‘By a Silken Thread’: regional banking integration and credit reallocation during Japan’s Lost Decade*

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Abstract

During Japan’s ‘Lost Decade’, reallocation of credit through the internal capital markets of country-wide banks mitigated the real effects from the bank liqudity shock in prefectures with many bank-dependent SMEs. We document that the regional fragmentation of banking markets in Japan goes back to the institutions set up for silk export finance in the late 19th century. Using silk as an instrument for modern-day regional banking integration, we find even stronger evidence of credit reallocation than in our baseline OLS-specifications. The sign of this OLS-bias is consistent with the underlying heterogeneity in bank-firm matches implied by the theory.

JEL-Codes: F36, F40, G01, N15, N25

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1 Introduction

How does banking integration affect the transmission of a financial crisis to the real economy? Banking integration increases an economy's exposure to foreign bank liquidity shocks but it can also insulate from idiosyncratic shocks to a country's or region's local banking system. The impact of a bank liquidity shock on output or employment will also depend on the ability of borrowers to substitute between local and foreign sources of bank and other credit. For example, a real sector with highly inelastic, bank-dependent borrowers will have more to gain from the insulation against local banking shocks that is provided by banking integration than a real sector that can easily substitute local bank loan supply for alternative sources of credit. How do historical factors determine this trade-off between integration and segmentation of banking markets?

Japan's 'lost decade' of the 1990s provides a quasi-laboratory setting in which to study 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 share 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. Our evidence suggests that the interaction between the firm-borrowing and the bank-lending channels is crucial for understanding the regional dimension of Japan's lost decade: prefectures with many bank dependent SME were more exposed to the downturn as were prefectures 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 reallocating credit to prefectures where it was most urgently needed—by small, bank-dependent firms that cannot easily substitute locally issued loans for alternative sources of finance from outside their prefecture. We call this the credit-reallocation channel and we argue that this channel is key for understanding the regional transmission of Japan's crisis.

We note that our 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 we argue 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 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 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).

This historical background also allows us to overcome potential challenges to identification in our baseline reduced-form specifications by providing us with an instrument for banking integration in the 1990s: the number of silk filatures per capita in a prefecture in 1895. A comparison between IV estimates and the baseline OLS estimates shows that our OLS estimates are conservative and that the sign of the OLS bias is consistent with the unobserved heterogeneity in bank-firm relationships that is implied by our theory. In this way, the IV approach allows us to at least partly overcome the lack of matched firm-bank level data with sufficient geographic coverage that would allow us to make statements about the regional dimension of Japan's lost decade.

Explictly taking into account both the credit reallocation and the bank lending channels, allows us to provide a novel perspective on the transmission of Japan's crisis of the 1990s to the real economy: internal capital markets attenuated the real effects of the crisis by allowing nationwide banks to lend relatively more 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 historically 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.

1.1 Contribution to the literature

Our study makes the following contributions: In a first step, we show that the the firm borrowing channel was important for the regional transmission of the crisis and that its strength varied across prefectures. Second, we provide evidence for the reallocation effect: via their internal capital markets, integrated banks allocated relatively more credit to prefectures with many bank-dependent SMEs, thus considerably attenuating the negative real impact that the country-wide bank lending shock. 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 and at the same helps us to show that the sign of the bias in our OLS baseline specifications is consistent with our theoretical interpretation and that OLS estimates tend to underestimate the reallocation effect.

Our analysis closely relates to and builds on Khwaja and Mian (2008) who use firm-level data from Pakistan 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. (2016) find that bank liquidity shocks after the Kobe earthquake negatively affect client firms' investment even in a highly developed market such as Japan. We add to these papers by showing 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 considerably mitigated through the reallocation channel. 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 also complement the findings by Cetorelli and Goldberg (2012a,b) who show that the internal liquidity management of US banks played a key role in the international transmission of the 2008 financial crisis.

At a methodologcial level, our results illustrate how the approach of Khwaja and Mian (2008) can be used to study the impact of liquidity shocks in regional- or country-level data sets. While only matched bank-firm level data ultimately allow to put the mechanism under the microscope, such data are often not available over long periods, nor is their geographic coverage usually sufficient to warrant statements about the spatial dimension of a crisis and its medium-term repercussions. Still, economic theory may suggest how OLS-estimates based on more aggregate data are affected by unobserved heterogeneity at the bank-firm level. An instrumental-variable procedure such as the one we suggest here may then help verify the sign of the bias, thus helping to shed light on the underlying mechanisms at the bank-firm level. Specifically, our theory and the historical background suggest that in highly integrated prefectures with many SMEs, the firms most vulnerable to a decline in local demand (SMEs) were also most likely to be linked to the type of bank most affected by the property market crash— city banks. With this cross-prefectural pattern of heterogeneity in bank-firm matches one should expect that OLS underestimates the positive effects of credit reallocation on lending and output growth. IV estimates of the reallocation effect allow us to confirm that this is indeed the case.

Our empirical analysis builds on a number of classic papers that have used the bursting of Japan's big property and stock market bubbles of the 1980s as an identifying shock to banks' lending behavior. Peek and Rosengren (1997, 2000) were the first to document how this shock to the balance sheet of Japanese banks affected local U.S. banking markets. 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 increased the exposure to negative shocks from outside the region. We follow their method to identify the shock to nationwide banks' lending supply, but we extend it to take account of the reallocation channel. Since SMEs are particularly dependent on local credit provison, they benefit strongly from integrated banks' ability to re-allocate funds flexibly across different locations.We find that taking account of this reallocation of credit by regionally integrated banks substantially dampens the negative effect of the bank-lending supply shock on output.

Last but not least, a key contribution of our paper is that we overcome the potential endogeneity of regional banking market integration using an instrumental variable (IV) approach that is informed by economic history. The 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 Japan's banking markets that lasted for over a century.[1]

2 Regional banking integration and crisis transmission

2.1 Theoretical considerations

Figure (1) presents a stylized version of a banking model in the spirit of Holmstrom and Tirole (1997) that we adapt from Morgan et al. (2004). We assume that there are two prefectures and three banks: two equally sized local 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.[2] 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

[1]The notion that incidental historical events can have a very persistent (sometimes over several centuries) effect on financial and economic development is well established. See Pascali (2016) for a recent important contribution. To our knowledge, we are the first to document such a long-run link in Japanese data. Our argument is subtly different from the bulk of the earlier literature, though: we are not arguing that silk-prefectures are financially less developed. Rather our point is that differences in local banking market structure that can be explained by different historical pathways to financial development turned out to segment banking markets in the particular context of a major financial crisis.

[2]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 (2007a) and Shimizu (1992)).

to SME customers, whereas the city bank lends to big firms.[3]

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 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.

This is the key empirical implication that we test in the remainder of the paper: conditioning on the size of the negative bank liquidity shock, a high-SME region will see a less marked reduction in lending (and to the extent that lending drives GDP through the firm-borrowing channel, also a higher GDP growth rate) if it is financially integrated. We call this effect the credit reallocation channel. It arises from the interaction between profit-maximizing behavior by integrated banks with local differences in bank dependence. Via their internal capital markets, integrated banks respond to cross-prefectural differences in bank dependence by allocating relatively more credit to the most bank-dependent prefectures where the willingness to pay for credit is hightest until the interest rate on the marginal loan is equalized across locations.

We make the following remarks: First, our exposition in in Figure (1) assumes 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. This assumption is likely to be 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 (Sharpe (1990); Rajan (1992)). We would expect that the extent of the hold-up faced 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 that it is easier for an SME to switch to an integrated bank. Below, we provide evidence that supports both of these conjectures. However,

[3] 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.

we note here that hold-up would tend to work against us finding evidence for the credit reallocation which should be strongest if all SMEs in a prefecture borrow from integrated banks.

Secondly, our 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 matter for the the reallocation effect: the theory implies that integrated bank would still preserve relatively higher levels of lending in high-SME prefectures. Our main econometric specifications throughout the paper allow for the possibility that local and integrated banks are affected asymetrically. Also, as we discuss below, the fact that local banks were (relatively) less distressed will tend to work against us finding evidence for the reallocation channel by inducing a downward bias into the OLS estimate of the reallocation effect.

2.2 Econometric framework and identification

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. In particular, we follow Imai and Takarabe (2011) who argue that integrated banks were more exposed to the land price decline in the major cities than local banks (at least those outside the major cities). We therefore use the average land price decline in the core prefectures (the greater Tokyo area, comprising of Tokyo, Kanagawa, Saitama and Chiba Prefectures) as well as Aichi (with Nagoya), Osaka, Hyogo (with Kobe) and Kyoto prefectures) as our main measure of the shock. We code the bank liqudity shock $\textsc{shock}_t$ as the *negative* of the core land price growth, so that

$$\textsc{shock}_t = -\textsc{landpricegrowth in core}_t \tag{1}$$

This normalization ensures that all of our main coefficients of interest are positive and easy to compare and interpret in our subsequent discussions: conditional on the negative bank liquidity shock, the credit reallocation channel should lead to relatively higher growth rates in lending and real economic activity.

The credit reallocation channel implies that integrated banks take advantage of differences in loan demand elasticities between prefectures to maximize profits. We index the elasticity of loan demand by the share of small firms in the local economy. Also, based on our model above, credit reallocation should be stronger in more integrated prefectures. Based on these considerations we posit the following supply equation for the growth of (log) bank lending, Δ_{Lending}, in prefecture k:

$$\Delta_{\text{Lending}_t^k} = \left[\beta_0 \text{SME}^k + \beta_1\right] \times \text{FI} \times \text{SHOCK}_t + \xi_t^k \tag{2}$$

where SME and FI^k denote, respectively, the (pre-crisis) share of small firms in output or employment in the local economy and the (pre-crisis) share of city banks in total lending in prefecture k. The term ξ_t^k captures local-specific lending supply factors, including the lending supply by local banks.

In this equation, β_0 captures the credit reallocation channel whereas β_1 indexes the strength of the classical bank-lending channel. We would expect that in the Japanese case, $\beta_1 < 0$: in more integrated prefectures lending growth was lower after the shock.

Importantly, however, the impact of the aggregate liquidity shock should not only be scaled by a prefectures exposure to aggregate shock (as measured by FI), but also by the local elasticity of demand, as indexed by SME. Our theory makes sharp predictions about how the nature of the aggregate shock affects the sign of the coefficient β_0 and thus the direction of this credit reallocation channel: if $\text{SHOCK}_t > 0$ captures a negative loan supply shock, then the discussion in the previous section would imply that $\beta_0 > 0$ — in response to a negative aggregate loan supply shock, integrated banks will maintain relatively higher levels of lending in high-SME prefectures. Conversely, it is easy to see from the model that $\beta_0 < 0$ will hold if $\text{SHOCK}_t > 0$ codes a negative aggregate loan demand shock. In this case, integrated banks would withdraw more strongly from high-SME prefectures after a negative aggregate demand shock.[4] Based on our earlier discussion, our focus is on the supply shock scenario and we therefore expect $\beta_0 > 0$.

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

$$\Delta_{\text{GDP}_t^k} = \gamma \times \Delta_{\text{Lending}_t^k} + \eta_t^k \tag{3}$$

[4]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, our theory does not *a priori* require us 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.

where ΔGDP_t^k a is the growth rate of GDP 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 regression (3) by OLS will lead to estimates that are biased upwards. Within prefectures, the productivity shock η_t^k will generally be positively correlated with the demand component of lending growth. To see how our approach solves this identification problem, we plug the lending supply equation into the reduced-form equation for GDP-growth (3), so that

$$\Delta\text{GDP}_t^k = \left[\underbrace{\gamma \times \beta_0 \times \text{SME}^k \times \text{FI}^k}_{\text{firm-borrowing}\times\text{credit-reallocation}} + \underbrace{\gamma \times \beta_1 \times \text{FI}^k}_{\text{firm-borrowing}\times\text{bank-lending}}\right] \times \text{SHOCK}_t + \psi_t^k \qquad (4)$$

where $\psi_t^k = \eta_t^k + \gamma \times \xi_t^k$ absorbs prefecture-specific influences on GDP coming from lending supply (ξ_t^k) as well as from local demand or productivity factors η_t^k. The second term in parentheses describes the classical interaction between the bank-lending and the firm borrowing channels emphasized by the earlier literature. The first term is the focus of our attention here: it tells us how credit-rellocation by integrated banks attenuates the real fallout from the shock.

Based on (2) and (4), our reduced-form specifications will be given by

$$\Delta\text{OUTCOME}_t^k = \left[\alpha_0 \times \text{SME}^k \times \text{FI}^k + \alpha_1 \times \text{FI}^k + \alpha_2 \times \text{SME}^k + \boldsymbol{\alpha}_3' X^k\right] \times \text{SHOCK}_t + \mu^k + \tau_t + \boldsymbol{b}' Z_t^k + \nu_t^k \qquad (5)$$

where OUTCOME stands, in turn for prefecture-level lending or GDP. This empirical specification allows aggregate shock to affect local output or lending growth via additional prefecture-level characteristics, summarized in the vector X^k. Specifically, we also include the interaction $\text{SME}^k \times \text{SHOCK}_t$ to capture effects of the burst of the bubble that could affect prefectures with more SMEs through other channels than integrated banks' lending. Z_t^k is a vector of additional controls that may vary by time and prefecture, and $\boldsymbol{b}$ is the associated vector of coefficients. The terms μ^k and τ_t are prefecture-fixed and time effects, respectively, and ν_t^k is the error term.

Identification Regression (5) is a double differences-in-differences (DiD) specification in which the interactions with the intervention (SHOCK_t) 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 et al. (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.

Our coefficient of interest is α_0. In the case of the lending growth regression, we wish to identify $\alpha_0 = \beta_0$ whereas in the GDP growth regression, we wish to obtain $\alpha_0 = \gamma \times \beta_0$. In our discussion here, we focus on the GDP growth regression but everything is analogous for lending growth. To see how our approach achieves identification of our parameters γ and β_0, note first that the within-prefecure time-series correlation between local lending supply and local shocks that caused the bias in equation (3) is much reduced by our use of a country-wide shock-variable: we can estimate α_0 and α_1 by OLS whenever $cov\left(\text{SHOCK}_t, \nu_t^k\right) = 0$, conditional on the controls $X^k \times \text{SHOCK}_t$ and Z_t^k. Any remaining correlation of SHOCK_t with v_t^k such that $v_t^k = \delta\text{SHOCK}_t + \epsilon_t^k$ will be absorbed by time effects in our estimation.

A more serious challenge to identification could arise if the correlation between SHOCK_t and the uncontrolled factors ν_t^k varied in the cross-section as a function of SME and FI. Suppose that $v_t^k = \delta^k \times \text{SHOCK}_t + \epsilon_t^k$ where $\delta^k = \delta_{SME} \times \text{SME}^k + \delta_{FI} \times \text{FI}^k$. For the GDP growth regression, we would then obtain

$$\Delta\text{GDP}_t^k = \left[\gamma \times \beta_0 \times \text{SME}^k \times \text{FI}^k + (\gamma \times \beta_1 + \delta_{FI}) \times \text{FI}^k + \delta_{SME} \times \text{SME}^k\right] \times \text{SHOCK}_t + \epsilon_t^k \tag{6}$$

Even in this case, OLS would still give us an unbiased estimate of $\alpha_0 = \gamma \times \beta_0$, even though there would now be a bias in the estimate of the average size of the interaction between firm borrowing and bank lending channel, $\alpha_1 = \gamma \times \beta_1 + \delta_{FI}$. Hence neither SME^k nor FI^k has to be cross-sectionally uncorrelated with v_t^k for our identification of $\alpha_0 = \gamma \times \beta$ to be valid. The OLS estimate of α_0 will be unbiased as long as the conditional correlation

$$cov\left(\text{SME}^k \times \text{FI}^k, \delta^k \middle| \text{FI}, \text{SME}^k, \text{controls}\right) = 0. \tag{7}$$

which is the assumption necessary for exact identification of the OLS regressions that we present in this paper.

This assumption is still likely not to be entirely satisfied in the data but we build on Khwaja and Mian (2008) in arguing that the correlation $cov\left(\text{SME}^k \times \text{FI}^k, \delta^k\right) < 0$. Since theory implies that $\gamma \times \beta_0 > 0$, this biases the estimate of α_0 downwards. This would mean that the OLS estimate is conservative and therefore informative. We provide evidence in our section on transmission to support this view. Here, we preview some of these arguments.

Similar to Khwaja and Mian (2008) our argument rests on the cross-prefectural heterogeneity in the structure of bank-firm relationships that is suggested by our theory. Specifically, the credit reallocation channel implies that in high-SME / high-FI prefectures, the typical customer of an integrated bank is much more likely to be an SME and that SMEs are more likely to bank with integrated rather than local banks. Below, we provide empirical evidence that this indeed the case. Hence, in the high-SME/high-FI prefectures, the firms most vulnerable to local shocks were relying on the type of banks that were the most exposed to the bank liqudity shock: first, SMEs are much less likely than big firms to export and therefore mainly serve domestic and local markets. Second, since integrated banks were generally hit stronger than local banks by the property bust, the credit supply shock may have affected other customers (such as private households) in the local economy in high-FI prefectures also more strongly, thus adversely affecting local demand. Hence, in the prefectures where we expect the credit allocation channel to be strongest, we would therefore also expect that local demand was also most adversely affected by the aggregate shock , suggesting that $cov\left(\text{SME}^k \times \text{FI}^k, \delta^k\right)$ is indeed negative.

While we provide empirical evidence to support this view, unlike Khwaja and Mian (2008), we do not have micro data that would allow us to directly check this correlation at the firm-bank-level. To overcome this limitation, we therefore also use an identification strategy in which we instrument FI^k using a variable that will be provided to us by our discussion of the historical origins of the regional segmentation of Japan's banking market below— the number of silk reeling filatures (per capita) in a prefecture in the late 19th century. In this case, our identifying assumption becomes

$$cov\left(\text{SME}^k \times \text{FILATURES}^k, \delta^k \middle| \text{FI}, \text{SME}^k, \text{controls}\right) = 0. \tag{8}$$

Using the IV procedure, we will then illustrate that the OLS-estimate is indeed conservative, i.e. biased downwards.

2.3 The silken thread: regional differences in banking integration

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 (our measure FI^k) : 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 (BoJ).

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 larger number of prefectures. The prefecture-level BoJ data to which we have access does not allow us to distinguish between lending by mega banks and first-tier regional banks,but from our perspective it is useful anyway to consider both banks as integrated banks. Due to their larger geographic presence, first-tier regional banks can meaningfully operate internal capital markets between prefectures, which makes them more like mega banks and distinguishes them from purely local banks. Also, the business model of first-tier banks is characterized much more clearly by arm's-length lending, whereas the purely local banks we will focus on tend to be cooperatives or mutuals and largely engage in relationship lending to their SME members. For brevity, we refer to all of these integrated banks under the Japanese term 'city banks' .[5]

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. Client SMEs usually also are members of these associations or cooperatives and many local banks, in particular the Shinkin, have explicit size caps (in terms of revenue or employment) on the membership firms. This has several interesting implications for our analysis: first, it implies that the ties between regional banks and their small-business customers are particularly tight in the Japanese context and we explore the historical origins of this system of SME finance in the next section. Secondly, it helps the interpretation of our results and our identification that local banks are *de facto* excluded from lending to non-SME (big) firms. Hence, while big firms can borrow only from the big, integrated banks (and, if very big, from the bond-market), SMEs can borrow from local banks and, in principle, also from integrated banks.

Historical background We argue that 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

[5] To the extent that first-tier regional banks are more regional in outlook and scope than true mega-banks, including them into the group of integrated banks—as we do here —will tend to work against us in finding the results we report in the remainder of the paper below.

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 Appendix H. 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 always 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 anti-competitive regulation (Grossman and Imai (2008)). Even though the 1927 bank law stipulated mergers of small banks, 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 et al. (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. 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.

Silk as an instrument for regional banking integration Table 1 further illustrates the relevance of silk for regional banking integration. The coefficient of a cross-sectional regression of pre-1990 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

[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.

the first (after 1858) and biggest open port. 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. We acknowledge that silk may be correlated with post-1990 day prefecture-level outcomes in other ways than just via its impact on banking integration. This might be true in particular with respect to the impact of silk on the development of the manufacturing sector and on industrial structure more generally. While we will control for these factors in our regressions, we note that the identifying assumption for our coefficient of interest is not that that $cov(\text{FILATURES}^k, \delta^k) = 0$ but rather that $cov(\text{SME}^k \times \text{FILATURES}^k, \delta^k) = 0$. Hence, the exclusion restriction amounts to assuming that silk affects the regional transmission of the crisis via banking integration only *given* the prefecture's SME-share. [7]

In spite of the generality of this assumption, there could still be a concern that the silk industry affected financial sector development more generally, thus leading to better access to finance for SMEs irrespective of the degree of banking integration. This does not seem to be the case. The last set of columns in Table 1 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.[8]

3 Data

We use data from 46 Japanese prefectures (excluding Okinawa). Nominal prefectural GDPs and population data are taken from the *Annual Report on Prefectural Accounts* (Cabinet Office of Japan). 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

[7]This, in particular, allows for the possibility that the development of the silk industry affected the emergence of a manufacturing sector with many SMEs. We are grateful to Tarek Hassan for pointing out this important issue.

[8]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.

the *Manufacturing Census of Japan* by the Ministry of Economy, Trade and Industry. We define SMEs as having fewer than 300 employees.[9] 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.

Prefectural borders in Japan have remained largely unchanged since the early 1890s. This allows us to use late 19th-century prefecture-level data as instrument for banking integration in the 1980s. 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*).

Table 2 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 (1991-96 averages). 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 GDP growth can be gleaned from the two maps in Figure 3.

4 Reduced-form results

We establish our main results in several ways: first through a series of univariate regressions in which we split the sample of prefectures into two groups of above- and below-median banking integration. Second, we present OLS- and IV-results for our reduced-form specifications (5) in which we include a long list of controls. Third, in the next section, we provide

[9]This cutoff corresponds to the maximum number of employess that SMEs are allowed to have to remain eligible as members and customers of mutual and industrial cooperative (Shinkin) banks.

further evidence on transmission and we directly estimate the structural equation for the firm-borrowing channel (3) by instrumenting for lending growth using FI and FILATURES respectively.

Sample splits Table 3 presents regressions of the form

$$\Delta\text{OUTCOME}_t^k = \alpha \times \text{SME}^k \times \text{SHOCK}_t + \mu^k + \tau_t + \epsilon_t^k \tag{9}$$

where OUTCOME stands in turn for lending and GDP growth. For both outcomes, we first present results for the sample of all 46 prefectures and then for the subsamples of high and low regional banking integration prefectures respectively.

The table clearly suggests that prefectures with a higher share of SMEs were more exposed to the aggregate shock and saw lower growth rates of GDP and lending after 1990. However, this pattern seems driven by prefectures with low levels of banking integration which see the largest declines in lending and GDP growth. Consistent with the credit reallocation channel, the fallout from the shock is considerably attenuated and generally not significant in high-FI prefectures.

OLS regressions In Table 4, we report the results for our reduced-form specification (5). We add a rich set of controls: i) to account for the impact of cross-regional differences in industrial structure, we construct a measure of predicted prefecture-level output growth as the weighted average of country-wide sector-level growth rates. As weights we use the pre-1990 averages of sector shares for each pefecture. ii) We control for local real estate shocks by including prefecture-level land-price growth. iii) We allow for heterogeneity in local banks' exposure to the aggregate shock. We do this by including an interaction between $\text{SHOCK}_t$and the pre-1990 average real estate lending exposure (as a fraction of total lending) of second-tier regional banks in the prefecture. Data on these exposures are obtained from the Nikkei NEEDS data base. iv) We control for geographic remoteness by including an interaction between the aggregate shock and a prefecture's disctance to Yokohama — which is part of the Greater Tokyo area and was historically the first port to open to international trade.

The left panel of Table 4 presents results from OLS estimation of our main specification. There is strong empirical support for the credit-reallocation channel: our main coefficient of interest, α_0 is positive and significant, both for lending and for GDP growth. Conversely, the coefficients on the stand-alone terms for SME and FI are both significantly negative. Ceteris paribus, higher levels of regional banking integration increased the exposure to the land price shock as did higher shares of local SMEs. But lending and GDP growth were significantly higher in prefectures with both high levels of SME and high levels of FI.

IV estimates In columns 3 and 4 of Table 4, we present our IV estimates. These confirm the previous pattern: conditional on SME shares, lending and GDP growth were higher in prefectures with higher banking integration. Importantly, however, the IV estimates of our main coefficient of interest, α_0, are all bigger than the OLS estimates. This not only reinforces our earlier findings, but also sheds light on the cross-prefectural heterogeneity in bank-firm relationships that is suggested by our theoretical mechanism. As we document empirically in the next section, SMEs in high-SME/ high-FI prefectures are more likely to have an integrated bank as their main bank and a larger share of integrated banks' customers are SMEs. Small firms are less likely than big firms to export and thus serve mainly local markets. They will therefore have experienced larger declines in demand for their output (and thus to have demanded less credit) following the aggregate shock. At the same time, the bank liquidity shock faced by integrated banks was generally higher than that faced by the average local bank. Hence, in the high-SME/ high-FI prefectures the firms that were most exposed to the negative local demand effects of the downturn (SMEs) were particularly likely to be linked to integrated banks that happened to experience the biggest liquidity shocks. This suggests that the cross-prefecture correlation between the exposure of local loan demand and the exposure of local loan supply to the aggregate shock is likely to be negative, $cov_K\left(\text{SME}^k\text{FI}^k, \delta^k\right) < 0$. Consistent with this pattern of cross-prefecture heterogeneity in bank-firm relationships, our IV results show that OLS will underestimate the mitigating impact that access to finance has for the allocation of credit to the most inelastic firms and for their output.

Columns 5 and 6 of Table 4 provide evidence on the fit of the first-stage of our IV regressions. 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 the interaction term SME $\times$ FI. We use our silk variable and its interaction with SME as instruments. Our instruments are relevant in all specifications reported in Table 4. 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 Cragg and Donald (1993) and the Kleibergen–Paap Kleibergen and Paap (2006) rank tests for underidentification as well as the conditional F-statistics recently suggested by Sanderson and Windmeijer (2016) (the latter two also allows us to take account of the clustered covariance matrix). All three tests indicate that underidentification does not seem to be an issue.[10]

Dynamic effects of the shock To appreciate the dynamics and persistence of the shocks and the importance of the reallocation effect for real outcomes, in Figure 4, 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 and the low-SME subgroups. High-SME prefectures generally had lower growth rates. But the difference between high- and low-SME prefectures is particularly marked for the group with low financial integration, suggesting that low regional banking integration was indeed associated with particularly low growth in bank-dependent prefectures with many SMEs. 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.

5 Transmission channel

Lending patterns of local and integrated banks In this section, we explore the reallocation channel in more detail. A first implication of the theory is that the reallocation of lending is driven primarily by integrated banks. In Table 5, we therefore repeat our previous regressions but now distinguishing between lending by city banks and the lending by local banks. Indeed we find that city banks' are driving the credit-reallocation channel: the coefficient on the interaction SME $\times$ FI is big and highly significant for city banks whereas it is close to zero and insignificant for the placebo sample of local banks. Again, the effect for integrated banks is stronger in the IV regression than in the OLS specification.

OLS bias and heterogeneity in bank-firm matches Throughout the paper, we have argued that OLS would tend to underestimate the reallocation channel if weak firms (SMEs) are linked to weak (integrated) banks in high-SME / high-FI prefectures. While we have no data at the firm-bank level for the 1990s, we provide survey-based evidence for later periods

[10] The Cragg and Donald (1993) statistic is identical to the Kleibergen and Paap (2006) rank test if the errors are homoskedastic. Only in this case the critical values from Stock and Yogo (2005) are directly applicable.

that show that SMEs are indeed more likely to be linked to integrated banks in prefectures where both SME and FI are high. Specifically, 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 local 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 memorandum item I at the bottom of Table 5—therefore confirms that a larger fraction of the local SME population borrows from financially integrated banks in more financially integrated areas.[11] Conversely, we also find evidence that in high-SME prefectures, a higher share of the customers of integrated banks are SMEs. Again, a direct measure of what fraction of city banks' customers are SMEs is not available by prefecture for the lost decade. We obtain a proxy of this fraction from the 2006 TSR firm-level data set which contains information about the three main banks for the majority of Japanese firms. The second memorandum item at the bottom of Table 5 shows a regression of this fraction on the pre-1990 share of SMEs in local value added. While this is undoubtedly a noisy regression with low R^2 (the sample is likely not to be respresentative and we only have the identity of the three main banks in one year, 2006), the cofficient is positive and appears significant at the 10 percent-level. These findings support our conjecture that SMEs and integrated banks are much more likely to be linked in high-SME $\times$ FI prefectures and provides an explanation for the sign of the OLS bias in our main specifications that is consistent with the theory.

Local interest rates In columns (5) and (6) of Table 5 we examine another implication of the theory in Figure 1: *ceteris paribus*, small firms that borrow from local banks face higher interest rates than those borrowing from integrated banks after the bank liquidity shock. In general, the extent of the interest rate rise faced by local banks' borrowers will depend on the size of the shock to local banks' balance sheets relative to that of integrated banks. It will also depend on SME's ability to substitute between credit from local and integrated banks. If firms could switch lender in a seamless manner, then demand should shift away from the local bank towards the integrated bank until both banks charge the same interest rate on their loans. Clearly, we would expect that it is easier for firms to obtain credit from integrated banks in prefectures where integrated banks have a strong presence in the SME lending market in the first place, which, as we have shown, are exactly those prefectures where SME$\times$FI is high and that are favored by the reallocation channel.

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

Following Kano and Tsutsui (2003), we construct the average interest rate charged by local banks as interest income divided by total lending of Tier 2 (Sogo) banks contained in the Nikkei NEEDS database. As an indicator if the size of the shock to local banks, we have already used local bank's exposure to the local real estate market as a control in our previous regressions. In the last panel of Table 5, we now report regressions of local banks' interest rates on the interaction between local banks' real estate exposure with the aggregate shock, splitting the sample into above- and below-median SME × FI prefectures.

As would be suggested by our theory, conditional on the shock to their balance sheets, local banks do not charge significantly higher interest rates in high-SME × FI prefectures where it is easy for SMEs to obtain credit from integrated banks instead. Conversely, in our sample of low-SME × FI prefectures, where SMEs should find it hard to substitute local bank credit with credit from integrated banks, we estimate a much bigger and significantly positive coefficient.

Credit reallocation and the firm-borrowing channel We conclude by examining how taking account of credit reallocation affects estimates of the firm borrowing channel. In columns 7-9 of Table 5, we estimate the firm-borrowing equation (3) directly by instrumenting city bank's lending growth. We do this in two ways: first, as in Imai and Takarabe (2011), we instrument integrated banks' lending growth with FI × SHOCK$_t$ only, thus ignoring the effect that reallocation has on lending growth. The result of this regression are reported in column 7. Secondly, by taking account of the reallocation channel and the bank lending channel jointly, using both SME × FI × SHOCK and FI × SHOCK$_t$ as instruments. The first stage of this latter IV regression is identical to the OLS regression for city bank's lending growth reported in column (1). The results of this estimation appear in column (8). We obtain very similar results if instead, we instrument integrated bank's lending with SME^k × FILATURES^k × SHOCK$_t$ and FILATURES^k × SHOCK$_t$ in column 9.[12] Taking account of the credit reallocation channel substantially lowers estimates of the real effects of the shock to banks' lending capacity during Japan's lost decade. If we account only for the bank-lending channel, we find that a one percent drop in city banks' lending lowers about growth in a prefecture by more than half a percent. This is very similar to the estimate obtained by Imai and Takarabe (2011) for city banks. Conversely, if we also take account of the effect of reallocation on bank's credit supply, a one percent drop in lending lowers output by just above 0.3 percent. The difference between the two estimates appears statistically and economically significant. Credit reallocation between prefectures seems to shield the

[12]This is amounts to using the second stage of the IV-regression in column (2) as the first stage for IV regressions in column (7).

most bank-dependent firms from reductions in credit. Taking account of this effect leads to smaller estimates of the real effect from the bank lending supply shock.

Figure (5) illustrates graphically how credit reallocation affected prefecture-level lending and helped stabilize prefectural growth patterns dring the lost decade. The left panel shows the geographical profile of integrated bank's lending growth, distinguishing between the bank lending channel and credit reallocation. Using the coefficient estimates from our IV-specification for city bank's lending growth in Table 5 we calculate the two channels as the cumulated fitted values $\beta_0 \times \textsc{sme}^k \times \textsc{fi}^k \times \textsc{shock}_t$ and $\beta_1 \times \textsc{sme}^k \textsc{shock}_t$ respectively. Note that both SME and FI are cross-sectionally demeaned in our regressions, so that all effects are measured relative to the country-wide mean. From eyeballing the graph it is clear that both the bank lending and reallocation channels are equally important for understanding the regional heterogeneity in integrated banks' lending patterns during Japan's lost decade: read and blue areas equally prevalent and, importantly, for many prefectures they almost balance out.

The right panel of the figure illustrates what this implies for estimates of the cumulated output effects over the period 1991-1996: the red line is the growth growth profile that we obtain when we take account of the bank lending channel only (column 7 of column 5). The blue line shows the profile we get taking account also of the reallocation channel, instrumenting lending with FILATURES and SME $\times$ FILATURES (column 9 of 5). While the two profiles are highly correlated, GDP growth appears considerably less heterogeneous across prefectures once we take account of credit reallocation: the cross -prefectural standard-deviation of the cumulated output growth effect from the bank lending shock over the period 1991-1996 is just half (1.6 percent) of what it is when only the bank lending channel is accounted for in the estimation (3.0 percent).

Robustness In the appendix we provide further robustness checks. First, in Table A.1 we show that our results on credit reallocation and the firm-borrowing channel actually become stronger once we drop the the core prefectures with the biggest cities from our sample. Second, we document that our results also survive in what Bertrand et al. (2004) have called a 'before–after' regression; i.e., a cross-sectional regressions of average post-1991 growth rates in GDP and lending on pre-1991 averages of $\textsc{sme}^k \times \textsc{fi}^k$, $\textsc{fi}^k$ and $\textsc{sme}^k$ (Table A.2). Third, we illustrate that the results also hold with alternative measures of SME importance and regional banking integration (Table A.3).

6 Conclusion

This paper has argued that the interaction between regional banking integration and the local dependence on bank credit is key for understanding the patterns of credit and output growth at the prefecture level during Japan's 'Lost Decade'.

Since Khwaja and Mian (2008) it is well understood that the real effects of bank liquidity shocks depend not only on the size of the shock to the banking sector (the bank-lending channel) but also on the ability of borrowers to substitute one source of credit for another (the firm-borrowing channel). Specifically, small firms are usually particularly dependent on bank credit and find it hard to obtain alternative sources of funding when their main bank is negatively affected by a liquidity shock. In this paper, we have drawn attention to a potentially important additional channel of adjustment: the reallocation of credit that happens through the internal capital markets of regionally integrated banks.

The bursting of Japan's property price bubble was a major shock to the lending capacity of the entire banking sector, but it hit integrated banks in particular. However, contrary to local banks, integrated banks, could reallocate credit between prefectures to those areas where they had the most bank-dependent customers (SMEs). Amidst a major liquidity shock, this induced them to reduce lending by less in prefectures where the marginal willingness to pay for loans—local bank dependence—was highest because of a strong presence of SMEs. As we show, this credit reallocation substantially muted the real impact of the liquidity shock on prefectures with many bank-dependent small firms.

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 finance, but small reeling firms could not typically borrow from the large banks in the big cities such as Yokohama. Japan's local banks developed as the institutional response to this problem. 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. Not only do we corroborate our main results: prefectures with many SMEs did relatively better if they were more integrated. The IV regressions also reveal a much stronger reallocation effect , suggesting that our previous OLS estimates are conservative. As we show, the sign of the OLS bias is consistent with the cross-prefectural heterogenity in the structure of bank-firm matches that is implied by our theoretical mechanism.

Our results have several interesting implications. First, at a methodological level, they illustrate how the approach of Khwaja and Mian (2008) can be applied in settings where no firm-bank level data is available. This will often be the case, if researchers are interested in the medium- to long-term effects of a bank liqudity shock or when they want to make inference about the regional dimension of such shocks and when the spatial coverage of bank-firm level data is limited. Secondly, our results draw attention to a potentially important channel of adjustment after a major shock to bank liqudity: the reallocation of credit within banks. Third, our results show 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.

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Table 1: Modern day (pre-1990) lending and silk filatures

	Financial Integration						Financial Development				
	pre-1990 share in prefecture-level lending by										
	City Banks		Regional Banks				$\frac{bank\ branches}{population \times area}$		Lending/GDP		
			All (Shinkin+Sogo)		Shinkins only		(pre-1990)		(pre-1990)		
filatures / population (log #)	-0.03 (-3.14)	-0.04 (-4.70)	0.03 (4.22)	0.03 (4.11)	0.04 (4.96)	0.04 (4.53)	0.01 (0.87)	0.01 (0.87)	-0.61 (-1.78)	-0.55 (-1.95)	-0.10 (-0.29)
Relative GDP (pre-90)		0.19 (3.32)		-0.01 (-0.18)		-0.01 (-0.24)		0.09 (1.68)		8.56 (4.21)	6.27 (2.88)
Core Dummy		0.07 (2.46)		-0.001 (-0.02)		0.02 (0.71)		-0.02 (-0.57)		1.92 (1.88)	1.06 (1.02)
Distance to Yokohama (log)		-0.02 (-1.33)		0.01 (0.66)		-0.01 (-0.93)		0.01 (0.74)		0.55 (1.25)	0.74 (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 (1980-90 average) prefectural lending shares by bank type (left panel) and of various (1980-90 average) financial development indicators (right panel) on the number of filatures per head of population in a prefecture in 1895. The control variables are relative (1980-90 average) 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 2: Japanese prefectures: descriptive statistics

	Prefecture	City bank share in total lending	SME share in GDP	post-1990 average growth rates of GDP per capita	post-1990 average growth rates of 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 3: Sample-split results

	lending growth		GDP growth	
	(1)	(2)	(3)	(4)
	Hi FI	Low FI	High FI	Low FI
$\text{SME}^k \times \text{SHOCK}_t$	-0.032	-0.246	-0.068	-0.253
	(-0.117)	(-1.958)	(-0.524)	(-2.029)
Adjusted R^2	0.572	0.587	0.701	0.657

The table shows the coefficient α in panel regressions of the form $\Delta\text{OUTCOME}_t^k = \alpha \times SME^k\text{SHOCK}_t + \mu^k + \tau_t + \epsilon_t^k + constant$ where ΔOUTCOME stands in turn for lending and GDP growth in prefecture k and SHOCK is the (negative of) the perecentage decline of land prices in the core prefectures. SME^k and $\text{FI}^k$are the 1980-1990 prefecture-level averages of, respectively, small-business importance and the share of city bank lending in total bank lending in prefecture k. The terms $\mu^k$and τ_t are prefecture- and time-fixed effects respectively. The sample of 46 prefectures is split into two groups of above- and below-median levels of FI. The sample period is 1980-2005 for GDP regressions and 1980-96 for lending regressions. Numbers in parentheses are t-statistics. Standard errors are clustered by prefecture and year.

Table 4: Reduced-form specifications (OLS and IV)

	(1)	(2)	(3)	(4)
	OLS		IV	
	GDP growth	Lending Growth	GDP growth	Lending Growth
$\text{SME}^k \times \text{FI}^k \times \text{SHOCK}_t$	0.844	2.342	1.439	2.999
	(1.695)	(4.386)	(2.123)	(3.359)
$\text{FI}^k \times \text{SHOCK}_t$	−0.067	−0.159	−0.107	−0.254
	(−3.166)	(−4.747)	(−1.603)	(−2.371)
$\text{SME}^k \times \text{SHOCK}_t$	−0.076	−0.224	−0.124	−0.301
	(−0.704)	(−1.917)	(−1.060)	(−2.102)
Distance to Yokohama$\times\text{SHOCK}_t$	0.00002	−0.00003	0.00001	−0.00005
	(1.138)	(−1.598)	(0.447)	(−2.620)
Core$\times\text{SHOCK}_t$	−0.015	−0.052	−0.012	−0.043
	(−2.764)	(−4.161)	(−1.318)	(−3.715)
Local banks real estate exposure$\times\text{SHOCK}_t$	0.097	0.038	0.102	0.044
	(1.218)	(0.467)	(1.402)	(0.514)
local land price growth	0.004	0.005	0.003	0.003
	(1.069)	(0.483)	(0.796)	(0.301)
predicted output growth	0.188	0.323	0.175	0.308
	(1.931)	(1.181)	(1.828)	(1.115)
adj. R^2	0.685	0.603	0.684	0.599

	(5)	(6)
	First Stage	
	$\text{SME}^k \times \text{FI}^k \times \text{SHOCK}_t$	$\text{FI} \times \text{SHOCK}_t$
$\text{SME}^k \times \text{FILATURES}^k \times \text{SHOCK}_t$	−0.05	0.02
	(−4.06)	(0.13)
$\text{FILATURES}^k \times \text{SHOCK}_t$	0.00	−0.05
	(0.17)	(−5.12)
$\text{SME}^k \times \text{SHOCK}_t$	0.04	0.00
	(1.60)	(0.00)
Distance to Yokohama$\times\text{SHOCK}_t$	0.00	−0.00
	(2.28)	(−2.15)
Core$\times\text{SHOCK}_t$	0.00	0.09
	(0.95)	(3.72)
Local banks real estate exposure$\times\text{SHOCK}_t$	−0.02	0.01
	(−1.49)	(0.06)
local land price growth	−0.00	−0.00
	(−0.17)	(−0.40)
predicted output growth	0.01	−0.13
	(1.79)	(−1.33)
adj. R^2	0.44	0.54
1st-stage F-statistics	19.67	18.01
Cragg-Donald Wald F statistics (p-val)	156.04	(<0.1)
Kleibergen-Paap rk LM statistics (p-val)	5.24	(0.02)
Conditional F-statistics	30.91	33.07

The table shows OLS- and IV-results for our reduced-form specifications (5) $\Delta\text{OUTCOME}_t^k = \left[\alpha_0 \times \text{SME}^k \times \text{FI}^k + \alpha_1 \times \text{FI}^k + \alpha_2 \times \text{SME}^k + \boldsymbol{\alpha}_3' X^k\right] \times \text{SHOCK}_t + \mu^k + \tau_t + \boldsymbol{b}' Z_t^k + \nu_t^k$ where $\Delta\text{OUTCOME}_t^k$ stands in turn for GDP and lending growth, SHOCK_t is the (negative) land price growth in the core prefectures, $\text{SME}^k$is small-business importance based on the SME share in total employment in prefecture k, FI^k is the measure of regional banking integration, X^k and Z_t^k are vectores of additional controls and $\mu^k$and τ_t are prefecture-fixed and time effects respectively. The sample period is 1980-2005 for the GDP growth regressions and 1980-96 for the lending growth regressions. Standard errors are clustered by prefecture and year, t-statistics in parentheses. Columns (5) and (6) report the first-stage regressions for the two endogenous variables, $\text{SME}^k \times \text{FI}^k\text{SHOCK}_t$ and $\text{FI}^k\text{SHOCK}_t$ based on the sample period 1980-2005. At the bottom of columns (5) and (6) we report the first-stage F-statistics on the excluded instruments, the Cragg and Donald (1993) and the Kleibergen and Paap (2006) rank statistics along with the associated p-values for the hypothesis of under-identification as well as the conditional F-statistics recently suggested by Sanderson and Windmeijer (2016).

Table 5: Transmission mechanism

	(1)	(2)	(3)	(4)	(5)	(6)		(7)	(8)	(9)
	City banks		local banks		local banks' interest rates			Sensitivity of output to lending growth		
								w/o reallocation	with reallocation	
	OLS	IV	OLS	IV	high SME × FI	low SME × FI		IV (FI)	IV (FI, SME × FI)	IV (FILATURES,FILATURES × SME)
$\text{SME}^k \times \text{FI}^k \times \text{SHOCK}_t$	3.151	4.846	0.904	0.260			$\Delta\text{Lending}_t^{k,city}$	0.502	0.350	0.333
	(6.688)	(4.067)	(1.271)	(0.114)				(3.336)	(3.077)	(2.578)
$\text{FI}^k \times \text{SHOCK}_t$	−0.151	−0.149	−0.155	−0.384						
	(−2.068)	(−1.368)	(−1.767)	(−1.629)						
Local banks real estate exposure$\times\text{SHOCK}_t$	0.073	0.085	0.003	0.002	0.002	0.037		0.099	0.107	0.107
	(0.630)	(0.693)	(0.033)	(0.016)	(0.156)	(1.687)		(0.861)	(1.011)	(1.016)
$\text{SME}^k \times \text{SHOCK}_t$	−0.310	−0.394	−0.183	−0.256	−0.010	−0.021		0.034	0.022	0.020
	(−2.517)	(−3.238)	(−1.161)	(−1.296)	(−0.365)	(−1.128)		(0.359)	(0.246)	(0.229)
Distance to Yokohama$\times\text{SHOCK}_t$	−0.00004	−0.0001	−0.00004	−0.00005	−0.00000	−0.00000		0.00003	0.00003	0.00003
	(−0.704)	(−1.662)	(−0.564)	(−1.031)	(−0.591)	(−0.242)		(1.032)	(1.252)	(1.045)
Core$\times\text{SHOCK}_t$	−0.061	−0.065	−0.031	−0.004	−0.006	−0.007		0.012	0.001	0.0001
	(−4.004)	(−3.629)	(−1.738)	(−0.156)	(−3.203)	(−2.002)		(0.927)	(0.153)	(0.013)
local land price growth	0.014	0.013	−0.022	−0.026	−0.002	−0.001		−0.004	−0.002	−0.002
	(1.058)	(1.029)	(−0.832)	(−0.851)	(−1.899)	(−0.743)		(−0.664)	(−0.311)	(−0.232)
predicted output growth	−0.083	−0.107	0.048	0.043	0.002	0.005		0.287	0.282	0.282
	(−0.192)	(−0.244)	(0.110)	(0.097)	(0.078)	(0.331)		(0.993)	(1.217)	(1.244)
adj. R^2	0.782	0.781	0.706	0.705	0.990	0.984		0.042	0.299	0.323
							First stage F-stat	5.344	24.57	6.857
							(p-value)	(0.02)	(0.00)	(0.003)

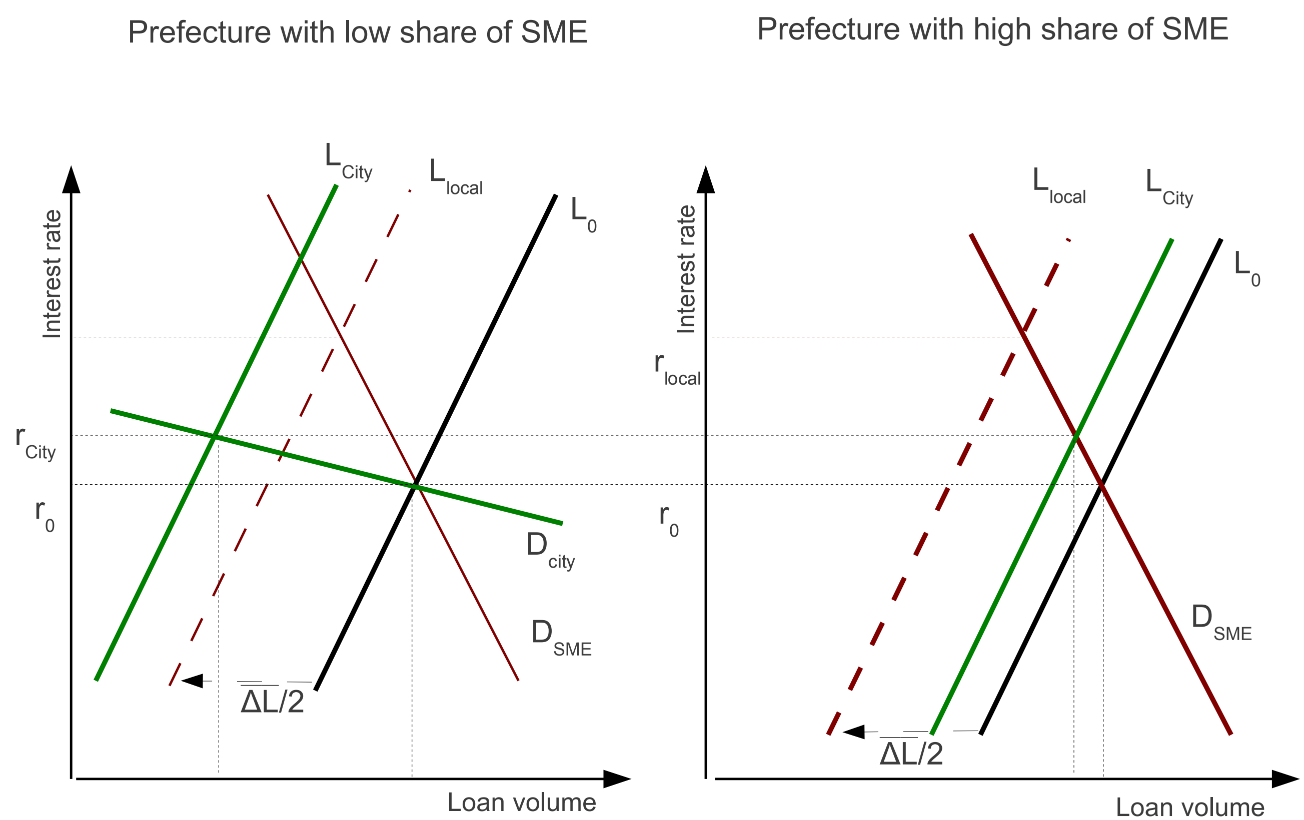
Memorandum items

I: FRACTION OF SME IN PREFECTURE k WITH CITY BANK AS MAIN BANK$_{2002} = \underset{(5.03)}{0.62} \times \text{FI}^k_{1980-90} + 0.08 \qquad R^2 = 0.49$

II: FRACTION OF CITY BANK CORPORATE CUSTOMERS IN PREFECTURE k THAT ARE SME$_{2006} = \underset{(1.74)}{0.067} \times \text{SME}^k_{1980-90} + 0.95 \qquad R^2 = 0.04$

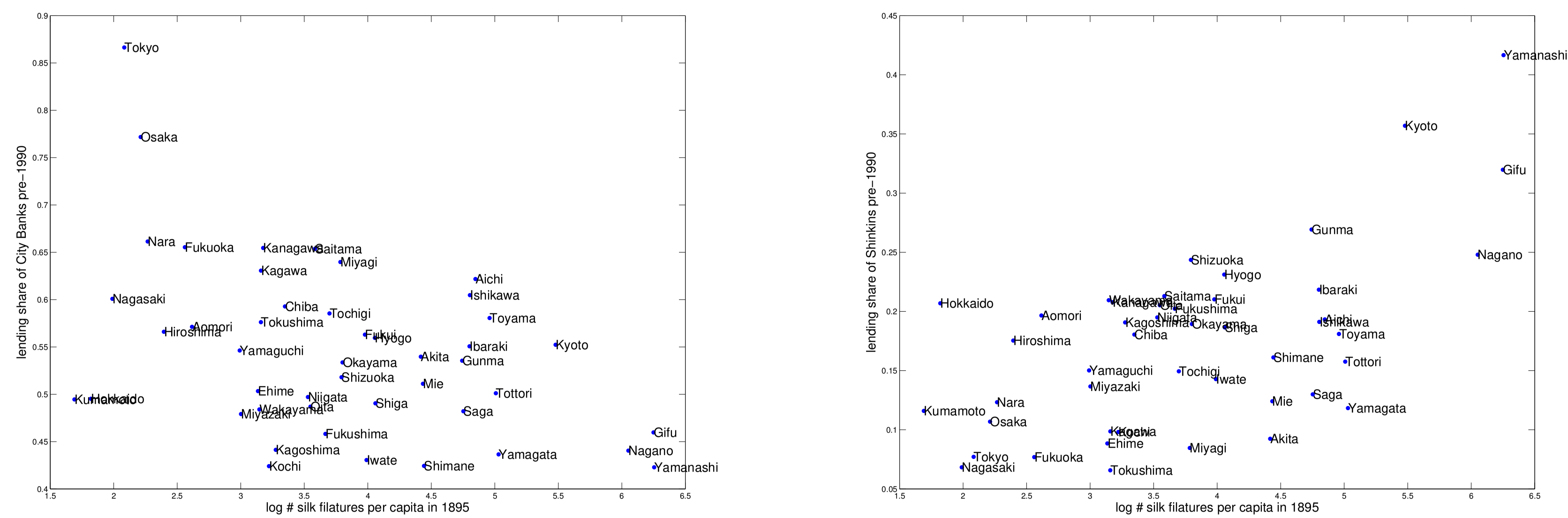
NOTES: Columns 1-4 of the table show OLS- and IV-results for the regression specification $\Delta\text{OUTCOME}_t^k = [\alpha_0 \times \text{SME}^k \times \text{FI}^k + \alpha_1 \times \text{FI}^k + \alpha_2 \times \text{SME}^k + \boldsymbol{\alpha}_3' X^k] \times \text{SHOCK}_t + \mu^k + \tau_t + \boldsymbol{b}' Z_t^k + \nu_t^k$ where $\Delta\text{OUTCOME}_t^k$ is now the lending growth for city and local banks in turn. As before, SHOCK_t is the (negative) land price growth in the core prefectures, $\text{SME}^k$is small-business importance based on the SME share in total employment in prefecture k, FI^k is the measure of regional banking integration, X^k and Z_t^k are vectors of additional controls and $\mu^k$and τ_t are prefecture-fixed and time effects respectively. The sample period is 1980-1996. In columns (5) and (6), we regress local banks' average loan interest rates on the interaction term LOCAL BANKS' REAL ESTATE EXPOSURE×SHOCK_t and a range of controls, splitting the sample into two groups of prefectures with above- and below-median banking integration. Columns 7-9 provide estimates of the firm-borrowing equation $\Delta\text{GDP}_t^k = \gamma \times \Delta\text{Lending}_t^k + \eta_t^k + \mu^k + \tau_t$ where $\Delta\text{Lending}_t^k$ is instrumented using $\text{FI}^k \times \text{SHOCK}_t$only (column 7), $\text{SME}^k \times \text{FI}^k \times \text{SHOCK}_t$, $\text{FI}^k \times \text{SHOCK}_t$ in column (8) and $\text{SME}^k \times \text{FILATURES}^k \times \text{SHOCK}_t$, $\text{FILATURES}^k \times \text{SHOCK}_t$ in column (9). Standard errors in columns 1-9 are clustered by time and prefecture. The memorandum items at the bottom of the table report I) a cross-sectional regression of the fraction of small firms reporting a city bank as main bank in the 2002 survey of enterprise finance (SEF) on FI^k II) a cross-sectional regressions of the fraction of SMEs among corporate customers of city banks in the 2006 TSR data set on SME^k. The t-statistics based on robust (HC) standard errors appear in parentheses.

Figure 1: The reallocation channel in a stylized interregional banking model



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

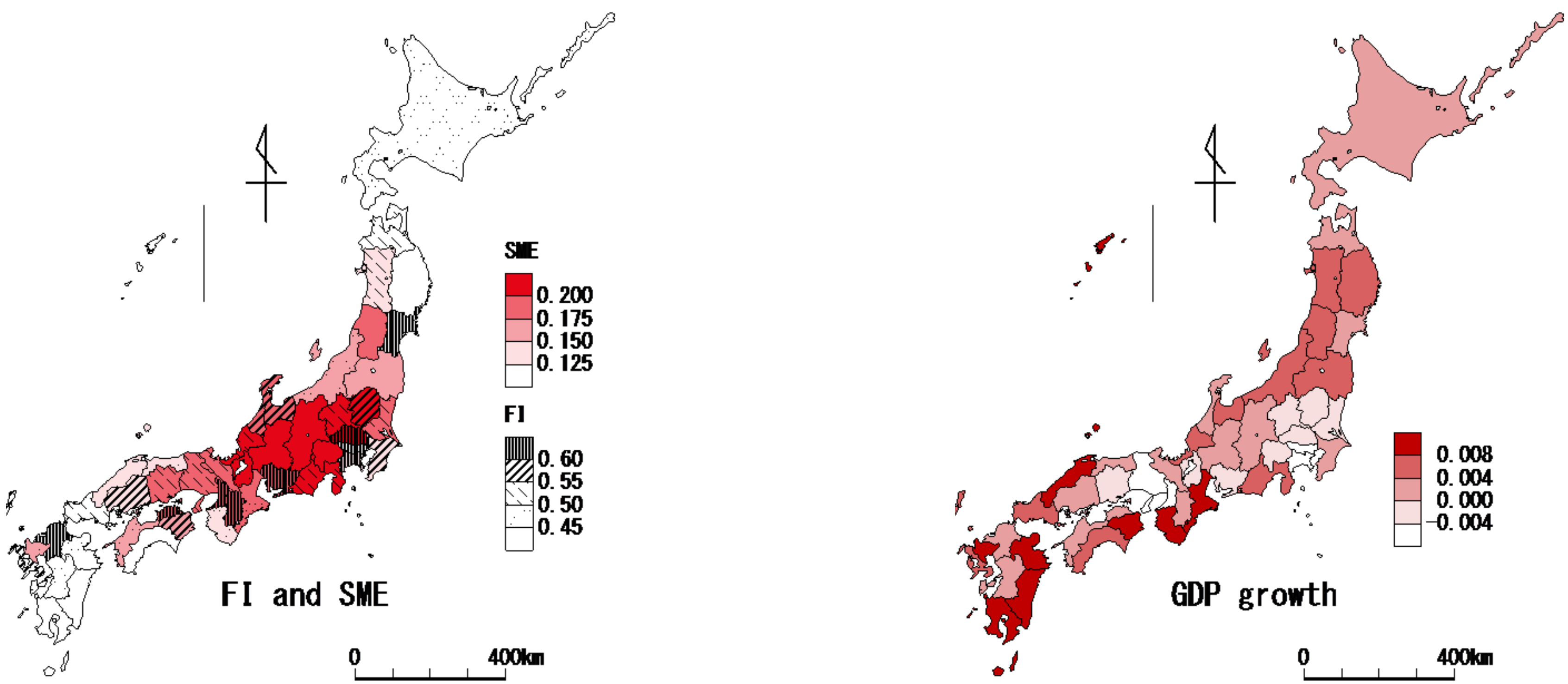
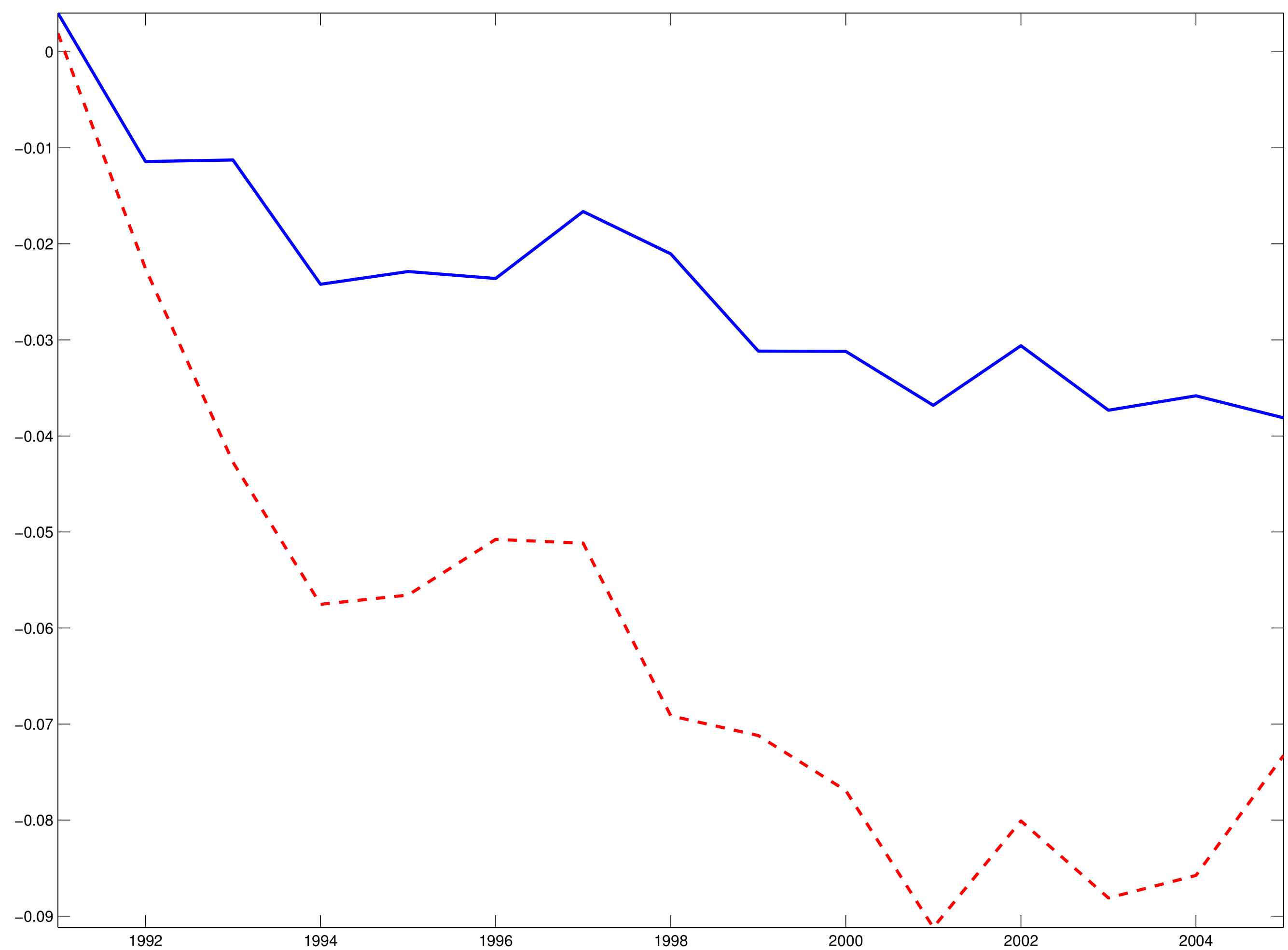


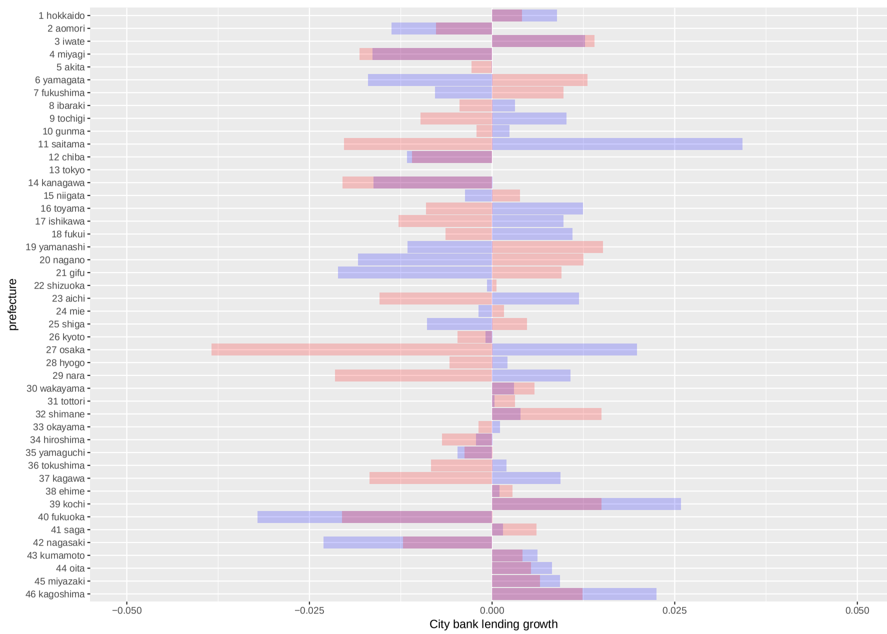
Figure 4: Cumulative Growth Differential (1991-2005) between high and low SME group for prefectures with high (blue, solid line) and low (red, dashed line) levels of banking integration.



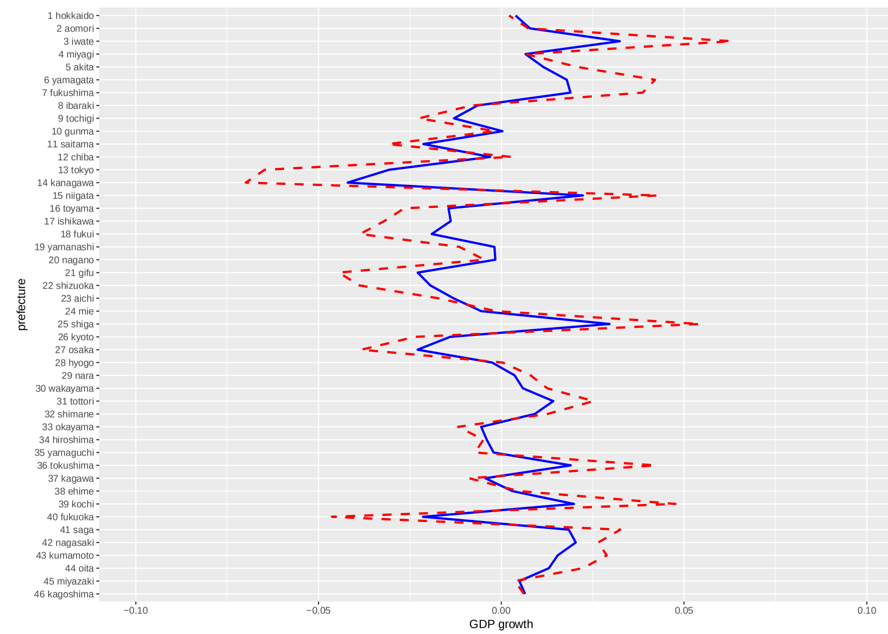
NOTES: The figure illustrates our difference-in-difference results. We split prefectures into four groups based on pre-1991 (1980-90 average) characteristics: above/below-median banking integration and above/below-median small business importance. Then, within each financial integration group, we calculate 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 5: Geographical profile of integrated banks' lending and output growth

I: Integrated banks' lending growth



II: Implied GDP growth patterns with and w/o reallocation



NOTES:

Panel I: for each prefecture, the bars indicate the growth contribution (relative to the country-wide average) of the bank-lending channel ($\alpha_1 \text{FI}^k \times \text{SHOCK}_t$,red) and the reallocation channel ($\alpha_0 \text{SME}^k \times \text{FI}^k \times \text{SHOCK}_t$, blue), as predicted from the the IV-regression in column 3 of Table 4, assuming a land price decline in the core cities of of 86 percent, as it occured over the period 1991-96.

Panel II: The figure gives the cumulated GDP growth effect over 1991-96 estimated from the firm-borrowing regressions (3). The red dashed line gives the effect estimated w/o accounting for reallocation in the first stage regression for lending (column 7 of Table 5). The blue, solid line provides the effect when credit reallocation is accounted for and lending is instrumented using FILATURES and SME × FILATURES (column 9 of Table 5).

In both panels, prefectures are ordered based on their official numbering, starting in the northeast (Hokkaido, number 1) and ending in the south-west of the country (Kagoshima, number 46).

H. 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.[13] 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)).[14]

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 one of the main markets for hand-reeled silk. The depression led to a drop in the price of hand-reeled silk, whereas demand for machine-reeled silk exploded in the US, leading to a considerable 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

[13]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.

[14]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.

intensive, mechanization required *some* capital, which not all small hand reelers could raise (Nakabayashi (2006) and Miwa and Ramseyer (2006)).[15] 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 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.[16] 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

[15]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.

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

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.[17]

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').[18] Very much like modern export finance, 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

[17] 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.

[18] 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 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.

its arrival in Yokohama.[19]

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

[19] 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.

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 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. 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.[20,21] In the early 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)).[22]

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

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

[21] 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, 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.

[22] 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.

hand reeling are all insignificant for all bank types.[23] 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.

[23]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.

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A Additional Tables (for online publication):

Robustness in sub-samples During the 1990s, the major cities saw the larges declines in output and the largest declines in land prices. This might lead us to overestimate the real effect from variations in big banks' lending supply in the rest of the country. On the other hand, lending patterns in the big cities might not necessarily be driven by the reallocation channel alone, given that big banks are headquartered there. In Table A.1, we therefore drop the core prefectures with the biggest cities from our sample altogether. All our results hold up: estimates of the reallocation effect in the lending growth regression for integrated banks actually increase, both in OLS and IV regressions, and they remain highly significant. As before, the IV estimate gives a higher estimate of the reallocation effect than OLS. Also, accounting for the reallocation effect in the lending regression again leads to lower estimates of the firm-borrowing parameter γ.

Cross-sectional regressions While the panel regressions we have presented throughout the paper allow us to control for a host of confounding factors that vary by time and across prefectures, our identification ultimately depends on cross-sectional variation in the two variables $\textsc{sme}^k$ and $\textsc{fi}$. We therefore check if our reduced-form results survive in what Bertrand et al. (2004) have called a 'before–after' regression; i.e., a cross-sectional regressions of average post-1991 growth rates in GDP and lending on pre-1991 averages of $\textsc{sme}^k \times \textsc{fi}^k$, $\textsc{fi}^k$ and $\textsc{sme}^k$. We report such regressions in Table A.2 in the appendix. The results confirm that the patterns we have documented throughout the paper are clearly discernible also in our relatively small cross-section of 46 prefectures. Again, the reallocation effect is generally stronger and appears more significant in the IV regressions. We also drop the core prefectures with the major cities from our sample. In all cross-sectional regressions the specification— we estimate at least four coefficients from a cross section of 46 prefectures (and only 38 prefectures in the sample excluding the core)—the coefficient is stable throughout and generally remains significant.

Alternative measures of $\textsc{sme}$ and $\textsc{fi}$ In Table A.3 we examine the robustness of our cross-sectional results for alternative measures of SME importance (the share of SME employment) and for alternative measures of regional banking integration (the lending share of tier 2 regional banks (Suogo banks) and of Shinkins (industrial credit associations), which both are negatively correlated with banking integration). In all specifications, the coefficient of $\overline{\textsc{sme}}^k \times \overline{\textsc{fi}}^k$ is consistent with our earlier specifications (which means it is negative for the cases in which we use regional banks lending shares as stand-ins for $\textsc{fi}$). Also, we again

Table A.1: Transmission mechanism, core prefectures dropped

	(1)	(2)	(3)	(4)	(5)	(6)		(7)	(8)	(9)
	City banks		local banks		local banks' interest rates			Sensitivity of output to lending growth		
								w/o reallocation	with reallocation	
	OLS	IV	OLS	IV	high $\text{SME} \times \text{FI}$	low $\text{SME} \times \text{FI}$		IV (FI)	IV (FI, SME)	IV (silk,SME)
$\text{SME}^k \times \text{FI}^k \times \text{SHOCK}_t$	2.559	5.971**	−1.160	0.299***			$\Delta\text{Lending}_t^{k,city}$	0.457	0.258	0.170
	(2.043)	(2.492)	(−18.418)	(0.066)				(2.692)	(3.416)	(0.845)
$\text{FI}^k \times \text{SHOCK}_t$	−0.142	−0.157	−0.118	−0.493						
	(−1.568)	(−0.787)	(−1.229)	(−1.298)						
Local banks real estate exposure$\times\text{SHOCK}_t$	0.131	0.169	0.006	0.035	−0.002	0.042		0.062	0.081	0.090
	(0.872)	(1.119)	(0.037)	(0.173)	(−0.108)	(1.843)		(0.443)	(0.672)	(0.769)
$\text{SME}^k \times \text{SHOCK}_t$	−0.294	−0.203	−0.352	−0.368	−0.012	−0.026		0.028	−0.041	−0.071
	(−1.611)	(−0.942)	(−1.311)	(−0.967)	(−0.366)	(−1.278)		(0.162)	(−0.317)	(−0.473)
Distance to Yokohama$\times\text{SHOCK}_t$	−0.00003	−0.00003	−0.00005	−0.0001	−0.00000	−0.00000		0.00003	0.00002	0.00002
	(−0.743)	(−0.770)	(−0.670)	(−0.823)	(−0.489)	(−0.414)		(0.885)	(0.950)	(0.800)
local land price growth	0.029	0.027	−0.012	−0.023	−0.002	0.001		−0.007	−0.001	0.003
	(2.072)	(1.776)	(−0.342)	(−0.728)	(−1.265)	(0.760)		(−0.748)	(−0.052)	(0.232)
predicted output growth	0.078	0.072	−0.310	−0.299	−0.009	0.0001		0.245	0.260	0.267
	(0.254)	(0.236)	(−0.651)	(−0.656)	(−0.314)	(0.009)		(1.026)	(1.435)	(1.712)
adj. R^2	0.802	0.801	0.740	0.736	0.991	0.984		0.068	0.358	0.431
							1st-stage F-stat.	2.444	2.597	3.899
							(p-value)	(0.1265)	(0.08)	(0.03)

Columns 1-4 of the table show OLS- and IV-results for the regression specification $\Delta\text{OUTCOME}_t^k = \left[\alpha_0 \times \text{SME}^k \times \text{FI}^k + \alpha_1 \times \text{FI}^k + \alpha_2 \times \text{SME}^k + \boldsymbol{\alpha}_3' X^k\right] \times \text{SHOCK}_t + \mu^k + \tau_t + \boldsymbol{b}' Z_t^k + \nu_t^k$ where $\Delta\text{OUTCOME}_t^k$ is now the lending growth for city and local banks in turn. As before, SHOCK_t is the (negative of the) land-price growth in the core prefectures, $\text{SME}^k$is small-business importance based on the SME share in total employment in prefecture k, FI^k is the measure of regional banking integration, X^k and Z_t^k are vectores of additional controls and $\mu^k$and τ_t are prefecture-fixed and time effects respectively. The sample period is 1980-1996. In columns (5) and (6), we regress local banks' average loan interest rates on the interaction LOCAL BANKS REAL ESTATE EXPOSURE$\times\text{SHOCK}_t$ and a range of controls, splitting the sample into two groups of prefectures with above- and below-median banking integration. Standard errors are clustered by time and prefecture.

Table A.2: Cross-Sectional Regressions

	city lending growth	GDP growth	city lending growth	GDP growth	city lending growth	GDP growth	city lending growth	GDP growth
	OLS	*OLS*	*IV*	*IV*	*OLS*	*OLS*	*IV*	*IV*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\text{SME}^k \times \text{FI}^k$	0.698	0.093	2.492	0.542	0.735	0.279	2.910**	1.254
	(1.065)	(0.918)	(2.063)	(1.696)	(0.615)	(2.325)	(1.227)	(1.886)
FI^k	−0.112	−0.014	0.026	−0.020	−0.107	−0.016	0.036	−0.030
	(−3.174)	(−2.629)	(0.411)	(−1.637)	(−2.608)	(−2.953)	(0.423)	(−1.547)
SME^k	−0.080	−0.013	−0.076	−0.033	0.074	0.015	0.177	0.055
	(−0.658)	(−0.666)	(−0.475)	(−1.367)	(0.457)	(0.563)	(0.898)	(1.133)
Distance to Yokohama	−0.00001	0.00000	−0.00002	−0.00000	0.00001	0.00001	0.00002	0.00001
	(−0.742)	(1.238)	(−0.784)	(−0.082)	(0.531)	(1.954)	(0.723)	(1.704)
Local banks' real estate exposure	0.025	0.002	0.032	0.004	0.087	0.004	0.098	0.015
	(0.359)	(0.140)	(0.411)	(0.330)	(1.145)	(0.198)	(1.147)	(0.723)
CoreDummy	−0.013	−0.004	−0.031	−0.004				
	(−1.514)	(−1.950)	(−3.057)	(−1.774)				
Constant	0.091	0.009	0.096	0.010	0.069	0.007	0.068	0.004
	(4.865)	(2.617)	(4.313)	(3.142)	(3.163)	(1.396)	(2.759)	(0.691)
Observations	46	46	46	46	38	38	38	38
R^2	0.359	0.501	0.145	0.360	0.175	0.310	−0.107	−0.137
Adjusted R^2	0.261	0.424	0.014	0.261	0.046	0.202	−0.280	−0.315
					Core prefectures dropped			

The Table presents cross-sectional OLS and IV regressions of the form $\Delta\overline{\text{OUTCOME}}^k = \alpha_0 \times \text{SME}^k \times \text{FI}^k + \alpha_1 \times \text{FI}^k + \alpha_2 \times \text{SME}^k + \boldsymbol{\alpha}_3' X^k + \nu^k$ where $\Delta\overline{\text{OUTCOME}}^k$ stands for the post-1991 prefecture-level averages of GDP and lending growth in turn and X^k is a vector of controls. The instrumental variables are $\text{SME}^k \times \text{FILATURES}^k$ and FILATURES^k respectively. In the regressions reported in columns 5-8, the core prefectures with the biggest cities have been dropped from the sample.

Table A.3: Cross-sectional Regressions with alternative measures of FI and SME

	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 $\Delta gdp^k_{post1990} = \alpha_0 SME^k \times FI^k + \alpha_1 FI^k + \alpha_2 SME^k + \boldsymbol{\alpha}_3' CoreDummy^k + const + \epsilon^k$ 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.

find a stronger effect based on the IV than on the OLS estimate.

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 (log #)	-0.01 (-1.35)		0.01 (0.98)		-0.00 (-0.07)	
mechanized filatures (log #)	-0.02 (-3.57)		0.02 (3.07)		0.03 (4.28)	
output: hand reeled (log tons)		-0.00 (-0.49)		-0.00 (-0.51)		-0.01 (-0.64)
output: machine reeled (log tons)		-0.03 (-3.98)		0.02 (2.96)		0.02 (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.