argument, if universal-bank financing leads to within-firm increases in risk, as documented in this paper, then this effect might be weaker for firms that are mature and have been financed by universal banks for a longer period of time. Note that this argument does not hinge on receiving multiple loans from the *same* universal bank over time.

To test this hypothesis, we interact our universal-bank dummies with a measure that captures the number of years a firm has already been financed by universal banks relative to its maturity. To this end, we define $Years\ ratio_{ijt} = \frac{Years\ since\ first\ UB\ loan_{ijt}+1}{Age\ at\ IPO_i}$, which is non-zero only for years in which at least one of the dummy variables $UB\ through\ M\&A_{jt}$ and $UB\ through\ Section\ 20_{jt}$ is equal to one.[16] To capture the firm's maturity with respect to universal-bank relationships in year t, we use the firm's age at the time of its IPO, which we have shown to be a starting point for initiating universal-bank relationships (and we cannot observe the relationship before the IPO). Thus, $Years\ ratio_{ijt}$ takes on a high value if, compared to its IPO age, firm i has become relatively old since its universal-banking initiation.

We conjecture that the impact of $Years\ ratio_{ijt}$ on sales-growth volatility will be negative. This has the potential to explain the dampening of the risk coefficients depicted in Figure 4 since, by the year 2000, most firms accumulated multiple years of experience with universal-bank financing. Then, even if the supply of risky projects in the economy has not necessarily gone down, firms that receive universal-bank financing and, thus, invest in riskier projects for the first time, should be outnumbered. To see this, one can compare the means of $Years\ ratio_{ijt}$ in our DealScan sample before and after 2000. As the variable is non-zero only for universal-bank loans, we focus on the latter, and find that the mean increases noticeably from 0.22 (with a standard deviation of 0.57) before 2000 to 0.38 (with a standard deviation of 1.32, in part due to a smaller sample) since 2000. This difference cannot be explained solely by different IPO ages of firms receiving loans before vs. after 2000, as the average values for the numerator of $Years\ ratio_{ijt}$ exhibit a similar relation: 2.13

[15] The authors also conjecture in their concluding remarks that the financing of riskier companies could explain high levels of productivity and innovation, which reflects the essence of our main findings.

[16] We augment the numerator by 1 for the case that $Years\ since\ first\ UB\ loan_{ijt} = 0$ in order to avoid confusion with years in which firm i does not receive any universal-bank financing.

(with a standard deviation of 2.23) before 2000 vs. 5.57 (with a standard deviation of 5.60) since 2000. Both differences are significant at the 1% level. Note that the numerator of $Years\ ratio_{ijt}$ is augmented by 1, so universal-bank loans before 2000 were, on average, issued around 1.13 years after the respective firm's first universal-bank loan. Indeed, 53% of the firms in our sample received their first universal-bank loan by 1998, 75% by 2002, and 95% by 2007.

In Table C.9, we re-run all specifications from Table 4 and from the third column of Table 6, and include the interaction effects $UB\ through\ M\&A_{jt} \times Years\ ratio_{ijt}$ and $UB\ through\ Section\ 20_{jt} \times Years\ ratio_{ijt}$, which are significantly negative throughout. In line with our hypothesis, firms that are relatively mature when they receive further universal-bank financing do not increase their risk as much as firms that receive a loan from a – and not necessarily the same – universal bank for the first time. Furthermore, the coefficients are robust to including $Cross-selling_{ij}$ in the last three columns of Table C.9, controlling for the possibility of multiple loans from *the same* universal bank driving the estimates.

Our results point to the idea that the dampening of the risk-increasing impact of universal-bank financing since 2000 is not exclusively due to a decreasing supply of risky projects in the economy. Instead, we show that by 2000, most firms had been in universal-bank relationships for multiple years, and that universal-bank loans later in the firm's life cycle are associated with less additional risk. Lastly, to strengthen the interpretation of our findings as supporting the partial reversal of the rise in firm volatility starting in 2000, we can test whether we find similar effects for TFP, which – unlike sales-growth volatility – increases further after 2000. In regressions unreported in this paper (but available upon request), using as dependent variables $\ln(TFP_i^{t+1})$ and $\ln(TFP_i^{t+4})$, the coefficients on $UB\ through\ M\&A_{jt} \times Years\ ratio_{ijt}$ and $UB\ through\ Section\ 20_{jt} \times Years\ ratio_{ijt}$ are either insignificantly different from zero or positive (for universal banks established through M&A). This further confirms our conjecture.

Quantification of Explanatory Power for Aggregate Rise in Sales-growth Volatility and Total Factor Productivity

Having shown that universal-bank finance has explanatory power for the time-series behavior of firm-level volatility before and after the peak around 2000, we now attempt to quantify the contribution to the rise in sales-growth volatility and TFP since 1989.

We proceed as follows. First, we drop all the firms in Compustat that are no longer public at the beginning of 1989, as well as public-service, energy, and financial-services firms, as we have done throughout the paper. Then, for each measure we determine the fraction of firms in Compustat (cf. Figure 1) covered in DealScan. For these firms, we determine the total number of loans at the bank-firm level (i.e., how many loans a firm received from a given universal bank over the years), and whether a firm also received an IPO or M&A advisory services from the same universal bank (in accordance with the definition of $Cross-selling_{ij}$). Using the estimates from the fifth column in Tables 4 and 5, one can calculate firm growth rates g_i of the six-year sales-growth volatility and (future) total factor productivity as follows (using as an example the coefficients from the fifth column in Table 5):

$$\begin{aligned} g_i = \quad & (1+0.005)^{total_i^{M\&A}-cs_i^{M\&A}} \times (1+0.028)^{total_i^{Section20}-cs_i^{Section20}} \\ & \times(1+0.005+0.063)^{cs_i^{M\&A}} \times (1+0.028+0.039)^{cs_i^{Section20}} - 1, \end{aligned}$$

where $total_i^{M\&A}$ and $total_i^{Section20}$ are equal to the total number of loans firm i received since going public from universal banks established through M&A and Section 20 subsidiaries, respectively, and $cs_i^{M\&A}$ and $cs_i^{Section20}$ denote the number of loans associated with a cross-selling relationship between firm i and universal banks established through M&A and Section 20 subsidiaries, respectively.

The following table displays the summary statistics for the equal-weighted growth rates.

Estimates used for g_i	Mean	Std. dev.	Min	Max	N
$\sigma(\widehat{sales_i})^{t,t+5}$	0.126	0.686	-0.008	18.286	4,505
TFP_i^{t+1}	0.062	0.277	0	9.364	5,419

The coefficients underlying the estimates come from Tables 4 and 5 for $\sigma(\widehat{sales_i})^{t,t+5}$ and TFP_i^{t+1}, respectively, and the unit of observation is the firm level.

We use different methods to weight the firms' growth rates. Besides calculating equal-weighted average growth rates, we use the firms' average market capitalizations $\overline{MVE_i}$ starting at the beginning of the DealScan data (1982), or in the earliest year available, to determine individual weights:

$$\overline{g_i}^{MVE} = \sum_{i=1}^{n} \left(\frac{\overline{MVE_i}}{\sum_{j=1}^{n} \overline{MVE_j}} \right) g_i,$$

where $\overline{MVE_i} = \frac{1}{T} \sum_{t=1}^{T} MVE_{it}$, MVE_{it} is firm i's market value of equity at the end of year t, $t = 1$ denotes the year 1982 or the first available year thereafter, and T corresponds to either 2011 or the year firm i went private.

Last, for total factor productivity, one may apply a potentially more suitable weighting scheme – namely, the one proposed by Domar (1961), which we adopt by weighting each firm's growth rate g_i by the ratio of its gross output (sales) to aggregate value added (GDP). The underlying rationale is to capture two effects of a change in sectoral factor efficiency: a direct effect on an industry's output and an additional effect on intermediate deliveries that, in turn, increases output in other industries. As a consequence, the sum of Domar weights is greater than one. We operationalize the Domar aggregation rule for our productivity growth rates as follows:

$$\overline{g_i}^{Domar} = \sum_{i=1}^{n} \left(\frac{1}{T} \sum_{t=1}^{T} \frac{Sales_{it}}{GDP_t} \right) g_i,$$

where $t = 1$ denotes the year 1982 or the first available year thereafter, and T corresponds to either 2011 or the year firm i went private.

To assess the explanatory power for the total rise in firm risk among public firms in the U.S., we turn to the time series in Compustat (as used in Figure 1). The bulk of the increases in sales-growth volatility and TFP occurs during the 1990s. To be conservative, we identify and use as our baseline the *maximal increase over any time period since 1989*, separately for both measures and each weighting scheme. For instance, market-value-weighted sales-growth volatility increased by 73.2% – compared to 26.5% under equal weighting, which demonstrates the potential importance of the weighting scheme adopted – from 1993 to 2000. Using the respective weighting scheme, the average growth rate of firms' sales-growth volatility turns out to be 0.854 in DealScan, which covers 66.1% of the relevant firms in Compustat. Thus, the portion of the observed increase in sales-growth volatility that can be explained by universal-bank financing is (at least): $\frac{0.854 \times 0.661}{0.732} = 0.771$. Note that the adjustment for the fraction of Compustat firms not covered in DealScan is not necessary when using Domar weights for TFP, because the sums of the Domar weights in the numerator and the denominator (the baseline value from the time series) are not equal. The following table summarizes all results.

Sales-growth volatility	Equal-weighted	Value-weighted	
Maximal slope (years)	26.5% (1992-2000)	73.2% (1993-2000)	
Outcome variable	Fraction explained		
$\sigma(\widehat{sales_i})^{t,t+5}$	0.314	0.771	
Total factor productivity	Equal-weighted	Value-weighted	Domar
Maximal slope (years)	15.9% (1991-2000)	55.2% (1993-2008)	108.6% (1991-2008)
Outcome variable	Fraction explained		
TFP_i^{t+1}	0.260	0.487	0.398

While the explanatory power increases notably when we do not use equal weighting of firms, it is fairly robust to the different weightings for TFP. Also, note that the particularly striking increase in TFP of over 100% based on Domar weights is due to the fact that they add up to more than one for most years in the data (and a notable increase in TFP among public firms between 2007 and 2008). When using as point of comparison the increase in TFP from 1989 to 2008 reported by the Federal Reserve Bank of San Francisco (Center for the Study of Income and Productivity), 19.2 or 19.3% (utilization-adjusted TFP), the Domar-weighted growth rate among firms with loans is more than twice as high. This hints at the idea that productivity growth among private firms and in sectors dropped from our data set (public services, energy, and financial services) developed differently, and is possibly negative. Overall, the estimated within-firm effects of universal-bank financing can explain one-quarter to three-quarters of the observed increases in sales-growth volatility and TFP. Interestingly, the explanatory power for both measures is balanced within each weighting scheme.

5.4 Impact of Universal Banking on IPO Age

In this section, we show that the risk-taking behavior of universal banks documented in the loan data extends to their role as underwriters, and we use as an alternative risk measure the age of firms at the time of their IPOs.

The evidence from the loan data suggests that universal-bank-financed firms are riskier. Given that the firms in our analysis are publicly listed and, thus, mature, our findings imply that riskier firms have become more likely to endure and grow in the market due to the accommodation by universal banks. In order to round up the implications for the composition of publicly listed firms with respect to their riskiness *earlier in their life cycle*, we now analyze whether universal banks have contributed to *increased entry into the stock market* of risky firms. For this purpose, we use SDC IPO data in conjunction with additional data on firm age at the time of the IPO to test whether universal banks take younger firms – which, as Pastor and Veronesi (2003) argue, are typically riskier – public than other underwriters.

In Figure 6, we plot the market-value-weighted average age of firms at the time of their IPOs and the proportion of IPOs accompanied by universal banks (universal banks established through both M&A and Section 20 subsidiaries). We observe a negative correlation that is fairly strong after 1996. Note, also, that the IPO market share of universal banks soars around 1996 as well, which coincides with the Federal Reserve Board's elimination of firewalls within bank-holding companies, and the simultaneous elevation of the revenue limit on underwriting discussed before.

Given that commercial banks that are not yet universal banks cannot be bookrunners, we cannot implement the difference-in-differences approach from the previous analysis. Instead, we run the following specification:

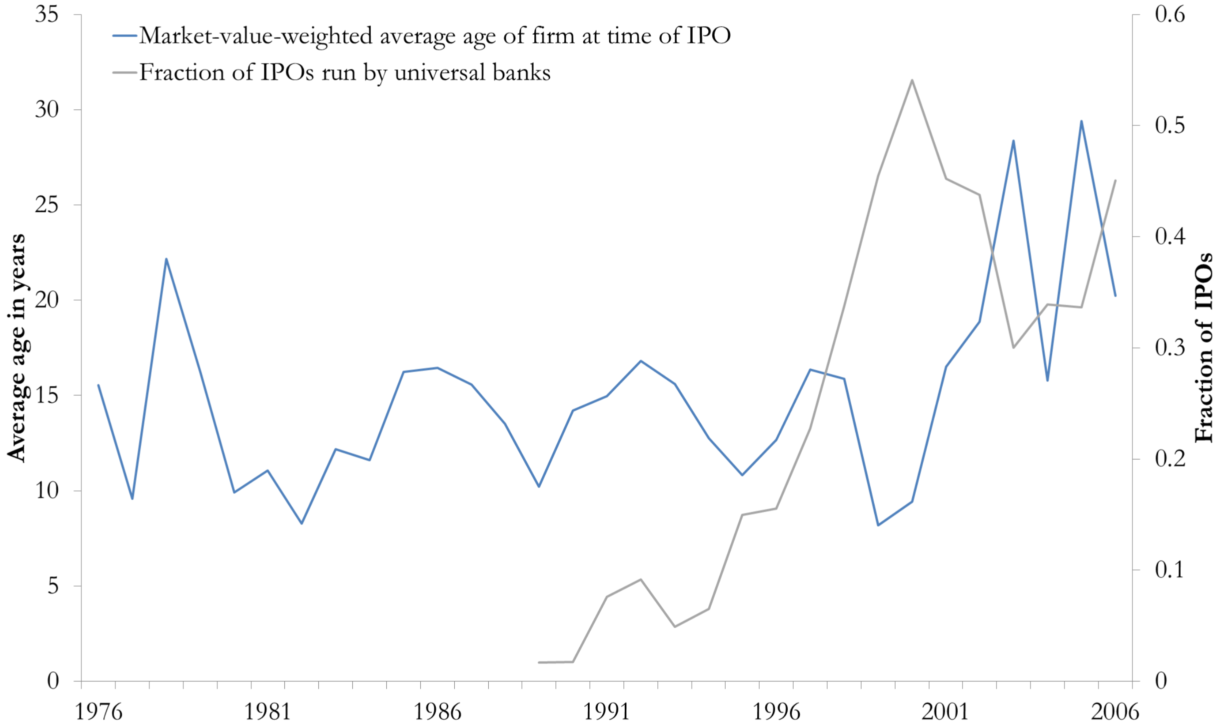


Figure 6: **Market-value-weighted Average Age of Firm at IPO vs. Fraction of IPOs run by Universal Banks (1976-2006).** Sources: own analysis based on SDC IPOs and data from Loughran and Ritter (2004) as well as Fink, Fink, Grullon, and Weston (2010).

$$\begin{aligned} IPO\ age_{ijt} &= \beta_1 UB\ through\ M\&A_j + \beta_2 UB\ through\ Section\ 20_j + \beta_3 Eventually \\ &\quad UB\ through\ M\&A_j + \beta_4 X_{ijt} + \beta_5 industry_i + \mu_t + \epsilon_{ijt}, \end{aligned} \tag{11}$$

where $IPO\ age_{ijt}$ is firm i's age in years at the time of the IPO, $UB\ through\ M\&A_j$ and $UB\ through\ Section\ 20_j$ are indicator variables for whether the bookrunner is a universal bank formed through a merger or through opening a Section 20 subsidiary, $Eventually\ UB\ through\ M\&A_j$ is an indicator variable for whether at *any point in time* the bookrunner, which used to be or still is an investment bank, becomes a universal bank through M&A, X_{ijt} denotes firm and IPO characteristics, and $industry_i$ and μ_t are industry and year fixed effects, respectively.

In the first two columns of Table 7, we run specification (11), and after controlling for firm and IPO-specific controls, we find no significant differences between universal-bank-run IPOs and those accompanied by investment banks, regardless of whether they eventually merged with commercial banks. We also observe that younger IPOs are compensated for by higher gross spreads: 1% for every 2.3 years.

Next, we use the 1996 deregulation as an exogenous shock to the scope of banking activities engaged in by universal banks, as we have done for loans, to examine whether universal banks established before that date take younger firms public following the deregulation. For this, we modify regression specification (11) in the following way:

$$\begin{aligned} IPO\ age_{ijt} \ = \ & \beta_1 UB\ through\ M\&A_j + \beta_2 UB\ through\ M\&A_j \times Est.(1996)_j \\ & \times After(1996)_t + \beta_3 UB\ through\ M\&A_j \times Est.(1996)_j \\ & + \beta_4 UB\ through\ Section\ 20_j + \beta_5 UB\ through\ Section\ 20_j \times Treated(1996)_j \\ & \times After(1996)_t + \beta_6 UB\ through\ Section\ 20_j \times Treated(1996)_j \\ & + \beta_7 UB\ through\ Section\ 20_j \times Est.(1996)_j \times After(1996)_t \\ & + \beta_8 UB\ through\ Section\ 20_j \times Est.(1996)_j + \beta_9 After(1996)_t \\ & + \beta_{10} Eventually\ UB\ through\ M\&A_j + \beta_{11} X_{ijt} + \beta_{12} industry_i + \mu_t + \epsilon_{ijt}, \quad (12) \end{aligned}$$

where $After(1996)_t$ is an indicator variable for whether the IPO was on or after August 1, 1996, $Est.(1996)_j$ is an indicator variable for whether a universal bank (through M&A or Section 20) was established prior to August 1, 1996, $Treated(1996)_j$ is an indicator variable denoting whether a universal bank established through a Section 20 subsidiary and actively underwriting securities prior to August 1, 1996 experienced a run-up in the number of IPOs and SEOs after that date, and the remaining variables are defined as above (cf. equation 11).

We estimate (12) in the third column of Table 7. The results mimic our findings in the loan data, as the coefficients on $UB\ through\ M\&A_j \times Est.(1996)_j \times After(1996)_t$ and $UB\ through\ Section\ 20_j \times Treated(1996)_j \times After(1996)_t$ are both significantly negative, reflecting younger and riskier IPOs. While the total effect of IPOs run by universal banks established through M&A before 1996 is indistinguishable from that of IPOs run by other investment banks (i.e., zero), universal banks established through M&A *after* 1996 accompany significantly younger IPOs (cf. negative coefficient on $UB\ through\ M\&A_j$). Note that the elimination of firewalls carries particular significance for the underwriting activities of universal banks established through M&A. Besides the increased scope for cross-selling, interaffiliate loans can be used to cross-finance riskier investment-banking operations.[17] An alternative explanation may be that commercial banks inherited the risk-taking properties of the smaller investment banks that they acquired or merged with. To control for this possibility, we include $Eventually\ UB\ through\ M\&A_j$ on the right-hand side. However, the respective coefficient is significantly larger (at the 1% level) than the coefficient on $UB\ through\ M\&A_j$, which renders this alternative unlikely.

Most notably, the sum of all five coefficients for Section 20 subsidiaries is equal to -6.3 years and significantly different (at the 1% level) from both zero and the coefficient on $Eventually\ UB\ through\ M\&A_j$. It also turns out that treated Section 20 subsidiaries take younger (significant at the 1% level) firms public after August 1, 1996 than do Section 20 subsidiaries established after that date. Just as in the loan data, once the scope of universal banks' activities widens, they take on more risk, here in the form of taking younger firms public. This time, we find a stronger effect for Section 20 subsidiaries, which can be argued is due to the fact that we consider IPOs, the core business and very reason for the establishment of Section 20 subsidiaries.

Finally, we consider an important competing explanation for the younger age of firms that are taken public by universal banks. Commercial banks entering the underwriting business as newly formed universal banks naturally lack a track record for IPOs. This may, in turn, force them to take younger firms public. That is, in an effort to build a track record, universal banks take young and particularly risky firms public – something that incumbent investment banks would not be likely to do.

To test for this possibility, we include interactions of $UB\ through\ M\&A_j$ and $UB\ through\ Section\ 20_j$ with $IPO\ count_{jt}$, which is equal to the number of IPOs accompanied by the respective universal banks, up to and including the IPO in question (of firm i with bookrunner j at time t).

[17] The Federal Reserve Act limits such loans to any single securities affiliate to 10% of a bank's capital.

If inexperience and lack of a track record were responsible for our findings, then one would expect the respective interaction effects to be positive, indicating that universal banks with an established track record of IPOs take older firms public. While the interaction effect for Section 20 subsidiaries is positive in the last column of Table 7, it fails to be significant. Furthermore, the interaction effect for universal banks established through M&A is not even positive, which goes against the prediction. Thus, we deem it unlikely that universal banks take younger firms public to start building a track record compared to their investment-bank competitors.

6 Macroeconomic Implications of Financial Deregulation: Income Inequality

Having shown how the rise of universal banking has contributed to an increase in firm-level volatility and productivity, we next discuss other important implications for aggregate outcomes. In particular, the efficiency gains of universal banking may contribute to growing income inequality, for they are accompanied by increasing firm risk. Figure 7 shows the close comovement of the income share accruing to the top 10% of the income distribution with firm-level sales-growth volatility beginning in the late 1980s, i.e., when the era of universal banking began. We view this as suggestive evidence of the importance of firm risk in driving the observed changes in income inequality over the last quarter century. We test this claim in a preliminary manner by analyzing state-level data on income inequality and matching them with our transaction-level data on loan issuance in the U.S. We find that the share of total funding that firms receive from universal banks has significant explanatory power for the observed variation in income inequality. In particular, when we consider income data disaggregated by occupation and education, universal banking is a driver of within-group inequality for entrepreneurs, workers with a high school education, and workers with a college education. Our empirical results, therefore, indicate that firm-level volatility, as instrumented for by the proliferation of universal banking, may affect the variation across the entire income distribution. We detail our empirical procedure below.

Our argument rests on the overall effect of universal banking on the composition of publicly listed firms with regard to their riskiness. First, with riskier firms in the equity market, entrepreneurs' business income varies more. Second, wages derived from riskier production processes will be more volatile as well (Comin, Groshen, and Rabin (2009)). Third, if households are not perfectly diversified, higher idiosyncratic risk, as documented in Table 3, leads to greater capital-earnings inequality. Indeed, a recent Congress report by Hungerford (2011) confirms that business-income and capital-earnings inequality were the most important drivers of the rise in income inequality in the U.S. between 1996 and 2006. Furthermore, economic theory provides solid underpinnings for the proposed link, as imperfect insurance against income risk is a prominent feature of many models with incomplete markets, limited commitment, or informational and search frictions. For example, an entrepreneur may be forced to refrain from holding a balanced portfolio to guard against moral hazard, and an employee in a frictional labor market with highly volatile firms may be forced to switch jobs more frequently and forgo the benefits of increased tenure. What is more, these approaches share a common feature: linking firm volatility to inequality through market frictions implies that we should see increased variation in *within-group* income distributions rather than in *between-group* income distributions.

Related to this section of our paper, Beck, Levine, and Levkov (2010) report a negative impact of branch deregulation on income inequality in the U.S. Note that this finding can, according to our line of reasoning, be reconciled with the volatility-stabilizing effect of interstate banking deregulation documented by Correa and Suarez (2009). Conversely, we demonstrate that the risk-increasing effect of universal banking has strong explanatory power for the rise in income inequality in the

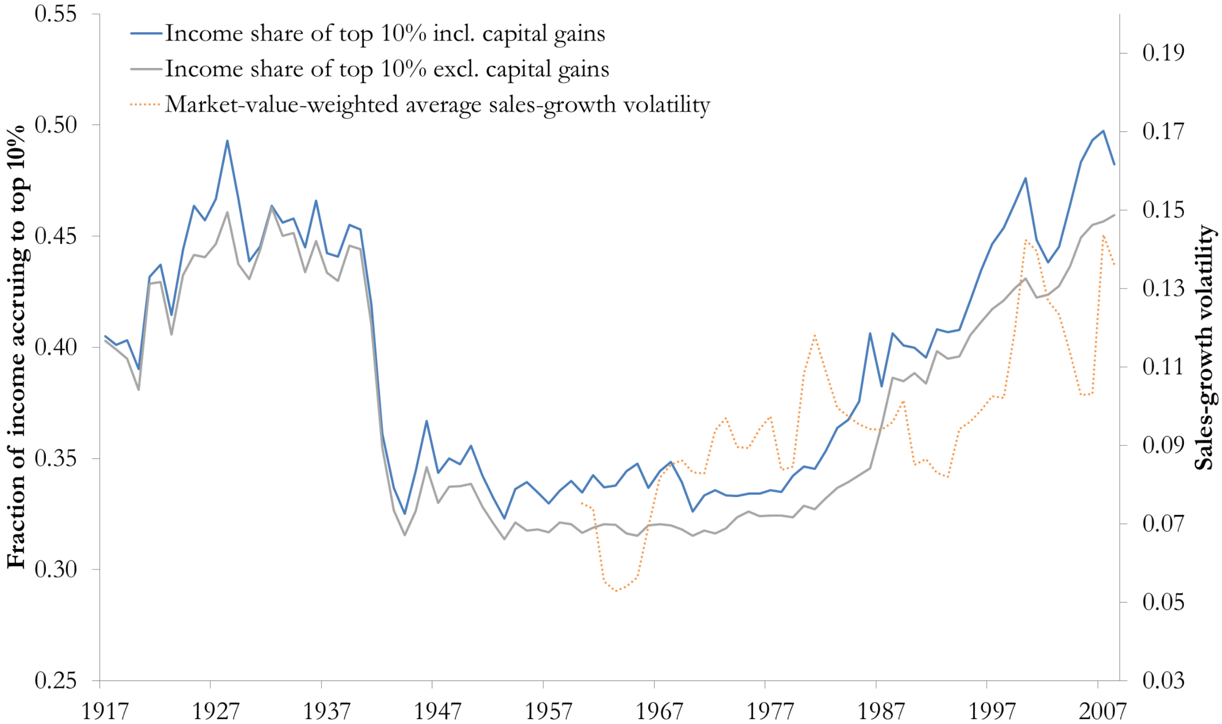


Figure 7: **Market-value-weighted Average 6y [t-3,t+2] Sales-growth Volatility vs. Income Inequality (1917-2008).** Sources: own analysis based on Compustat and updated tables from Piketty and Saez (2003).

U.S. More recently, Larrain (2012) focuses on wage inequality, and finds an increase in inequality following financial liberalization, particularly in industries characterized by strong capital-skill complementarity. Unlike these studies, we consider a different facet of financial deregulation: the removal of the barriers between commercial and investment banking, which we believe has a broader impact on income inequality – not just among salaried workers – by increasing the level of firm risk in the market.

Our analysis in this paper has revealed that universal banks lend to riskier firms more than pure commercial banks do, and that they take younger firms public more than investment banks do. If the level of firm risk is an important determinant of income inequality, we hypothesize that the proportion of loans granted by universal banks to firms in a given state increases income inequality therein. In order to test this, we use the income-inequality data prepared by Beck, Levine, and Levkov (2010), who report an inequality-reducing effect of branch deregulation. We use two of their original tables, and re-run the respective regression specifications by augmenting them with variables that reflect, in any given state and year, the proportion of loans by universal banks – formed through M&A or Section 20 subsidiaries – and by commercial banks that eventually become universal banks. In the spirit of our previous difference-in-differences estimation strategy, we run the following regression:

$$\begin{aligned} ineq_{st} \;=\; & \beta_1 Proportion\ UB\ M\&A_{st} + \beta_2 Proportion\ Eventually\ UB\ M\&A_{st} \\ & + \beta_3 Proportion\ UB\ Section\ 20_{st} + \beta_4 Proportion\ Eventually\ UB\ Section\ 20_{st} \\ & + \beta_5 X_{st} + \theta_s + \mu_t + \epsilon_{st}, \qquad (13) \end{aligned}$$

where $ineq_{st}$ is the natural logarithm of the Gini coefficient, the natural logarithm of the Theil index, or the natural logarithm of the ratio of the 90^{th} and 10^{th} percentiles of the total-income distribution, $Proportion\ UB\ M\&A_{st}$ and $Proportion\ UB\ Section\ 20_{st}$ are the fractions of the total loan amount provided to firms in state s and year t by syndicates with at least one lead arranger that is a universal bank formed through M&A or through opening a Section 20 subsidiary, respectively, $Proportion\ Eventually\ UB\ M\&A_{st}$ and $Proportion\ Eventually\ UB\ Section\ 20_{st}$ are the fractions of the total loan amount provided to firms in state s and year t by syndicates with at least one lead arranger that is a commercial bank that at *any point in time* becomes a universal bank formed through M&A or through opening a Section 20 subsidiary, X_{st} denotes time-varying characteristics of state s, and θ_s and μ_t are state and year fixed effects, respectively.

We match the income-inequality data of Beck, Levine, and Levkov (2010), based on the Current Population Survey (CPS), for each state and year with the loan data via the borrowing entities' location registered in the DealScan database. This method yields a time series from 1984 to 2006. Table C.10 presents our results, and corresponds to Table II in Beck, Levine, and Levkov (2010). States with a high proportion of loans granted by commercial banks that eventually become universal banks do not exhibit higher income inequality – irrespective of the inequality measure under consideration; however, as soon as the lending activity of actual universal banks takes off, so does income inequality. We find a strong effect of both universal banks formed through M&A and commercial banks with Section 20 subsidiaries.[18] For example, in the data, the proportion of loan amounts granted by universal banks formed through M&A surges from almost zero in the late 1980s to roughly 25% in the 2000s, and the proportion of loan amounts granted by commercial banks with Section 20 subsidiaries increases from 40% in the late 1980s to 70% in the 2000s. Under reasonable assumptions, which are verified in the data, $Proportion\ Eventually\ UB\ M\&A_{st}$ and $Proportion\ Eventually\ UB\ Section\ 20_{st}$ are relatively stable across time within states, so that β_1 and β_3 can be interpreted as difference-in-differences estimates.

Consider the development of the Gini coefficient. The (more conservative estimation in the) second column of Table C.10 suggests that the Gini coefficient increased by $(25\% - 0\%) \times 2.3\% + (70\% - 40\%) \times 1.2\% = 0.9\%$ from the late 1980s to the 2000s. In that time period, the Gini coefficient increased by 2.3% from 0.43 to 0.44. According to this calculation, the rise of universal banking and subsequent increase in firm risk potentially account for two-fifths of the increase in income inequality in the U.S. Similarly, the Theil index went up by 7.8% from 0.32 to 0.345, between the late 1980s and the 2000s. According to the estimates in the fourth column of Table C.10, universal banking implies an increase in income inequality by $(25\% - 0\%) \times 5.8\% + (70\% - 40\%) \times 2.4\% = 2.2\%$, thus accounting for approximately 30% of the increase in the Theil index.

No matter how striking these estimates may be, it is instrumental to seek evidence that the relationship between firm risk, which increased with the rise of universal banking, and income inequality takes on a form that is reasonable for such a link. To this end, we use the decomposition of the Theil index from Table IV in Beck, Levine, and Levkov (2010), and elucidate whether the effect of universal banking estimated in Table C.10 increases inequality within or between different employment groups, namely business owners and workers. Based on our proposed mechanism, we would expect increased variation in *within-group* rather than *between-group* income distributions. We also would expect both groups to be affected by the rise in income inequality due to increasing firm risk under universal banking. In Panel A of Table C.11, we find that the increase in inequality due to universal banking – based on both M&A and Section 20 subsidiaries – almost exclusively affects the within-group income distributions, whereas the change in between-group inequality is zero (cf. first three columns). In the last two columns, we decompose the increase in income inequality by employment groups, and find that the effect is accounted for by an increase in income inequality among both entrepreneurs and salaried workers. Note that while financing by universal banks established through M&A has a greater impact on inequality among entrepreneurs than on inequality among salaried workers, it is not statistically significant. An important reason for this

[18] Our results are robust to controlling for the total amount of loans provided to firms in state s and year t.

is that in the CPS data the self-employed account for only 9% of the sample.

In Panel B of Table C.11, we focus on salaried workers, again in correspondence with Table IV in Beck, Levine, and Levkov (2010), and we decompose the effect of universal-bank financing by education groups. Beck, Levine, and Levkov (2010) find that their inequality-reducing effect of branch deregulation is accounted for primarily by a reduction in inequality *within* the two education categories. One would not expect the inequality-increasing effect of universal banking to differ for educated vs. less educated workers, because an increase in firm risk should affect the wages of both types of workers in a similar fashion. Judging from the last two columns in Panel B of Table C.11, this is, once again, the case for the impact of universal banks established through M&A. Our results support the idea that income inequality did not rise solely on the basis of the income of risk-taking bank managers or other top earners, for that matter.[19]

7 Conclusion

This paper aims to establish a link between financial deregulation and rising firm-level volatility in the United States from 1989 to the present. We focus on a narrowly defined set of deregulatory events that paved the way for a financial system based on universal banking. We empirically establish that firms that obtain financing from universal banks are significantly riskier relative to those that obtain financing from commercial banks. Moreover, these firms are also more productive, attesting to the increased efficiency of financial intermediation. We also propose a stylized model of a financing relationship between a firm and a universal bank, on the basis of which one can assess general-equilibrium effects of universal banking, such as income inequality. As a first effort, we provide preliminary evidence that universal banking and the subsequent increase in idiosyncratic risk may have contributed substantially to the rising income dispersion in the U.S.

[19] This potentially explains the weaker effects of universal banking on the ratio of the 90^{th} and 10^{th} percentiles of the total-income distribution in the last two columns of Table C.10.

References

Amore, M. D., C. Schneider, and A. Zaldokas (2012): "Credit Supply and Corporate Innovation," *Copenhagen Business School & HKUST Working Paper*.

Ang, J. S., and T. Richardson (1994): "The Underwriting Experience of Commercial Bank Affiliates prior to the Glass-Steagall Act: A Reexamination of Evidence for Passage of the Act," *Journal of Banking & Finance*, 18(2), 351–395.

Barth, J. R., R. D. Brumbaugh, and J. A. Wilcox (2000): "Policy Watch: The Repeal of Glass-Steagall and the Advent of Broad Banking," *Journal of Economic Perspectives*, 14(2), 191–204.

Beck, T., R. Levine, and A. Levkov (2010): "Big Bad Banks? The Winners and Losers from Bank Deregulation in the United States," *Journal of Finance*, 65(5), 1637–1667.

Benfratello, L., F. Schiantarelli, and A. Sembenelli (2008): "Banks and Innovation: Microeconometric Evidence on Italian Firms," *Journal of Financial Economics*, 90(2), 197–217.

Bennett, J. A., R. W. Sias, and L. T. Starks (2003): "Greener Pastures and the Impact of Dynamic Institutional Preferences," *Review of Financial Studies*, 16(4), 1203–1238.

Bharath, S., S. Dahiya, A. Saunders, and A. Srinivasan (2007): "So What Do I Get? The Bank's View of Lending Relationships," *Journal of Financial Economics*, 85(2), 368–419.

Bhargava, R., and D. R. Fraser (1998): "On the Wealth and Risk Effects of Commercial Bank Expansion into Securities Underwriting: An Analysis of Section 20 Subsidiaries," *Journal of Banking & Finance*, 22(4), 447–465.

Brandt, M. W., A. Brav, J. R. Graham, and A. Kumar (2010): "The Idiosyncratic Volatility Puzzle: Time Trend or Speculative Episodes?," *Review of Financial Studies*, 23(2), 863–899.

Brown, G., and N. Kapadia (2007): "Firm-specific Risk and Equity Market Development," *Journal of Financial Economics*, 84(2), 358–388.

Campbell, J. Y., M. Lettau, B. G. Malkiel, and Y. Xu (2001): "Have Individual Stocks Become More Volatile? An Empirical Exploration of Idiosyncratic Risk," *Journal of Finance*, 56(1), 1–43.

Chava, S., and M. R. Roberts (2008): "How Does Financing Impact Investment? The Role of Debt Covenants," *Journal of Finance*, 63(5), 2085–2121.

Clementi, G. L., and H. A. Hopenhayn (2006): "A Theory of Financing Constraints and Firm Dynamics," *Quarterly Journal of Economics*, 121(1), 229–265.

Comin, D., E. L. Groshen, and B. Rabin (2009): "Turbulent Firms, Turbulent Wages?," *Journal of Monetary Economics*, 56(1), 109–133.

Comin, D., and S. Mulani (2009): "A Theory of Growth and Volatility at the Aggregate and Firm Level," *Journal of Monetary Economics*, 56(8), 1023–1042.

Comin, D. A., and T. Philippon (2006): "The Rise in Firm-Level Volatility: Causes and Consequences," in *NBER Macroeconomics Annual 2005, Volume 20*, pp. 167–228. National Bureau of Economic Research, Inc.

Cornett, M. M., E. Ors, and H. Tehranian (2002): "Bank Performance around the Introduction of a Section 20 Subsidiary," *Journal of Finance*, 57(1), 501–521.

Correa, R., and G. A. Suarez (2009): "Firm Volatility and Banks: Evidence from U.S. Banking Deregulation," *Board of Governors of the Federal Reserve System, Finance and Economics Discussion Series Working Paper No. 2009-46.*

Davis, S. J., J. Haltiwanger, R. Jarmin, and J. Miranda (2007): "Volatility and Dispersion in Business Growth Rates: Publicly Traded versus Privately Held Firms," in *NBER Macroeconomics Annual 2006, Volume 21*, pp. 107–180. National Bureau of Economic Research, Inc.

Dewatripont, M., and J. Tirole (1994): "A Theory of Debt and Equity: Diversity of Securities and Manager-Shareholder Congruence," *Quarterly Journal of Economics*, 109(4), 1027–1054.

Domar, E. D. (1961): "On the Measurement of Technological Change," *Economic Journal*, 71(284), 709–729.

Drucker, S., and M. Puri (2005): "On the Benefits of Concurrent Lending and Underwriting," *Journal of Finance*, 60(6), 2763–2799.

Fama, E. F., and K. R. French (1993): "Common Risk Factors in the Returns on Stocks and Bonds," *Journal of Financial Economics*, 33(1), 3–56.

Farre-Mensa, J. (2011): "Why are Most Firms Privately Held?," *Harvard Business School Working Paper.*

Fink, J., K. E. Fink, G. Grullon, and J. P. Weston (2010): "What Drove the Increase in Idiosyncratic Volatility during the Internet Boom?," *Journal of Financial and Quantitative Analysis*, 45(05), 1253–1278.

Gande, A., M. Puri, A. Saunders, and I. Walter (1997): "Bank Underwriting of Debt Securities: Modern Evidence," *Review of Financial Studies*, 10(4), 1175–1202.

Greenwood, J., J. M. Sanchez, and C. Wang (2010): "Financing Development: The Role of Information Costs," *American Economic Review*, 100(4), 1875–1891.

Herrera, A. M., and R. Minetti (2007): "Informed Finance and Technological Change: Evidence from Credit Relationships," *Journal of Financial Economics*, 83(1), 223–269.

Hungerford, T. L. (2011): "Changes in the Distribution of Income Among Tax Filers Between 1996 and 2006: The Role of Labor Income, Capital Income, and Tax Policy," *Congressional Research Service Paper R42131.*

Imrohoroglu, A., and S. Tuzel (2011): "Firm Level Productivity, Risk, and Return," *USC Working Paper.*

Ivashina, V. (2009): "Asymmetric Information Effects on Loan Spreads," *Journal of Financial Economics*, 92(2), 300–319.

Jayaratne, J., and P. E. Strahan (1996): "The Finance-Growth Nexus: Evidence from Bank Branch Deregulation," *Quarterly Journal of Economics*, 111(3), 639–670.

Kanatas, G., and J. Qi (1998): "Underwriting by Commercial Banks: Incentive Conflicts, Scope Economies, and Project Quality," *Journal of Money, Credit and Banking*, 30(1), 119–133.

——— (2003): "Integration of Lending and Underwriting: Implications of Scope Economies," *Journal of Finance*, 58(3), 1167–1191.

Kerr, W. R., and R. Nanda (2009): "Democratizing Entry: Banking Deregulations, Financing Constraints, and Entrepreneurship," *Journal of Financial Economics*, 94(1), 124–149.

——— (2010): "Banking Deregulations, Financing Constraints, and Firm Entry Size," *Journal of the European Economic Association*, 8(2-3), 582–593.

Kroszner, R. S., and R. G. Rajan (1994): "Is the Glass-Steagall Act Justified? A Study of the U.S. Experience with Universal Banking before 1933," *American Economic Review*, 84(4), 810–832.

Larrain, M. (2012): "Financial Liberalization, Capital-skill Complementarity, and Wage Inequality," *UC Berkeley Working Paper*.

Laux, C., and U. Walz (2009): "Cross-Selling Lending and Underwriting: Scope Economies and Incentives," *Review of Finance*, 13(2), 341–367.

Lóránth, G., and A. D. Morrison (2012): "Tying in Universal Banks," *Review of Finance*, 16(2), 481–516.

Loughran, T., and J. Ritter (2004): "Why Has IPO Underpricing Changed Over Time?," *Financial Management*, 33(3), 5–37.

Malmendier, U., M. M. Opp, and F. Saidi (2012): "Cash is King – Revaluation of Targets after Merger Bids," *NBER Working Paper No. 18211*.

Morgan, D., B. Rime, and P. E. Strahan (2004): "Bank Integration and State Business Cycles," *Quarterly Journal of Economics*, 119(4), 1555–1584.

Olley, G. S., and A. Pakes (1996): "The Dynamics of Productivity in the Telecommunications Equipment Industry," *Econometrica*, 64(6), 1263–1297.

Pastor, L., and P. Veronesi (2003): "Stock Valuation and Learning about Profitability," *Journal of Finance*, 58(5), 1749–1790.

Piketty, T., and E. Saez (2003): "Income Inequality In The United States, 1913-1998," *Quarterly Journal of Economics*, 118(1), 1–39.

Puri, M. (1996): "Commercial Banks in Investment Banking: Conflict of Interest or Certification Role?," *Journal of Financial Economics*, 40(3), 373–401.

Saunders, A., E. Strock, and N. G. Travlos (1990): "Ownership Structure, Deregulation, and Bank Risk Taking," *Journal of Finance*, 45(2), 643–654.

Townsend, R. M. (1979): "Optimal Contracts and Competitive Markets with Costly State Verification," *Journal of Economic Theory*, 21(2), 265–293.

Xu, Y., and B. G. Malkiel (2003): "Investigating the Behavior of Idiosyncratic Volatility," *Journal of Business*, 76(4), 613–644.

Yasuda, A. (2005): "Do Bank Relationships Affect the Firm's Underwriter Choice in the Corporate-Bond Underwriting Market?," *Journal of Finance*, 60(3), 1259–1292.

Zhang, C. (2010): "A Reexamination of the Causes of Time-Varying Stock Return Volatilities," *Journal of Financial and Quantitative Analysis*, 45(03), 663–684.

8 Tables

Table 1: **Summary Statistics**

Loans sample	Mean	Std. dev.	Min	Max	N
$\sigma(\widehat{sales_i})^{t,t+5}$	0.19	0.18	0.01	3.15	3,054
$\sigma^{t,t+5}_{idiosyncratic,i}$	0.39	0.20	0.10	1.85	2,473
UB through M&A	0.05	0.22	0	1	3,054
UB through Section 20	0.53	0.50	0	1	3,054
Eventually UB through M&A	0.23	0.42	0	1	3,054
Eventually UB through Section 20	0.72	0.45	0	1	3,054
Log of sales at close in 2010 $	20.41	2.22	13.82	26.26	3,054
No. of employees in millions	0.02	0.05	0.00	0.75	3,054
Deal size/Assets in %	11.95	1.08	4.57	15.55	3,054
Refinancing indicator	0.43	0.50	0	1	3,054
Syndicate size	1.14	0.35	1	3	3,443
No. of loans from same UB M&A (bank-firm)	1.78	2.02	1	15	316
No. of loans from same UB Section 20 (bank-firm)	1.75	1.93	1	20	1,734
No. of UBs M&A					7
No. of UBs M&A with $Est.(1996) = 1$					5
No. of UBs Section 20					36
No. of UBs Section 20 with $Est.(1996) = 1$					25
No. of UBs Section 20 with $Treated(1996) = 1$					4
Compustat sample	Mean	Std. dev.	Min	Max	N
$\sigma(\widehat{sales_i})^{t,t+5}$	0.22	0.22	0.01	3.15	49,200
TFP^t_i	-0.49	0.46	-5.15	2.33	56,979
Firm age in years	33.81	33.12	0	234	93,922
M&A sample	Mean	Std. dev.	Min	Max	N
ln(Total transaction volume in 2010 $m)	5.98	1.95	-3.07	12.30	12,896
Loan from same UB (if $UB = 1$)	0.13	0.33	0	1	2,290
No. of transactions from same bank	1.82	1.99	1.00	28.00	12,896
Average cash payment	0.55	0.43	0	1	12,896
Hostile fraction	0.04	0.16	0	1	12,896
IPO sample	Mean	Std. dev.	Min	Max	N
IPO age in years	15.37	21.35	0	165	2,936
UB through M&A	0.11	0.31	0	1	2,936
UB through Section 20	0.07	0.26	0.00	1.00	2,936
Eventually UB through M&A	0.26	0.44	0.00	1.00	2,936
Log of market capitalization in 2010 $m	5.10	1.53	0.70	11.19	2,936
No. of employees in millions	0.00	0.01	0.00	0.12	2,936
Book-value leverage	0.19	0.21	0.00	0.89	2,936
Gross spread in %	7.40	1.27	0.70	20.00	2,936
No. of UBs M&A					5
No. of UBs M&A with $Est.(1996) = 1$					3
No. of UBs Section 20					12
No. of UBs Section 20 with $Est.(1996) = 1$					10
No. of UBs Section 20 with $Treated(1996) = 1$					4

Table 2: **Impact of Universal-bank Financing on Sales-growth Volatility – Loans Sample**

	$\sigma(\widehat{sales_i})^{t,t+5}$				
UB through M&A	0.040***	0.040***	0.097***	0.028**	0.038***
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
UB M&A × $Est.(1996)$ × $After(1996)$		0.102***		0.067***	0.047*
		(0.02)		(0.02)	(0.03)
UB M&A × $Est.(1996)$		-0.094***		-0.088***	0.009
		(0.02)		(0.03)	(0.03)
UB through Section 20	0.007	0.036**	0.077	0.063***	0.084***
	(0.01)	(0.02)	(0.07)	(0.02)	(0.03)
UB Sec. 20 × $Treated(1996)$ × $After(1996)$		0.043***		0.063***	0.079***
		(0.02)		(0.02)	(0.02)
UB Sec. 20 × $Treated(1996)$		-0.032*		-0.055	-0.066
		(0.02)		(0.04)	(0.05)
UB Sec. 20 × $Est.(1996)$ × $After(1996)$		-0.005		-0.010	-0.016
		(0.02)		(0.02)	(0.02)
UB Sec. 20 × $Est.(1996)$		-0.026		-0.062*	-0.073**
		(0.02)		(0.03)	(0.04)
$After(1996)$		0.030		0.030	0.034
		(0.02)		(0.03)	(0.03)
Eventually UB through M&A	-0.010	-0.008			
	(0.01)	(0.01)			
Eventually UB through Section 20	-0.011	-0.011			
	(0.01)	(0.01)			
Log of sales at close in 2010 $	-0.005	-0.005	-0.012**	-0.006	-0.004
	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
Log of no. employees	-0.026***	-0.026***	-0.019***	-0.027***	-0.031***
	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
Deal size/Assets in %	-0.016***	-0.016***	-0.014***	-0.017***	-0.016***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Refinancing indicator	-0.004	-0.004	-0.005	-0.005	-0.009
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Bank-year FE	N	N	Y	N	N
Bank FE	N	N	N	Y	Y
Industry FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Sample	All	All	All	All	Purpose not CF
N	3,054	3,054	3,054	3,054	2,373

Notes: $\sigma(\widehat{sales_i})^{t,t+5}$ is the six-year standard deviation of firm i's sales growth from year t (= year of financing) to $t+5$. The unit of observation is a loan transaction. *UB through M&A* and *UB through Section* 20 are indicator variables for whether at the time of the loan transaction any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary, *Eventually UB through M&A* and *Eventually UB through Section* 20 are indicator variables for whether at *any point in time* any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary. $After(1996)$ is an indicator for whether the loan-issue date was on or after August 1, 1996, summarizing two events: the increase in the limit of revenues from underwriting by Section 20 subsidiaries as well as the elimination of firewalls applying to bank holding companies. $Est.(1996)$ indicates whether a universal bank (through M&A or Section 20) was established prior to August 1, 1996. $Treated(1996)$ is a dummy variable denoting whether a universal bank established through a Section 20 subsidiary and actively underwriting securities prior to August 1, 1996 experienced a run-up in the number of IPOs and SEOs after that date. All firm-level explanatory variables are measured at the end of the year prior to the loan-issue year. The sample in the fifth column comprises only loans whose purpose is not related to corporate financial restructuring (e.g., recapitalization). Bank(-year) fixed effects are included for *all* lead arrangers of the respective loan that are or eventually become universal banks, whereas all remaining commercial banks are grouped together. Industry fixed effects are based on two-digit SIC codes. Public-service, energy, and financial-services firms are dropped. Robust standard errors (clustered at the bank-parent level, as specified in Section 4.2) are in parentheses.

Table 3: **Impact of Universal-bank Financing on Idiosyncratic Volatility – Loans Sample**

	$\sigma^{t,t+5}_{idiosyncratic,i}$				
UB through M&A	0.017	0.052***	0.016	0.006	0.013
	(0.02)	(0.01)	(0.01)	(0.03)	(0.03)
UB M&A × $Est.$(1996) × $After$(1996)		0.053**		0.051**	0.061***
		(0.03)		(0.02)	(0.02)
UB M&A × $Est.$(1996)		-0.128***		-0.104**	-0.044
		(0.03)		(0.05)	(0.04)
UB through Section 20	-0.010	-0.054*	-0.058	-0.088***	-0.095***
	(0.01)	(0.03)	(0.04)	(0.02)	(0.03)
UB Sec. 20 × $Treated$(1996) × $After$(1996)		0.064***		0.065**	0.069**
		(0.02)		(0.03)	(0.03)
UB Sec. 20 × $Treated$(1996)		-0.027		0.006	0.012
		(0.03)		(0.05)	(0.05)
UB Sec. 20 × $Est.$(1996) × $After$(1996)		-0.014		0.005	-0.003
		(0.02)		(0.03)	(0.03)
UB Sec. 20 × $Est.$(1996)		0.048		0.039	0.078**
		(0.03)		(0.03)	(0.04)
$After$(1996)		-0.009		-0.026	-0.026
		(0.03)		(0.03)	(0.03)
Eventually UB through M&A	0.005	0.004			
	(0.01)	(0.01)			
Eventually UB through Section 20	-0.004	-0.008			
	(0.02)	(0.02)			
Log of sales at close in 2010 $	-0.033***	-0.033***	-0.032***	-0.032***	-0.028***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Log of no. employees	-0.019***	-0.020***	-0.023***	-0.022***	-0.026***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Deal size/Assets in %	0.002	0.003	0.000	0.002	0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Refinancing indicator	0.000	-0.000	-0.001	-0.000	0.003
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Bank-year FE	N	N	Y	N	N
Bank FE	N	N	N	Y	Y
Industry FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Sample	All	All	All	All	Purpose not CF
N	2,473	2,473	2,473	2,473	1,960

Notes: $\sigma^{t,t+5}_{idiosyncratic,i}$ is firm i's idiosyncratic volatility from year t (= year of financing) to $t+5$, estimated from the Fama and French (1993) three-factor model using monthly CRSP data, and is expressed in annualized terms. The unit of observation is a loan transaction. *UB through M&A* and *UB through Section* 20 are indicator variables for whether at the time of the loan transaction any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary, *Eventually UB through M&A* and *Eventually UB through Section* 20 are indicator variables for whether at *any point in time* any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary. $After$(1996) is an indicator for whether the loan-issue date was on or after August 1, 1996, summarizing two events: the increase in the limit of revenues from underwriting by Section 20 subsidiaries as well as the elimination of firewalls applying to bank holding companies. $Est.$(1996) indicates whether a universal bank (through M&A or Section 20) was established prior to August 1, 1996. $Treated$(1996) is a dummy variable denoting whether a universal bank established through a Section 20 subsidiary and actively underwriting securities prior to August 1, 1996 experienced a run-up in the number of IPOs and SEOs after that date. All firm-level explanatory variables are measured at the end of the year prior to the loan-issue year. The sample in the fifth column comprises only loans whose purpose is not related to corporate financial restructuring (e.g., recapitalization). Bank(-year) fixed effects are included for *all* lead arrangers of the respective loan that are or eventually become universal banks, whereas all remaining commercial banks are grouped together. Industry fixed effects are based on two-digit SIC codes. Public-service, energy, and financial-services firms are dropped. Robust standard errors (clustered at the bank-parent level, as specified in Section 4.2) are in parentheses.

Table 4: **Impact of Universal-bank Financing on Sales-growth Volatility – Compustat Sample**

	$\ln(\sigma(\widehat{sales_i})^{t,t+5})$				
UB through M&A	0.110***	0.110**	0.088	-0.013	-0.008
	(0.04)	(0.05)	(0.06)	(0.08)	(0.08)
UB through M&A × Cross-selling				0.151**	0.157**
				(0.08)	(0.08)
UB through Section 20	0.016	0.068**	0.070**	0.089**	0.089**
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
UB through Section 20 × Cross-selling				-0.022	-0.019
				(0.03)	(0.03)
Eventually UB through M&A	0.007				
	(0.02)				
Eventually UB through Section 20	0.059***				
	(0.02)				
Only CB Financing	0.026				
	(0.02)				
Log of sales in 2010 $			-0.122***	-0.122***	-0.122***
			(0.01)	(0.01)	(0.01)
Log of no. employees			0.000	0.000	0.000
			(0.01)	(0.01)	(0.01)
Firm age in years					0.004***
					(0.00)
Average Deal size/Assets in %					0.002
					(0.00)
Refinancing $\in [0, 1]$					-0.026
					(0.02)
Bank FE	N	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
N	49,200	49,200	49,200	49,200	49,200

Notes: $\sigma(\widehat{sales_i})^{t,t+5}$ is the six-year standard deviation of firm i's sales growth from year t (= year of financing) to $t + 5$. The unit of observation is the firm-year level. *UB through M&A* and *UB through Section* 20 are indicator variables for whether, given any loan transactions in a year, at the time of any loan transaction any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary, *Eventually UB through M&A* and *Eventually UB through Section* 20 are indicator variables for whether, given any loan transactions in a year, at *any point in time* any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary. $Cross - selling$ is an indicator variable for whether, during the entire bank-firm relationship, the firm receives another loan, M&A advisory services, or its IPO from the same universal bank. *Only CB Financing* indicates whether, given any loan transactions in a year, none of the lead arrangers in any loan transaction is (eventually) a universal bank. All firm-level explanatory variables (except for firm age) are measured at the end of the year, whereas the loans' deal sizes and refinancing status (dummy variable) are year averages. Bank fixed effects are included for *all* lead arrangers of all loans in a given year that are or eventually become universal banks, whereas all remaining commercial banks are grouped together. Public-service, energy, and financial-services firms are dropped. Robust standard errors (clustered at the firm-year level) are in parentheses.

Table 5: **Impact of Universal-bank Financing on Total Factor Productivity – Compustat Sample**

	$\ln(TFP_i^{t+1})$				
UB through M&A	0.070***	0.042**	0.037*	0.002	0.005
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
UB through M&A × Cross-selling				0.067**	0.063**
				(0.03)	(0.03)
UB through Section 20	0.029**	0.024*	0.025*	0.019	0.028
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
UB through Section 20 × Cross-selling				0.040***	0.039***
				(0.01)	(0.01)
Eventually UB through M&A	-0.005				
	(0.01)				
Eventually UB through Section 20	-0.002				
	(0.01)				
Only CB Financing	0.007				
	(0.01)				
Log of sales in 2010 $			0.204***	0.204***	0.204***
			(0.01)	(0.01)	(0.01)
Log of no. employees			-0.216***	-0.216***	-0.216***
			(0.01)	(0.01)	(0.01)
Firm age in years					-0.015***
					(0.00)
Average Deal size/Assets in %					-0.001
					(0.00)
Refinancing $\in [0,1]$					-0.009
					(0.01)
Bank FE	N	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
N	54,480	54,480	54,480	54,480	54,480

Notes: TFP_i^{t+1} is firm i's average total factor productivity in year $t+1$ (= year of financing +1) from Imrohoroglu and Tuzel (2011). The unit of observation is the firm-year level. *UB through M&A* and *UB through Section* 20 are indicator variables for whether, given any loan transactions in a year, at the time of any loan transaction any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary, *Eventually UB through M&A* and *Eventually UB through Section* 20 are indicator variables for whether, given any loan transactions in a year, at *any point in time* any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary. $Cross-selling$ is an indicator variable for whether, during the entire bank-firm relationship, the firm receives another loan, M&A advisory services, or its IPO from the same universal bank. *Only CB Financing* indicates whether, given any loan transactions in a year, none of the lead arrangers in any loan transaction is (eventually) a universal bank. All firm-level explanatory variables (except for firm age) are measured at the end of the year, whereas the loans' deal sizes and refinancing status (dummy variable) are year averages. Bank fixed effects are included for *all* lead arrangers of all loans in a given year that are or eventually become universal banks, whereas all remaining commercial banks are grouped together. Public-service, energy, and financial-services firms are dropped. Robust standard errors (clustered at the firm-year level) are in parentheses.

Table 6: **Impact of Universal-bank Financing on Sales-growth Volatility and Total Factor Productivity – Only Firms with both Universal-bank and Commercial-bank Interactions, Compustat Sample**

	$\ln(\sigma(\widehat{sales_i})^{t,t+5})$			$\ln(TFP_i^{t+1})$		
UB through M&A	0.251***	0.222***	-0.011	0.101***	0.099***	0.092***
	(0.07)	(0.08)	(0.17)	(0.02)	(0.02)	(0.04)
UB through M&A × Cross-selling			0.266			0.007
			(0.18)			(0.04)
UB through Section 20	0.098**	0.096**	0.091*	0.056***	0.049***	0.011
	(0.04)	(0.04)	(0.06)	(0.02)	(0.02)	(0.02)
UB through Section 20 × Cross-selling			0.005			0.075***
			(0.05)			(0.03)
Log of sales in 2010 $		-0.128***	-0.128***		0.193***	0.193***
		(0.01)	(0.01)		(0.01)	(0.01)
Log of no. employees		0.017*	0.017*		-0.208***	-0.207***
		(0.01)	(0.01)		(0.01)	(0.01)
Firm age in years			0.000			-0.017***
			(0.00)			(0.00)
Average Deal size/Assets in %			0.003			-0.003
			(0.00)			(0.00)
Refinancing $\in [0,1]$			-0.013			-0.002
			(0.03)			(0.01)
Bank FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
N	31,869	31,869	31,869	34,809	34,809	34,809

Notes: $\sigma(\widehat{sales_i})^{t,t+5}$ is the six-year standard deviation of firm i's sales growth from year t (= year of financing) to $t+5$. TFP_i^{t+1} is firm i's average total factor productivity in year $t+1$ (= year of financing +1) from Imrohoroglu and Tuzel (2011). The unit of observation is the firm-year level. The sample is limited to firms that, if they ever received financing from a universal bank, also interacted with that bank when it was still a commercial bank. *UB through M&A* and *UB through Section* 20 are indicator variables for whether, given any loan transactions in a year, at the time of any loan transaction any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary, *Eventually UB through M&A* and *Eventually UB through Section* 20 are indicator variables for whether, given any loan transactions in a year, at *any point in time* any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary. $Cross-selling$ is an indicator variable for whether, during the entire bank-firm relationship, the firm receives another loan, M&A advisory services, or its IPO from the same universal bank. *Only CB Financing* indicates whether, given any loan transactions in a year, none of the lead arrangers in any loan transaction is (eventually) a universal bank. All firm-level explanatory variables (except for firm age) are measured at the end of the year, whereas the loans' deal sizes and refinancing status (dummy variable) are year averages. Bank fixed effects are included for *all* lead arrangers of all loans in a given year that are or eventually become universal banks, whereas all remaining commercial banks are grouped together. Public-service, energy, and financial-services firms are dropped. Robust standard errors (clustered at the firm-year level) are in parentheses.

Table 7: **Determinants of IPO Age**

	IPO age in years			
UB through M&A	4.610**	0.455	-4.843***	2.033
	(2.29)	(1.34)	(1.21)	(2.28)
UB through M&A × *Est.*(1996) × *After*(1996)			-7.155**	
			(3.74)	
UB through M&A × *Est.*(1996)			10.484***	
			(3.40)	
UB through M&A × IPO count				-0.022
				(0.02)
UB through Section 20	-1.228	-2.037	-2.018*	-4.617***
	(1.94)	(1.37)	(1.14)	(1.43)
UB though Section 20 × *Treated*(1996) × *After*(1996)			-7.432***	
			(2.34)	
UB though Section 20 × *Treated*(1996)			2.105	
			(1.56)	
UB though Section 20 × *Est.*(1996) × *After*(1996)			3.581*	
			(2.07)	
UB though Section 20 × *Est.*(1996)			-2.507*	
			(1.39)	
UB though Section 20 × IPO count				0.116
				(0.07)
After(1996)			0.912	
			(2.22)	
Eventually UB through M&A	1.888	-0.727	-0.601	-0.731
	(1.70)	(1.02)	(1.02)	(1.00)
Log of market capitalization in 2010 $		1.217***	1.227***	1.204***
		(0.34)	(0.33)	(0.33)
No. of employees in millions		749.024***	755.955***	754.695***
		(90.48)	(90.01)	(90.94)
Book-value leverage		16.781***	16.713***	16.807***
		(2.77)	(2.80)	(2.76)
Gross spread in %		-2.339***	-2.265***	-2.348***
		(0.46)	(0.44)	(0.45)
Industry FE	Y	Y	Y	Y
IPO-year FE	Y	Y	Y	Y
N	2,936	2,936	2,936	2,936

Notes: *IPO age* is firm *i*'s age in years at the time of its IPO. The unit of observation is a firm's IPO. *UB through M&A* and *UB through Section* 20 are indicator variables for whether the bookrunner is a universal bank formed through a merger or through opening a Section 20 subsidiary, and *Eventually UB through M&A* is an indicator variable for whether at *any point in time* the bookrunner, which used to be or still is an investment bank, becomes a universal bank formed through a merger. *After*(1996) is an indicator for whether the loan-issue date was on or after August 1, 1996, summarizing two events: the increase in the limit of revenues from underwriting by Section 20 subsidiaries as well as the elimination of firewalls applying to bank holding companies. *Est.*(1996) indicates whether a universal bank (through M&A or Section 20) was established prior to August 1, 1996. *Treated*(1996) is a dummy variable denoting whether a universal bank established through a Section 20 subsidiary and actively underwriting securities prior to August 1, 1996 experienced a run-up in the number of IPOs and SEOs after that date. *IPO count* denotes the number of IPOs accompanied by universal banks, up to and including the current IPO. Book-value leverage is winsorized at the 1^{st} and 99^{th} percentiles. All firm-level explanatory variables are measured at the end of the IPO year. Industry fixed effects are based on two-digit SIC codes. Public-service, energy, and financial-services firms are dropped. Robust standard errors (clustered at the bank-parent level, as specified in Section 4.2) are in parentheses.

A Evidence of Cross-selling by Universal Banks

To investigate cross-selling relationships, we run regressions of the following form:

$$\begin{aligned} Cross-selling\ outcome_{ij} &= \beta_1 Product\ from\ same\ UB_{ij} + \beta_2 X_{ij} + \beta_3 industry_i \\ &\quad + \psi_i + \lambda_j + \epsilon_{ij}, \end{aligned}$$

where $Cross - selling\ outcome_{ij}$ denotes an outcome such as the total transaction volume or a cross-selling indicator between firm i and bank j, $Product\ from\ same\ UB_{ij}$ is an indicator variable for whether firm i purchased another product (which determines the data sample) from j at *any point in time* if j is a universal bank, and X_{ij} denotes other characteristics of the bank-firm pair ij. $industry_i$, ψ_i, and λ_j are industry, firm, and bank fixed effects, respectively.

The first cross-selling outcome that we consider is the depth of M&A cross-selling. To this end, we use all M&A transactions recorded in the SDC database involving at least one public firm (acquirer and/or target), and match the respective firms with the loans in DealScan. We hand-matched the universal banks providing the loans and advisory services. On this basis, we generate a cross-section of bank-firm pairs with characteristics measured over the recorded relationship between the two entities.

In Table C.1, we estimate the above regression specification, and use as the dependent variable the total transaction value on which bank j (not necessarily a universal bank) advised firm i. On the right-hand side, we include an indicator variable for whether i received a loan from j (as a lead arranger, so j is a universal bank) at any point in time, and three more explanatory variables. First, we control for the number of transactions from which the total transaction value stems. Second, we add the average fraction of offer prices to be paid in cash, as large transactions are typically in stock (see, for instance, Malmendier, Opp, and Saidi (2012)). Third, we control for the fraction of hostile deals. The estimates in Table C.1 unanimously indicate that receiving a loan from the same universal bank that advises a firm on its M&A transactions is associated with larger transaction volumes and, thus, higher fees for the bank. Most importantly, the results are robust to including bank and firm fixed effects, which absorb variation in the size of acquired firms and related characteristics of the banks' client base.

Note that we focus on cross-selling by *universal banks* in Table C.1. However, M&A advisory services, unlike underwriting, were not forbidden under Glass-Steagall. While the typical providers of M&A advisory – namely, investment banks – only recently entered the loan business, commercial banks did advise firms on M&A matters. The market share of commercial banks is, however, fairly small, particularly for the subset of public firms in Table C.1. Therefore, it becomes critical to scrutinize whether increased M&A revenue through cross-selling in association with loans translates into higher revenue from equity underwriting. This product triplet would be unique to universal banks, and we are among the first to shed light on cross-selling relationships of such depth.

For this purpose, we consider the set of universal-bank loans, and match the borrowers with both M&A and IPO data from SDC. The final data set is limited to public firms (and their banks) for which the corresponding IPO is fully recorded in the SDC database. The results in Table C.2 suggest that firms that received loan financing from the same universal bank that (at some point in time) advised them on an M&A transaction are at least 20% more likely to have also been taken public by that bank as bookrunner. In the second and third columns, we control for whether the firm in any given bank-firm pair has ever been involved in an M&A transaction. The respective coefficient is indistinguishable from zero and, thus, does not explain the positive impact of M&A cross-selling. In the last two columns of Table C.2, we include bank and firm fixed effects, which account for bank characteristics, such as general size of operations (also of the loan and

M&A business), as well as firms' overall M&A activity that may be correlated with unobservable characteristics underlying IPO-bookrunner choice. The estimated effect of M&A cross-selling on the likelihood of a firm's being taken public by a universal bank that was the lead arranger of at least one loan to that firm remains robust, and actually increases after including firm fixed effects in the fourth column.

B Supplementary Figures

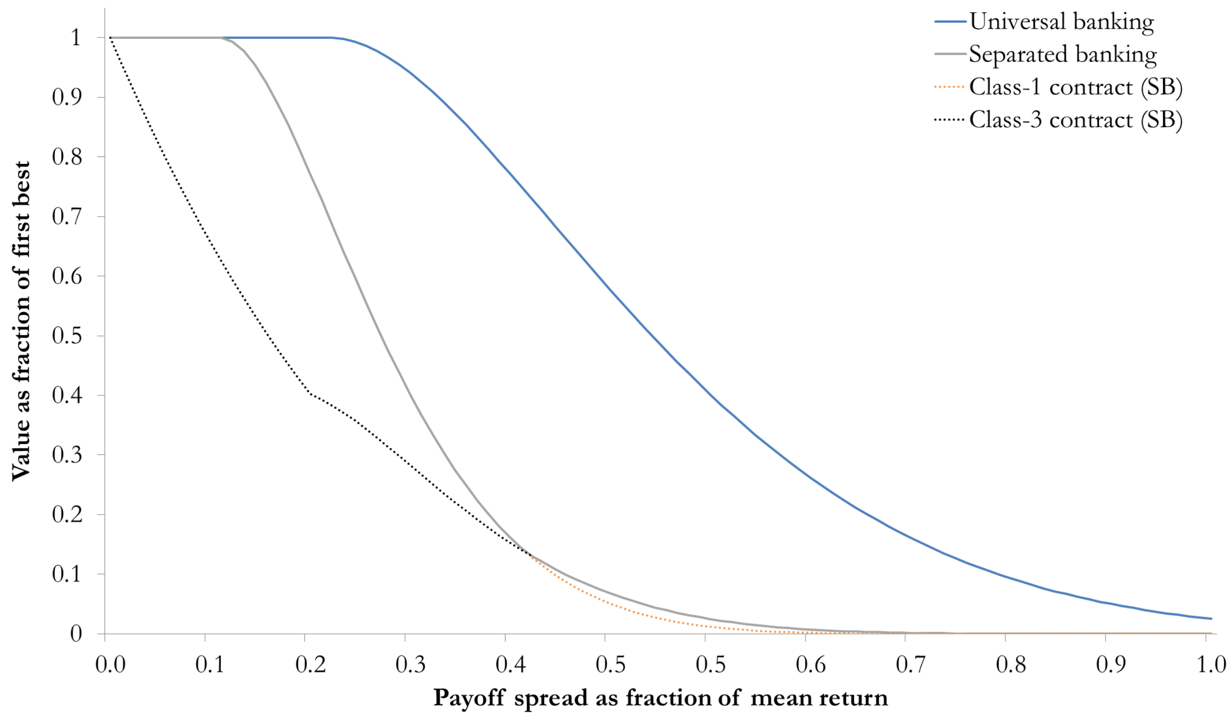


Figure B.1: **Equilibrium Value of the Firm under Universal and Separated Banking as a Function of the Payoff Spread** $(Z^S - Z^F)$**.** Parameter values fixed at $p = 0.5$, $q = 0.2$, $\alpha = 0.9$, $\bar{Z} = 1$, $\phi = \bar{\phi}$.

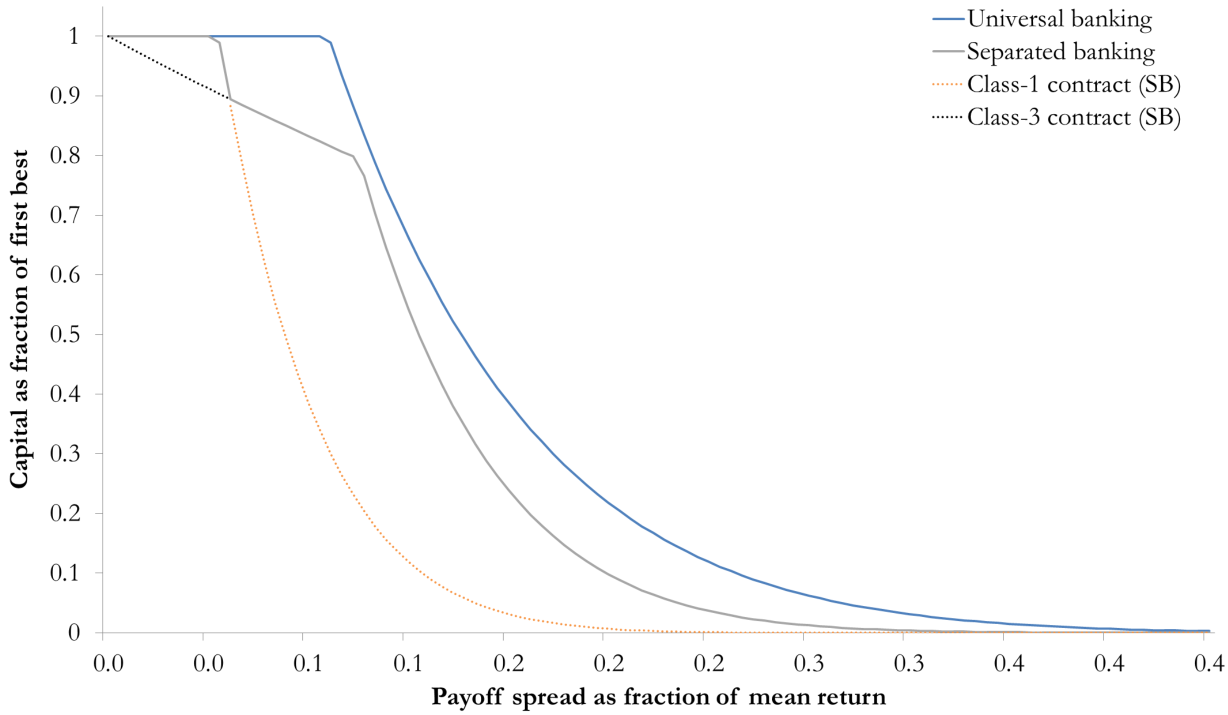


Figure B.2: **Equilibrium Capital Stock under Universal and Separated Banking as a Function of the Payoff Spread** $(Z^S - Z^F)$**.** Parameter values fixed at $p = 0.7$, $q = 0.2$, $\alpha = 0.9$, $\bar{Z} = 1$, $\phi = \bar{\phi}$.

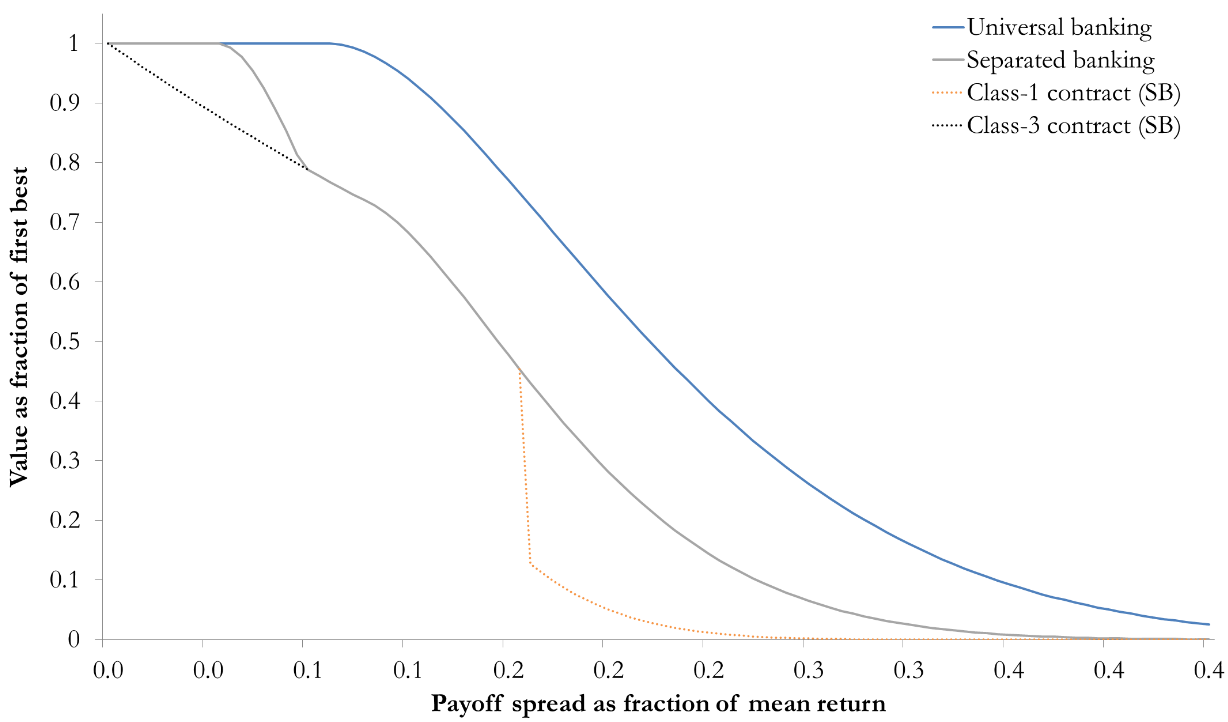


Figure B.3: **Equilibrium Value of the Firm under Universal and Separated Banking as a Function of the Payoff Spread** $(Z^S - Z^F)$**.** Parameter values fixed at $p = 0.7$, $q = 0.2$, $\alpha = 0.9$, $\bar{Z} = 1$, $\phi = \bar{\phi}$.

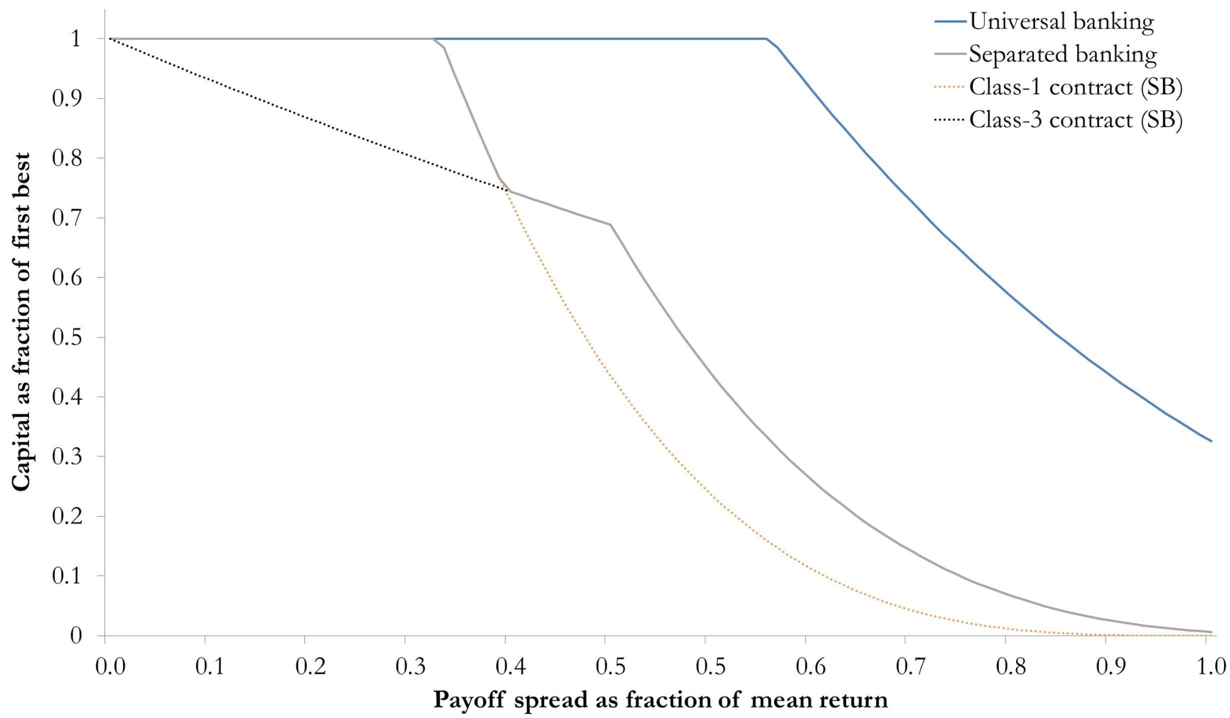


Figure B.4: **Equilibrium Capital Stock under Universal and Separated Banking as a Function of the Payoff Spread** $(Z^S - Z^F)$**.** Parameter values fixed at $p = 0.5$, $q = 0.2$, $\alpha = 0.7$, $\bar{Z} = 1$, $\phi = \bar{\phi}$.

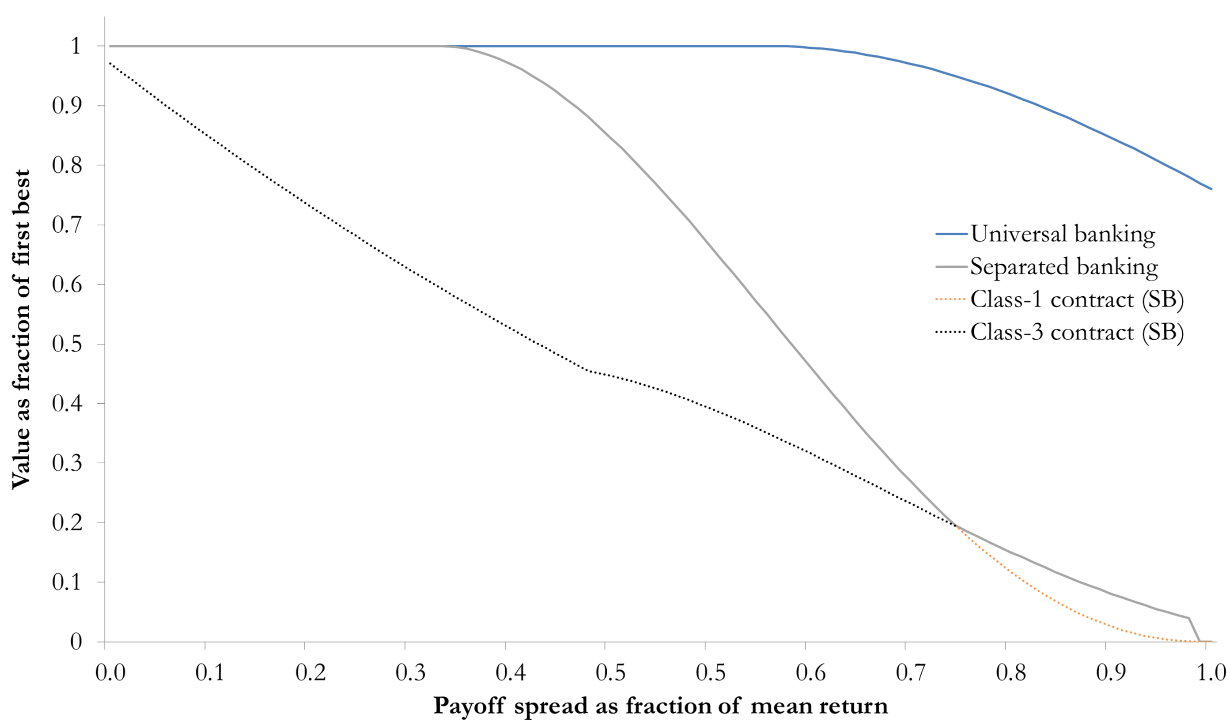


Figure B.5: **Equilibrium Value of the Firm under Universal and Separated Banking as a Function of the Payoff Spread** $(Z^S - Z^F)$**.** Parameter values fixed at $p = 0.5$, $q = 0.2$, $\alpha = 0.7$, $\bar{Z} = 1$, $\phi = \bar{\phi}$.

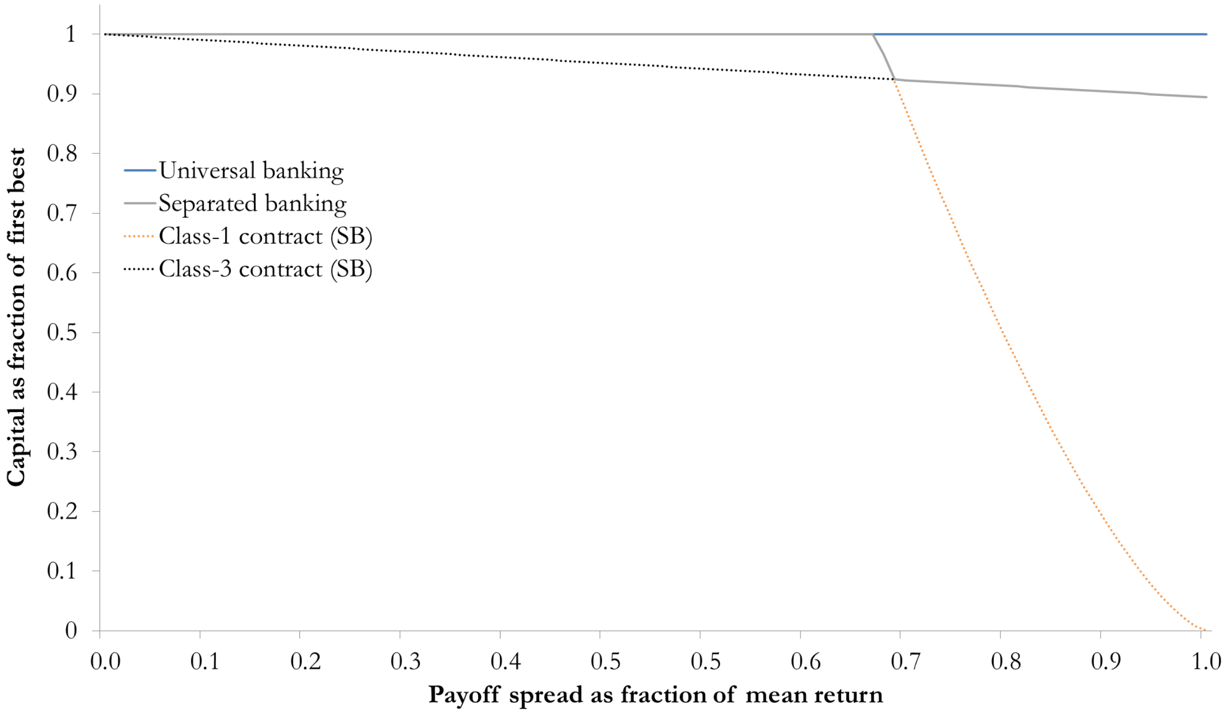


Figure B.6: **Equilibrium Capital Stock under Universal and Separated Banking as a Function of the Payoff Spread** $(Z^S - Z^F)$**.** Parameter values fixed at $p = 0.5$, $q = 0.1$, $\alpha = 0.3$, $\bar{Z} = 1$, $\phi = \bar{\phi}$.

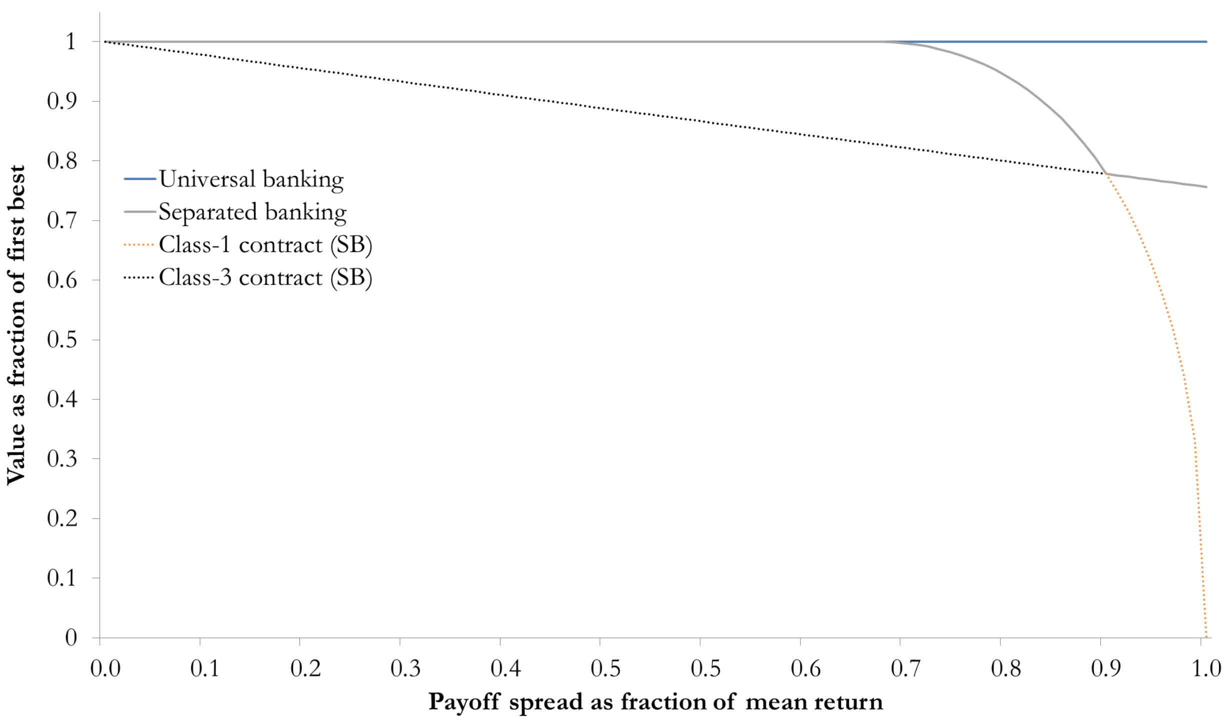


Figure B.7: **Equilibrium Value of the Firm under Universal and Separated Banking as a Function of the Payoff Spread** $(Z^S - Z^F)$**.** Parameter values fixed at $p = 0.5$, $q = 0.1$, $\alpha = 0.3$, $\bar{Z} = 1$, $\phi = \bar{\phi}$.

C Supplementary Tables

Table C.1: **Cross-selling of M&A Advisory and Loans – M&A Sample**

	ln(Total transaction volume in 2010 \$m)				
Loan from same UB $\in \{0,1\}$	0.879***	0.916***	0.844***	0.502***	0.487***
	(0.31)	(0.25)	(0.22)	(0.14)	(0.14)
No. of transactions from same bank		0.302***	0.317***	0.328***	0.328***
		(0.11)	(0.08)	(0.03)	(0.03)
Average cash payment $\in [0,1]$		-0.211**	-0.196**	-0.072	-0.244***
		(0.08)	(0.08)	(0.07)	(0.06)
Hostile fraction $\in [0,1]$		2.022***	1.839***	1.252***	1.060***
		(0.19)	(0.18)	(0.17)	(0.16)
Sample	All transactions with public acquirer and/or target				
Bank FE	N	N	N	N	Y
Firm FE	N	N	N	Y	Y
Industry FE	N	N	Y	Y	Y
N	12,896	12,896	12,896	12,896	12,896

Notes: The total transaction volume is calculated as the sum of all transaction values involving firm i advised by bank j at any point in time. *Loan from same UB* is an indicator variable for whether firm i, advised by *universal bank* j in at least one M&A transaction (irrespective of whether i was a target or an acquirer), also received a loan from j at any point in time. The number of transactions, the average fraction of the offer price to be paid in cash, and the fraction of hostile deals (both between 0 and 1) are also determined at the bank-firm level. The sample is restricted to all deals involving at least one public firm. Industry fixed effects are based on two-digit SIC codes. Public-service, energy, and financial-services firms are dropped. Robust standard errors (clustered at the bank-parent level) are in parentheses.

Table C.2: **Cross-selling of M&A Advisory, Loans, and IPOs – Loans Sample**

	IPO from same UB $\in \{0, 1\}$				
M&A advisory from same UB $\in \{0, 1\}$	0.220**	0.213**	0.212**	0.257**	0.205**
	(0.08)	(0.08)	(0.08)	(0.11)	(0.09)
Any M&A activity $\in \{0, 1\}$		0.008	0.005		
		(0.02)	(0.02)		
ln(Total loan volume in 2010 $m)		-0.002	-0.002	0.008	0.008
		(0.01)	(0.01)	(0.02)	(0.02)
Refinance fraction $\in [0, 1]$		0.034	0.032	0.024	0.049*
		(0.02)	(0.02)	(0.02)	(0.03)
Average maturity of loans (in months)		0.001*	0.001**	-0.001	-0.001
		(0.00)	(0.00)	(0.00)	(0.00)
Sample	All loans provided by universal banks				
Bank FE	N	N	N	N	Y
Firm FE	N	N	N	Y	Y
Industry FE	N	N	Y	Y	Y
N	1,106	1,106	1,106	1,106	1,106

Notes: *IPO from same UB* and *M&A advisory from same UB* are indicator variables for whether firm i receiving loan financing from universal bank j also went public with j as bookrunner, or was advised by j in an M&A transaction (irrespective of whether i was a target or an acquirer). *Any M&A activity* is an indicator variable for whether firm i has ever been engaged in any such transaction. The total loan volume is calculated as the sum of all loans granted to firm i by bank j at any point in time. The fraction of refinancing deals (between 0 and 1) and the average maturity of loans (in months) are also determined at the bank-firm level. The sample is restricted to all loan transactions involving public firms and universal banks. Industry fixed effects are based on two-digit SIC codes. Public-service, energy, and financial-services firms are dropped. Robust standard errors (clustered at the universal-bank level) are in parentheses.

Table C.3: **Summary Statistics for Universal Banks Established through M&A and Section 20 Subsidiaries**

	M&A			Section 20		
	$t=-1$	$t=0$	$t=1$	$t=-1$	$t=0$	$t=1$
Total assets in 2010 $bn	274.2	488.6	485.8	51.45	60.00	84.27
	(239.7)	(588.5)	(574.2)	(52.01)	(59.46)	(90.14)
Total equity/assets in %	6.015	6.153	7.216	7.353	7.512	7.412
	(1.844)	(1.244)	(1.149)	(1.900)	(1.698)	(2.345)
Total loans/assets in %	57.62	51.69	50.80	65.55	64.89	62.74
	(24.86)	(19.28)	(15.63)	(6.004)	(6.708)	(9.043)
Cash balance/assets in %	4.242	4.685	6.576	5.690	5.993	5.340
	(2.725)	(2.634)	(4.395)	(1.705)	(2.428)	(2.083)
Net income in 2010 $bn	2.815	1.576	5.241	0.124	0.315	0.376
	(3.755)	(3.899)	(6.809)	(0.454)	(0.397)	(0.536)
EBIT in 2010 $bn	4.310	2.720	8.344	0.282	0.503	0.630
	(5.598)	(6.183)	(10.82)	(0.425)	(0.578)	(0.719)
No. of employees in thousands	65.03	101.4	99.14	15.09	16.56	21.04
	(64.69)	(119.6)	(121.2)	(14.00)	(14.47)	(22.16)
N		5			27	

Notes: This table reports means with standard deviations in parentheses, for universal banks established through M&A in the first three columns and for Section 20 subsidiaries in the last three columns. The data are taken from the respective banks' call reports. t indicates the year of the respective call report, and $t=0$ denotes the first call report after the bank becomes a universal bank, and $t=-1$ and $t=1$ correspond to the call reports one year before and after the call report used for $t=0$, respectively. Cash balance is the sum of non-interest-bearing balances and currency and coin, and interest-bearing balances in U.S. offices. EBIT is net income before income taxes, extraordinary items, and other adjustments on a fully taxable equivalent basis.

Table C.4: **Impact of Universal-bank Financing on Sales-growth Volatility by Universal-bank Size – Loans Sample**

	$\sigma(\widehat{sales_i})^{t,t+5}$					
UB through M&A	0.038**	0.044***	0.039***	0.037***	0.059***	0.047***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
UB M&A × *Est.*(1996) × *A.*(1996)		0.091***	0.076***		0.067***	0.077***
		(0.03)	(0.02)		(0.02)	(0.02)
UB M&A × *Est.*(1996)		-0.081***	-0.054*		-0.086***	-0.060*
		(0.02)	(0.03)		(0.02)	(0.04)
UB through Section 20	0.021*	0.033*	0.062**	0.025**	0.032*	0.064**
	(0.01)	(0.02)	(0.03)	(0.01)	(0.02)	(0.03)
UB Sec. 20 × *Treat.*(1996) × *A.*(1996)		0.067*	0.079***		0.085**	0.086***
		(0.04)	(0.03)		(0.04)	(0.03)
UB Sec. 20 × *Treat.*(1996)		-0.032*	-0.052		-0.037**	-0.047
		(0.02)	(0.05)		(0.02)	(0.06)
UB Sec. 20 × *Est.*(1996) × *A.*(1996)		-0.028	-0.035		-0.047*	-0.042*
		(0.03)	(0.02)		(0.02)	(0.02)
UB Sec. 20 × *Est.*(1996)		0.004	-0.016		0.020	-0.022
		(0.03)	(0.06)		(0.02)	(0.06)
A.(1996)		0.039	0.039		0.036	0.032
		(0.03)	(0.03)		(0.03)	(0.03)
Eventually UB through M&A	-0.013	-0.014		-0.020*	-0.027**	
	(0.01)	(0.01)		(0.01)	(0.01)	
Eventually UB through Section 20	-0.013	-0.011		-0.014	-0.013	
	(0.01)	(0.01)		(0.01)	(0.01)	
Log of sales at close in 2010 $	-0.005	-0.005	-0.007	-0.004	-0.004	-0.007
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Log of no. employees	-0.029***	-0.029***	-0.030***	-0.029***	-0.029***	-0.031***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Deal size/Assets in %	-0.020***	-0.020***	-0.022***	-0.020***	-0.020***	-0.022***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Refinancing indicator	-0.004	-0.003	-0.005	-0.003	-0.002	-0.003
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Bank FE	N	N	Y	N	N	Y
Industry FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Banks dropped from sample	Top 5	Top 5	Top 5	Top 10	Top 10	Top 10
N	2,168	2,168	2,168	2,025	2,025	2,025

Notes: $\sigma(\widehat{sales_i})^{t,t+5}$ is the six-year standard deviation of firm i's sales growth from year t (= year of financing) to $t+5$. The unit of observation is a loan transaction. *UB through M&A* and *UB through Section* 20 are indicator variables for whether at the time of the loan transaction any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary, *Eventually UB through M&A* and *Eventually UB through Section* 20 are indicator variables for whether at *any point in time* any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary. *A.*(1996) is an indicator for whether the loan-issue date was on or after August 1, 1996, summarizing two events: the increase in the limit of revenues from underwriting by Section 20 subsidiaries as well as the elimination of firewalls applying to bank holding companies. *Est.*(1996) indicates whether a universal bank (through M&A or Section 20) was established prior to August 1, 1996. *Treat.*(1996) is a dummy variable denoting whether a universal bank established through a Section 20 subsidiary and actively underwriting securities prior to August 1, 1996 experienced a run-up in the number of IPOs and SEOs after that date. All firm-level explanatory variables are measured at the end of the year prior to the loan-issue year. The five and ten largest banks (according to their asset size, with the top four banks being Bank of America, Citigroup, J.P. Morgan, and Wells Fargo) are dropped from the sample in the first three and last three columns, respectively. Bank fixed effects are included for *all* lead arrangers of the respective loan that are or eventually become universal banks, whereas all remaining commercial banks are grouped together. Industry fixed effects are based on two-digit SIC codes. Public-service, energy, and financial-services firms are dropped. Robust standard errors (clustered at the bank-parent level, as specified in Section 4.2) are in parentheses.

Table C.5: **Impact of Universal-bank Financing on Sales-growth Volatility by Loan Spread – Loans Sample**

	$\sigma(\widehat{sales_i})^{t,t+5}$				
UB through M&A	0.039***	0.053***	0.079***	0.040***	0.052***
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
UB M&A × $Est.(1996)$ × $After(1996)$		0.083***		0.071***	0.057*
		(0.03)		(0.02)	(0.03)
UB M&A × $Est.(1996)$		-0.104***		-0.147**	-0.022
		(0.02)		(0.04)	(0.04)
UB through Section 20	0.006	0.035*	0.018	0.068***	0.092***
	(0.01)	(0.02)	(0.13)	(0.03)	(0.03)
UB Sec. 20 × $Treated(1996)$ × $After(1996)$		0.044**		0.085***	0.108***
		(0.02)		(0.03)	(0.03)
UB Sec. 20 × $Treated(1996)$		-0.024		-0.068	-0.096
		(0.02)		(0.05)	(0.07)
UB Sec. 20 × $Est.(1996)$ × $After(1996)$		-0.022		-0.026	-0.034
		(0.02)		(0.02)	(0.02)
UB Sec. 20 × $Est.(1996)$		-0.018		-0.060*	-0.080**
		(0.02)		(0.03)	(0.04)
$After(1996)$		0.015		0.011	0.006
		(0.03)		(0.03)	(0.03)
Eventually UB through M&A	-0.013	-0.013			
	(0.01)	(0.01)			
Eventually UB through Section 20	-0.006	-0.006			
	(0.01)	(0.01)			
Log of sales at close in 2010 $	-0.008	-0.008	-0.016***	-0.010	-0.009
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Log of no. employees	-0.024**	-0.025**	-0.016***	-0.025**	-0.030**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Deal size/Assets in %	-0.022***	-0.022***	-0.017***	-0.024***	-0.024**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Refinancing indicator	-0.004	-0.004	-0.007	-0.006	-0.012
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Bank-year FE	N	N	Y	N	N
Bank FE	N	N	N	Y	Y
Industry FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Sample	Limited	Limited	Limited	Limited	Limited, purpose not CF
N	2,256	2,256	2,256	2,256	1,719

Notes: $\sigma(\widehat{sales_i})^{t,t+5}$ is the six-year standard deviation of firm i's sales growth from year t (= year of financing) to $t+5$. The unit of observation is a loan transaction. *UB through M&A* and *UB through Section* 20 are indicator variables for whether at the time of the loan transaction any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary, *Eventually UB through M&A* and *Eventually UB through Section* 20 are indicator variables for whether at *any point in time* any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary. $After(1996)$ is an indicator for whether the loan-issue date was on or after August 1, 1996, summarizing two events: the increase in the limit of revenues from underwriting by Section 20 subsidiaries as well as the elimination of firewalls applying to bank holding companies. $Est.(1996)$ indicates whether a universal bank (through M&A or Section 20) was established prior to August 1, 1996. $Treated(1996)$ is a dummy variable denoting whether a universal bank established through a Section 20 subsidiary and actively underwriting securities prior to August 1, 1996 experienced a run-up in the number of IPOs and SEOs after that date. All firm-level explanatory variables are measured at the end of the year prior to the loan-issue year. All samples are limited to loans with loan spreads below or equal to the firm-level average spread on loans provided by universal and commercial banks. In addition, the sample in the fifth column comprises only loans whose purpose is not related to corporate financial restructuring (e.g., recapitalization). Bank(-year) fixed effects are included for *all* lead arrangers of the respective loan that are or eventually become universal banks, whereas all remaining commercial banks are grouped together. Industry fixed effects are based on two-digit SIC codes. Public-service, energy, and financial-services firms are dropped. Robust standard errors (clustered at the bank-parent level, as specified in Section 4.2) are in parentheses.

Table C.6: **Impact of Universal-bank Financing on Sales-growth Volatility – 1989 Deregulation, Loans Sample**

	$\sigma(\widehat{sales_i})^{t,t+5}$				
UB through M&A	0.039***	0.031**	0.041***	-0.043	-0.039
	(0.01)	(0.01)	(0.01)	(0.03)	(0.04)
UB through Section 20	0.034**	0.062***	0.083***	-0.024	-0.004
	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)
UB Sec. 20 × $Treated(1989)$ × $After(1989)$	0.096***	0.104***	0.148***	0.094***	0.150***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
UB Sec. 20 × $Treated(1989)$	-0.054	-0.180***	-0.292***	-0.138***	-0.185***
	(0.03)	(0.05)	(0.06)	(0.05)	(0.07)
UB Sec. 20 × $Est.(1989)$ × $After(1989)$	-0.049	-0.047	-0.041	-0.031	-0.028
	(0.03)	(0.04)	(0.05)	(0.05)	(0.06)
UB Sec. 20 × $Est.(1989)$	0.063*	0.075*	0.076	0.053	0.030
	(0.03)	(0.04)	(0.05)	(0.05)	(0.06)
UB Sec. 20 × $Treated(1996)$ × $After(1996)$	0.025*	0.060***	0.075***		
	(0.01)	(0.01)	(0.02)		
UB Sec. 20 × $Treated(1996)$	-0.063**	0.005	0.052		
	(0.03)	(0.03)	(0.04)		
UB Sec. 20 × $Est.(1996)$ × $After(1996)$	0.002	-0.006	-0.013		
	(0.02)	(0.02)	(0.02)		
UB Sec. 20 × $Est.(1996)$	-0.040*	-0.074**	-0.088**		
	(0.02)	(0.03)	(0.04)		
$After(1989)$	-0.051	-0.045	-0.047	-0.050	-0.059
	(0.03)	(0.03)	(0.04)	(0.03)	(0.04)
$After(1996)$	0.028	0.028	0.033		
	(0.03)	(0.03)	(0.03)		
Eventually UB through M&A	-0.012				
	(0.01)				
Eventually UB through Section 20	-0.010				
	(0.01)				
Log of sales at close in 2010 $	-0.005	-0.006	-0.004	-0.001	0.007
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Log of no. employees	-0.026***	-0.027***	-0.031***	-0.036	-0.047
	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)
Deal size/Assets in %	-0.016***	-0.018***	-0.017***	-0.020**	-0.016*
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
Refinancing indicator	-0.004	-0.005	-0.008	0.007	0.000
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Bank FE	N	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Sample	All	All	All, purpose not CF	Until 96	Until 96, purpose not CF
N	3,054	3,054	2,373	1,251	999

Notes: $\sigma(\widehat{sales_i})^{t,t+5}$ is the six-year standard deviation of firm i's sales growth from year t (= year of financing) to $t+5$. The unit of observation is a loan transaction. *UB through M&A* and *UB through Section* 20 are indicator variables for whether at the time of the loan transaction any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary, *Eventually UB through M&A* and *Eventually UB through Section* 20 are indicator variables for whether at *any point in time* any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary. $After(1989)$ is an indicator for whether the loan-issue date was on or after September 13, 1989, which is when Section 20 subsidiaries were first allowed to generate up to 10% in revenues from underwriting corporate debt and equity. $After(1996)$ is an indicator for whether the loan-issue date was on or after August 1, 1996, summarizing two events: the increase in the limit of revenues from underwriting by Section 20 subsidiaries as well as the elimination of firewalls applying to bank holding companies. $Est.(1989)$ and $Est.(1996)$ indicate whether a universal bank was established prior to September 13, 1989 and August 1, 1996, respectively. $Treated(1989)$ is a dummy variable denoting whether a universal bank established through a Section 20 subsidiary experienced a run-up in the number of IPOs and SEOs after September 13, 1989. $Treated(1996)$ is a dummy variable denoting whether a universal bank established through a Section 20 subsidiary and actively underwriting securities prior to August 1, 1996 experienced a run-up in the number of IPOs and SEOs after that date. All firm-level explanatory variables are measured at the end of the year prior to the loan-issue year. The samples in the third and fifth columns comprise only loans whose purpose is not related to corporate financial restructuring (e.g., recapitalization). The samples in the last two columns comprise only loans issued before August 1, 1996. Bank fixed effects are included for *all* lead arrangers of the respective loan that are or eventually become universal banks, whereas all remaining commercial banks are grouped together. Industry fixed effects are based on two-digit SIC codes. Public-service, energy, and financial-services firms are dropped. Robust standard errors (clustered at the bank-parent level, as specified in Section 4.2) are in parentheses.

Table C.7: **Impact of Universal-bank Financing on Sales-growth Volatility and Total Factor Productivity – Robustness, Compustat Sample**

	$\ln(\sigma(\widehat{sales_i})^{t,t+5})$		$\ln(TFP_i^{t+1})$	
UB through M&A	-0.035	-0.038	-0.001	-0.002
	(0.08)	(0.08)	(0.03)	(0.03)
UB through M&A × Cross-selling	0.175**	0.174**	0.067**	0.065**
	(0.08)	(0.08)	(0.03)	(0.03)
UB through Section 20	0.056	0.067*	0.019	0.022
	(0.04)	(0.04)	(0.02)	(0.02)
UB through Section 20 × Cross-selling	-0.023	-0.041	0.040***	0.033**
	(0.03)	(0.03)	(0.01)	(0.01)
Log of total loan volume in 2010 $	0.003	0.013***	-0.000	0.003
	(0.00)	(0.00)	(0.00)	(0.00)
Log of total M&A transaction volume in 2010 $	0.015***	0.015***	0.003***	0.003***
	(0.00)	(0.00)	(0.00)	(0.00)
Log of sales in 2010 $	-0.124***	-0.124***	0.203***	0.203***
	(0.01)	(0.01)	(0.01)	(0.01)
Log of no. employees	-0.008	-0.008	-0.218***	-0.218***
	(0.01)	(0.01)	(0.01)	(0.01)
Firm age in years		0.003**		-0.015***
		(0.00)		(0.00)
Average Deal size/Assets in %		-0.015**		-0.005
		(0.01)		(0.00)
Refinancing $\in [0, 1]$		-0.031		-0.010
		(0.02)		(0.01)
Bank FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
N	49,200	49,200	54,480	54,480

Notes: $\sigma(\widehat{sales_i})^{t,t+5}$ is the six-year standard deviation of firm i's sales growth from year t (= year of financing) to $t+5$. TFP_i^{t+1} is firm i's average total factor productivity in year $t+1$ (= year of financing +1) from Imrohoroglu and Tuzel (2011). The unit of observation is the firm-year level. *UB through M&A* and *UB through Section* 20 are indicator variables for whether, given any loan transactions in a year, at the time of any loan transaction any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary. $Cross-selling$ is an indicator variable for whether, during the entire bank-firm relationship, the firm receives another loan, M&A advisory services, or its IPO from the same universal bank. Total loan and M&A transaction volumes are cumulative deal sizes involving firm i – as borrower in loan transactions and as either target or acquirer in M&A deals – up to and including year t in which firm i receives a loan or M&A advisory services *from any bank*. All firm-level explanatory variables (except for firm age) are measured at the end of the year, whereas the loans' deal sizes and refinancing status (dummy variable) are year averages. Bank fixed effects are included for *all* lead arrangers of all loans in a given year that are or eventually become universal banks, whereas all remaining commercial banks are grouped together. Public-service, energy, and financial-services firms are dropped. Robust standard errors (clustered at the firm-year level) are in parentheses.

Table C.8: **Impact of Universal-bank Financing on Future Total Factor Productivity – Compustat Sample**

	$\ln(TFP_i^{t+4})$					
UB through M&A	0.032*	0.018	0.005	-0.042	-0.045	0.084*
	(0.02)	(0.03)	(0.03)	(0.05)	(0.06)	(0.05)
UB through M&A × Cross-selling				0.072	0.075	-0.050
				(0.05)	(0.05)	(0.05)
UB through Section 20	0.043***	0.062***	0.063***	0.058***	0.050**	0.013
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
UB through Section 20 × Cross-selling				0.028*	0.029*	0.102***
				(0.02)	(0.02)	(0.03)
Eventually UB through M&A	-0.005					
	(0.01)					
Eventually UB through Section 20	-0.008					
	(0.01)					
Only CB Financing	0.029					
	(0.02)					
Log of sales in 2010 $			0.010	0.011	0.010	0.006
			(0.01)	(0.01)	(0.01)	(0.01)
Log of no. employees			-0.073***	-0.072***	-0.072***	-0.075***
			(0.01)	(0.01)	(0.01)	(0.01)
Firm age in years					-0.009***	-0.010***
					(0.00)	(0.00)
Average Deal size/Assets in %					0.001	-0.001
					(0.00)	(0.00)
Refinancing $\in [0, 1]$					0.007	0.008
					(0.01)	(0.02)
Bank FE	N	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Sample	All	All	All	All	All	Table 6
N	41,941	41,941	41,941	41,941	41,941	26,246

Notes: TFP_i^{t+4} is firm i's average total factor productivity in year $t+4$ (= year of financing +4) from Imrohoroglu and Tuzel (2011). The unit of observation is the firm-year level. *UB through M&A* and *UB through Section* 20 are indicator variables for whether, given any loan transactions in a year, at the time of any loan transaction any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary, *Eventually UB through M&A* and *Eventually UB through Section* 20 are indicator variables for whether, given any loan transactions in a year, at *any point in time* any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary. $Cross-selling$ is an indicator variable for whether, during the entire bank-firm relationship, the firm receives another loan, M&A advisory services, or its IPO from the same universal bank. *Only CB Financing* indicates whether, given any loan transactions in a year, none of the lead arrangers in any loan transaction is (eventually) a universal bank. All firm-level explanatory variables (except for firm age) are measured at the end of the year, whereas the loans' deal sizes and refinancing status (dummy variable) are year averages. The sample in the sixth column comprises firms that, if they ever received financing from a universal bank, also interacted with that bank when it was a commercial bank. Bank fixed effects are included for *all* lead arrangers of all loans in a given year that are or eventually become universal banks, whereas all remaining commercial banks are grouped together. Public-service, energy, and financial-services firms are dropped. Robust standard errors (clustered at the firm-year level) are in parentheses.

Table C.9: **Impact of Universal-bank Financing on Sales-growth Volatility – Time-varying Effects during Universal-bank Relationships, Compustat Sample**

	$\ln(\sigma(\widehat{sales_i})^{t,t+5})$					
UB through M&A	0.132***	0.135**	0.113**	-0.001	0.004	0.009
	(0.04)	(0.06)	(0.06)	(0.08)	(0.08)	(0.18)
UB through M&A × Years ratio	-0.049**	-0.049**	-0.053**	-0.060***	-0.059**	-0.057**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
UB through M&A × Cross-selling				0.174**	0.179**	0.276
				(0.08)	(0.08)	(0.18)
UB through Section 20	0.026	0.077**	0.078**	0.096***	0.097**	0.098*
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.06)
UB through Section 20 × Years ratio	-0.033***	-0.033***	-0.027**	-0.026**	-0.026**	-0.029**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
UB through Section 20 × Cross-selling				-0.016	-0.013	0.012
				(0.03)	(0.03)	(0.05)
Eventually UB through M&A	0.006					
	(0.02)					
Eventually UB through Section 20	0.059***					
	(0.02)					
Only CB Financing	0.026					
	(0.02)					
Log of sales in 2010 $			-0.122***	-0.122***	-0.122***	-0.128***
			(0.01)	(0.01)	(0.01)	(0.01)
Log of no. employees			0.000	0.000	0.000	0.017*
			(0.01)	(0.01)	(0.01)	(0.01)
Firm age in years					0.004***	0.000
					(0.00)	(0.00)
Average Deal size/Assets in %					0.002	0.003
					(0.00)	(0.00)
Refinancing $\in [0, 1]$					-0.025	-0.012
					(0.02)	(0.03)
Bank FE	N	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Sample	All	All	All	All	All	Table 6
N	49,200	49,200	49,200	49,200	49,200	31,869

Notes: $\sigma(\widehat{sales_i})^{t,t+5}$ is the six-year standard deviation of firm i's sales growth from year t (= year of financing) to $t+5$. The unit of observation is the firm-year level. *UB through M&A* and *UB through Section* 20 are indicator variables for whether, given any loan transactions in a year, at the time of any loan transaction any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary, *Eventually UB through M&A* and *Eventually UB through Section* 20 are indicator variables for whether, given any loan transactions in a year, at *any point in time* any one of the lead arrangers is a universal bank formed through a merger or through opening a Section 20 subsidiary. *Years ratio* is equal to $\frac{Years\ since\ first\ UB\ loan+1}{Age\ at\ IPO}$. $Cross-selling$ is an indicator variable for whether, during the entire bank-firm relationship, the firm receives another loan, M&A advisory services, or its IPO from the same universal bank. *Only CB Financing* indicates whether, given any loan transactions in a year, none of the lead arrangers in any loan transaction is (eventually) a universal bank. All firm-level explanatory variables (except for firm age) are measured at the end of the year, whereas the loans' deal sizes and refinancing status (dummy variable) are year averages. The sample in the sixth column comprises firms that, if they ever received financing from a universal bank, also interacted with that bank when it was a commercial bank. Bank fixed effects are included for *all* lead arrangers of all loans in a given year that are or eventually become universal banks, whereas all remaining commercial banks are grouped together. Public-service, energy, and financial-services firms are dropped. Robust standard errors (clustered at the firm-year level) are in parentheses.

Table C.10: **Universal Banking and Income Inequality**

	Log Gini		Log Theil		Log 90/10	
Proportion UB M&A	0.025**	0.023**	0.061**	0.058***	0.036	0.034
	(0.01)	(0.01)	(0.02)	(0.02)	(0.05)	(0.04)
Proportion Eventually UB M&A	-0.018***	-0.015**	-0.042***	-0.035***	-0.070**	-0.054*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)
Proportion UB Section 20	0.013**	0.012**	0.026**	0.024**	0.047*	0.040*
	(0.01)	(0.00)	(0.01)	(0.01)	(0.02)	(0.02)
Proportion Eventually UB Section 20	-0.013*	-0.012*	-0.024*	-0.021	-0.070**	-0.059*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)
Growth of GDP per capita		0.045		0.106		0.927***
in 2000 $		(0.06)		(0.14)		(0.27)
Proportion blacks		0.044		0.014		-0.086
		(0.23)		(0.46)		(0.90)
Proportion high-school dropouts		0.418***		0.755***		0.975*
		(0.13)		(0.27)		(0.49)
Proportion female-headed households		0.022		0.042		-0.170
		(0.08)		(0.15)		(0.37)
Unemployment rate		0.009***		0.019***		0.063***
		(0.00)		(0.00)		(0.01)
State FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
N	769	769	769	769	769	769

Notes: The dependent variable in the first two columns is the natural logarithm of the Gini coefficient, in the third and fourth columns the natural logarithm of the Theil index, and in the last two columns the natural logarithm of the ratio of the 90^{th} and 10^{th} percentiles of the total-income distribution. *Proportion UB M&A* and *Proportion UB Section* 20 are the fractions (between 0 and 1) of the total loan amount provided to firms in any given state and year by syndicates with at least one lead arranger that is a universal bank formed through M&A or through opening a Section 20 subsidiary, respectively. *Proportion Eventually UB M&A* and *Proportion Eventually UB Section* 20 are the fractions (between 0 and 1) of the total loan amount provided to firms in any given state and year by syndicates with at least one lead arranger that is a commercial bank that at *any point in time* becomes a universal bank formed through M&A or through opening a Section 20 subsidiary. Delaware and South Dakota are excluded from the analysis. Robust standard errors (clustered at the state level) are in parentheses.

Table C.11: **Universal Banking and Income Inequality − Decomposition**

				Employment groups	
Panel A:		Between	Within	Self-	
All workers	Total	groups	groups	employed	Salaried
Proportion UB M&A	0.021***	0.001	0.020***	0.027	0.017***
	(0.01)	(0.00)	(0.01)	(0.02)	(0.01)
Proportion Eventually UB M&A	-0.010***	0.000	-0.010***	-0.013	-0.009***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
Proportion UB Section 20	0.007**	-0.000	0.007**	-0.003	0.008**
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
Proportion Eventually UB Section 20	-0.006	0.000	-0.007*	-0.008	-0.007*
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
Growth of GDP per capita	-0.004	0.010	-0.013	-0.189	0.001
in 2000 $	(0.04)	(0.01)	(0.04)	(0.13)	(0.05)
Proportion blacks	0.042	-0.004	0.045	0.011	0.055
	(0.12)	(0.01)	(0.12)	(0.20)	(0.12)
Proportion high-school dropouts	0.201**	0.003	0.198**	-0.049	0.241***
	(0.08)	(0.01)	(0.08)	(0.19)	(0.08)
Proportion female-headed households	-0.009	-0.005	-0.005	0.048	-0.011
	(0.04)	(0.01)	(0.04)	(0.12)	(0.04)
Unemployment rate	0.004***	-0.000	0.004***	0.005	0.004***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
State FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
N	769	769	769	769	769

				Education groups	
Panel B:		Between	Within	High school	Some college
Salaried workers	Total	groups	groups	or less	or more
Proportion UB M&A	0.017***	0.004***	0.013**	0.015*	0.010
	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)
Proportion Eventually UB M&A	-0.009***	-0.002*	-0.007**	-0.006	-0.005*
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
Proportion UB Section 20	0.008**	0.002	0.007**	0.001	0.008**
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
Proportion Eventually UB Section 20	-0.007*	-0.001	-0.006	-0.004	-0.006
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Growth of GDP per capita	0.001	-0.010	0.011	-0.034	0.022
in 2000 $	(0.05)	(0.01)	(0.04)	(0.06)	(0.06)
Proportion blacks	0.055	0.009	0.046	0.072	0.060
	(0.12)	(0.02)	(0.11)	(0.11)	(0.10)
Proportion high-school dropouts	0.241***	0.067***	0.174**	0.242***	0.093
	(0.08)	(0.02)	(0.07)	(0.09)	(0.08)
Proportion female-headed households	-0.011	-0.005	-0.006	0.031	-0.014
	(0.04)	(0.01)	(0.03)	(0.05)	(0.03)
Unemployment rate	0.004***	0.000	0.003***	0.005***	0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
State FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
N	769	769	769	769	769

Notes: The dependent variable is the Theil index in any given state and year. In both panels, the second and third columns add up to the first column, and the last two columns report the impact of universal-bank financing on the Theil index separately within each of the groups. *Proportion UB M&A* and *Proportion UB Section* 20 are the fractions (between 0 and 1) of the total loan amount provided to firms in any given state and year by syndicates with at least one lead arranger that is a universal bank formed through M&A or through opening a Section 20 subsidiary, respectively. *Proportion Eventually UB M&A* and *Proportion Eventually UB Section* 20 are the fractions (between 0 and 1) of the total loan amount provided to firms in any given state and year by syndicates with at least one lead arranger that is a commercial bank that at *any point in time* becomes a universal bank formed through M&A or through opening a Section 20 subsidiary. Delaware and South Dakota are excluded from the analysis. Robust standard errors (clustered at the state level) are in parentheses.

D Theory Appendix

Proof of Lemma 1

Suppose the project succeeded in period 1. To generate enough cash to pay down debt from D to $\bar{D}(k)$, the entrepreneur must sell off a stake $\bar{s}(k) = \frac{D-\bar{D}(k)}{V_2^S}$. Suppose, for a contradiction, that the entrepreneur prefers to sell off a stake $\bar{s}(k)$ in order to pay down the outstanding debt. Then, it must be the case that:

$$(1 - s_1 - \bar{s}(k))p\left(R^S(k) - \bar{D}(k)\right) \geq (1 - s_1)(p - q)\left(R^S(k) + \Delta^S(k) - D\right).$$

Using the definition of $\bar{s}(k)$ and $\bar{D}(k)$, this can be written as:

$$(1 - s_1)\left[\frac{p(p-q)}{q}\Delta^S(k) - (p - q)\left(R^S(k) + \Delta^S(k)\right)\right] + \bar{D}(k) \geq D\left[1 - (1 - s_1)(p - q)\right].$$

Since $D > \bar{D}(k)$, a necessary condition for the above expression to hold is:

$$(1 - s_1)\left[\frac{p(p-q)}{q}\Delta^S(k) - (p - q)\left(R^S(k) + \Delta^S(k)\right)\right] > -\bar{D}(k)(1 - s_1)(p - q),$$

which can be simplified to

$$\frac{q(p-q)}{q}\Delta^S(k) > (p - q)\Delta^S(k)$$

or

$$0 > 0,$$

a contradiction.

Finally, if the entrepreneur does not want to pay down debt after a success, he will not want to do so after a failure. To see why, note that outstanding debt is always weakly larger after a failure than after a success, so that $V_2^S \geq V_2^F$. An analogous argument then implies that the entrepreneur will not issue equity to pay down debt after a failure. Hence, the entrepreneur will not issue equity to pay down debt after any history. ■

Proof of Proposition 1

We begin by showing that sufficiently productive firms achieve the first best under separated banking. The bank's participation constraint is

$$k \leq p\left[\tau_1^S + p_2^S\tau_2^{SS} + (1 - p_2^S)\tau_2^{SF}\right] + (1 - p)\left[\tau_1^F + p_2^F\tau_2^{FS} + (1 - p_2^F)\tau_2^{FF}\right] + s_1V_1, \tag{14}$$

while the entrepreneur's hidden-information IC constraint now reads

$$(1 - s_1)(\tau_1^S - \tau_1^F) + s_1(R^S(k) - R^F(k)) \leq (1 - s_1)(V_2^S - V_2^F). \tag{15}$$

The entrepreneur aims to maximize his residual claim in the firm, subject to the incentive constraint and the bank's participation. The optimal contracting problem is

$$U_1 = \max_{\{s_1,d,D,k\}} \quad (1 - s_1)V_1 \tag{OBJ}$$
$$\text{s.t.} \quad (14), (15)$$

Clearly, (14) will be binding in equilibrium. We can use this to rewrite the (OBJ) as:

$$\begin{aligned} U_1 = \max_{\{s_1,d,D,k\}} \quad & p\left[R^S(k) + p_2^S\left(R^S(k) + \Delta^S(k)\mathbb{1}_{\{A^S=G\}}\right) + (1-p_2^S)\left(R^F(k) - \Delta^F(k)\mathbb{1}_{\{A^S=G\}}\right)\right] \\ & + (1-p)\left[R^F(k) + p_2^F\left(R^S(k) + \Delta^S(k)\mathbb{1}_{\{A^F=G\}}\right) + (1-p_2^F)\left(R^F(k) - \Delta^F(k)\mathbb{1}_{\{A^F=G\}}\right)\right] - k \\ & \text{s.t} \end{aligned} \tag{15}$$

Without loss of generality given limited liability, we can restrict attention to $d \leq R^S(k)$. As such, rewrite the IC constraint as:

$$(1-s_1)\max(d - R^F(k), 0) + s_1(R^S(k) - R^F(k)) \leq (1-s_1)(V_2^S - V_2^F). \tag{16}$$

Consider the RHS of this constraint. Whenever $A^S = A^F$, we have that $p_2^S = p_2^F$. Call this probability p_2. Again without loss of generality, restrict attention to contracts satisfying $D'_\theta \leq R^S(k) + \Delta^S(k)$ for all k and all θ. Then, we can write:

$$V_2^S - V_2^F = p_2\left[D'_F - D'_S\right] + (1-p_2)\left[\min(D'_F, R^F(k) - \Delta^F(k)) - \min(D'_S, R^F(k) - \Delta^F(k))\right],$$

where we know that $D'_F = D'_S + \max(d - R^F(k), 0)$. Using this fact implies that $V_2^S - V_2^F \leq \max(d - R^F(k), 0)$, so that the IC constraint becomes:

$$(1-s_1)\max(d-R^F(k),0) + s_1(R^S(k) - R^F(k)) \leq (1-s_1)(V_2^S - V_2^F) \leq (1-s_1)\max(d-R^F(k),0).$$

Hence, whenever $p_2^S = p_2^F = p_2$ and $k > 0$, incentive compatibility requires $s_1 = 0$, i.e., a pure-debt contract. It is then straightforward to show under which conditions a firm can achieve the first-best outcome under separated banking. Recall that the first best requires $A^S = A^F = S$, which, in turn, requires $D'_F \leq \bar{D}(k)$. This is equivalent to requiring $d - \min(d, R^F(k)) + D \leq \bar{D}(k)$. To maximize pledgeable wealth, it is optimal to set $d \geq R^F(k)$. Beyond this point, however, the split between short-term and long-term debt is clearly indeterminate. We thus set $d = R^F(k)$ and $D = \bar{D}(k)$. Note, also, that this contract is trivially incentive compatible in that the requirement repayment streams are identical under success and failure, and the expected income to a bank under separated banking given $A^S = A^F = S$ is bounded above by $R^F(k) + p\bar{D}(k) + (1-p)R^F(k)$.

Next, we characterize the optimal contract for firms that are not sufficiently productive so as to achieve the first best. For all three classes of contracts, insert (IC) in (PC) and rearrange. For the class-1 contract, which never induces a gamble, one then yields:

$$k_1^* = ps_1R^S(k_1^*) + (2-p)s_1R^F(k_1^*) + p(1-s_1)\tau_2^{FS} + (1-p)(1-s_1)\tau_2^{FF} + (1-s_1)\tau_1^F,$$

which is maximized for $s_1 = 0$, $d = R^F(k_1^*)$, and $D = \bar{D}(k_1^*)$ (see first-best contract).

Similarly for the class-2 contract:

$$\begin{aligned} k_2^* = & (p-q)s_1R^S(k_2^*) + (2-p+q)s_1R^F(k_2^*) + (p-q)(1-s_1)\tau_2^{FS} \\ & + (1-p+q)(1-s_1)\tau_2^{FF} + (1-s_1)\tau_1^F - \frac{q}{1-p}s_1\Delta^S(k_2^*). \end{aligned}$$

Notice that, as before, incentive compatibility requires $s_1 = 0$. Since the contract induces a gamble after both success and failure, we have $p_2^S = p_2^F = p - q$. The upside is that the feasible amount of long-term debt is now bounded above only by the limited-liability requirement. The amount of short-term debt is still constrained by the IC constraint, which now reads:

$$\max(d - R^F(k), 0) \leq \min(D + \max(d - R^F(k), 0), R^F - \Delta^F) - \min(D, R^F - \Delta^F).$$

As τ_1^F cannot exceed $R^F(k_1^*)$, we set $d = R^F(k_1^*)$. To maximize τ_2^{FS} and τ_2^{FF}, given that the entrepreneur gambles in both states of the world (i.e., $D > \bar{D}(k_2^*)$), we optimally set $D = R^S(k_2^*) +$

$\Delta^S(k_2^*)$, which fulfills the IC constraint. This yields $\tau_2^{FS} = R^S(k_2^*) + \Delta^S(k_2^*)$ and $\tau_2^{FF} = R^F(k_2^*) - \Delta^F(k_2^*)$.

Finally, we turn to the third class of contracts, which induce a gamble after failure and prevent a gamble after success. Again, we insert (IC) in (PC), and yield:

$$k_3^* = (qp + (p-q)s_1)R^S(k_3^*) + (s_1(2-p+q) - pq)R^F(k_3^*) + (p-q)(1-s_1)\tau_2^{FS}$$
$$+ (1-p+q)(1-s_1)\tau_2^{FF} + (1-s_1)\tau_1^F - \frac{q}{1-p}(s_1 - p)\,\Delta^S(k_3^*),$$

where, again, it is optimal to set $s_1 = 0$.

Now, in order to induce a gamble only after failure in the first period while maximizing τ_2^{FS} and τ_2^{FF} such that $\tau_2^{FS} = R^S(k_3^*) + \Delta^S(k_3^*)$ and $\tau_2^{FF} = R^F(k_3^*) - \Delta^F(k_3^*)$, we set $D = \bar{D}(k_3^*)$ but $d > R^F(k_3^*)$. As dictated by the IC constraint, we seek the smallest possible value for d that yields $\tau_2^{FS} = R^S(k_3^*) + \Delta^S(k_3^*)$, which is given by:

$$\bar{D}(k_3^*) + d - R^F(k_3^*) = R^S(k_3^*) + \Delta^S(k_3^*).$$

This yields $d = R^F(k_3^*) + \frac{p}{q}\Delta^S(k_3^*)$.

Thus, we have that τ_1^F, τ_2^{FS}, and τ_2^{FF} are equal under class-2 and class-3 contracts. Given $s_1 = 0$, one can falsely assume that $k_2^* = k_3^*$, and yields that the above-noted expression for k_3^* is strictly greater than that for k_2^*, which, in turn, implies that $k_3^* > k_2^*$.

Last, to see that k_3^* can, but need not, be greater than k_1^*, again falsely assume that they were equal s.t. $k_3^* = k_1^* = k^{**}$. Then:

$$k_3^* - k_1^* = (R^S(k^{**}) - R^F(k^{**}))(pq - q) + \Delta^S(k^{**})\left(\frac{pq-q}{1-p} + \frac{p^2}{q}\right) \gtrless 0,$$

a contradiction. Most importantly, the direction of the contradiction and, thus, the ordinality of the two equilibrium capital amounts depend on p, q, as well as the functional forms for $R^S(\cdot)$, $R^F(\cdot)$, and $\Delta^S(\cdot)$. To see that our model assumption $\bar{D}(k) \geq R^F(k)$ does not preclude the possibility that $k_3^* > k_1^*$, use $\bar{D}(k^{**}) \geq R^F(k^{**})$ in the above equation, and yield:

$$k_3^* - k_1^* \leq \Delta^S(k^{**})\left(\frac{p^2}{q} + (pq-q)\left(\frac{1}{1-p} + \frac{p-q}{q}\right)\right),$$

where the right-hand side is strictly greater than zero because $\frac{p^2}{q} + (pq-q)\left(\frac{1}{1-p} + \frac{p-q}{q}\right) > 0$ as long as:

$$p^2 > (q - pq)\left(\frac{q}{1-p} + p - q\right) = qp(1-p+q),$$

which is always true as $p > q$. ■

Proof of Proposition 2

We begin by characterizing the firms that achieve the first best under universal banking. To this end, we restrict attention to contracts satisfying $A^S = A^F = S$. As the participation constraint will hold with equality, the problem of the entrepreneur can be written as follows:

$$\max \quad 2\left[pR^S(k) + (1-p)R^F(k)\right] - k$$
$$\text{s.t.} \quad (3)$$

Begin by analyzing (3). Given that the agent never gambles, we can write:

$$V_2^F = V_2^S - \underbrace{\Big[p \max(d - R^F(k), 0) + (1-p)\Big[\min(D'_F, R^F(k)) - \min(D'_S, R^F(k))\Big]\Big]}_{\equiv \Phi},$$

which implies that the RHS of (3) can be written as

$$(s_2^F - s_2^S)V_2^S - (1 - s_2^F)\Phi.$$

By (2) and using the fact that $D'_S = D$, we then have:

$$\begin{aligned} k = p\Big[d + pD + (1-p)\min(D, R^F(k))\Big] + p(s_2^S - s_2^F)V_2^S + ps_2^F\Phi + s_2^F V_2^F + \\ (1-p)\Big[\min(d, R^F(k)) + p\min(D'_F, R^S(k)) + (1-p)\min(D'_F, R^F(k))\Big] \\ + s_1\Big[p(R^S(k) - d) + (1-p)(R^F(k) - \min(d, R^F(k))\Big]. \end{aligned}$$

Since the bank's participation constraint will bind at the optimal contract, the entrepreneur's problem is to maximize pledgeable income subject to the incentive constraint. As such, observe, first, that setting $s_2^F = 1$ loosens the IC constraint while simultaneously increasing pledgeable income. Similarly, it is always optimal to set $d \geq R^F(k)$, since any $d < R^F(k)$ decreases pledgeable income without relaxing the incentive constraint. Second, pledgeable income is maximized when the IC constraint is binding. Combining the binding PC and IC constraints implies that maximizing pledgeable income is equivalent to maximizing

$$\begin{aligned} p\Big[d + pD'_S + (1-p)\min(D'_S, R^F(k)) + V_2^S - (1-s_1)(d - R^F(k)) - s_1(R^S(k) - R^F(k))\Big] \\ + s_1 p(R^S(k) - d), \end{aligned}$$

which is equivalent to maximizing

$$R^F(k) + (1-p)R^F(k) + pR^S(k) + (1-s_1)R^F(k).$$

Hence, it is always optimal to set $s_1 = 0$, while the split between d, and s_2^S is immaterial beyond $s_2^F = 1$, $d \geq R^F(k)$, and $D'_S \leq \bar{D}(k)$, which we require to induce the safe action. The maximum pledgeable income is, thus, given by

$$R^F(k) + (1-p)R^F(k) + pR^S(k),$$

and the firm achieves the first best whenever

$$R^F(k^*) + (1-p)R^F(k^*) + pR^S(k^*) \geq k^*.$$

Next, we characterize the optimal contract for firms that are not sufficiently productive so as to achieve the first best. We first state the following lemma.

Lemma 2 (No gambles under universal banking) *Under universal banking, it is never optimal to allow the agent to gamble.*

Proof: Since the gamble is inefficient, it reduces the value of the firm. Since bank and firm can commit to state-contingent equity swaps, any incentives provided by increasing the residual debt after failure can be replicated by selling off sufficient amounts of equity at date 2. ■

From the previous lemma, we have that it is never optimal to allow the entrepreneur to gamble. The remainder of the argument then follows from the characterization of the optimal contract for firms that achieve the first best under universal banking. Since the PC constraint is binding, the firm aims to maximize pledgeable income subject to the incentive constraint. As the firm is constrained below the first best, the IC constraint will be binding at the optimum. Maximized pledgeable income is given by:

$$R^F(k) + (1-p)R^F(k) + pR^S(k)$$

for any k such that the highest feasible k is defined as the largest k that satisfies

$$R^F(k) + (1-p)R^F(k) + pR^S(k) = k.$$

We have shown above that we must have $s_2^F = 1$, $d \geq R^F(k)$, and $D'_S \leq \bar{D}(k)$. Beyond this point, the capital structure is determined by the binding IC constraint. ■

Proof of Proposition 3

The proof follows immediately from comparing the equations determining the equilibrium levels of capital under separated and universal banking. In particular, for any $\Delta^S > 0$, the concavity of $R^\theta(\cdot)$ implies that we must have that $k^*_{SB} \leq k^*_{UB}$. Second, note that the equilibrium level of capital is strictly decreasing in the spread between success and failure payoffs since $pR^S(k) + (1-p)R^F(k)$ is constant for each k, while $R^F(k)$ is decreasing for each k. To compare equilibrium values to the entrepreneur, note that the binding PC constraint implies that the entrepreneur transfers at most k units of expected payments to the bank. The equilibrium payoff is then determined solely by k and whether the inefficient gamble occurs in period 2. Under universal banking, any given level of incentives achieved under separated banking by forcing a gamble can be replicated *without* resorting to forcing the entrepreneur to gamble at date 2. Furthermore, equilibrium capital is weakly larger under universal banking. As such, contract values are always weakly larger under universal banking, and strictly larger for at least one level of the payoff spread $S(k)$. ■