'By a Silken Thread': regional banking integration and pathways to financial development in Japan's Great Recession[1]

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Abstract

We explore the real effects of regional banking integration on small, bank-dependent manufacturing firms (SME) during Japan's 'lost decade'. We show that in Japan's regionally tiered banking system, internal capital markets of country-wide banks offset local credit supply disruptions in prefectures with many bank-dependent SMEs. We instrument for regional banking integration using the local importance of silk-reeling in the 19th century: silk export finance was the origin of Japan's relationship-based model of SME lending. After 1990, this relationship-based model contributed to a *de facto* segmentation of banking markets because local SMEs could not easily turn to non-local lenders.

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1 Introduction

What is the role of banking integration in a financial crisis? At a theoretical level, banking integration increases an economy's exposure to foreign bank liquidity shocks while insulating it from idiosyncratic shocks to its domestic banking system. How do historical factors determine this trade-off between integration and segmentation of banking markets? As the world is recovering from the worst financial crisis in 80 years, and as Europe is moving into a banking union, these questions are more pertinent than ever. In this paper, we study them in the context of a quasi-laboratory setting: Japan's Great Recession of the 1990s.

Japan's 'lost decade' of the 1990s is uniquely suited to help address these questions: In the early 1990s Japan saw the bust of a major real estate bubble. This bubble was particularly prickly in the big cities such as Tokyo or Osaka where it was predominantly financed by credit from big, nationwide banks (referred to as 'city' banks in Japan). When real estate markets crashed they did so across the country, but the burst was most dramatic in the big cities, thus affecting the balance sheets of city banks more than those of most local banks. At the same time, Japan's banking market—for regulatory and historical reasons that we will discuss in detail—was highly segmented along regional lines, with local banks mainly financing the activities of local small and medium sized manufacturing enterpricses (SME) for which bank credit is often the only source of external finance.

We exploit variation across Japanese prefectures in both regional banking integration (measured as the markets hare of city banks in local lending) and local firms' dependence on bank credit to study the the real effects of Japan's bursting real estate bubble of the 1990s. We provide evidence for both the firm-borrowing and the lending channel: prefectures with many bank dependent SME were more exposed to the downturn as were regions with a higher market share of city banks. However—and this is our key result—prefectures with many SME did relatively better if their banking sectors were more integrated. We show this pattern to be consistent with a stylized model in which internal capital markets allow nationwide banks to react to regional differences in loan demand by shifting credit to prefectures where it was most urgently needed—by small, bank-dependent firms that cannot substitute locally issued loans for alternative sources of finance from outside their prefecture. We note that these findings hold true even though financially integrated prefectures with a high market share of city banks were generally more exposed to the property market crash because city banks were more exposed to the big cities than local banks.

These results raise the question how and why in Japan's generally highly integrated national economy, regional differences in banking integration could be so persistent as to affect the regional spread of a major crisis across the country. We show that the *de facto* regional segmentation of Japan's banking market has long-standing historical origins and that it consisted in persistent bank-firm relationships that for many bank-dependent firms were virtually impossible to switch in the years after 1990.

Prefectures in which silk reeling emerged as the first main export industry in the late 19th century developed a particular system of trade credit and export finance in which regional, cooperative or mutual banks came to play a key role in local banking markets. Because of their cooperative

structure and local focus, these financial institutions had a comparative advantage in resolving the financing frictions faced by the highly fragmented silk export industry—an advantage that these local banks were able to preserve after the decline of the silk industry by lending to small manufacturing firms in other sectors. The model of financial development of the old silk regions therefore is characterized by a strong presence of local, cooperative banks and very tight relationships between these banks and SMEs. As we argue, these features meant that the banking markets of the silk prefectures were *de facto* weakly integrated with the rest of the country at the onset of the Great Recession. Hence, the extent to which a large, common, countrywide shock—the bursting of Japan's asset price bubble in the early 1990s—was transmitted to different parts of the country literally hung 'by a silken thread' that was reeled 100 years earlier, during the days of Meiji-era Japan (1868–1912).

Our findings provide a novel perspective on the transmission of Japan's crisis of the 1990s to the real economy. By operating internal capital markets, nationwide banks could spread out the property price shock in the major cities in a way that equalized the interest rate on the marginal loan in different prefectures. Therefore, they reduced lending less in prefectures in which the marginal willingness to pay for bank loans—bank dependence —was highest because of a strong presence of SMEs and where the nationwide banks were able to reach many of these SMEs as customers because of a traditionally high market share in the local market. Conversely, in prefectures where regional banks had a high market share, the tight links between SMEs and their local cooperative banks (and low competition from nationwide banks) made it difficult for local SMEs to switch lenders when their local bank was facing an adverse shock to its lending ability. Hence, the tight relationships between SMEs and local banks led to a *de facto* segmentation of local credit markets when a big nationwide shock hit Japan in the late 20th century. This is what we call the 'silken thread'. We illustrate the importance of this 'silken thread' by showing that the prefecture-level number of silk filatures (reeling factories) in the late 19th century is indeed a powerful predictor of the degree of regional banking integration at the onset of Japan's Great Recession of the 1990s, some 100 years later (and of the persistence of bank relationships during the lost decade that followed). Using silk as an instrument for banking integration, we corroborate our previous results.

Our findings are directly relevant for current policy discussions at the international level and, in particular, hold important lessons for a banking union in Europe. First, prefectures with many SMEs that depend on the local provision of bank loans have more to gain from banking integration. Second, our historical evidence suggests that banking systems of the member countries of the European Monetary Union—many of which are also characterized by the presence of small, regional banks—could remain highly fragmented *de facto* even long after a European banking union was formed. Third, our results highlight that SME access to credit from local banks can be a poor substitute for improved access from outside the region and that true banking integration in Europe will require an increase in SME access to credit from Europe-wide banks.

1.1 Contribution to the literature

Our study makes the following contributions: In a first step, we show that the ability of firms to switch lender given a shock to lending supply—the firm borrowing channel—varied across prefectures and was important for the regional transmission of the crisis. Second, we provide evidence that internal capital markets of integrated banks played an important role in attenuating the impact of the firm-borrowing channel. Third, we discuss the historical origins and the persistence of the regional segmentation of Japan's banking market. This discussion, fourth, provides us with an instrument that allows us to overcome the potential endogeneity of regional banking integration in our empirical specifications.

A number of papers have used the bursting of Japan's big property and stock market bubbles of the 1980s as an identifying shock to banks' lending behavior as we do here. Peek and Rosengren (1997, 2000) emphasize the common lender effect of the Japanese shock of the early 1990s on US banks. Imai and Takarabe (2011) show that more financially integrated prefectures were more exposed to the property price downturn in the big cities via the bank-lending channel. Their approach emphasizes that banking integration increases the exposure to negative shocks from outside the region. We corroborate their results in our sample, but—importantly—our approach also allows for cross-prefectural differences in the elasticity of loan demand, thus shedding light on the role of internal capital markets in country-wide banks. Since SME are particularly dependent on local credit provison, they benefit strongly from integrated banks' ability to allocate funds flexibly across different locations. At the level of the individual prefecture, the real output effect of financial integration during Japan's crisis, therefore, depended on both the relative extent to which local and nationwide banks' lending was affected by the property price downturn (the bank lending channel) and the extent to which the local economy could substitute the local supply of bank credit for other sources of finance (the firm-borrowing channel). We find that the negative real effects from financial integration were substantially mitigated in prefectures with high levels of bank dependence.

Amiti and Weinstein (2011) use differences in the external finance dependence of exporting and non-exporting firms to identify the impact of bank-level loan supply shocks on real economic activity. In our analysis, we focus on differences in bank dependence and credit supply between prefectures to identify the impact of financial constraints on real economic activity.

Our analysis closely relates to Khwaja and Mian (2008) who use Pakistani firm-level data to study the impact of bank liquidity shocks. They find that lending to the same firm by more exposed banks is affected more (the bank lending channel). However, the real effects from reduced lending are mainly due to smaller firms that cannot tap alternative sources of credit (the firm-borrowing channel). Giannetti and Simonov (2013) use a similar approach to study the effects of bank recapitalizations in Japan. Hosono et al. (forthcoming) find that bank liquidity shocks after the Kobe earthquake negatively affect client firms' investment even in a highly developed market such as Japan. Our identification builds on these findings by exploiting regional variation in SME importance to identify the importance of the firm-borrowing channel at the regional level. We show that the negative real effects that arise from the inability of small firms to switch to alternative sources

of finance (the firm-borrowing channel) are mitigated by regional banking integration. The patterns that we uncover in the data support the view that internal capital markets played a key role in explaining cross-prefectural differences in credit supply by nationwide banks during Japan's crisis. Our results therefore complement the findings by Cetorelli and Goldberg (2012*a*,*b*) who show that the internal liquidity management of internationally active US banks played a key role in the transmission of domestic (i.e., US) liquidity shocks to foreign economies.

As shown by Peek and Rosengren (2005) and Caballero, Hoshi and Kashyap (2008), big banks seem to have engaged in 'evergreening' insolvent borrowers in the hope that either these borrowers or the banks themselves would eventually be bailed out by the government. This led to the emergence of a class of 'zombie' firms; i.e., insolvent firms that starved other, productive firms of credit and hindered the creation and growth of new firms and thus stifled growth in the aggregate economy. As we discuss, our results are consistent with evergreening. We find evidence that lending to particularly zombie-prone sectors was less pervasive in prefectures in which city banks had traditionally strong ties to small manufacturers. Conversely, city banks may have withdrawn credit from prefectures in which they had traditionally weak ties to SMEs in order to evergreen large customers in their core business regions.

To our knowledge, our analysis is the first to indicate the importance of persistent banking relationships for the macroeconomic transmission of Japan's crisis during the 1990s. We draw on the insights from the literature on relationship lending that has emphasized that small banks may have a comparative advantage in lending to small businesses (Berger et al. (2005)). Furthermore, our findings are consistent with Uchida, Udell and Watanabe (2008), who show that banking relationships are particularly persistent in the Japanese context. While much of the literature has emphasized the benefits that small firms may reap from long-term bank relationships, the asymmetry of information between the relationship lender and any potential new lender may make it difficult or impossible for the borrower to switch if the relationship lender faces an adverse shock to its lending ability—as was clearly the case for most regional banks in Japan after 1990. This holdup problem was first described theoretically by Sharpe (1990) and Rajan (1992). Our results suggest that it had first-order macroeconomic implications during Japan's crisis after 1990 by contributing to the *de facto* segmentation of local banking markets.

An important contribution of our paper is that it explores the long-term historical origins of why Japan's crisis of the 1990s spread across the country as it did. These historical aspects of our results build on literature showing that Japan's opening to trade was indeed a natural experiment. Bernhofen and Brown (2005, 2004) demonstrate that this opening spurred the development of industries in which Japan had a comparative advantage, with the silk industry as a preeminent example. The role of special institutions involved in trade credit and export finance for the development of the silk industry has been explored by several scholars of Japanese economic history (Nakabayashi (2001, 2006, 2014) and Miwa and Ramseyer (2006)). However, to our knowledge, we are the first to identify the persistence of the role of these institutions and the fact that it led to a regional segmentation in banking markets that lasted for over a century.

2 Regional banking integration and Japan's Great Recession

2.1 Theoretical considerations

From a theoretical point of view, the effect of regional banking integration during a major crisis such as Japan's is *a priori* ambiguous. On the one hand, more integrated prefectures are more exposed to bank liquidity shocks that originate outside the region. On the other hand, banking integration can also improve access to finance during a crisis that hits the domestic banking sector. This is because an integrated banking sector can respond to regional differences in loan demand while a regionally segmented banking sector cannot. Given its costs (in terms of higher exposure to external shocks), the benefits from banking integration (in the form of improved local access to finance from outside the region) should be relatively more important in prefectures where the dependence on the local provision of bank credit is particularly strong. Therefore, the interaction between dependence on local bank finance and banking integration should play a key role in determining how severely the crisis hits a region. To identify regional differences in the dependence on bank credit, we use the share of SME in the prefecture's output or employment: SME cannot easily borrow from the countrywide capital market or from a bank outside their region and are therefore particularly dependent on the local provision of bank credit.[1]

To formalize our intuition, Figure (1) presents a stylized version of a banking model in the spirit of Holmstrom and Tirole (1997) that we adapt from Morgan, Rime and Strahan (2004). We assume that there are two prefectures and three banks: two equally sized local ('regional') banks, each of which operates in one of the two prefectures only and one integrated ('city') bank operating in both prefectures. The integrated bank operates an internal capital market in which the interest rate charged on the marginal loan in each prefecture is equalized. To formalize the notion that SMEs cannot easily borrow from banks outside the prefecture or from the bond market, we assume that the loan demand of SMEs is less elastic with respect to loan interest rates than that of big firms. We further assume that local banks specialize in lending only to SMEs (very much in keeping with the actual situation in Japan that we present in more detail below) while the city bank generally lends to both SMEs and big firms. The left panel of the figure illustrates the case of a prefecture with a small share of SMEs, and the right panel illustrates the case of a prefecture with many SMEs. The demand curve of the city bank in the low-SME prefecture is flatter than the one faced by the regional bank because the local bank only lends to SME customers, whereas the city bank lends to big firms.[2]

Consider now a countrywide land price decline that forces both the local and the integrated banks to reduce their countrywide loan supply by an amount $\overline{\Delta L}$. Suppose at the outset that both

[1] Hoshi and Kashyap (2000) show that SMEs in the manufacturing sector kept their bank-debt-to-asset ratios of around 30-35 percent largely constant during the 1980s and 1990s. By contrast, big manufacturing firms switched to the bond market, thus considerably lowering this ratio during the 1990s to levels of well below 20 percent on average. Also, since bank loans in Japan traditionally are secured by collateral (mainly land), banks' credit provision to SMEs is likely to be particularly dependent on fluctuations in local land values (see Gan (2007*a*) and Shimizu (1992)).

[2] For expositional simplicity, we assume that the city bank does not lend to SME customers in the low-SME prefecture while there are no big firms in the high-SME prefecture so that both the city and the local bank face only demand from SMEs in the high-SME prefecture.

local and integrated banks have the supply curve L_0 and that both types of banks lend to their customers at rate r_0. As we assumed all local banks to be equal (and, therefore, equally hit by the shock), each of them will reduce its loan supply by $\overline{\Delta L}/2$, as illustrated by the shift from L_0 to L_{local} in the two panels. By contrast, the integrated bank operates an internal capital market across prefectures and will therefore allocate loans such that the interest rate on the marginal loan in each prefecture is equalized. Therefore, it will reduce its lending by less than $\overline{\Delta L}/2$ in the high-SME prefecture and by more than $\overline{\Delta L}/2$ in the low-SME prefecture, as shown in the shift from L_0 to L_{City} in the respective panel.

The model captures the intuition above and provides us with a key empirical implication that we test in the remainder of the paper: given the size of the banking sector shock, a high-SME region will see a less marked reduction in lending (and to the extent that lending drives GDP, also a higher GDP growth rate) if it is financially integrated.

We make the following remarks: First, an implicit assumption in our exposition here is that SMEs that have borrowed from a local bank cannot easily switch to borrowing from an integrated bank in the same prefecture to take advantage of the lower lending rates offered by the integrated bank – at least not in the short run. Below, we show that this assumption is justified empirically because the tight relationships in Japan between local banks and SMEs are likely to create a holdup problem that effectively segments the banking market within the prefecture. Clearly, we would expect that the extent of the hold-up fcaed by the average SME in a prefecture to depend on the degree of banking integration itself: in high-SME prefectures with high financial integration it is likely that a big share of SMEs already bank with integrated banks at the outset. Also, if integrated banks have a strong local presence, we would expect the average duration of search for an SME that wishes to switch from a local to an integrated bank will be lower. Below, we provide evidence that supports both of these conjectures.

Secondly, note that our simple expositon in Figure (1) assumes that the liquidity shock affects both the integrated and the local banks equally. It is well documented in the literature that during Japan's lost decade, city (i.e. integrated) banks were hit more strongly than regional (i.e. local) banks because their exposure to the big cities, where property prices declined most strongly was much higher than that of most local banks (Imai and Takarabe (2011). The integrated banks are therefore likely to have reduced lending by more than the local bank overall. We emphasize that this does not change our key argument: internal capital markets still imply that the integrated bank would still withdraw relatively less from high-SME prefectures than from low-SME prefectures. In our main econometric specifications throughout the paper, we allow for the possibility that the local and the integrated bank sectors are affected asymetrically. In addition, when we zoom in on details of the transmission mechanism below, we will also allow for differences across prefectures in the exposure of local banks to their local property markets.

2.2 Econometric framework and identification

Our ultimate interest is in identifying the effects of the banking shock on regional economic activity. To link fluctuations in bank lending to output growth, we conjecture that

$$\Delta \text{GDP}_t^k = \gamma \times \Delta \text{Lending}_t + \eta_t^k \tag{1}$$

where ΔGDP_t^k a is the growth rate of GDP in prefecture k, $\Delta \text{Lending}_t^k$ is the growth of bank lending to firms in prefecture k and η_t^k is a productivity shock for firms in region k. The coefficient γ captures the firm-borrowing channel (Khwaja and Mian (2008)): if $\gamma = 0$ firms can fully offset variations in loan supply, e.g. by obtaining credit from banks in other regions or countries or by turning to internal finance or non-bank finance, e.g. by issuing bonds. If $\gamma > 0$, then fluctuations cannot be fully offset and have real effects.

Estimating the above regression by OLS will lead to estimates that are biased upwards. Within prefectures, the productivity shock η_t^kwill generally be positively correlated with the demand component of lending growth. To obtain an exogenous measure of bank loan supply, we build on the literature (Peek and Rosengren (1997)) and interpret the decline of Japan's real estate market as an exogenous shock to the balance sheet of the banking sector. Imai and Takarabe (2011) show that the decline in land prices was sharper in the big cities than in the rest of the country. Still, land prices declines were highly synchronized across the country so that the lending capacity of regional banks was also affected. Given the pervasive nature of the decline in land prices during Japan's lost decade, it may therefore be difficult to cleanly interpret the decline in land prices as a loan supply shock only: the country-wide effect on collateral values may well have affected loan demand at the local level as well as in the aggregate.

We take guidance from our theoretical model to help solve this identification problem. Our model makes sharp predictions about differences in the lending behavior of local and integrated banks. Local banks' provision of credit is determined by local factors (even though these factors may be correlated with the aggregate, as we discuss below). Integrated banks, by contrast, pool funds across prefectures. Hence, their lending decisions will be correlated across prefectures mainly due to fluctuations in country-wide loan supply and demand. They then scale aggregate variation in loan demand and supply to local markets according to the local elasticity of demand. Specifically, taking stock of our theory we can express the growth rate of lending by integrated banks in prefecture k as

$$\Delta \text{Lending}_t^{city,k} = \left[\beta \, \text{SME}^k + 1\right] \times \Delta \text{Lending}_t^{city}$$

where $\Delta \text{Lending}_t^{City}$ is the country-wide growth rate of lending of the integrated ('city') banks and where SME^k is the (cross-sectionally demeaned) share of SME in prefecture k. This equation captures the reduced from of our model of internal capital markets: lending growth of integrated banks is equalized across prefectures up to differences in the elasticity of local demand. We capture these differences by the local incidence of bank-dependent SMEs. Importantly, the theory also makes sharp predictions about how the nature of an aggregate shock to $\Delta \text{Lending}_t^{City}$ affects the sign of the

coefficient β: if $\Delta\text{Lending}_t^{City}$ mainly reflects aggregate loan supply shocks, then based on the discussion in the previous section, we will have $\beta < 0$ — in response to a negative aggregate loan supply shock, integrated banks will reduce lending less in high *SME* prefectures. Conversely, it is easy to see from the model that $\beta > 0$ will hold if $\Delta\text{Lending}_t^{City}$ is mainly driven by loan demand. In this case, integrated banks will withdraw more strongly from high-SME prefectures after a negative aggregate demand shock.[3]

We now decompose total lending growth in prefecture k according to

$$\begin{aligned}\Delta\text{Lending}_t^k &\approx \text{FI}^k \times \Delta\text{Lending}_t^{city,k} + (1-\text{FI}^k)\Delta\text{Lending}_t^{local,k} \\ &= \left[\beta\,\text{SME}^k + 1\right] \text{FI}^k \times \Delta\text{Lending}_t^{city} + (1-\text{FI}^k) \times \Delta\text{Lending}_t^{local,k}\end{aligned}$$

where FI^k is the pre-crisis (long-term average) share of city banks in total lending in prefecture k. Then plugging into the reduced-form equation for GDP-growth (1), we obtain the relation

$$\Delta\text{GDP}_t^k = \left[\alpha_0 \times SME^k \times FI^k + \alpha_1 \times FI^k\right] \times \Delta\text{Lending}_t^{city} + \nu_t^k$$

where $\alpha_0 = \gamma \times \beta$ and $\alpha_1 = \gamma$ and where ν_t^k absorbs prefecture-specific influences on GDP, including in particular the local productivity shock (η_t^k) and fluctuations in local banks' lending ($(1-\text{FI}^k) \times \Delta\text{Lending}_t^{local,k}$), but also the impact of local land prices and other unobserved or unmodelled prefecture-specific and time-varying characteristics.

Our coefficient of interest is $\alpha_0 = \gamma \times \beta$. It tells us, to what extent the adverse output effects of the lending shock (captured by the firm-borrowing channel γ) are affected by the operation of integrated banks' internal capital markets. To see how our approach helps us in obtaining identification, note that we can estimate α_0 and α_1 by OLS whenever $cov\left(\Delta\text{Lending}_t^{city}, \nu_t^k\right) = 0$. Clearly, the within-prefecure time-series correlation between lending and local shocks that caused the bias in equation (1) is much reduced by our use of a county-wide shock-variable such as $\Delta\text{Lending}_t^{city}$. The very notion of county-wide banks operating internal capital markets means they mainly react to aggregate fluctuations and that region-specific shocks to demand wash out in the aggregate. Any remaining correlation of $\Delta\text{Lending}_t^{city}$ with ν_t^ksuch that $\nu_t^k = \delta\Delta\text{Lending}_t^{city} + \varepsilon_t^k$ will be absorbed by time effects in our estimation.

A more serious challenge to identification could arise if the correlation between aggregate city bank lending and the uncontrolled factors ν_t^k varied in the cross-section as a function of SME and FI. Suppose that $\nu_t^k = \delta^k \times \Delta\text{Lending}_t^{city} + \varepsilon_t^k$ where $\delta^k = \delta_{SME} \times \text{SME}^k + \delta_{FI} \times \text{FI}^k$. Then

$$\Delta\text{GDP}_t^k = \left[\gamma \times \beta \times \text{SME}^k \times \text{FI}^k + (\gamma + \delta_{FI}) \times \text{FI}^k + \delta_{SME} \times \text{SME}^k\right] \times \Delta\text{Lending}_t^{city} + \varepsilon_t^k \qquad (2)$$

[3]The literature has predominantly interpreted the burst of Japan's real estate bubble as a shock to loan supply. Our empirical results very strongly support that $\beta < 0$ and are therefore consistent with this interpretation. However, to the extent that our interest in this paper is in studying how regional banking integration (via integrated banks' internal capital markets) have interacted with firms local bank dependence, we do not *a priori* have to take a stand on the nature of the shock. As long as we accept the view that the burst of Japan's real estate bubble was a negative shock to lending, the sign of β will allows us to identify the prevalent nature – loan demand or supply — of the shock from the perspective of the integrated bank.

Even in this case, OLS would still give us an unbiased estimate of $\alpha_0 = \gamma \times \beta$, even though there would now be a bias in the estimate of the average size of the firm borrowing channel $\alpha_1 = \gamma + \delta_{FI}$. Hence neither SME^k nor FI^k has to be cross-sectionally uncorrelated with v_t^k for our identification to be valid. Rather, the OLS estimate of $\gamma \times \beta$ will be unbiased as long as

$$cov\left(\text{SME}^k \times \text{FI}^k, \delta^k\right) = 0. \tag{3}$$

This is the key identifying assumption for the OLS regressions that we present in the first part of our paper. We will relax this assumption later on: our discussion of the historical origins of the regional segmentation of Japan's banking market will provides us with an instrument for FI^k and also for SME^k. Based on these considerations, we now state our full reduced-form regression:

$$\Delta\text{GDP}_t^k = \left[\alpha_0 \times \text{SME}^k \times \text{FI}^k + \alpha_1 \times \text{FI}^k + \alpha_2 \times \text{SME}^k + \alpha_3' X^k\right] \times \text{SHOCK}_t + \mu^k + \tau_t + b' Z_t^k + \varepsilon_t^k \tag{4}$$

This specification enriches the model in (2) to allow for the aggregate shock to affect local output growth via additional prefecture-level characteristics, summarized in the vector X^k, and that could be unrelated to the banking shock. Z_t^k is a vector of additional controls that may vary by time and prefecture, and b is the associated vector of coefficients. The terms $\mu^k$and τ_t are prefecture-fixed and time effects, respectively, and ε_t^k is again the error term.

For our baseline results, instead of $\Delta\text{Lending}_t^{city}$, we choose $\text{SHOCK}_t = Post1990_t$ where $Post1990_t$ is a dummy that is zero until 1990 and one from 1991 onward. This specification allows a convenient interpretation of all estimated coefficients in terms of average post-1990 growth rates and considerably simplifies the discussion of the quantitative aspects of our results.[4] Note that coding the negative shock with a (positive) dummy inverts the expected sign of the coefficients relative to our discussion above, so that for the case of an aggregate loan supply shock, we now expect $\alpha_0 > 0$ and $\alpha_1, \alpha_2 < 0$.

Regression (4) is a double differences-in-differences (DiD) specification in which the interactions with the intervention (the aggregate shock) vary only by prefecture (k) and not by time. This approach emphasizes the spirit of our analysis: we do not claim that short-term, year-to-year fluctuations in financial integration or small-business importance affect post-1990 prefecture-level outcomes. In fact, we use pre-1990 characteristics to eliminate short-term feedback effects of growth on financial integration or the share of small businesses in the prefectural economy from our analysis. Bertrand, Duflo and Mullainathan (2004) strongly advocate this approach, arguing that the use of longer-term averages (instead of characteristics that vary over time and cross section) significantly improves the reliability of DiD estimates.

[4]Our results do not change if we use alternative measures of the aggregate shock , such as the land price decline in the core prefectures or aggregate city bank lending directly. We report some of these results below for comparison. The discussion concerning our key identifying assumptions above remains unaffected by this change in metric.

2.3 Local banks and small-business finance in Japan.

The regional tiering of Japan's bankings system is well documented in the literature (Hoshi and Kashyap (2004); Kano and Tsutsui (2003)) and provides us with a natural indicator of cross-prefectural differences in banking integration (FI^k) for our empirical analysis: the prefecture-level share in bank lending accounted for by banks that operate nationwide or at least in many prefectures (and that therefore can pool bank funds across prefectures) vs. those that operate only in one prefecture. For each type of bank (integrated and local) we construct pre-1990 averages of prefecture-level lending shares from data on bank lending by prefecture and by bank type from the Bank of Japan

In our data, the group of integrated banks comprises Japan's biggest banks, the so-called 'mega' banks, all of which operate nationwide. It also includes some large, regional banks (so-called first-tier regional banks) that have outgrown their local origins and operate nationwide or at least in a large number of prefectures. For brevity and following the Japanese convention, we refer to these large banks collectively as 'city banks'.

Genuinely regional (local) banks fall into two main groups: mutual banks (Sogo banks, also often referred to as second-tier regional banks) and industrial credit associations (Shinkins). By their statutes, these banks are mostly organized as cooperatives that, from the outset, were set up to provide finance to local small businesses in the manufacturing sector. This implies that the ties between regional banks and their small-business customers are particularly tight in the Japanese context. Below we discuss in detail the origins of many of these banks in the development of cooperatives in the silk reeling sector in the late 19th century.[5]

2.4 The silken thread: the origins of Japan's regional banking model

A key contribution of our paper is to show that these cross-regional differences in the importance of regional vs. nationwide banks ultimately reflect long-standing differences in the particular model of local financial development that can be traced back in history to the opening of Japan for international trade after 1854. Specifically, when silk reeling emerged as Japan's first main export industry in the late 19th century, it fostered the development of a specific model of export finance that was centered on small, local cooperative banks. We present the details of the historical background in a separate appendix. Here, we emphasize two aspects of the history of the silk-reeling industry that contributed to the development of a local banking system in the silk-reeling prefectures and favored the formation of particularly tight relationships between SME and local banks.

The first aspect is that, for technological and natural reasons, the silk-reeling industry was al-

[5]By construction, the regional bank lending share is negatively related to financial integration, whereas the city bank lending share is positively related. There are a host of smaller regional and nationwide (government-sponsored) banks that overall account for a small share of SME lendin only. Therefore, the joint share of Sogo banks and Shinkins in a prefecture's total lending is not exactly equal to one minus the share of city banks. For robustness, we therefore generally report results for both measures, and sometimes also for the narrower regional measure based on the Shinkin lending share alone, since Shinkin (industrial credit associations) are historically most closely related with the development of silk and SME finance.

ways highly fragmented and characterized by many small firms, many of them located in remote parts of the country. The second aspect is that the mechanization of the silk-reeling process from the later part of the 1880s induced a big increase in demand for credit for working capital among these small silk reelers (Nakabayashi (2014)). Mechanization contributed to the separation of cocoon growing and silk reeling (which were previously often done within the same firm, in the manner of a cottage industry). This separation implied that cocoons had to be bought in the spring but the finished reeled silk could only be shipped to the international market for silk—concentrated in Yokohama—in the late summer. As the purchases of cocoons accounted for 80 percent of the operating costs of a prefecture, the separation of reeling and cocoon-growing made credit for working capital a necessity.

On the one hand, therefore, the many small firms in the reeling industry were unable to borrow from the large banks that had begun to develop in the major cities (Yokohama, Tokyo and Osaka) during the late 19th century, because these big banks could not efficiently screen the many firms in this industry because of their remote location and small size. On the other hand, however, to succeed in the export market, reelers had to provide silk of very consistent quality, which would only be attained through the mechanization of the reeling process. Mechanization, in turn, required access to credit for working capital.

Japan's system of local cooperatives and mutual banks to a large extent emerged as the institutional response to this dilemma. Specifically, local banks were often founded with the help of the large Yokohama merchants or directly by the silk-reeler associations—most of them as mutuals or cooperatives. Both the merchants and the associations possessed superior information (vis-à-vis the big banks) about market conditions in the silk industry as well as about the quality provided by individual silk-reeling firms. In particular, from the late 19th century onwards, the silk reelers' associations developed elaborate quality control systems for their members in a (successful) attempt to establish brand names in the US market (Nakabayashi (2006)). The information that they thus acquired about the quality of their members' output and about their creditworthiness gave them a comparative advantage in the provision of trade credit to these small reelers. We argue that this comparative advantage persisted for over a century: even as the silk industry was superseded by other manufacturing sectors, small local banks with their intimate knowledge of their customers' industry and their individual circumstances (after all, the customers were (and are) also members of the cooperatives running the banks), led to particular persistent relationships between small firms and their local banks.[6]

Political and regulatory factors contributed to the century-long persistence of regional segmentation. While a national banking market had started to develop during the late 19th century, regional banking integration in the prewar era remained limited due to very anticompetitive regulation (Grossman and Imai (2008)). Even though the 1927 bank law stipulated mergers of small banks,

[6]Miwa and Ramseyer (2006) emphasize the role of trade credit and cooperative structures in providing working capital for the silk-reeling industry. As shown by Nakabayashi (2001), the local banks became the center of a system of silk finance that is in many ways reminiscent of the system of modern export finance as described in, e.g., Amiti and Weinstein (2011). We discuss the details of the workings of the system in the historical appendix.

under the pressure of local elites, most of these mergers happened along regional lines (Okazaki and Sawada (2007)). In the late 1930s, finance minister Eiichi Baba explicitly declared the goal of one "prefecture — one bank", so that there were a lot of mergers between banks at the regional level, but, importantly, almost none across prefectural borders (Hoshi (1995)). During the postwar era and well into the 1990s, government regulation under the convoy system continued to restrict regional banks from opening branch networks outside their prefecture of origin (see Hoshi and Kashyap (2000) and Hosono, Sakai and Tsuru (2007) for details).

This is what we call the 'silken thread': the silk regions embarked onto a particular pathway to financial development that helped to solve the particular financial frictions faced by the SMEs that clustered in these regions. A hallmark of this development model was the close link between local, cooperative or mutual lenders and their small-firm customers. The informal information acquired by the local bank during such a relationship will lead to quite favorable loan conditions in good times but makes it difficult for the small firm to signal its quality credibly to an alternative lender when the local bank's ability to lend is impaired in a crisis. We argue that this holdup problem (Sharpe (1990); Rajan (1992)) led to a *de facto* segmentation of regional banking markets during Japan's financial crisis of the 1990s.

We document this silken thread in Figure 2, which plots the (logarithmic) number of silk filatures per head of population in a prefecture in 1895 against the average prefecture-level lending share between 1980 and 1990 of regional and city banks. There is a clear positive relation between regional bank lending shares and the number of silk filatures per capita in 1895, whereas the link is clearly negative for city banks. In section four, we will use the number of silk filatures as an instrument for regional banking intgeration. In a separate appendix, we provide ample historical detail to further support the view that silk is indeed a valid instrument.

3 Results

3.1 Data sources

We use data from 46 Japanese prefectures (excluding Okinawa). Nominal prefectural GDPs are taken from the *Annual Report on Prefectural Accounts* (Cabinet Office of Japan). We obtain per capita values using population data from the same source. We deflate using the countrywide consumer price index, obtained from the Ministry of Internal Affairs and Communications. The importance of small manufacturing firms in terms of employees and value added at the prefectural level is taken from the *Manufacturing Census of Japan* by the Ministry of Economy, Trade and Industry. We define SMEs as having fewer than 300 employees.[7] The lending data by bank type (city and first-tier regional banks, Sogo banks, Shinkin, Shoko Chukin, etc.) at the prefecture level are taken from the *Economic Statistics Annual by Prefecture* (Bank of Japan). The prefecture-level breakdown of these data by bank type only runs to 1996. GDP and SME data cover the period 1980–2005.

[7] Note that this cutoff is also consistent with the membership constraint of Shinkin banks.

Prefectural borders in Japan have remained largely unchanged since the early 1890s. This allows us to use late 19th-century prefecture-level data as instruments in the second part of our analysis. In particular, data on the number of silk filatures in 1895 are taken from *Zenkoku Seishi Kojo Chosa* (*Survey of Silk-reeling Factories throughout Japan*). Prefecture-level data on population in 1895 are from the *Nihon Teikoku Minseki Kokouhyo* (*Registered Household Tables of Imperial Japan*).

3.2 A first look at the data

Table 1 provides a first look at the data. For each prefecture, the first two columns of the table present averages over the period 1980–1990 of city bank lending shares and of our measure of SME importance (by valued added). The last two columns report post-1990 (1991–2005) prefectural GDP growth rates and the growth rates of lending by city banks. The table highlights the core economic areas that we define to include Greater Tokyo (Tokyo, Chiba, Saitama and Kanagawa—with Yokohama as the major city), the Kansai region (Osaka, Hyogo—with Kobe as the major city—and Kyoto) and Aichi prefecture (with Nagoya as the major city). The cross-prefectural standard deviations show that for each of these characteristics, there is considerable variation around the mean. The average lending share of city banks is around 55 percent, ranging from just over 40 percentto over 70 or even 80 percent in Greater Tokyo and other core prefectures. The GDP share of small manufacturing firms is around 16 percent, ranging from around 10 percent to almost 25 percent.

A visual impression of the regional distribution of pre-1990 characteristics (SME importance and banking integration) and post-1990 growth can be gleaned from the two maps in Figure 3. The map on the left shows the geographical dispersion of SME importance and financial integration (the city bank lending share). Clearly, the city bank share is highest in the core areas: the Greater Tokyo and Kansai regions. Conversely, financial integration is quite low not only in some remote prefectures but also in many manufacturing prefectures in central Japan and in the areas surrounding the big cities. This is the silken thread: many of these prefectures were silk-reeling prefectures and took a special pathway to financial development. Turning to post-1990 GDP growth (right map), we again see the fallout of the crisis in the core areas (white, low growth), but there is significant variation in GDP growth rates across prefectures, and again many areas in central Japan have relatively low growth rates.

3.3 Baseline results

Table 2 presents our first set of results: Panel A for the measure of SME importance based on value added and Panel B for the employment-based measure. The first column estimates the simple specification

$$\Delta gdp_t^k = \alpha AggShock_t \times SME^k + \mu^k + \tau_t + \varepsilon_t^k \tag{5}$$

based on all prefectures. Prefectures with a higher share of small manufacturing businesses in terms of either output or employment clearly were affected more severely by the crisis. Increasing the

share of SMEs in employment or output by just one percentage point lowers the average growth rate by between 0.07 and 0.08 percent, but the effect is significant only at the 10 percent level. However, once we split the sample into two groups of 23 prefectures according to the levels of financial integration, based on our measure of the lending shares of regional and city banks, we find that the previous estimate of $0.07-0.08$ masks considerable heterogeneity across prefectures. In the group with low financial integration (i.e., a high regional and low city bank share), post-1990 growth depends much more strongly on SME importance: the estimated coefficient is consistently between -0.12 and -0.15, and is highly significant in all specifications. Increasing the prefecture-level share of SME in value added by one standard deviation (around 0.05) lowers that prefecture's output growth rate by between $0.12 \times 0.05 = 0.006$ and $0.15 \times 0.05 = 0.0075$. This is our first main result, and it is consistent with the stylized theoretical model above: bank-dependent small firms faced more severe credit constraints in prefectures where cross-regional banking flows were limited.

In Table 3, we report the results for our main regression specification with interaction terms (4). Note that the sample split regressions in Table 2 are a special case of this main specification in which FI is coded as a dummy. Column I replicates these regressions, but now we also include a dummy indicating whether a prefecture is a core economic area. We also drop Tokyo from the sample, which could be an outlier because it headquarters most major banks and many big corporations, and thus has particularly high levels of financial integration and a relatively low presence of SMEs. In the subsequent columns $III-IV$, we report the regressions for the continuous versions of our two FI-measures. In all cases, our results remain: again the negative effect of credit dependence on post-1990 growth appears stronger in prefectures with low levels of banking integration.

We emphasize that our results do not imply that financial integration is unequivocally good for post-1990 growth. In the regressions in columns $I-IV$ of Table 3, the coefficient α_1 on the first-order term for financial integration is significantly positive for the regional bank lending share and negative for the city bank lending share. This suggests that for prefectures with very low levels of local dependence on bank credit ($SME = 0$), there is a strong negative effect from financial integration on post-1990 growth. However, the coefficient on the interaction between bank dependence and banking integration shows that the trade-off between costs and benefits of banking integration is significantly more favorable for prefectures with high levels of SME, in line with our theoretical conjecture.

To appreciate this trade-off for the average prefecture, in columns $V-VII$, we provide regressions in which we remove the cross-sectional mean of SME and FI. This changes the interpretation of the stand-alone terms for FI and SME: these coefficients now capture the marginal effect of changing FI (or SME) for a prefecture with *average* levels of both FI and SME.[8] The marginal effect of changing SME away from its cross-sectional mean is significantly negative and economically important in magnitude. However, for the average prefecture, changing FI while keeping SME at

[8]Conversely, the stand-alone coefficients in the previous specifications measure the marginal effect when the respective other variable in the interaction is set to zero. See Balli and Sørensen (2013) about the interpretation of coefficients in regressions with interaction effects.

its cross-sectional mean now only has a negligible and insignificant effect on growth, whereas the coefficient on $SME \times FI$ remains significant. This suggests that the overall impact of FI is indeed largely scaled by the local dependence on credit, SME, and therefore varies across prefectures.

Figure (4) provides a graphical representation of regional post-1990 growth patterns. The prefectures are in their official order, starting in the northeast (Hokkaido) and ending in the southwest of the country (Kagoshima). The solid line shows the geographical profile of post-1990 growth as predicted from one of our regressions (the specification in column VI): the sum $\alpha_0 SME^k \times FI^k + \alpha_1 FI^k + \alpha_2 SME^k$. For each prefecture, the bars indicate the growth contribution (relative to the countrywide average) of financial integration ($\alpha_1 F^k$), of local bank dependence ($\alpha_2 SME^k$) and of the interaction between the two ($\alpha_0 SME^k \times FI^k$). The graph illustrates the major effect of local bank dependence ($\alpha_2 SME$) on the patterns of post-1990 growth. By contrast, FI had only a relatively minor direct influence on growth. Instead, FI impacted the local economy mainly through its interaction with local bank dependence: in high-SME areas, high levels of FI attenuated the negative effect of local bank dependence on growth. In low-SME areas, financial integration compounded the negative effect of the countrywide banking shock, consistent with the simple model that we discussed above.

Columns $VIII - X$ of Table 3 provide results for specifications of our baseline regression in which we code above-median levels of both SME and FI using a dummy variable respectively. Column $VIII$ is based on all prefectures, column IX drops Tokyo from the sample, column X drops any potential outliers by removing all prefectures for which SME or FI are more than 1.64 standard deviations from the respective cross-prefectural mean. In these specifications—all three of which yield very similar results—the group of low-SME / low-FI prefectures implicitly serves as the benchmark. The coefficient on the stand-alone SME term can then directly be interpreted as the (*ceteris paribus*) average growth rate of a high-SME/ low-FI prefecture after 1990 relative to this benchmark group. For example, in the specification reported in column IX, our estimate of this coefficient is -0.013, and it is highly significant. In the same way, the stand-alone coefficient on FI is the average growth rate of the high-FI/ low-SME prefectures relative to the benchmark group (-0.005) and the sum of the stand-alone coefficients and the interaction term ($-0.013 - 0.005 + 0.009 = -0.009$) is the growth rate of the high-SME / high-FI prefectures (again relative to the benchmark group). These results provide a simple quantitative perspective on the magnitude of the trade-off between financial integration and local bank dependence that is suggested by theory: moving a prefecture from the lower half of the SME distribution to the upper half of the distribution lowers post-1990 growth by 0.9 percent per year in highly financially integrated areas and by even more—1.3 percent—in the least financially integrated areas. Conversely, moving a prefecture from the lower half of the FI distribution to the upper half lowers the annual growth rate by only around 0.5 percent (for low-SME prefectures) and can even increase it by 0.9 percent (for high-SME prefectures). This ranking of the growth outcomes of the four groups (high/low-SME and high/low-FI), is consistent with our model: increasing FI while keeping SME low will lead to low growth as will increasing SME without increasing FI. By increasing both SME and FI together, a much better outcome is

achieved—during Japan's financial crisis of the 1990s, banking integration and local dependence on finance appear complementary.

3.4 Robustness

Additional controls In Table A.1 in the appendix, we report on a number of additional robustness tests. We control for geographical features by including the share of lowland in a prefecture's area and its ruggedness (defined as the share of surface area with a steepness gradient above 15 degrees) into the interactions. These data are from the Japan Statistical Yearbook. We also control for differences in sectoral composition by including measures of sectoral specialization into the interaction. Finally, we include a set of dummies for Japan's eight regions (Hokkaido, Tohoku, Kanto, Chubu, Kansai (Kinki), Chugoku, Shikoku, and Kyushu). This does not affect our results.

The interaction between SME and FI could be picking up some nonlinearity in the impact of small-firm importance on post-1990 growth that is related to financial integration but not explained by it. For example, it could be the case that for some other reason, the impact of small firms on local growth was particularly strong in the areas where the silk-reeling industry first started (and where, for reasons we discuss later) regional banking also happened to be predominant. We therefore include quadratic terms of both FI and SME in the interaction. However, these quadratic terms are not significant, whereas our estimate of the coefficient on the interaction of $SME \times FI$ remains significant and quantitatively unchanged.

Alternative measures of the aggregate shock In Table A.2 we also report results based on an alternative measure of the aggregate shock, the price of land in the main city prefectures as constructed by Imai and Takarabe (2011). In these specifications, we also control for local land price movements. Again, this does not affect our results. Note that, of course, all signs change because the shock now is the decline in the price of land (whereas our previous dummy indicator for the crisis increases after 1990). We corroborate the findings by Imai and Takarabe: the first-order effect of financial integration is negative, in the sense that more financially integrated prefectures were more exposed to the shock. However, our previous result holds up: the negative impact of financial integration in transmitting the shock was considerably mitigated in areas with many bank-dependent firms. Again, the findings are robust with respect to different sets of controls.

Financial integration and local financial development Our results so far raise the question of whether it is really the segmentation of banking markets that drives our results or whether we are simply picking up regional differences in local financial development - understood here as the ability of the local financial system to mobilize funds for investment or consumption, irrespective of whether these come from inside or outside the prefecture. We explore this point in Table A.3, in the appendix, which reports the same basic regression as Table 3, but now we also include an interaction variable between credit dependence (SME) and various measures of financial development (FD). The results clearly suggest that it is indeed primarily variation in the ability to raise funds from

outside the prefecture—financial integration —and not financial development *per se* that matters for our results.

Dynamic effects In Figure 5 we look at the role of banking integration in the dynamics of growth during the 'Lost Decade'. We split prefectures into four groups based on pre-1990 characteristics: above/below-median banking integration and above/below-median SME importance. Then, within each financial integration group, we look at the cumulative growth differential between the high-SME (i.e., high-credit-dependence) and the low-SME (low-credit-dependence) subgroups. The results in the figure show that irrespective of the degree of banking integration, prefectures with many SME generally grew less than did those with few small firms: both the blue (solid) and the red (dashed) lines are below zero. However, the within-group growth differential is particularly marked for the group with low financial integration, suggesting that low regional banking integration was indeed associated with particularly low growth in very credit-dependent areas. This effect is large: in the least financially integrated areas, the cumulative growth difference until 2005 between the high- and low-SME groups amounts to an almost 8 percent difference in per capita GDP; in the most financially integrated areas, the effect is only around 3 percent. Furthermore, for the least integrated areas, the maximum cumulative growth differential between low- and high-SME groups was almost 9 percent in 2001.

3.5 Transmission channel

Our analysis so far has focused on GDP growth. This is justified under the assumption that fluctuations in lending supply in the stylized model in Figure 1 ultimately translate into output fluctuations. To check this assumption, and in order to focus on the transmission mechanism, in Table 4, we therefore repeat our previous regressions but now with various measures of lending growth as the dependent variable: total prefecture-level lending, lending by city banks and the lending by regional banks.[9] Our regressions in columns $I-III$ show the same general pattern as that previously documented for GDP growth. The negative spillovers from the aggregate shock on local lending that come with high levels of financial integration are substantially mitigated in prefectures with many SME, as can be seen from the positive coefficient on $SME \times FI$. The second and third columns show that it is indeed city banks' lending (and not lending by regional banks) that is driving this pattern. This is consistent with the model in Figure 1, where it is the city banks that reduced their lending by less in the high-SME-prefecture. We repeat the same regression in columns IV-VI, but now dropping Tokyo as in our previous regressions for GDP growth. Now, the coefficient on $SME \times FI$ is insignificant in the regression for total lending, but it stays significant in the city bank regression, reinforcing our finding that the pattern we have documented in the data is indeed related to the lending behavior of city banks. The same picture arises when we use the land price decline in

[9] Our prefecture lending data set ends in 1996. Note also that lending by Sogo banks after 1991 is no longer reported as a separate item in our data set but is included in the definition of 'zenkoku ginko' (the nationwide or 'city' banks). As Sogo banks account for a small share of total lending by 'zenkoku ginko', we continue to refer to this category as 'city banks' and to the remainder as 'regional banks'.

the core prefectures from Imai and Takarabe (2011) as a measure of the shock (of course, all signs now change because the land price change is negative after 1990).

The key assumption underlying the stylized model in Figure (1) is that local credit markets are segmented so that small firms borrowing from local banks cannot easily switch lenders. The *de facto* segmentation of local banking markets in the crisis that is created by this holdup is likely to be mitigated in prefectures with a strong presence of city banks, either because there are many SMEs that borrowed from city banks even before the crisis or because competition from city banks made it easier for SMEs to switch away from local banks during the crisis. We now provide further evidence for this point.

We start by showing that in financially integrated prefectures, SMEs did indeed have better access to credit from city banks.[10] To this end, we obtain data on small firms' main banking relationship from the 2004 *Basic Survey on Small and Medium Enterprises*. For each prefecture, this survey gives us the fraction of firms (across all sectors) with fewer than 300 employees that have a city or a regional bank as their main bank. A univariate regression of the share of small firms reporting a main banking relationship with a city bank on the pre-1990 share of city banks in local lending yields a coefficient of 0.62 and a t-statistic higher than 6 with an R^2 of roughly 0.5. The regression—reported as a memorandum item at the bottom of Table 4—therefore confirms that a larger fraction of the local SME population could borrow from financially integrated banks in more financially integrated areas.[11]

We illustrate next that SMEs' bank relationships are more persistent in less financially integrated areas. Figure 6 plots the fraction of SME in a prefecture that did not change *any* of their banking relationships in the decade 1990–2000 against the city bank share in local lending in the years prior to 1990.[12] The visual impression of a negative relation between the two variables is confirmed by a regression (details reported in the figure notes) that yields a significantly negative coefficient. This is consistent with the view that local banks engage in long-term relationships with SMEs, as argued above. Given the high persistence of SMEs' bank relationships in Japan (in the average prefecture, 84 percent of firms do not change any of their bank affiliations), it appears plausible that SME borrowing from local banks may have faced considerable holdup in the face of adverse shocks to the lending ability of the local bank.

We provide further evidence on the transmission mechanism by testing some ancillary implications of the stylized model in Figure 1.

A first implication is that the holdup problem that is created by the banking relationship between local banks and *SMEs* forces small firms that borrow from local banks to face higher interest rates

[10] In the traditional Japanese main bank system, large banks primarily lent to big firms. However, following the liberalization of Japan's financial markets in the 1980s, the main bank system increasingly came under pressure as large, corporate customers started to move to the bond market, a trend that was reinforced by the crisis after 1990 (Hoshi, Kashyap and Scharfstein (1993), Weinstein and Yafeh (1998)). As small firms cannot turn to the bond market, this is likely to have increased the value of SME relationships for big banks.

[11] Unfortunately, no contemporaneous (pre-1990) data on SME relationships with city banks are available.

[12] The bank relationship data are computed based on various tables in Kano (2004). The data, however, do not allow us to distinguish between relationships with local or city banks.

following the shock. If there was no holdup, the local bank's customers could easily switch to the city bank after the shock, borrowing at the city bank lending rate r_{City}. Hence, relationship lending leads to a *de facto* segmentation of the banking market within a prefecture. In aggregate, we expect holdup to be more severe in high-*SME* prefectures (because mainly *SME*s face holdup). Conversely, the holdup problem should be mitigated in prefectures with high levels of financial integration because financially integrated banks can react to local SME loan demand by shifting funds from other prefectures. A strong presence of city banks would therefore make it more difficult for local banks to charge their SME borrowers high interest rates.

A second implication is borne out by the model once we allow the funding shocks to the local banks and the city banks to be imperfectly correlated across prefectures: in prefectures in which many SMEs borrow from financially integrated banks, we would expect loan supply and output growth to be less dependent on funding shocks to local banks (as measured by, e.g., local house price declines that should mainly affect the balance sheets of local banks but not of nationwide banks).

We document that both of these implications of the model stand up to empirical scrutiny. To test the first implication, we recognize that *ceteris paribus*, the consequences of holdup for the local banks' customers (in terms of higher interest rates) should be more severe, the bigger the funding shock for the local bank. Following Watanabe (2007) and Gan (2007*b*), we exploit cross-prefectural differences in local bank's exposure to the post-1990 property downturn to identify funding shocks to local banks: local banks with higher shares of real estate lending in their balance sheets should have been more impaired in their ability to lend to local small businesses (relative to that of city banks) after 1990.[13]

We construct prefecture-level exposures using data from the Nikkei NEEDS database, which contains lending for individual banks to the extent that they are listed companies. This includes all city banks as well as all first- and second-tier regional banks but not the Shinkin. We aggregate these data up to the prefecture level, distinguishing between first-tier and second-tier banks. Recall that the important difference between these two types of banks is that first-tier banks are regional in origin but big enough to operate across prefectural boundaries.[14] Conversely, second-tier banks (Sogos) are essentially constrained to operate in their prefecture of origin. In the empirical exercise in this section, we therefore associate second-tier banks with regional / local banks, and first-tier banks with city banks.[15] In this way, we are able to obtain the lending to real-estate-related sectors

[13]Our main empirical specifications elsewhere in the paper focus on the different exposures of the local and the nationwide parts of the banking system to the same country-wide property price shock. We generally preserve this setup throughout the remainder of the paper for simplicity. However, in order to zoom in on the transmission mechanism, in this subsection we, first, recognize that regional banks differed across prefectures in their exposure to their respective local property market and thus in their exposure to the countrywide component of land price declines. Secondly, while there was a considerable common component in land price declines, there was also some regional heterogeneity in the strength of this decline. We exploit this to show that local banks with their nondiversified portfolios of real estate lending were more exposed to local property price shocks than integrated banks.

[14]This is why their lending is subsumed under that of the city banks in our empirical analysis throughout the paper.

[15]Our data also allow us to calculate the real estate exposure of the big city banks. However, we cannot directly observe the regional dimension of these banks' lending for real estate, because our raw data are at the bank level and not at the loan level. For Tier 1 and Tier 2 banks, we identify this regional dimension using the prefecture of the banks' headquarters

(as a share of total assets) for both types of banks at the prefecture level. Following Kano and Tsutsui (2003), we then also construct corresponding time series of the average loan interest rate charged by each type of bank for each prefecture by dividing interest income by total lending.

Panel A of Table 5 provides empirical evidence on the holdup mechanism: the post-1990 average loan interest rate is positively related to the pre-crisis real estate exposure of the local (Tier 2) banks, and this effect is stronger in prefectures with many captive borrowers; i.e., many SMEs (column *I*). Columns *II* and *III* of Table 5 show the regressions for the local banks for the two subsamples of prefectures: the group of prefectures with high pre-1990 levels of financial integration and the one with low levels. It is clearly apparent that the interest rate hike associated with the holdup problem is prevalent mainly in less integrated prefectures, in line with our theory. By contrast, when we run the same regressions for the integrated (Tier 1) banks (results reported in columns $IV - VI$), we do not find this pattern. This suggests that it was indeed the geographic nondiversification of the local banks' loan portfolio that led them to reduce local lending in a particularly strong manner, again consistent with the basic model in Figure (1).

Panel B of Table 5 shows that higher levels of financial integration also reduce the exposure to loan supply shocks by local banks, very much as our model would suggest. This panel reports results for regressions that have the same form as in our main specifications in equation (4), except that now we let the shock variable vary by prefecture. Specifically, we use local land price changes as a measure of the shock to the local economy. To control for the impact of an aggregate shock on the local economy, we also include the interaction between SME and the average land price decline in the core areas. In these regressions, the local land price decline gets scaled by the regional banks' precrisis real estate exposure, and it should have a stronger effect in high-SME prefectures —provided that SMEs have to borrow mainly from local banks. (i.e., financial integration is low). This is exactly what we observe: when we split the sample into high- and low-financial-integration prefectures, the interaction between SME, real estate exposure and the local shocks is positive and significant in the areas where regional banks' lending share is high. This suggests that local GDP growth is more exposed to the local land price decline in these prefectures. Conversely, in more financially integrated prefectures, the effect is significantly negative, showing that local *GDP* growth is relatively insulated from the impact of the local land price decline on the credit supply of local banks.

We conclude this section by noting that our results are also consistent with 'zombie lending' or 'evergreening' by large banks. First, Peek and Rosengren (2005) argue that banks tended to evergreen mainly borrowers that were large relative to their balance sheets. The small firms that are our focus here, however, are likely to be small borrowers for city banks. Second, Caballero, Hoshi

as the main prefecture of operation. While Tier 2 banks clearly do operate across prefectural boundaries—a fact that we exploit here—they can still plausibly be attributed to a particular region or prefecture in this way. As almost all prefectures have the headquarters of at least one regional bank, we can therefore assign all individual banks to a prefecture so that we can obtain prefecture-level aggregates for virtually all prefectures (because of mergers among regional banks, from the late 1990s onwards, there are no second-tier banks in a few prefectures any more, which means that we have to drop a couple of our 46 prefectures from the sample). Clearly, for the big nationwide banks (most of which are headquartered in Tokyo) we cannot follow this approach.

and Kashyap (2008) show that manufacturing was one of the sectors that was least affected by this form of evergreening. It is therefore plausible that city banks engaged in less evergreening in areas where there were a lot of SME in their local customer base, consistent with our findings.

4 Endogenous banking integration

In this section, we discuss how our results might be affected by the endogeneity of FI or SME. Note that all regressions presented so far use *SME* and lending shares that are time averages from the period *before* the bursting of the bubble (i.e., over the period 1980–1990). However, it could still be the case that FI^k systematically correlates with unobserved or omitted pre-1990 trends that affected the spread of the crisis differentially across prefectures. As we have discussed in section (2.2), even the endogeneity of FI^k (or for that matter, SME^k) in itself would not directly affect the estimation of our main coefficient of interest, since our identification strategy would only be affected if the *product* $\text{SME}^k \times \text{FI}^k$ is cross-sectionally correlated with the way the error terms correlate with the aggregate shock. This could be the case if city banks deliberately shifted funds to prefectures in a way that systematically correlated with prefecture-level SME shares and if these prefectures then grew systemactially faster or slower after the crisis. For example, real estate is important as collateral for manufacturing SMEs in Japan. If, before 1990, city banks directed funds to areas with many collateral-rich manufacturing SMEs and if housing markets (and output growth) in these areas then declined more (less) than in other parts of the country after 1990, OLS would tend to under (over-) estimate the effects of internal capital markets on post-1990 growth.

To deal with sich concerns, we use the number of silk filatures per capita in 1895 as an instrument for regional banking integration at the outset of the 1990s crisis. We discuss instrument relevance first. Table 6 provides a detailed analysis of the link between silk and regional banking integration. The coefficient of a regression of lending shares on silk filatures is significant for all bank types. We also run the same regression with a set of controls: the pre-1990 relative GDP of a prefecture, a dummy for the core prefectures and the (logarithmic) distance to Yokohama, as the first (after 1858) and biggest open port. These are the controls that we also include later in our IV regressions. The link between the importance of silk reeling and lending shares remains unaffected by these controls, and the individual t-statistics in the regressions with controls are all greater than four in absolute value. The number of filatures therefore clearly seems relevant as an instrument for financial integration.

We discuss the exclusion restriction next. Clearly, this restriction cannot be directly tested, but we substantiate it with some supportive evidence. Specifically, one might expect that if silk affects financial integration, then it is also correlated with financial development more broadly. This is not the case. The last set of columns in Table 6 also report regressions of indicators of financial development on our silk instrument, again with and without controls. There is no significant link between silk and the density of bank branches in a region. Total lending relative to GDP is negatively correlated with the instrument, but it is much less significant than in the regressions for the integration

indicators. Once we also include our financial integration measure, silk becomes insignificant in the regression for lending/GDP. This suggests that lending/GDP is correlated with silk mainly via the correlation with regional financial integration.[16] The silk prefectures were less financially integrated with the rest of the country because, for historical reasons, they had adopted a path to financial development in which local banks and their tight relations to local small firms played a central role. But silk clearly does not correlate with broader measures of financial development.

A second dimension in which silk might not fulfill the exclusion restriction is through its long-run impact on industrial structure. We have argued that the specific financial institutions that were associated with the rise of the silk industry had a comparative advantage in relationship lending to small manufacturing firms more generally. The presence of these institutions in a prefecture could therefore have been conducive to the emergence of a big manufacturing sector with many small firms and high levels of local bank dependence (see Fisman and Love (2004) for a related discussion). Indeed it is a well-documented fact that silk-reeling prefectures served as a nucleus for the development of manufacturing know-how, notably in the machinery sector.[17] Interindustry (Jacobian) externalities in the form of knowledge spillovers may have lead to the emergence of manufacturing clusters.[18] To address this concern we show that such externalities are a direct function of proximity to silk prefectures and and occurred independently from the impact that the intensity of silk production had on regional banking integration. Specifically, we use a prefecture's minimum distance to one of the four prefectures with the highest number of mechanized filatures in 1895 (Kyoto, Nagano, Gifu and Shizuoka) as an exogenous measure of growth expectations in the manufacturing sector at the end of the 19th century and as predictor of its industry structure in the late 20th century.[19]

Table 7 shows multivariate regressions of industry structure (our previous measures of SME and of the local manufacturing share) and of FI on the logarithmic distance to the main (mechanized) silk prefectures and on our previous instrument, the (logarithmic) *number* of total filatures per head. The regressions show that controlling for distance allows us to disentangle the effect of silk on industry structure from that on finance quite clearly. In the regression where industry structure is the dependent variable, the distance variable has a much larger coefficient than does the number of filatures per head, and it is also much more highly significant. Conversely, where our financial integration measure is the dependent variable, the picture is exactly the opposite: the coefficient of distance is small and insignificant, whereas that of the number of filatures is both large and significant. This suggests that we can use the logarithmic distance to the main silk areas as an indicator of growth expectations in the late 19th century and as an instrument for the role of (small) manufacturing firms (and therefore local credit dependence) at the end of the 20th century. Conversely,

[16] Conversely, if we include lending/GDP in our regression for the integration indicators, it is insignificant, whereas silk is even more significant. These results are available upon request.

[17] See, e.g., Yamazawa (1975), Ma (2004), Nakabayashi (2006).

[18] This view is consistent with the role of interindustry spillovers emphasized by Glaeser et al. (1992). Specifically, Jacobian (i.e., interindustry) externalities tend to be particularly important in the early stages of an industry's development.

[19] See the historical appendix for a detailed discussion of the role of mechanization for the development of the silk industry.

we continue to use the number of filatures per capita as an instrument for banking sector integration during the 1980s.[20]

Based on these results, we proceed in two steps: first, we instrument FI^k with the number of filatures per head in 1895, continuing to treat industrial structure as exogenous. After all, our OLS regressions already *do* control for industrial structure via the interaction between SME^k and the aggregate shock and so will our IV estimates. Note also that the identifying assumption for our IV estimate of α_0 is that $cov\left(\text{SME}^k \times \text{FILATURES}^k, \delta^k\right) = 0$, i.e. the interaction between silk and *SME* is uncorrelated with the way in which the aggregate shock after 1990 differs in its impact across prefectures. This assumption is not necessarily violated even if SME^k is affected by silk in the long-run. However, to alleviate any remaining concerns, in a second step we also present IV-regressions in which we treat both FI^k and SME^k and their interaction as endogenous, using the distance to the main silk prefectures and its product with the number of filatures as well as the interaction of filatures and distance as instruments.

4.1 IV Results

Table 8 now presents our IV results for the case in which we treat only banking integration as endogenous. As the endogenous variable, FI, appears as an interaction in our regressions, we need to instrument two variables: our measure of banking integration, FI, and its interaction with our measure of credit dependence, $SME^k \times FI^k$. We use our silk variable and its interaction with SME^k as instruments.

Our instruments are relevant in all specifications reported here and for all three of our measures of financial integration. At the bottom of the table, we report the first-stage F-statistics for the regression of the interaction term of the post-1990 dummy with $SME \times FI$ on the instruments. The value of this first-stage F-statistic is above 10 throughout, which provides a first indication as to the strength of the instruments with respect to the individual endogenous regressors (Staiger and Stock (1997)). However, these values can be misleading with respect to the overall instrument strength and with respect to identification if there is more than one endogenous variable, as is the case here. We therefore also report the Kleibergen–Paap (2006) rank test for underidentification. For all specifications reported in Table 8, we strongly reject the null of underidentification. The Kleibergen and Paap (2006) statistics are also all well beyond the critical values tabulated by Stock and Yogo (2005), suggesting that our instruments are also sufficiently strong to avoid large asymptotic bias.[21]

The first set of regressions in Table 8 shows the results without further controls. The magnitude of our main coefficient of interest—the interaction between the post-1991 dummy, the *SME* share and our measure of financial integration—is generally similar to the one obtained from the baseline

[20] Our line of argument is similar to that of Acemoglu and Johnson (2005), who, in a different setting, report that both colonial settler mortality and English legal origin individually have prognostic power for measures of property rights and contracting institutions today. However, when both are included as regressors simultaneously, English legal origin mainly affects contracting institutions, whereas settler mortality affects property rights but not contracting institutions.

[21] The critical values from Stock and Yogo (2005) apply to the Cragg and Donald (1993) statistic, which is identical to the Kleibergen and Paap (2006) rank test if the errors are homoscedastic.

panel regressions in Table 3. If anything, the estimated effects are even stronger than in the baseline specification.

In the remaining regressions in the table, we now include additional controls in the first and second stages. First, we present a set of regressions in which, besides a core area dummy, we also include relative GDP. This leaves our first-stage results very much intact. Furthermore, our coefficient of interest in the IV regression remains stable relative to the specifications without controls and vis-à-vis the baseline regressions. Clearly, relative GDP is likely to be endogenous and financial integration may actual be causal for GDP. We therefore replace GDP with a plausibly exogenous measure of economic and financial development: the logarithmic distance of a prefecture to Yokohama as the first open port after 1858.[22] Now, our coefficient of interest, while again remarkably stable vis-à-vis the other specifications, is significant at the 10 percent level for all three measures of banking integration.

These results suggest a strong link between the degree of regional banking integration in the 1980s, the spread of the Great Recession and the silk industry. Our main specification, which is based on a panel, helps us to overcome the limited coverage of our cross section by allowing us to control for common time variation and unobserved heterogeneity at the prefecture level. However, our instrument is purely cross-sectional. We therefore also check our results based on what Bertrand, Duflo and Mullainathan (2004) have called a 'before–after' regression; i.e., a cross-sectional regression of average post-1991 growth rates on pre-1991 characteristics. We report the results for such regressions in Table A.5, one based on OLS and one based on IV. Besides our interaction variable of interest, $SME^k \times FI^k$, we include the first-order terms SME^k and FI^k, and the core dummy as a control. In all cases, and for all three measures of banking integration and the two measures of small-firm importance (based on value added and employment), the coefficient of $SME^k \times FI^k$ has the same sign as before. Given that we estimate five coefficients from a cross section of 46 prefectures, it is also very interesting to see that the coefficient is significant at the 10 percent level or close to it in most specifications, by both OLS and IV. Note also that in spite of the limited sample size, the F-statistics for the individual first-stage regressions as well as the Kleibergen–Paap rank statistics in most cases indicate that our instruments are relevant.

In Table 9, we report Panel IV regressions which treat both SME and FI as endogenous. Based on our discussion from before, we instrument the two variables and their interaction using the distance to the main mechanized silk filatures, the number of filatures and the interaction of these two. The results corroborate our previous findings: the first stages of the IV regressions are relevant throughout, and our coefficient of interest generally stays significant and quantitatively stable vis-à-vis our baseline OLS specifications. The last three columns show that the results are also robust to removing potential outliers. Hence, our previous conclusions remain intact even if we allow the share of small manufacturing firms—and thus local bank dependence—to be endogenous.

[22] The cross-sectional correlation between relative GDP and distance to Yokohama is -0.47.

5 Conclusion

This paper has explored the regional spread of Japan's Great Recession following the bursting of the stock market and housing bubbles in the early 1990s. We have shown that the interaction between regional banking integration and the local dependence on bank credit determined growth differentials at the prefecture level during Japan's 'Lost Decade'. Prefectures with a strong presence of small, bank-dependent manufacturing firms did did relatievly better if their banking market were more integrated with the rest of the country.

The bursting of the property price bubble was a major shock to the lending capacity of the entire banking sector. However, by operating internal capital markets, nationwide banks dispersed the shock by arbitraging interest rates on the marginal loan in different prefectures. This induced them to reduce lending by less in areas where the marginal willingness to pay for loans—local bank dependence—was highest because of a strong presence of SMEs and where the nationwide banks were able to reach a lot of these SMEs as customers because of a traditionally high market share in the local market.

Our analysis makes use of the fact that Japan has a regionally fragmented banking system whose historical roots go back to the rise of silk reeling as Japan's first main export industry in the late 19th century. Silk reeling was strongly dependent on trade credit, but small reeling firms could not typically borrow from the large banks in the big cities such as Yokohama. Japan's regional banks developed as the institutional response to this problem: because of their cooperative structure—many were founded by the silk reelers' associations—and their local focus, regional banks had a comparative advantage in monitoring local borrowers and forged very persistent relationships with local small manufacturing firms. Aided by regulation, they were able to preserve this comparative advantage over a century, long after the decline of the silk industry. This is what we call the 'silken thread'.

This historical background motivates us to use the prefecture-level number of silk-reeling mills in the late 19th century as an instrument to control for the endogeneity of regional banking integration in the run-up to the crisis of the 1990s. We corroborate our main results: prefectures with many SMEs did relatively better if they were more integrated. The 'silken thread' also provides an explanation for the *de facto* segmentation of local banking markets during the crisis: the highly persistent relationships between local banks and small manufacturing firms created a holdup problem that made it difficult for many firms to switch away from weak lenders in the depth of the recession.

Our findings show that bank-firm relationships can help explain how regional differences in *de facto* financial integration can persist even if there are no formal barriers to capital flows within a country, as is clearly the case for modern Japan. This result may have implications for regional business cycle transmission in many countries in which banking markets have traditionally been regionally segmented. Examples include Germany's *Volksbanken* and *Sparkassen*, Spain's *Caixas* and the United States, where banking markets were segmented along state-borders until the 1990s. Our results also inform the debate about the trade-offs between banking integration and regionalization facing Europe as it is moving towards a banking union.

References

Acemoglu, Daron, and Simon Johnson. 2005. "Unbundling institutions." *Journal of Political Economy*, 113(5): 949–95.

Amiti, Mary, and David E. Weinstein. 2011. "Exports and Financial Shocks." *The Quarterly Journal of Economics*, 126(4): 1841–1877.

Balli, Hatice Ozer, and Bent E. Sørensen. 2013. "Interaction effects in econometrics." *Empirical Economics*, 45(1): 583–603.

Berger, Allen N., Nathan H. Miller, Mitchell A. Petersen, Raghuram G. Rajan, and Jeremy C. Stein. 2005. "Does function follow organizational form? Evidence from the lending practices of large and small banks." *Journal of Financial Economics*, 76(2): 237–269.

Bernhofen, D. M, and J. C Brown. 2004. "A Direct Test of the Theory of Comparative Advantage: The Case of Japan." *Journal of Political Economy*, 112(1): 48–67.

Bernhofen, D. M, and J. C Brown. 2005. "An Empirical Assessment of the Comparative Advantage Gains From Trade: Evidence from Japan." *The American economic review*, 95(1): 208–225.

Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan. 2004. "How much should we trust Differences-in-Differences Estimates?" *Quarterly Journal of Economics*, 119 (1): 249–275.

Caballero, Ricardo J., Takeo Hoshi, and Anil K. Kashyap. 2008. "Zombie Lending and Depressed Restructuring in Japan." *American Economic Review*, 98(5): 1943–77.

Cetorelli, Nicola, and Linda Goldberg. 2012*a*. "Banking Globalization and Monetary Transmission." *Journal of Finance*, 67(5): 1811–1843.

Cetorelli, Nicola, and Linda S. Goldberg. 2012*b*. "Liquidity management of U.S. global banks: Internal capital markets in the great recession." *Journal of International Economics*, 88(2): 299–311.

Cragg, John G., and Stephen G. Donald. 1993. "Testing Identifiability and Specification in Instrumental Variable Models." *Econometric Theory*, 9(02): 222–240.

Federico, Giovanni. 1997. *An Economic History of the Silk Industry, 1830-1930. Cambridge Studies in Modern Economic History*, Cambridge University Press.

Fisman, Raymond, and Inessa Love. 2003. "Trade Credit, Financial Intermediary Development, and Industry Growth." *Journal of Finance*, 58(1): 353–374.

Fisman, Raymond, and Inessa Love. 2004. "Financial Development and Intersectoral Allocation: A New Approach." *Journal of Finance*, 59(6): 2785–2807.

Gan, Jie. 2007*a*. "Collateral, debt capacity, and corporate investment: Evidence from a natural experiment." *Journal of Financial Economics*, 85(3): 709–734.

Gan, Jie. 2007*b*. "The Real Effects of Asset Market Bubbles: Loan- and Firm-Level Evidence of a Lending Channel." *Review of Financial Studies*, 20(6): 1941–1973.

Giannetti, Mariassunta, and Andrei Simonov. 2013. "On the Real Effects of Bank Bailouts: Micro Evidence from Japan." *American Economic Journal: Macroeconomics*, 5(1): 135–67.

Glaeser, Edward L, Hedi D. Kallal, Jose A. Scheinkman, and Andrei Shleifer. 1992. "Growth in Cities." *Journal of Political Economy*, 100(6): 1126–52.

Grossman, Richard S., and Masami Imai. 2008. "The evolution of a national banking market in pre-war Japan." *Explorations in Economic History*, 45(1): 17 – 29.

Holmstrom, Bengt, and Jean Tirole. 1997. "Financial Intermediation, Loanable Funds, and the Real Sector." *The Quarterly Journal of Economics*, 112(3): pp. 663–691.

Hoshi, Takeo. 1995. "Evolution of the Main Bank System in Japan." In *The Structure of the Japanese Economy. Studies in the Modern Japanese Economy*, , ed. Mitsuaki Okabe, 287–322. Macmillan Press Ltd.

Hoshi, Takeo, and Anil Kashyap. 2000. "The Japanese Banking Crisis: Where Did it Come from and How Will it End?" *NBER Macroeconomics Annual 1999*, 14: 129–201.

Hoshi, Takeo, Anil Kashyap, and David Scharfstein. 1993. "The Choice Between Public and Private Debt: An Analysis of Post-Deregulation Corporate Financing in Japan." National Bureau of Economic Research Working Paper 4421.

Hoshi, T., and A. Kashyap. 2004. "Japan's Economic and Financial Crisis: an Overview." *Journal of Economic Perspectives*, 18: 3–26.

Hosono, Kaoru, Daisuke Miyakawa, Taisuke Uchino, Makoto Hazama, Arito Ono, Hirofumi Uchida, and Iichiro. Uesugi. forthcoming. "Natural Disasters, Damage to Banks, and Firm Investment." *International Economic Review*.

Hosono, K., K. Sakai, and K. Tsuru. 2007. *Consolidation of Banks in Japan: Causes and Consequences.* National Bureau of Economic Research Cambridge, Mass., USA.

Imai, M., and S. Takarabe. 2011. "Bank Integration and Transmission of Financial Shocks: Evidence from Japan." *American Economic Journal: Macroeconomics*, 3(1): 155–183.

Kano, Masaji. 2004. "An empirical analysis of the number of bank relationships." *Keiei Johou Kenkyu (Faculty of Business Administration and Information, Setsunan University, Japan)*, 12 (1)(1): 33–46. (in Japanese).

Kano, Masaji, and Yoshiro Tsutsui. 2003. "Geographical segmentation in Japanese bank loan markets." *Regional Science and Urban Economics*, 33(2): 157 – 174.

Khwaja, Asim Ijaz, and Atif Mian. 2008. "Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market." *American Economic Review*, 98(4): 1413–42.

Kleibergen, Frank, and Richard Paap. 2006. "Generalized reduced rank tests using the singular value decomposition." *Journal of Econometrics*, 133(1): 97–126.

Li, M. L. 1982. "Silks by Sea: Trade, Technology, and Enterprise in China and Japan." *The Business History Review*, 56(2): 192–217.

Ma, D. 2004. "Why Japan, not China, was the First to Develop in East Asia: Lessons from Sericulture, 1850-1937." *Economic Development and Cultural Change*, 369–394.

Miwa, Y., and J. M Ramseyer. 2006. "Japanese Industrial Finance at the Close of the 19th Century: Trade Credit and Financial Intermediation." *Explorations in Economic History*, 43(1): 94–118.

Morgan, Donald P., Bertrand Rime, and Philip E. Strahan. 2004. "Bank Integration and State Business Cycles." *Quarterly Journal of Economics*, 119 (4): 1555–85.

Naito, T. 2008. "A Business Model of Silk Filature Financing by Local Banks: The Case of the Koide Bank." *Japanese Research in Business History*, 25: 11–32.

Nakabayashi, M. 2001. "The Rise of the Modern Silk Reeling Industry and Financial Institutions: The Formation of the Institution of Providing Advances on Documentary Bills." *Japanese Yearbook on Business History*, 18: 119–139.

Nakabayashi, Masaki. 2006. "The Rise of a Factory Industry: Silk Reeling in Suwa District." In *The Role of Tradition in Japan's Industrialization*. Vol. Volume 2 of *Japanese Studies in Economic and Social History*, , ed. Masayuki Tanimoto. Oxford University Press.

Nakabayashi, Masaki. 2014. "Imposed Efficiency of the Treaty Port: Japanese Industrialization and Western Imperialist Institutions." *Review of Development Economics*, 18(2): 254–271.

Okazaki, Tetsuji, and Michiru Sawada. 2007. "Effects of a bank consolidation promotion policy: evaluating the 1927 Bank Law in Japan." *Financial History Review*, 14: 29–61.

Peek, J., and E. S Rosengren. 2000. "Collateral Damage: Effects of the Japanese Bank Crisis on Real Activity in the United States." *The American Economic Review*, 90(1): 30–45.

Peek, Joe, and Eric S. Rosengren. 1997. "The International Transmission of Financial Shocks: The Case of Japan." *The American Economic Review*, 87(4): pp. 495–505.

Peek, Joe, and Eric S. Rosengren. 2005. "Unnatural Selection: Perverse Incentives and the Misallocation of Credit in Japan." *The American Economic Review*, 95(4): pp. 1144–1166.

Petersen, Michell A., and Raghuram G. Rajan. 1997. "Trade Credit: Theories and Evidence." *The Review of Financial Studies*, 10(3): pp. 661–691.

Rajan, Raghuram G. 1992. "Insiders and Outsiders: The Choice between Informed and Arm's-Length Debt." *The Journal of Finance*, 47(4): 1367–1400.

Sharpe, Steven A. 1990. "Asymmetric Information, Bank Lending and Implicit Contracts: A Stylized Model of Customer Relationships." *The Journal of Finance*, 45(4): pp. 1069–1087.

Shimizu, Yoshinori. 1992. "Problems in the Japanese Financial System in the Early 1990s." *Hitotsubashi Journal of Commerce and Management*, 27(1): 29–49.

Staiger, Douglas, and James H. Stock. 1997. "Instrumental Variables Regression with Weak Instruments." *Econometrica*, 65(3): 557–586.

Stock, James H., and Motohiro Yogo. 2005. "Testing for Weak Instruments in Linear IV Regression." In *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg*. , ed. Donald W. K. Andrews and James H. Stock, 80–108. Cambridge: Cambridge University Press.

Uchida, Hirofumi, Gregory F. Udell, and Wako Watanabe. 2008. "Bank size and lending relationships in Japan." *Journal of the Japanese and International Economies*, 22(2): 242–267.

Watanabe, Wako. 2007. "Prudential Regulation and the ÒCredit CrunchÓ: Evidence from Japan." *Journal of Money, Credit and Banking*, 39(2-3): 639–665.

Weinstein, David E., and Yishay Yafeh. 1998. "On the Costs of a Bank-Centered Financial System: Evidence from the Changing Main Bank Relations in Japan." *The Journal of Finance*, 53(2): 635–672.

Yamazawa, Ippei. 1975. "Silk export and Japanese economic development (Kiito Yushutu to Nihon no Keizai Hatten)." Department of Economics, Hitotsubashi University, Tokyo, Japan. Department Bulletin Paper 19.

Table 1: Japanese prefectures: descriptive statistics

	Prefecture	City bank share in total lending	SME share in GDP	post-1990 average growth rates of GDP per capita	City bank lending
1	Hokkaido	49.53	9.30	0.35	9.85
2	Aomori	57.13	8.53	0.40	5.86
3	Iwate	43.05	12.26	0.78	12.94
4	Miyagi	63.97	10.77	0.14	9.42
5	Akita	53.97	12.72	0.66	8.93
6	Yamagata	43.65	18.29	0.51	13.22
7	Fukushima	45.81	17.06	0.58	14.27
8	Ibaraki	55.07	19.31	-0.15	12.69
9	Tochigi	58.54	20.70	-0.08	12.33
10	Gunma	53.55	21.17	-0.16	9.93
11	**Saitama**	65.37	24.47	-0.22	9.33
12	**Chiba**	59.28	13.89	0.12	12.87
13	**Tokyo**	86.64	7.98	-0.49	4.16
14	**Kanagawa**	65.46	13.84	-0.67	9.02
15	Niigata	49.71	17.48	0.58	11.60
16	Toyama	58.06	19.30	0.41	8.29
17	Ishikawa	60.47	17.70	0.36	5.82
18	Fukui	56.30	20.94	0.60	6.68
19	Yamanashi	42.29	20.09	-0.14	8.97
20	Nagano	44.05	21.91	0.28	9.85
21	Gifu	45.97	24.68	0.16	8.18
22	Shizuoka	51.80	22.26	0.43	6.61
23	**Aichi**	62.18	18.08	-0.04	7.46
24	Mie	51.11	19.72	0.89	12.54
25	Shiga	49.05	24.86	-0.16	14.61
26	**Kyoto**	55.23	17.85	0.23	6.57
27	**Osaka**	77.18	19.21	-0.40	6.36
28	**Hyogo**	55.96	17.66	-0.72	9.05
29	Nara	66.14	19.67	0.08	9.92
30	Wakayama	48.40	14.95	1.08	11.48
31	Tottori	50.11	12.74	0.02	10.07
32	Shimane	42.43	13.66	1.01	10.25
33	Okayama	53.36	17.90	-0.21	10.52
34	Hiroshima	56.60	14.32	0.31	10.97
35	Yamaguchi	54.63	12.16	0.76	9.23
36	Tokushima	57.62	15.36	0.89	13.14
37	Kagawa	63.06	18.00	0.17	9.63
38	Ehime	50.34	16.87	0.38	12.42
39	Kochi	42.41	10.00	0.52	14.76
40	Fukuoka	65.54	10.49	0.26	8.96
41	Saga	48.21	15.81	1.10	11.45
42	Nagasaki	60.09	7.87	0.41	10.09
43	Kumamoto	49.46	9.96	0.12	13.82
44	Oita	48.69	10.39	0.92	10.58
45	Miyazaki	47.91	10.68	1.01	9.37
46	Kagoshima	44.13	9.48	0.94	9.47
	Mean	**54.55**	**15.92**	**0.31**	**10.08**
	Std. Deviation	**9.16**	**4.74**	**0.46**	**2.51**

Note: all numbers in percent. Core prefectures highlighted in bold.

Table 2: Small business importance, financial integration and the Great Recession — baseline results

		Panel A: Based on value added SME-measure					
	All prefectures	Sample split by importance of ...					
		Regional Banks		City Banks		Regional Banks: Shinkins only	
		high	low	high	low	high	low
$Post1990_t \times SME^k_{VA}$	-0.07	-0.13	-0.01	-0.01	-0.12	-0.11	0.02
	(-1.89)	(-4.01)	(-0.08)	(-0.17)	(-3.76)	(-3.69)	(0.34)
R^2	0.55	0.565	0.58	0.60	0.53	0.57	0.56
		Panel B: Based on employment based SME-measure					
	All prefs.	high	low	high	low	high	low
$Post1990_t \times SME^k_{EMP}$	-0.08	-0.15	0.01	-0.006	-0.15	-0.13	-0.03
	(-1.77)	(-3.71)	(0.15)	(-0.08)	(-3.76)	(-3.18)	(-0.37)
R^2	0.55	0.55	0.58	0.60	0.53	0.57	0.56

The Table shows the coefficient α in panel regressions of the form $\Delta gdp^k_t = \alpha \times Post1990_t \times SME^k + \mu^k + \tau_t + \varepsilon^k_t + constant$ where $Post1990_t$ is a dummy indicating the period after 1990, SME^k is small-business importance and $\mu^k$and τ_t are prefecture- and time-fixed effects respectively. Sample period is 1980-2005. Regional banks include Sogo banks, Shinkins and nonagricultural credit cooperatives. OLS estimates, t-statistics in parentheses. Standard errors are clustered by prefecture.

Table 3: Baseline results — interaction terms and robustness

	I	II	III	IV	V	VI	VII	VIII	IX	X
	$FI=$		$FI=$		$FI=$					$FI=$
Interactions of $Post1990_t$ with ...	High Regional (dummy)	High City (dummy)	Regional (share)	City (share)	Regional (dummy)	City (share)	Regional (share)			High City (dummy)
$...SME^k \times FI^k$	-0.09	0.08	-1.42	0.74	-0.09	0.51	-1.07	0.012	0.009	0.007
	(-2.15)	(1.93)	(-3.24)	(3.78)	(-2.15)	(1.75)	(-2.14)	(2.53)	(2.24)	(1.73)
$...FI^k$	0.01	-0.01	0.24	-0.13	-0.00	-0.01	0.01	-0.006	-0.005	-0.004
	(1.93)	(-1.97)	(3.87)	(-5.03)	(-0.49)	(-0.65)	(0.21)	(-1.96)	(-1.66)	(-1.35)
$...SME^k_{VA}$	-0.03	-0.12	0.32	-0.48	-0.08	-0.08	-0.08	-0.013	-0.013	-0.012
	(-1.12)	(-3.84)	(2.72)	(-4.06)	(-3.64)	(-3.51)	(-3.80)	(-3.97)	(-3.97)	(-3.56)
Controls:										
X^k : $...CoreArea$	-0.01	-0.01	-0.01	-0.008	-0.01	-0.01	-0.01	-0.012	-0.008	-0.009
	(-3.25)	(-3.30)	(-4.00)	(-2.63)	(-3.25)	(-2.46)	(-3.37)	(-3.05)	(-3.33)	(-2.75)
R^2	0.55	0.55	0.57	0.57	0.55	0.56	0.56		0.56	0.55
Prefectures	Tokyo dropped		All		Tokyo dropped			All	Tokyo dropped	potential outliers dropped
Remarks					SME, FI demeaned				*SME* dummy	

The Table shows results from the regression $\Delta gdp^k_t = Post1990_t \times \left[\alpha_0 SME^k_{VA} \times FI^k + \alpha_1 FI^k + \alpha_2 SME^k_{VA} + \alpha_3' X^k_t\right] + \mu^k + \tau_t + \varepsilon^k_t$ where $Post1990_t$ is a dummy indicating the period after 1990 (1991-2005), $SME^k_{VA}$is small-business importance based on value added, FI^k is the measure of financial integration (regional or city bank share in total lending in prefecture k), as indicated in the column heading. $\mu^k$and τ_t are prefecture-fixed and time effects respectively. The vector X^k captures prefecture characteristics. In the regressions it is interacted with our crisis dummy $Post1990_t$ and contains $CoreArea^k$, a dummy for the core economic areas (Tokyo, Osaka, Aichi, Kanagawa, Chiba, Saitama, Hyogo and Kyoto prefectures). The sample period is 1980-2005. OLS estimates, t-statistics in parentheses. Standard errors are clustered by prefecture.

In the regressions in column X, we identify a prefecture as a potential outlier if *SME* or FI are more than 1.64 standard deviations away from the cross-prefectural mean of the respective variable. This leads us to exclude the following six prefectures: Saitama, Tokyo, Gifu, Shiga, Osaka, Nagasaki .

Table 4: Prefecture-level lending after 1990

	Lending growth								
	total	City Banks	Local Banks	total	City Banks	Local Banks	total	City Banks	Local Banks
	I	II	III	IV	V	VI	VII	VIII	IX
Interactions of $Post1990_t$ with pre-1991 variables	FI =CityBankShare			FI = CityBankShare Tokyo excluded			FI=CityBankShare Tokyo excluded $AggShock_t$=$\Delta log(LandPrice_t)$		
$...SME^k \times FI^l$	0.70	1.46	-0.91	0.16	1.77	-1.22	-1.74	-3.09	1.02
	(2.67)	(2.61)	(-1.27)	(0.37)	(1.98)	(-0.98)	(-1.48)	(-1.86)	(0.81)
FI^k	-0.18	-0.37	0.03	-0.09	-0.42	0.08	0.53	0.68	-0.06
	(-3.91)	(-4.60)	(0.25)	(-1.08)	(-2.78)	(0.38)	(2.39)	(2.09)	(-0.32)
SME^k	-0.40	-0.88	0.61	-0.12	-1.04	0.77	1.33	2.01	-0.16
	(-2.65)	(-2.47)	(1.31)	(-0.54)	(-2.00)	(1.09)	(2.16)	(2.33)	(-0.24)
$...CoreArea$	-0.02	-0.02	0.01	-0.02	-0.02	0.01	0.07	0.07	0.05
	(-4.06)	(-3.06)	(1.04)	(-3.83)	(-3.17)	(1.15)	(8.18)	(6.63)	(3.79)
R^2	0.61	0.80	0.73	0.60	0.81	0.74	0.66	0.81	0.74

Memorandum item: $Fraction\ of\ SME\ with\ City\ Bank\ as\ main\ bank_{2002} = \underset{(tstat=6.49)}{0.6230} \times CityBankShare^k_{1980-90} - 0.25 \qquad R^2 = 0.49$

The Table shows results from the regression $\Delta log(X^k_t) = Post1990_t \times \left[\alpha_0 SME^k_{EMP} \times FI^k + \alpha_1 FI^k + \alpha_2 SME^k + \alpha_3' X^k_t\right] + \mu^k + \tau_t + \varepsilon^k_t$ where X^k_t stands in turn for total lending (columns I, IV and VII), city bank lending (columns II, V and $VIII$) and city bank lending relative to regional bank lending (columns III, VI and IX) in prefecture k. $Post1990_t$ is a dummy indicating the period after 1990 (i.e. 1991-2005), SME^k is our measure of bank dependence (small-business importance, based on value added) , FI^k is a measure of financial integration, the pre-1991 (1980-90) average city bank share in total lending in prefecture k. In the third panel (columns $VII - IX$), the aggreagte shock is given by the land price decline in the core prefectures from Imai and Takarabe (2011).$\mu^k$and τ_t are prefecture-fixed and time effects respectively. $CoreArea$ is a dummy for the core economic areas (Tokyo, Osaka, Aichi, Kanagawa, Chiba, Saitama, Hyogo and Kyoto prefectures). The sample period is 1980-1996. The memorandum item at the bottom of the table reports the regression of the fraction of small firms reporting a city bank as main bank on our pre-1990 measure of financial integration, the average lending share of city banks in a prefecture in 1980-1990.

Table 5: Transmission mechanism: ancillary implications of model

A: Hold-up

Interactions of $Post1990_t$ with pre-1991 variables	Tier 2 banks			Tier 1 banks		
	All	High FI	Low FI	All	High FI	Low FI
	I	II	III	IV	V	VI
	Dependent variable is average loan interest rate $FI = CityBankShare$					
$...SME^k_{VA} \times$ Real estate exposure	0.21	0.15	0.27	-0.12	0.40	-0.31
	(2.13(	(1.00)	(2.02)	(-0.59)	(0.59)	(-2.09)
Real estate exposure	0.01	0.01	0.01	0.002	-0.02	0.02
	(0.86)	(1.64)	(0.42)	(0.16)	(-1.03)	(1.54)
SME^k_{VA}	-0.01	-0.01	-0.0045	0.01	0.01	0.01
	(-1.52)	(-0.80)	(-0.67)	(1.46)	(1.32)	(0.97)
$...CoreArea$	-0.002	-0.002		-0.002	-0.003	
	(-3.57)	(-2.8)		(-1.21)	(-1.35)	
R^2	0.99	0.99	0.98	0.99	0.98	0.99
number of prefectures	35	16	19	38	17	21

B: Exposure to local shocks

Interactions of $\Delta LocalLandPrice^k_t$ with pre-1991 variables	High FI	Low FI
	VII	VIII
	Dependent variable is GDPgrowth $FI = CityBankShare$	
$...SME^k_{VA} \times$ Tier 2 Real estate exposure	-9.03	4.46
	(-2.22)	(4.65)
...Tier 2 Real estate exposure	0.10	-0.12
	(0.89)	(-3.70)
$...SME^k_{VA}$	-0.08	0.19
	(-0.64)	(2.21)
Add'l controls		
$\Delta LocalLandPrice^k_t$	0.01	0.01
	(1.44)	(0.93)
$SME^k \times \Delta Citylandprice_t$	0.13	0.13
	(1.03)	(1.47)
R^2	0.62	0.55
number of prefectures	21	21

The Table shows regressions illustrating the ancillary implications of the stylized banking model discussed in the main text: hold-up (panel A) and differential exposure to local shocks (panel B). Panel A presents regressions of the form $R^k_t(Tier) = Post1990_t \times \left[\alpha_0 SME^k_{VA} \times REE(Tier)^k + \alpha_1 REE(Tier)^k + \alpha_2 SME^k_{VA} + \alpha'_3 X^k_t\right] + \mu^k + \tau_t + \varepsilon^k_t$ where $Tier = 1, 2$ stands for either Tier 1 (supraregional) or Tier 2 (local) banks and $R(Tier)^k_t$ is the average interest rate charged by banks of the respective tier in prefecture k and $REE(Tier)^k$ denotes these banks' pre-1990 real estate exposure. Regressions are reported for all (columns I and IV), and for high (low) financial integration prefectures (columns II-III for Tier 2 and columns V-VI for Tier 1). As before, $Post1990_t$ is a dummy indicating the period after 1990 (i.e. 1991-2005), SME^k is our measure of small-business importance (based on value added) , FI^k is our measure of financial integration, the pre-1990 lending share of city banks in prefecture k. $CoreArea$ is a dummy for the core economic areas (Tokyo, Osaka, Aichi, Kanagawa, Chiba, Saitama, Hyogo and Kyoto prefectures). The sample period is 1980-2005.

Panel B shows the regressions of the form $\Delta gdp^k_t = \Delta LocalLandprice^k_t \times \left[\alpha_0 SME^k_{VA} \times REE(2)^k + \alpha_1 REE(2)^k + \alpha_2 SME^k_{VA} + \alpha_3\right] + \alpha_4 \Delta CityLandprice_t \times SME^k + \mu^k + \tau_t + \varepsilon^k_t$ where $\Delta LocalLandprice^k_t$ is the log change in land prices in prefecture k and $\Delta CityLandprice_t$ is the log change in land prices in the core areas and $REE(2)^k$ is the pre-1990 real estate exposure of local ($Tier = 2$) banks in prefecture k. The variables SME and FI are as before. The sample period is 1980-2003. In both panels, $\mu^k$and τ_t are prefecture-fixed and time effects respectively.

Table 6: Modern day (pre-1990) lending and silk filatures

	Financial Integration						Financial Development				
	pre-1990 share in prefecture-level lending by										
	City Banks		Regional Banks				$\frac{bank\ branches}{population \times area}$ (pre-1990)		Lending/GDP (pre-1990)		
			All (Shinkin+Sogo)		Shinkins only						
filatures / population (log #)	-0.03	-0.04	0.03	0.03	0.04	0.04	0.01	0.01	-0.61	-0.55	-0.10
	(-3.14)	(-4.70)	(4.22)	(4.11)	(4.96)	(4.53)	(0.87)	(0.87)	(-1.78)	(-1.95)	(-0.29)
Relative GDP (pre-90)		0.19		-0.01		-0.01		0.09		8.56	6.27
		(3.32)		(-0.18)		(-0.24)		(1.68)		(4.21)	(2.88)
Core Dummy		0.07		-0.001		0.02		-0.02		1.92	1.06
		(2.46)		(-0.02)		(0.71)		(-0.57)		(1.88)	(1.02)
Distance to Yokohama (log)		-0.02		0.01		-0.01		0.01		0.55	0.74
		(-1.33)		(0.66)		(-0.93)		(0.74)		(1.25)	(1.75)
City Bank Lending											12.20
											(2.28)
R^2	0.18	0.60	0.29	0.30	0.36	0.40	0.02	0.08	0.07	0.46	0.53

The Table shows regressions of modern-day (pre-1990) average prefectural lending shares by bank type (left panel) and of various (pre-1990) financial development indicators (right panel) on the number of filatures per head of population in a prefecture in 1895. The control variables are relative (pre-199) per capita GDP, the (log) distance to Yokohama and a dummy for the core areas (Tokyo, Osaka, Aichi, Kanagawa, Chiba, Saitama, Hyogo and Kyoto prefectures), t-statistics in parentheses.

Table 7: Disentangling financial integration & industrial structure

	Industrial structure				Financial Integration		
	Small manufacturing firm share		Manufacturing Share		pre-1990 lending share by		
					City Banks	Regional Banks	
	in *GDP*	in *EMP*	in *GDP*	in *EMP*		All	Shinkin
distance to most highly mechanized silk regions (log)	-0.03	-0.02	-0.06	-0.03	-0.02	-0.01	-0.01
	(-6.28)	(-5.41)	(-5.05)	(-5.26)	(-1.35)	(-1.46)	(-1.07)
filatures / population (log #)	0.01	0.01	0.00	0.01	-0.04	0.02	0.03
	(2.04)	(2.87)	(0.31)	(1.87)	(-4.41)	(3.09)	(3.60)
Core Dummy	-0.03	-0.03	-0.05	-0.03	0.08	-0.01	0.01
	(-2.30)	(-2.77)	(-1.39)	(-1.77)	(2.53)	(-0.46)	(0.37)
Distance to Yokohama (log)	-0.01	-0.01	-0.03	-0.02	-0.03	0.01	-0.01
	(-1.68)	(-1.61)	(-2.03)	(-2.32)	(-1.96)	(1.01)	(-0.70)
R^2	0.69	0.68	0.57	0.65	0.56	0.34	0.42

The Table shows cross-sectional regressions of modern-day (1980-90 average) industrial structure (left panel) and 1980-1990 average prefectural lending shares by bank type (right panel) on our two alternative silk-related variables: the minimum (log) distance to one of the four prefectures with the most highly mechanized silk industry in 1895 (Kyoto, Nagano, Gifu and Shizuoka) and the (log) number of filatures per head in 1895 and a set of controls. The control variables are the (log) distance to Yokohama (the main silk market) and a dummy for the Core areas (Tokyo, Osaka, Aichi, Kanagawa, Chiba, Saitama, Hyogo and Kyoto prefectures). t-statistics appear in parentheses.

Table 8: Panel IV Regressions with filatures / head in 1895 as instrument

Interactions terms	City Banks	Regional Banks		City Banks	Regional Banks		City Banks	Regional Banks	
of $Post1990_t$ with ...		All	Shinkin		All	Shinkin		All	Shinkin
$SME^k_{VA} \times FI^k$	0.89	-1.57	-1.94	1.04	-1.41	-1.42	0.86	-1.46	-1.65
	(2.15)	(-2.18)	(-2.08)	(1.69)	(-1.50)	(-1.42)	(1.84)	(-1.81)	(-1.76)
FI^k	-0.18	0.43	0.40	-0.20	0.28	0.27	-0.16	0.31	0.33
	(-2.21)	(2.00)	(1.96)	(-1.58)	(1.28)	(1.28)	(-1.86)	(1.64)	(1.65)
SME^k_{VA}	-0.57	0.32	0.21	-0.65	0.30	0.17	-0.53	0.32	0.22
	(-2.44)	(1.80)	(1.61)	(-1.81)	(1.39)	(1.20)	(-1.92)	(1.73)	(1.63)
Controls	no	no	no	yes	yes	yes	yes	yes	yes
relative GDP				0.01	-0.01	-0.01			
				(0.33)	(-0.60)	(-2.02)			
Core				-0.01	-0.01	-0.01	-0.00	-0.01	-0.01
				(-1.72)	(-2.38)	(-2.51)	(-0.78)	(-1.58)	(-1.85)
Distance to Yokohama							0.00	0.00	0.00
							(0.93)	(1.03)	(2.71)
R^2	0.69	0.69	0.69	0.70	0.70	0.70	0.70	0.70	0.70
1st-Stage F-stat for $SME^k \times FI^k \times Post1991_t$	303.29	288.56	407.01	420.48	279.43	479.21	383.56	297.11	439.05
Kleibergen-Paap rank test	**77.26**	**37.53**	**41.56**	**66.78**	**25.76**	**38.98**	**94.57**	**37.86**	**44.68**
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

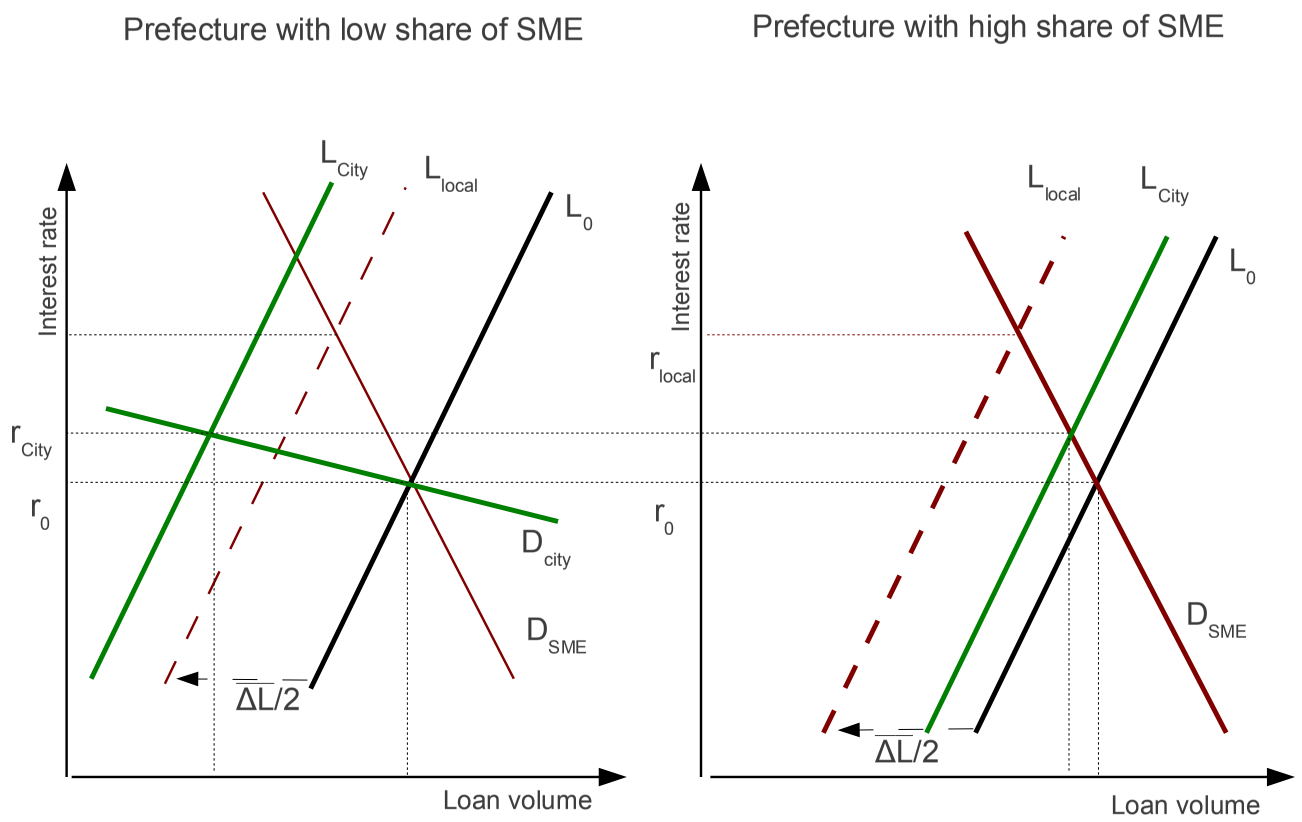
The Table shows results from the IV regression $\Delta gdp^k_t = Post1990_t \times \left[\alpha_0 \widehat{SME^k \times FI^k} + \alpha_1 \widehat{FI^k} + \alpha_2 SME^k + \alpha'_3 X_t\right] + \mu^k + \tau_t + \varepsilon^k_t$ where where $Post1990_t$ is a dummy indicating the period starting in 1991, $SME^k$is small manufacturing firm importance (value-added or employment based) and X_t is a vector of controls. $\widehat{SME^k \times FI^k}$ and $\widehat{FI^k}$ are the first-stage fitted values of $SME^k \times FI^k$ and FI^k using $SME^k \times Silk^k$ and $Silk^k$ as instruments, where $Silk^k$ is the log number of silk filatures per head of population in a prefecture in 1895. *CoreArea* is a dummy for the core economic areas (Tokyo, Osaka, Aichi, Kanagawa, Chiba, Saitama, Hyogo and Kyoto prefectures). The sample period is 1980-2005, t-statistics appear in parentheses. The bottom of the Table reports information on instrument relevance: the F-statistics associated with the first stage regression of the interaction term on all instruments and the Kleibergen and Paap (2006) (KP) rank statistics and its associated p-value for the hypothesis of under-identification. The KP-statistics appears in boldface (italics) if it exceeds the Stock and Yogo (2005) weak-instrument critical values of 7.03 (4.58) (see Table 5.2. in Stock and Yogo (2005), for the case of $n = 2$ endogenous variables and $K = 2$ excluded instruments), This suggests that the instruments can be taken to be sufficiently strong to ensure a maximal size of no more than 10% (15%) for a nominal 5% size Wald Test on the IV-estimates.

Table 9: Panel IV Regressions (both credit dependence and financial integration endogenous)

	$CD = SME_{VA}$			$CD = SME_{EMP}$			$CD = SME_{EMP}$		
Interactions terms	City Banks	Regional Banks		City Banks	Regional Banks		City Banks		Shinkin
of $Post1990_t$ with ...		All	Shinkin		All	Shinkin	Tokio dropped	potential outliers dropped	
$CD \times FI^k$	1.30	-3.25	-3.98	2.68	-5.35	-5.78	3.01	3.3	-4.71
	(1.79)	(-1.94)	(-1.88)	(1.98)	(-2.06)	(-2.03)	(1.88)	(2.12)	(-2.50)
FI^k	-0.24	0.65	0.80	-0.40	0.86	0.93	-0.48	-0.5	0.78
	(-1.93)	(1.90)	(1.86)	(-2.08)	(2.00)	(2.00)	(-1.92)	(-2.16)	(2.35)
CD	-0.78	0.76	0.53	-1.56	1.30	0.80	-1.69	-1.89	0.56
	(-1.93)	(1.83)	(1.72)	(-2.06)	(2.00)	(1.92)	(-1.98)	(-2.24)	(2.24)
Controls	yes	yes	yes	yes	yes	yes	yes	yes	yes
R^2	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.69	0.70
1st-Stage F-stat for $CD^k \times FI^k$	384.83	723.66	726.13	335.05	757.38	776.77	304.27	200.46	362.08
Kleibergen-Paap rank test	**33.93**	**10.87**	*8.15*	**19.13**	*9.08*	*8.14*	**21.81**	**27.41**	**14.73**
p-value	0	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01

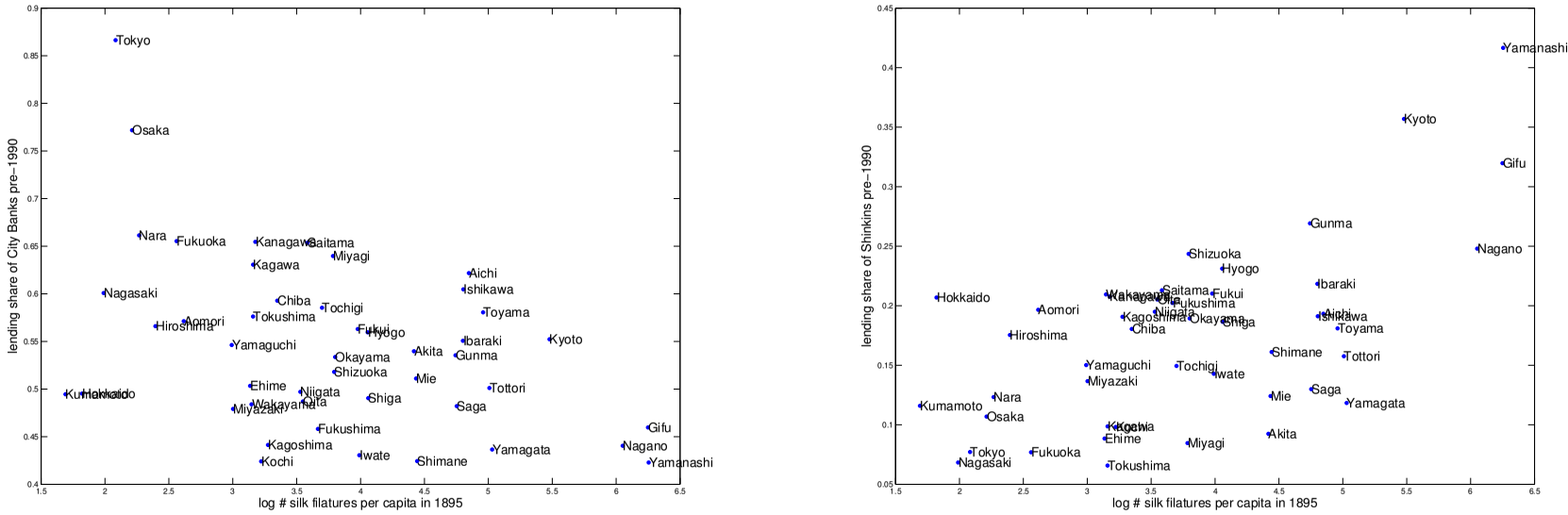
The Table shows results from the IV regression $\Delta gdp_t^k = Post1990_t \times \left[\alpha_0 \widehat{CD^k \times FI^k} + \alpha_1 \widehat{FI^k} + \alpha_2 \widehat{CD^k} + \alpha_3' X^k\right] + \mu^k + \tau_t + \varepsilon_t^k$ where where $Post1990_t$ is a dummy indicating the period after 1990, CD^k is our measure of bank credit dependence and FI^k our regional banking integration measures as indicated in the respective column headings and X^k is a vector of controls. $\widehat{CD^k \times FI^k}$, $\widehat{FI^k}$, and $\widehat{CD^k}$ are the first-stage fitted values of $CD^k \times FI^k$,FI^k and CD^k using the log numbers of filatures per head ($filatures^k$), the (log) distance to one of the three most mechanized silk regions and the interaction between these two as instruments. Control variates are (log) distance to Yokohama and a dummy for the core economic areas (Tokyo, Osaka, Aichi, Kanagawa, Chiba, Saitama, Hyogo and Kyoto prefectures). The sample period is 1980-2005. t-statistics in parentheses. The bottom of the Table reports the F-statistics associated with the first stage regression of the interaction term on all instruments and the Kleibergen and Paap (2006) rank statistics and the associated p-value for the hypothesis of under-identification. Values of the KP-statistics in boldface or italics indicate that the hypothesis of weak identification is rejected. We reject if the asymptotic bias of the TSLS estimator is less than 5% (KP in bold) or 10% (KP in italics) based on the critical values tabulated in Table 5.1. of Stock and Yogo (2005). Since values for our case of $n = 3$ endogenous variables and $K = 3$ instruments are not directly tabulated, we use the more conservative values for $n = 3$ and $K = 5$ which are 9.53 and 6.61 respectively. In the regressions reported in the last three columns, we drop Tokyo and potential outliers, again defined as prefectures for which *SME* or *FI* are more then 1.64 standard deviations away from their respective cross-sectional means.

Figure 1: A stylized interregional banking model with relationship lending



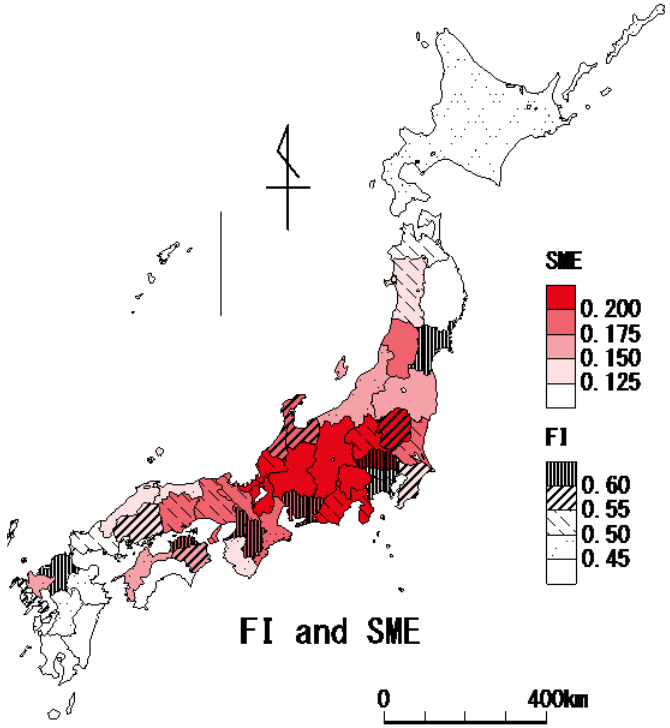
NOTES: The left panel illustrates the case of a prefecture with a small share of SMEs. The right panel illustrates the case of a prefecture with many SMEs. The demand curve of the city bank in the low-SME prefecture in the left panel is flatter than the one faced by the regional bank because the local bank only lends to SME customers, whereas the city bank lends to big firms. In the high-SME prefecture, both the regional and the city bank only lend to SMEs. At the outset, all banks have the local supply curve L_0. The shock to the banking system forces regional banks to reduce lending by $\overline{\Delta L}/2$—the horizontal distance between L_0 and L_{local} in each panel. The city bank operates an internal capital market, equating the interest rate on the marginal loan in both prefectures. Therefore, faced with the same need to reduce lending by $\overline{\Delta L}/2$ on *average* in each prefecture, it reduces lending by more than $\overline{\Delta L}/2$ in the low-SME prefecture and by less than $\overline{\Delta L}/2$ in the high-SME prefecture.

Figure 2: The 'Silken Thread': prefecture-level City and Regional bank lending Shares (pre-1990 (1980-1990) averages) vs. number of silk filatures per head in 1895



NOTE: Left panel shows link for city banks, right panel for regional banks.

Figure 3: Geographical distribution of Pre-1990 SME importance and financial integration and post-1990 p.c. GDP growth rates



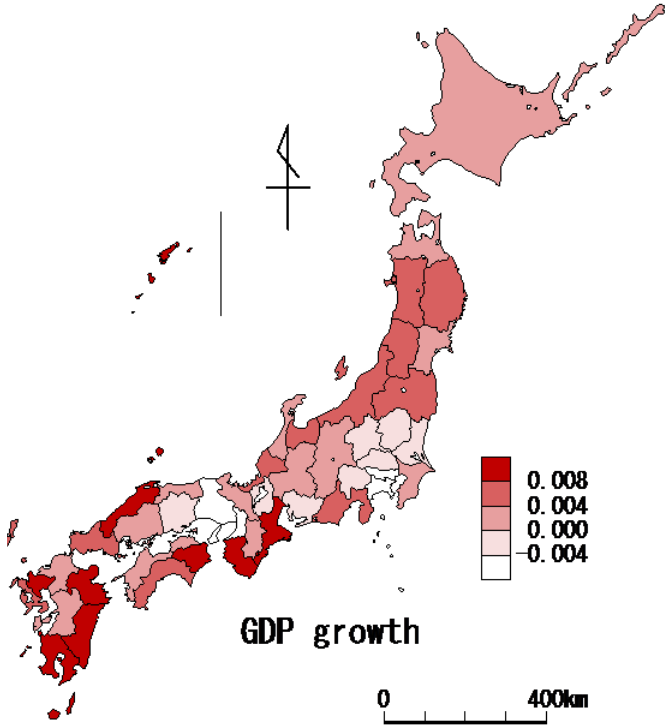
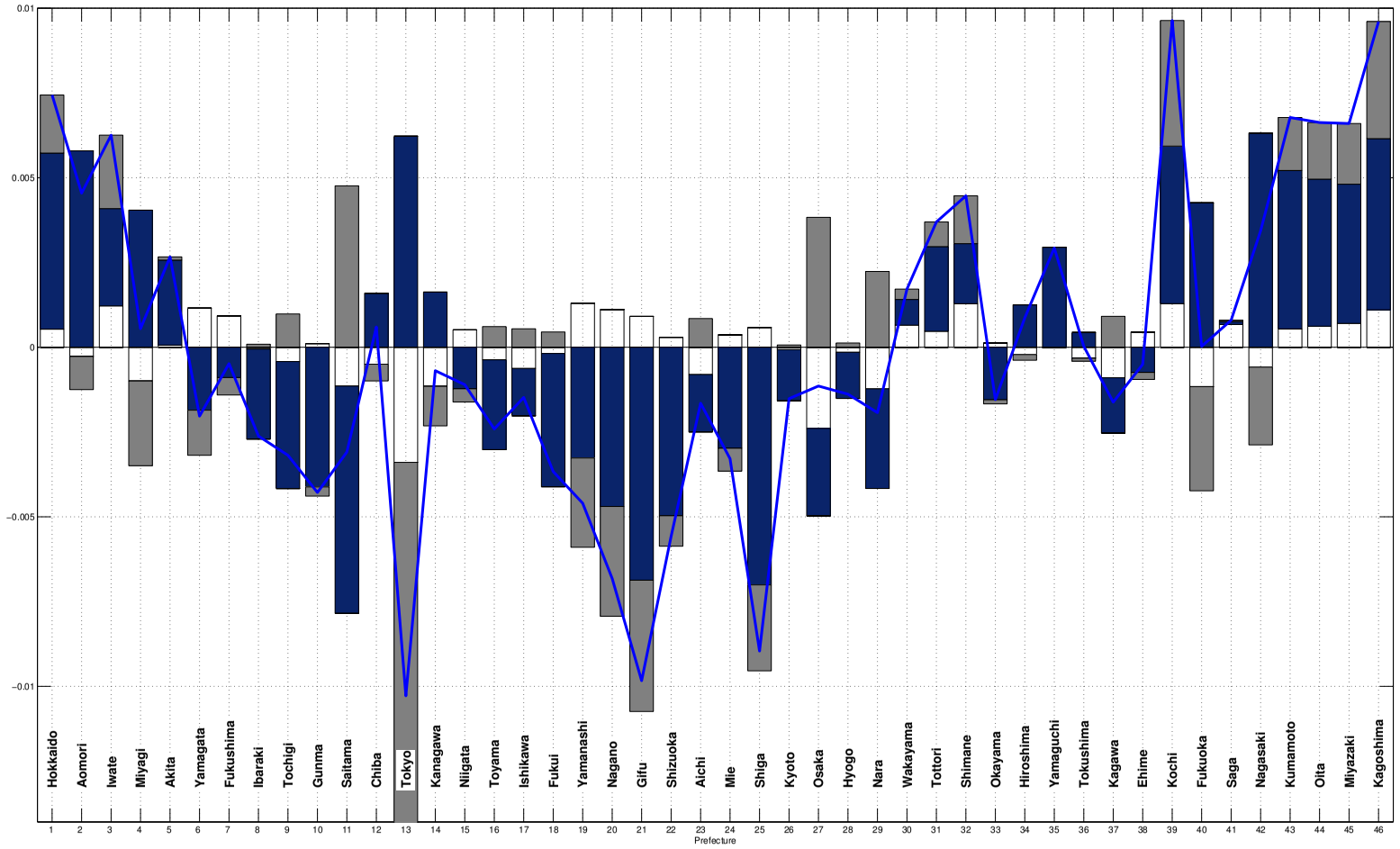
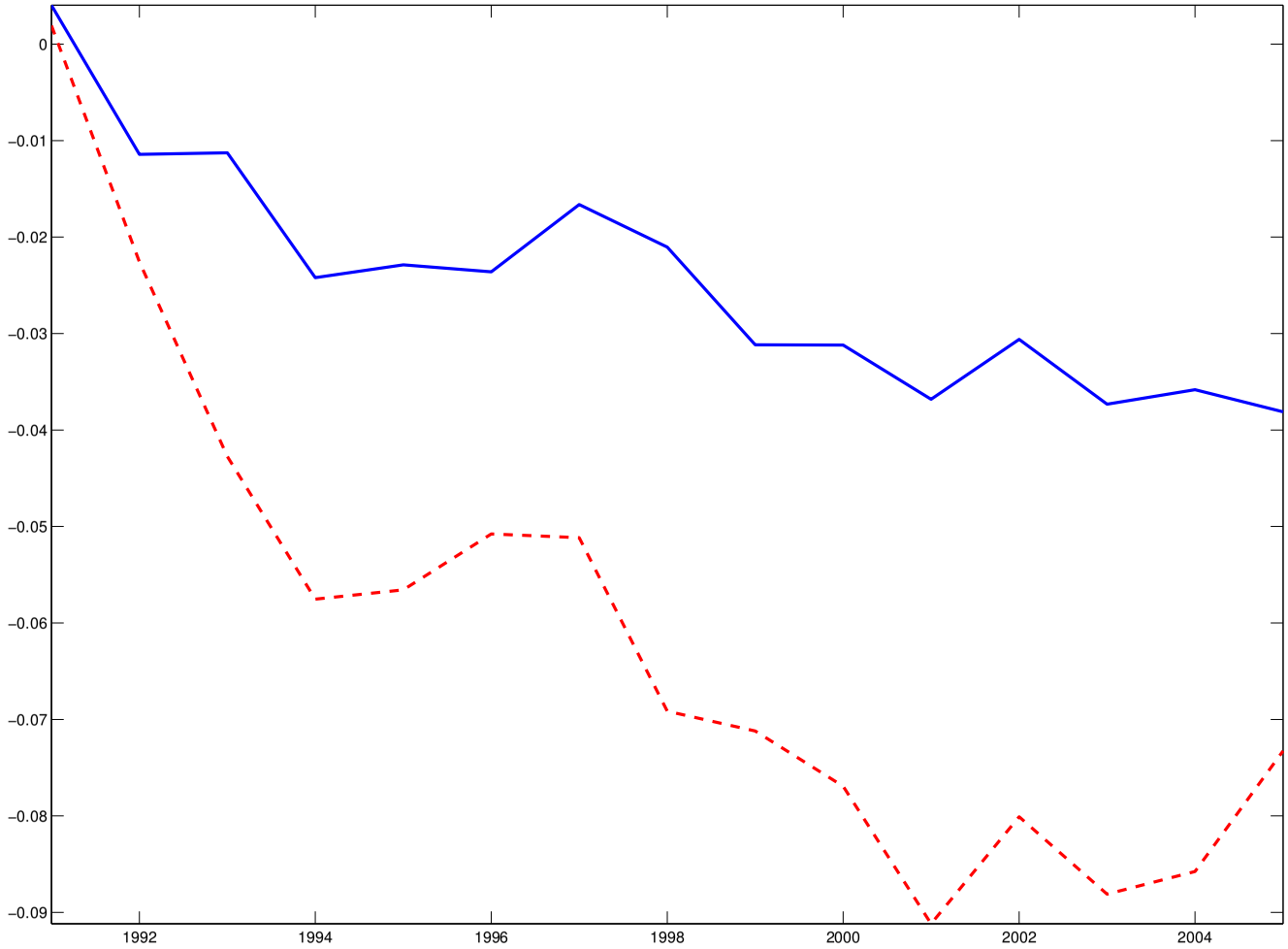


Figure 4: Geographical profile of the interaction between bank dependence and financial integration



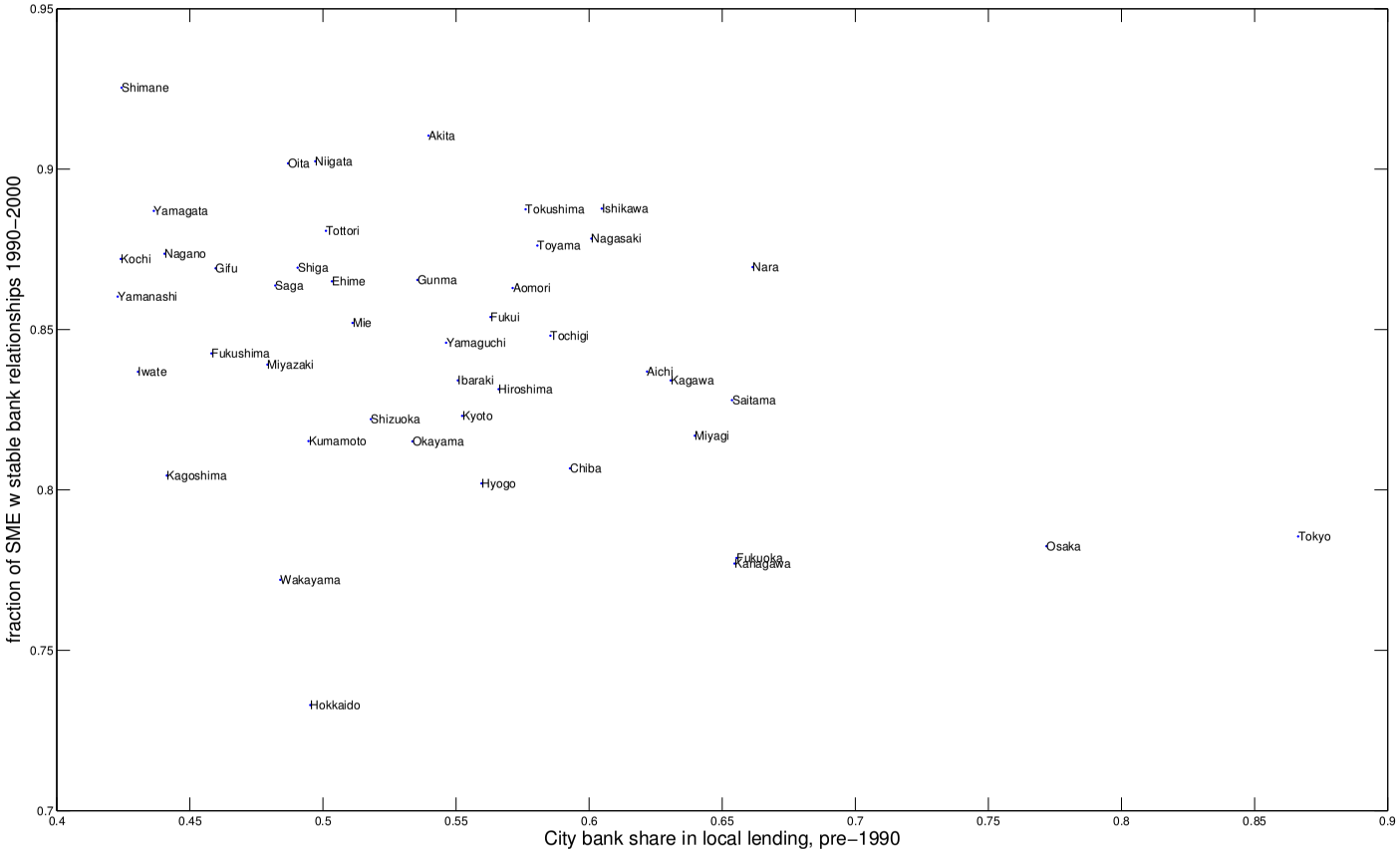
NOTES: The prefectures are in their official order, starting in the northeast (Hokkaido, number 1) and ending in the west of the country (Kagoshima, number 46). The solid line shows the geographical profile of post-1990 growth as predicted from the regression in column *VI* of Table 3: the sum $\alpha_0 SME^k \times FI^k + \alpha_1 FI^k + \alpha_2 SME^k$. For each prefecture, the bars indicate the growth contribution (relative to the country-wide average) of financial integration ($\alpha_1 F^k$,white/transparent), of local bank dependence ($\alpha_2 SME^k$, dark blue) and of the interaction between the two ($\alpha_0 SME^k \times FI^k$, light grey).
The specification in column *VI* is based on cross-sectionally demeaned values of *SME* (based on value added) and *FI* (city bank share), so that all effects are measured relative to the country-wide mean.Tokyo is dropped from the sample. The values for Tokyo reported in the graph are predicted out-of sample using the coefficient estimates for $\alpha_0, \alpha_1$and α_2 based on the 45 prefectures outside Tokyo.

Figure 5: Cumulative Growth Differential (1991-2005) between high and low SME group for prefectures with high (blue, solid line) and low (red, dashed line) levels of banking integration.



NOTES: The figure illustrates our difference-in-difference results. We split prefectures into four groups based on pre-1991 (1980-90 average) characteristics: above/below-median banking integration and above/below-median small business importance. Then, within each financial integration group, we calculate the cumulative growth differential between the high-SME (i.e. high credit dependence) and the low-SME (low credit dependence) subgroups. The blue (solid) line is this cumulative growth differential between high and low SME prefectures for the highly financially integrated group. The red (dashed) line is the cumulative growth differential between high and low SME prefectures for the prefectures with low levels of financial integration. Financial Integration is measured here using the City bank lending shares.

Figure 6: Persistence of bank relationships and banking integration



NOTES: The figure plots the prefecture-level share of small manufacturing establishments that kept their banking relationships stable in the period 1990-2000 against the pre-1990 city bank lending share. The cross-sectional regression of the form

$$Fraction\ of\ SMEs\ with\ stable\ bank\ relationships^{k}_{1990-2000} = b \times FI^{k} + constant + \varepsilon^{k}$$

yields a coefficient estimate of $b = -0.17$, a t-statistics of 2.74 and $R^2 = 0.15$. The graph suggests that Tokyo and Osaka could be outliers, as could be Hokkaido which experienced a major regional bank failure in the mid-1990s (that plausibly forced a lot of local SMEs to change bank affiliation). Controlling for these three observations using dummies changes the estimate to $b = -0.16$ (t-stat -2.18 , $R^2 = 0.35$).

Historical Appendix (for online publication)

The opening of Japan's ports for trade following the Harris Treaty of 1858 was an exogenous event that led to the emergence of silk thread as Japan's first and (until the onset of World War II) foremost export good.[23] The international circumstances of Japan's entry into the world market for raw silk were propitious. Silkworm pests had severely reduced French and Italian silk output by the mid-19th century. The opening of the Suez Canal also substantially increased access to European markets. Furthermore, and most importantly, the increased industrialized use of silk in the US had opened up a new market on the other side of the Pacific (see Federico (1997) and Li (1982)).[24]

Unlike other industries that started to emerge with the opening of the treaty ports, e.g. cotton mills and machinery, the silk industry was highly fragmented—and largely remained so until its decline on the eve of World War II. While sericulture had started to spread throughout Japan during the Tokugawa period, the mountainous areas of central Japan were climatically best suited for raising silkworms. This initially led sericulture to be particularly concentrated in these areas. In the early days, silk growing and reeling was largely a cottage industry, with farmers who grew the cocoons also reeling the silk.

The reeling of cocoons was initially largely done by hand. As described in Nakabayashi (2006), the French depression of the 1880s changed this. France had traditionally been a market for hand-reeled silk. The depression therefore led to a huge decline in the price of hand-reeled silk, whereas demand for machine-reeled silk exploded in the US, leading to a huge relative price increase for the latter. The reason for this shift in demand from hand-reeled to machine-reeled silk was that the US market—as the first mass consumer market for silk products—required industrial-scale quantities of silk thread of very consistent (though not necessarily the highest) quality. Only thread of such consistent quality could be woven on mechanized looms. The consistent quality of the thread, in turn, could mainly be achieved through a mechanized reeling process (Nakabayashi (2006)).

The need for increased mechanization accelerated the separation of silkworm farming and silk reeling. This was the case for two reasons. First, though not particularly capital intensive, mechanization required *some* capital, which not all small hand reelers could raise (Nakabayashi (2006) and Miwa and Ramseyer (2006)).[25] Second, and most importantly for this paper, the separation of reeling and cocoon growing made it necessary for reelers to purchase cocoons. This required access to working capital: cocoons had to be bought in the spring, but the reeled raw silk could only be shipped to the Yokohama market toward the end of the summer. Hence, filatures strongly depended on credit for working capital. In fact, the purchase of cocoons accounted for up to 80 percent of the annual operating costs of a filature (see e.g. Federico (1997)).

We argue that this need for credit, which was brought about by the separation of sericulture from the increasingly mechanized process of silk reeling, had a considerable impact on regional financial development. Smaller filatures were largely unable to borrow from the new, western-style banks

[23] Bernhofen and Brown (2005, 2004) argue very convincingly that Japan's opening was a natural experiment and that the specialization in silk reflected a comparative advantage.

[24] While China was historically the leading producer of silk, with its best produce outstripping Japanese silk in quality, Japanese innovations in sericulture in the late Tokugawa period and the emergence of cooperative structures to ensure quality, provide credit and assist in the purchase of machinery (to be discussed below) soon put Japan in a position to provide silk of very consistent quality to the world market. This standardization in quality proved a particularly important competitive advantage for Japan, as silk weaving became increasingly industrialized, in particular in the US (Li (1982)). Note also that the US maintained high tariffs on woven silk but strongly depended on imports of silk thread for its weaving factories. Hence, it was reeled silk thread that became Japan's main export staple.

[25] Many farmers who had previously also reeled silk by hand would now specialize in the growing of cocoons. The shift in demand led to an expansion of sericulture to all parts of Japan. Gradually, infrastructure improved and railways made possible the quick transport of cocoons over large distances by the late 1880s.

that had started to emerge soon after the opening of the country in the 1870s and 1880s. Located mainly in the big cities such as Yokohama, Osaka or Tokyo, these banks found it difficult to assess borrower quality among the small silk reeling firms, most of which were located in remote and inaccessible parts of the country.[26] A key role was therefore played by the Yokohama silk brokers, who not only acted as intermediaries between the international market for silk thread (largely based in Yokohama, as foreigners were not allowed to travel the country by themselves) and the reelers, but also organized the whole production and marketing chain. Importantly, these brokers had detailed knowledge of market conditions in Yokohama. They also travelled to the silk regions frequently and therefore had an informational advantage when it came to knowledge of local conditions in the silk reeling areas and the borrower quality of small silk reeling firms. It was these silk brokers who extended trade credit to small filatures so they were able to buy cocoons. The growing financing needs of the silk business soon also led to the emergence of the first local banks. Often, these banks were founded by silk reelers' cooperatives and/or with the help of the Yokohama merchants. However, these banks did not effectively raise the capital required for the loans from outside the region. Rather, it was the Yokohama silk merchant who effectively raised the capital for the loan to the silk reelers in the Yokohama market. Nakabayashi (2001) details the working of this system of silk finance as follows. A silk reeling firm would promise to sell its entire production for the year to a Yokohama silk merchant, obtaining in return a documentary bill issued by a Yokohama bank on behalf of the silk merchant. At this stage, the merchant would then either make a working capital loan to the silk reeler directly, or the silk reeler would obtain such a loan from his regional bank against presentation of the documentary bill. This advance on the documentary bill would allow the reeler to purchase cocoons and to reel the silk. A couple of months later, once the silk had been reeled and transported to Yokohama, the Yokohama bank would issue a bill of acceptance to the reeler, who would then be able to fully discount the documentary bill with his regional bank, thus obtaining final payment for the merchandise and clearing the working capital loan received earlier. The regional bank would then settle payment of the documentary bill with the Yokohama bank, which would, in turn, pass the silk on to the merchant after receiving payment.

In this system, while the Yokohama wholesalers would refinance themselves from city banks in Yokohama, or directly based on promissory notes discounted by the Bank of Japan, the Yokohama banks would generally not lend to the reelers directly. As Nakabayashi emphasizes, it was therefore the wholesaler who ultimately had to screen the quality of the borrower, i.e. the silk reeling firms. Conversely, the regional banks mainly acted as local intermediaries for the documentary bills issued by Yokohama banks on behalf of the silk merchants.[27]

The financing institutions of the silk trade were in fact very similar to the modern institutions of export finance as they have recently been described in e.g. Amiti and Weinstein (2011). In the terminology of export finance, the regional banks acted as the 'advising' bank of the silk reeler (the 'exporter'). The Yokohama banks acted as 'issuing' banks for 'letters of credit' (the documentary bills) drawn on the Yokohama merchant (the 'importer').[28] Very much like modern export finance,

[26] In particular, in the early stages of the industry's development, there was no direct access to these prefectures via railway.

[27] Miwa and Ramseyer (2006) argue that, even when they started to make direct loans to the silk reelers, banks 'piggy-backed' on the informational advantage of the Yokohama silk brokers, e.g. by only complementing loans that were made by the silk brokers. Furthermore, the Yokohama merchants themselves were also often involved in the foundation of the regional banks or had substantial shareholdings in them. See also Naito (2008) for a detailed case study of the emergence of local banks in the silk reeling regions.

[28] In this context, it is important to note that, as a treaty port, Yokohama was an almost extraterritorial market for silk in which the silk merchants acted as *de facto* importers. Once in Yokohama, the silk would usually be sold on directly to the foreign trading companies, whose representatives were not allowed to source silk outside Yokohama directly. Nakabayashi (2014) studies the price dynamics for silk in the Yokohama market and the New York market, showing

this system was designed to overcome the many possible frictions that could occur in any stage of the process: the financing friction faced by the silk reeler who needed working capital to produce silk, the informational friction arising from the uncertainty about the quality of the silk the reeler might produce, the risk of damage to the silk during transport from remote prefectures such as Nagano and Gifu to the port of Yokohama and, finally, the possibility of the silk merchant failing to pay for the silk upon its arrival in Yokohama.[29]

Like modern export finance, this system allowed the 'advising' banks in the silk region to remain predominantly local: the bank raised deposits locally and lent locally to the silk reelers. In this system, international (or out-of-region) transactions by the local banks could remain limited to the settlement of the documentary bills with the Yokohama banks. Hence, the Yokohama banks, from the outset, transacted with local banks in many prefectures—they were financially integrated with the whole country. Conversely, local banks in the silk reeling regions could remain predominantly regional.

The growth of the silk industry is a case in point for recent literature that has emphasized that access to trade credit is an important driver of industry growth when financial development is low and bank finance is not available (Petersen and Rajan (1997) and Fisman and Love (2003)). We go beyond these papers in arguing that relatively easy access to trade credit through the Yokohama silk brokers also had an important feedback effect on the development of the banking system in the silk reeling regions.

The informational advantages that come with trade credit relationships (see Petersen and Rajan (1997)) also provide a related but distinct explanation for why the banking system in the silk regions developed very much along regional lines. As we have argued, mechanization was important for improving quality and for competing in the US market. However, mechanization also led to a separation of cocoon growing from silk reeling, thus making trade credit for working capital a necessity. Silk reelers reacted to this challenge by forming regional cooperatives. These cooperatives were at the forefront of mechanization, and they also acted as local financial intermediaries.

Specifically, cooperatives played a key role in attaining the consistent quality levels required for the US market by organizing a process called re-reeling. Japan's high humidity levels during the summer carried the risk that reeled silk would curl or get sticky during transport. Therefore, the thread was reeled a second time. Whereas the first round of reeling would usually take place in a decentralized way in the individual small reeling firms—initially often still by hand—a second round of mechanical reeling was performed centrally in larger filatures that were operated by the cooperatives. Not only did the centralized mechanical re-reeling allow small reelers to improve the quality of their silk without having to invest in mechanized filatures of their own, but the centralized reprocessing of the silk also enabled reelers' cooperatives to implement a strict quality control system (see again Nakabayashi (2006) for an excellent and detailed description). Thanks to this type

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that these two markets were very highly integrated. Hence, market segmentation mainly existed between the Yokohama market and the silk-producing regions within Japan, and the Yokohama silk merchants acted as export intermediaries for the many small silk reeling firms.

[29] Note that this system did not require the Yokohama banks that issued the letters of credit to acquire much information about individual exporters. It was the Yokohama silk merchants and, as we will discuss shortly, the local banks that gathered information about the quality of individual silk reelers. It is conceivable that this network of local lending relationships, with its customer base of small silk filatures, may have endowed the regional banks with an important competitive advantage relative to their nationwide competitors— even long after the silk industry had eventually declined and been displaced by other small-scale manufacturing industries. However, this network of long-standing relationships may in turn have made it difficult for these small firms to switch to nationwide, integrated lenders when credit dried up during the recession of the 1990s. We believe that this is just one possible but potentially powerful channel that illustrates how the *de facto* segmentation of banking markets may have persisted even after technology and regulation had removed any formal barriers to banking flows between prefectures.

of quality assurance system, Japanese silk exporters came to dominate the US market and were able to build considerable brand reputations in the New York silk market by the late 19th century. However, the quality control system also allowed the cooperatives to acquire much information about their member firms. This information, in turn, allowed the silk cooperatives to act as intermediaries and provide trade credit to their members (e.g. by providing advances on the documentary bills drawn on Yokohama merchants).

By the turn of the century, the role of the cooperatives had become so important that they were regulated by law in the first industrial cooperative act of 1900. For the first time, this law also regulated the role of industrial credit cooperatives. These industrial credit cooperatives were the direct precursors of modern-day Shinkins (cooperative banks), which (along with the Sogo—mutual—banks) are the main regional banks that we are studying here and which, to the present day, mainly raise capital from and lend to their local membership of small businesses.

Mechanization and the development of the trade credit and export finance system fed on each other: with high-quality silk came access to the Yokohama export market and, therefore, access to trade credit. The consistent quality of the raw silk was an important part of the credit relationship between the Yokohama silk merchants and the reelers and their cooperatives (see Nakabayashi (2006)). The most reputed producers of silk (e.g. the *Kaimeisha* cooperative from the Suwa district, Japan's silk heartland, in Nagano prefecture) also had access to the most reputed Yokohama silk merchants—those with the best refinancing options.[30] Access to trade credit (and export finance) fostered the growth of the silk industry, and it was the most reputed, high-quality reelers who came to dominate the export market, whereas hand reelers and lower-quality mechanical reelers ended up serving only the domestic market.

Exogeneity

Several concerns could be raised concerning silk as an instrument for regional banking integration during the 1980s. First, access to finance may have been a precondition for the mechanization of the silk industry, not its outcome. Therefore, second, mechanization may just be one aspect of the general growth of the silk industry, which as a whole had to rely on credit for its development. We make the following remarks. First, even if true, this objection is unlikely to invalidate our instrument for the late 20th century market shares of regional vs. city banks. The reason is that the main concern about endogeneity of the financial integration measures in our late 20th century regressions arises from expectational feedbacks from post-1990 growth rates to pre-1990 lending shares. We think that it is very unlikely that post-1990 prefecture-level growth expectations feedback on the development of the financial sector and the silk industry before 1900.

Second, even to the extent that preexisting differences in financial development, or other unobserved regional characteristics, may have favored the move towards mechanization, they did not directly cause it. As we have argued, it was an exogenous price shock that produced the incentives for mechanization. We address these two issues in turn.

Scholars of economic history who have studied industrialization during the Meiji period have argued that one of the factors that favored the emergence of silk as an export staple was that silk reeling, mechanized or not, was not particularly intensive in terms of fixed capital.[31,32] In the early

[30]There were different strata of wholesalers. The most reputed wholesalers could refinance themselves directly from the Bank of Japan and Japan's export bank, the Yokohama Specie Bank. A second tier of wholesalers would refinance themselves only through the private city banks (see Nakabayashi (2014)).

[31]See e.g. Yamazawa (1975) .

[32]Even mechanized filatures are not particularly lumpy investments. In principle, what is required is a steam boiler to heat the thread at a constant temperature and water or steam power for the reeling. Even in the mechanized filatures,

stages of the industry's development, it is not even clear that mechanization offered huge advantages in terms of increased productivity. In fact, mechanization made only slow progress throughout the 1860s and 1870s, in spite of significant government support aimed at the improvement of silk quality. The exogenous shock that changed this was the decline in the price of hand-woven silk in the 1880s following the French depression, coupled with the huge demand for mechanically reeled silk in the US (see Nakabayashi (2014)).[33]

Table A.4 shows that it was not the general development of the silk sector *per se* but rather its mechanization that is closely related to the development of regional vs. city banking. In the table, we report specifications in which we regress our pre-1990 lending shares by bank type on both mechanized and hand filatures. We also consider output-related measures: i.e. we regress lending shares on the output of hand-reeled silk (so-called 'hanks') and on the output of machine-reeled silk. In all specifications and across all bank types it is apparent that it is always the variable measuring mechanization—be it the number of filatures or the machine-reeled output—that is significant, whereas the variables related to hand reeling are all insignificant for all bank types.[34] This suggests that mechanization plays a special role in explaining the link between silk and the regional fragmentation of banking markets. This is consistent with our interpretation that mechanization led to the need for trade credit because it necessitated a separation of cocoon growing and reeling and because it improved silk quality, thus signaling borrower quality to the Yokohama silk merchants.

manual labor, not fixed capital, remained the main input. Thus, mechanization could, in principle, be afforded by even small firms or groups of silk farmers.

[33] As a prime example, Nakabayashi (2014) reports the attempt of the Meiji government to install a role-model plant in the village of Tomioka in Gunma prefecture in the 1870s. This plant was very successful in training skilled workers but did not become economically viable. Instead, it was in the Suwa area in the neighboring Nagano prefecture and in Aichi prefecture that mechanization quickly took hold in the 1880s, following the decline in the relative price of hand-woven silk.

[34] Note that this result is not because of a generally very low share of hand production: on average, machine-reeled silk accounted for approximately three quarters of prefecture-level output of silk in 1895, and the range is from around five percent to more than 90 percent. Hence, in many prefectures, a significant share of output continued to be reeled by hand. Note also that the cross-sectional correlation between the prefecture-level output of hand-reeled and machine-reeled silk is quite low: no higher than 0.3.

A Additional Tables (for online publication):

Table A.1: Robustness – interaction terms and additional controls

Interactions of $Post1990_t$ with ...		I Regional	II City	III Regional	IV City	V Regional	VI City
	$...SME^k \times FI^k$	-1.28	0.66	-0.66	0.47	-1.09	0.55
		(-3.04)	(3.33)	(-1.23)	(2.51)	(-2.06)	(2.78)
	$...FI^k$	0.23	-0.11	0.44	0.02	0.25	-0.06
		(3.59)	(-3.72)	(3.61)	(0.22)	(1.50)	-0.61
	$...SME^k_{VA}$	0.34	-0.39	0.17	-0.14	0.32	-0.11
		(2.88)	(-3.17)	(0.80)	(-0.79)	(1.48)	(-0.59)
	$\left(FI^k\right)^2$			-0.55	-0.12	-0.12	-0.03
				(-1.96)	(-1.61)	(-0.30)	(-0.44)
	$...\left(SME^k_{VA}\right)^2$			-0.22	-0.62	-0.12	-0.69
				(-0.38)	(-1.33)	(-0.28)	(-1.49)
Controls:							
X^k :	$...CoreArea$	-0.003	-0.003			-0.003	-0.004
		(-0.57)	(-0.44)			(-0.53)	(-0.79)
	$...Share\ Lowland\ Areas$	0.01	0.01			0.01	0.01
		(0.62)	(1.01)			(0.62)	(0.94)
	$...Share\ \ of\ steep\ areas$	0.003	0.004			0.003	0.003
		(0.44)	(0.61)			(0.58)	(0.45)
	...Min. distance to core	0.002	0.002			0.002	0.002
		(1.04)	(0.91)			(1.05)	(0.76)
	$...Sectoral\ Specialization$	0.02	0.02			0.02	0.02
		(1.99)	(1.59)			(2.28)	(1.44)
Z^k_t:							
Region Fixed Effect		Yes	Yes	Yes	Yes	Yes	Yes
R^2		0.57	0.56	0.56	0.56	0.57	0.56

The Table shows results from the regression $\Delta gdp^k_t = Post1990_t \times \left[\alpha_0 SME^k_{VA} \times FI^k + \alpha_1 FI^k + \alpha_2 SME^k_{VA} + \alpha_3' X^k_t\right] + \delta' Z^k_t + \mu^k + \tau_t + \varepsilon^k_t$ where $Post1990_t$ is a dummy indicating the period after 1990 (1991-2005), SME^k_{VA} is small-business importance based on value added, FI^k is the measure of financial integration (regional and city bank share in total lending in prefecture k), as indicated in the column heading. μ^k and τ_t are prefecture-fixed and time effects respectively. The vector X^k captures various prefecture characteristics. In the regressions it is interacted with our crisis dummy $Post1990_t$ and contains $CoreArea^k$, a dummy for the core economic areas (Tokyo, Osaka, Aichi, Kanagawa, Chiba, Saitama, Hyogo and Kyoto prefectures), topographical features (the share of lowlands and steep (gradient above 15 degrees) areas in a prefectures total sufrace area), the minimal distance to one of the core prefectures and a index of sectoral specialization. Z^k_t contains fixed effects for the eight regions of Japan (Hokkaido, Tohoku, Kanto, Chubu, Kansai (Kinki), Chugoku, Shikoku, and Kyushu). The sample period is 1980-2005. OLS estimates, t-statistics in parentheses. Standard errors are clustered by prefecture.

Table A.2: Robustness – other shock indicators and control for local shocks

Interactions of $\Delta LandPrice_t$ with ...	I Regional	II City	III Regional	IV City	V Regional	VI City	VII Regional	VIII City
$...SME^k \times FI^k$			2.20	-1.12	2.18	-1.11	1.76	-0.93
			(2.29)	(-3.02)	(2.34)	(-3.00)	(2.22)	(-2.51)
$...FI^k$	-0.08	0.12	-0.42	0.28	-0.42	0.27	-0.31	0.21
	(-1.16)	(3.48)	(-2.68)	(5.39)	(-2.74)	(5.16)	(-2.42)	(3.89)
$...SME^k_{VA}$	0.21	0.19	-0.40	0.81	-0.40	0.80	-0.51	0.55
	(3.89)	(3.64)	(-1.54)	(3.49)	(-1.61)	(3.49)	(-2.25)	(2.35)
Controls:								
X^k : $...CoreArea$	0.03	0.02	0.03	0.02	0.03	0.02	0.001	0.002
	(4.51)	(3.02)	(5.41)	(3.34)	(5.33)	(3.22)	(0.12)	(0.20)
Extended Set of Controls	no	no	no	no	no	no	yes	yes
Z^k_t:								
$\Delta LocalLandPrice^k_t$					0.006	0.005	0.005	0.004
					(1.94)	(1.75)	(1.78)	(1.34)
Regional Fixed Effects	no	no	no	no	no	no	yes	yes
R^2	0.56	0.57	0.57	0.57	0.57	0.57	0.57	0.57

The Table shows results from the regression $\Delta gdp^k_t = \Delta Landprice_t \times \left[\alpha_0 SME^k_{VA} \times FI^k + \alpha_1 FI^k + \alpha_2 SME^k_{VA} + \alpha_3' X^k_t\right] + \delta' Z^k_t + \mu^k + \tau_t + \varepsilon^k_t$ where $\Delta Landprice_t$ is the change in land prices in the core prefectures from Imai and Takarabe, $SME^k_{VA}$is small-business importance based on value added, FI^k is the measure of financial integration (regional and city bank share in total lending in prefecture k), as indicated in the column heading. $\mu^k$and τ_t are prefecture-fixed and time effects respectively. The vector X^k captures various prefecture characteristics. In the regressions it is interacted with $\Delta Landprice_t$ and in teh baslein specification contains $CoreArea^k$, a dummy for the core economic areas (Tokyo, Osaka, Aichi, Kanagawa, Chiba, Saitama, Hyogo and Kyoto prefectures) and, where indicated, an extended set of controls (for topography (share of lowlands and steep areas in a prefecture), minimum distance to the core, and sectoral specialization as in Table A.1). Z^k_t contains the change in local (prefecture-level) land prices as an additional (non-interacted) control for local shocks and, where indicated, a set of regional dummies. The sample period is 1980-2003. OLS estimates, t-statistics in parentheses. Standard errors are clustered by prefecture.

Table A.3: Alternative measures of financial development and financial integration

	I	II	III	IV
	$FI = \frac{City\ Bank\ Lending}{Total\ Lending}$		$FI = \frac{CityBankLending}{GDP}$	$FI = \frac{City\ Bank\ Lending}{Total\ Lending}$
Interactions of $Post1990_t$ with pre1990 variables:	$FD = \frac{\#Branches}{Population \times Area}$	$FD = \frac{Lending}{GDP}$	$FD = \frac{Regional\ Bank\ Lending}{GDP}$	$FD = \frac{Regional\ BankLending}{GDP}$
$...SME^k \times FI^k$	0.78	0.46	0.03	0.81
	(3.00)	(1.73)	(4.07)	(4.52)
$...FI^k$	-0.14	-0.09	-0.004	-0.14
	(-3.89)	(-2.28)	(-6.76)	(-5.55)
$...SME^k_{VA}$	-0.48	-0.45	-0.07	-0.55
	(-3.82)	(-3.73)	(-0.81)	(-4.42)
$...SME^k \times FD^k$	-0.32	0.02	-0.07	0.02
	(-0.43)	(2.61)	(-1.31)	(0.42)
$...FD^k$	0.07	-0.002	0.01	0.00
	(0.54)	(-2.09)	(1.79)	(0.12)
$...CoreArea$	-0.01	-0.01	-0.01	-0.01
	(-2.14)	(-3.43)	(-4.85)	(-4.01)
R^2	0.56	0.56	0.56	0.56

The Table shows results from the regression

$$\Delta gdp^k_t = Post1990_t \times \left[\alpha_0 SME^k_{VA} \times FI^k + \alpha_1 FI^k + \alpha_2 SME^k_{VA} + \alpha_3 SME^k_{VA} \times FD^k + \alpha_4 FD^k + \alpha_5' CoreArea^k\right] + \mu^k + \tau_t + \varepsilon^k_t$$

where where $Post1990_t$ is a dummy indicating the period after 1990 (i.e. 1991-2005), $SME^k_{VA}$is small-business importance based on value added, and FI^k and FD^k are the measures of financial integration and financial development respectively as indicated in the column heading. μ^k and τ_t are prefecture-fixed and time effects respectively. *CoreArea* is a dummy for the core economic areas (Tokyo, Osaka, Aichi, Kanagawa, Chiba, Saitama, Hyogo and Kyoto prefectures). The sample period is 1980-2005. OLS estimates, t-statistics in parentheses. Standard errors are clustered by prefecture.

In column *I*, our measure of FD is the density of financial intermediaries' branches in a prefecture. The coefficients of *SME* and $SME \times FD$ are both insignificant, whereas the coefficient of financial integration (FI) remains essentially unchanged vis-à-vis the specifications in Table 3.

A popular indicator of financial development is lending relative to GDP. Once we choose this indicator as our measure of FD (column *II*), we do indeed find significant coefficients with the expected signs: higher pre-1990 levels of lending relative to GDP mitigated the impact of the credit dependence of growth. However, the interaction between *SME* and FI remains significant, if only at the 10 percent level. Note also that lending/GDP will be affected by the ability of the financial system to raise funds both locally and from outside the region. The latter, however, would correspond to our notion of financial integration. We therefore decompose

$$\frac{Total\ Lending}{GDP} = \underbrace{\frac{CityBank\ Lending}{GDP}}_{FI} + \underbrace{\frac{Regional\ Bank\ Lending}{GDP}}_{\text{Local component of FD (LFD)}}.$$

The first term is a proxy for the ability of the financial system to raise funds from outside the region. It can therefore be interpreted as another indicator of banking integration. The second term proxies for the system's ability to raise funds locally, and we therefore refer to it as the purely *local* component of financial development (LFD). Column *III* reports a regression in which lending by city banks relative to GDP is our measure of financial integration and in which FD is chosen to be the purely local component of financial development, LFD. The regression clearly suggests that it is mainly the cross-sectional variation in the ability of the financial system to raise funds from outside the prefecture that accounts for the significance of lending/GDP in the regression in column *II*. In our last specification (column *IV*), we let our baseline measure of integration (the share of city banks in local lending) compete against the local component of financial development.

Table A.4: Mechanization in silk reeling (1895) and regional banking integration in the 1980s.

	FI =Share in prefecture-level lending by					
	City Banks		Regional Banks			
			All (Shinkin+Sogo)		Shinkins only	
hand filatures	-0.01		0.01		-0.00	
(log #)	(-1.35)		(0.98)		(-0.07)	
mechanized filatures	-0.02		0.02		0.03	
(log #)	(-3.57)		(3.07)		(4.28)	
output: hand reeled		-0.00		-0.00		-0.01
(log tons)		(-0.49)		(-0.51)		(-0.64)
output: machine reeled		-0.03		0.02		0.02
(log tons)		(-3.98)		(2.96)		(2.45)
R^2	0.60	0.60	0.24	0.20	0.39	0.23
Controls	yes	yes	yes	yes	yes	yes

The Table shows results from regression of pre-1991 (1980-90) average prefectural lending shares by bank type on various silk industry characteristics in 1895: the number of hand-powered and machine filatures at prefecture-level, and the output of hand-powered and machine filatures respectively. Controls are: relative GDP pre-1990, a core area dummy and log distance to Yokohama. Core areas are as described in previous tables. t-statistics appear in parentheses.

Table A.5: Robustness — Cross-sectional Regressions

	SME_{VA} (output based)						SME_{EMP} (employment based)					
	$FI=$						$FI=$					
	City Banks		Regional Banks				City Banks		Regional Banks			
			All		Shinkin				All		Shinkin	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
$SME^k \times FI^k$	0.14	0.36	-0.35	-0.77	-0.29	-0.98	0.16	0.56	-0.52	-0.85	-0.44	-1.08
	(1.33)	(1.71)	(-2.12)	(-1.52)	(-1.68)	(-1.55)	(1.12)	(1.70)	(-2.22)	(-1.78)	(-1.94)	(-1.87)
FI^k	-0.04	-0.08	0.06	0.18	0.05	0.22	-0.04	-0.10	0.07	0.16	0.06	0.18
	(-2.36)	(-2.01)	(2.15)	(1.50)	(1.59)	(1.52)	(-1.97)	(-2.01)	(2.18)	(1.92)	(1.79)	(1.90)
SME^k	-0.10	-0.23	0.07	0.15	0.03	0.11	-0.12	-0.34	0.12	0.19	0.05	0.14
	(-1.79)	(-1.94)	(1.48)	(1.25)	(0.79)	(1.25)	(-1.51)	(-1.88)	(1.72)	(1.43)	(1.16)	(1.45)
Controls												
Core	-0.00	-0.00	-0.01	-0.00	-0.01	-0.01	-0.00	-0.00	-0.01	-0.01	-0.01	-0.01
	(-2.73)	(-1.06)	(-4.58)	(-1.99)	(-4.79)	(-3.73)	(-2.89)	(-1.32)	(-4.87)	(-3.36)	(-5.03)	(-4.42)
R^2	0.50	0.46	0.46	0.46	0.44	0.46	0.48	0.46	0.45	0.46	0.44	0.46
First-Stage F-stat for $SME^k \times FI^k$		14.21		10.56		17.07		13.13		6.94		12.40
Kleibergen-Paap rank test		3.50		1.32		1.71		4.19		3.04		**3.75**
p-value		0.06		0.25		0.19		0.04		0.08		**0.05**

The Table shows results from the cross-sectional OLS and IV regressions $\Delta gdp^k_{post1990} = \alpha_0 SME^k \times FI^k + \alpha_1 FI^k + \alpha_2 SME^k + \alpha_3' CoreDummy^k + const + \varepsilon^k$ where $\Delta gdp^k_{post1990}$ is average post-1990 (1991-2005) *GDP* growth in prefecture k, $SME^k$is small manufacturing firm importance (value-added or employment based) and FI^k our measure of regional banking integration (city bank share, regional bank share, Shinkin share) as indicated in the column headings. *CoreArea* is a dummy for the core economic areas (Tokyo, Osaka, Aichi, Kanagawa, Chiba, Saitama, Hyogo and Kyoto prefectures). In the IV-regressions, $SME^k \times FI^k$ and FI^k are instrumented using $SME^k \times Silk^k$ and $Silk^k$, where $Silk^k$is the log number of silk filatures per head of population in a prefecture in 1895. t-statistics appear in parentheses. The last two rows of the table report F-statistics associated with the first stage regression of the interaction term $SME^k \times FI^k$ on all instruments and the Kleibergen-Paap (2006) rank statistics and the associated p-value for the hypothesis of under-identification.