MACROECONOMIC EFFECTS OF CORPORATE DEFAULT CRISES: A LONG-TERM PERSPECTIVE

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Abstract. Using an extensive new data set on corporate bond defaults in the U.S. from 1866 to 2010, we study the macroeconomic effects of bond market crises and contrast them with those resulting from banking crises. During the past 150 years, the U.S. has experienced many severe corporate default crises in which 20 to 50 percent of all corporate bonds defaulted. Although the total par amount of corporate bonds has often rivaled the amount of bank loans outstanding, we find that corporate default crises have far fewer real effects than do banking crises. These results provide empirical support for current theories that emphasize the unique role that banks and the credit and collateral channels play in amplifying macroeconomic shocks.

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In this paper, we use an extensive new data set on corporate bond defaults in the U.S. from 1866 to 2010 to study the macroeconomic effects of major crises in the corporate bond market. To provide additional perspective, we also contrast these effects with those resulting from banking crises.

Our motivation for doing this is threefold. First, while banking crises in the U.S. have been the focus of many studies (important examples include Reinhart and Rogoff (2009) and Schularick and Taylor (2011)), relatively little attention has been given to corporate bond market default crises (corporate default crises for short) in the literature. The corporate bond market, however, has been a major source of credit in the U.S. during the past 150 years, and the amount of outstanding corporate bonds has often rivaled, or even exceeded, the amount of bank loans outstanding. We focus on the U.S. since it has been the only country where privately owned corporations issued public debt on a large scale until the latter part of the 20th Century. By studying this important but underresearched market, we hope to broaden our understanding of the role that credit plays in the macroeconomy.

Second, the corporate debt markets have experienced many major shocks during the past 150 years. A number of these shocks were much more severe than even those during the Great Depression. For example, more than 50 percent of all outstanding bonds in the U.S. defaulted during the 1871–1879 period as many railroads found themselves overextended in the wake of their rapid expansion during the post Civil-War "technology" boom.[1] Thus, corporate bond markets have suffered crises that may be as severe as any experienced by the banking sector. Furthermore, Friedman and Schwartz (1963) argue that large declines in the market value of banks' portfolios of corporate bonds were a major contributing factor to the widespread bank failures of the Great Depression.[2] Because of this, the historical experience of the corporate bond market in the U.S. may be able to provide a new perspective on financial crises.

Third, by contrasting the effects of corporate default and banking crises on the economy, we also hope to be able to shed new light on the mechanisms by which financial crises propagate economic fluctuations. This is because the two primary channels by which current theory suggests that banking crises accelerate economic downturns are largely absent in corporate bond market crises. Thus, studying the macroeconomic effects of corporate default crises essentially provides us with an "out

[1]In contrast, the highest corporate default rate during the Great Depression was 6.73 percent in 1933. The highest business failure and mortgage foreclosure rates during the Great Depression were 1.53 percent in 1932, and 2.39 percent in 1933, respectively (rates based on series V27 and N301 of *Historical Statistics of the United States: Colonial Times to 1970*).

[2]For a discussion of the evidence on this issue, see Calomiris and Mason (2003a).

of sample" test of the role of these two channels.

More specifically, current theoretical models of banking crises emphasize the central role of the credit and collateral channels. For example, Bernanke (1983) argues that a major reason for the persistence of the Great Depression was the collapse of the credit channel after a large fraction of U.S. banks failed. This collapse hit small and medium sized firms particularly hard since they did not have the same access to alternative forms of credit that a larger firm might (see the discussion by Reinhart and Rogoff (2009) in their comprehensive review of banking crises). This theme also appears in Bernanke, Gertler, and Gilchrist (1996) who explicitly incorporate heterogeneity in firms' abilities to borrow in the capital markets into their model of the financial accelerator.[3] Another important literature focuses on the role of the collateral channel in triggering economic downturns. For example, Kiyotaki and Moore (1997) show how an initial decline in asset values can reduce the ability of firms to borrow since their collateral is impaired, which, in turn, can lead to further rounds of declines in asset values. Similarly, Bernanke and Gertler (1995) study a model in which shocks affect the value of a firm's collateral, forcing them to turn to more expensive external credit channels.

In contrast, neither the credit nor collateral channels are likely to play much of a role in a corporate bond market crisis. In particular, only larger firms would be initially affected by a corporate default crisis since they are the only firms that participate in this capital market. Among the many reasons why this is the case are the fixed costs of issuance as well as the disclosure costs which make only issues of large size economically viable. These larger firms, however, might be able to find alternative sources of credit in a crisis, thereby cushioning the output effects of the initial shock. Furthermore, the vast majority of corporate bonds issued in the U.S. are in the form of unsecured debentures rather than mortgage or equipment-secured bonds.[4] Thus, large firms that issue bonds in the capital markets are able to borrow against their future income streams, rather than being limited to their current collateral. Because collateral plays a much smaller role in the corporate bond market, the ability of the collateral channel to function as an accelerator in a corporate default crisis is limited, thereby dampening the potential effects on the macroeconomy.

For these reasons, an examination of the macroeconomic effects of a corporate default crisis could provide useful insights about the importance of the credit and

[3]Also see Calomiris (1993) who discusses the evidence showing that larger manufacturing firms had greater access to credit during the Great Depression than smaller firms.

[4]This is also true during the earlier part of the study period. For example, Hickman (1953) estimates that the fraction of corporate bonds issued in the U.S. prior to 1945 that were secured by claims against assets such as equipment was on the order of two to three percent.

collateral channels. For example, finding that the real effects of a corporate default crisis were just as severe as those of a banking crisis would argue against these two channels playing a central role in accelerating economic downturns. On the other hand, finding that corporate default crises have only relatively minor macroeconomic effects would provide corroborative evidence that the credit and collateral channels are the prime suspects for explaining why banking crises are particularly damaging.

We begin by showing that corporate default and banking crises are separate and distinct phenomena. In particular, there is very little correlation between the timing of corporate default and banking crises.

Next, we confirm that there are in fact significant differences in the roles that the credit and collateral channels play in the two types of crises. Not surprisingly, we find that bank lending growth declines after a banking crises and, similarly, that corporate bond market growth declines after a corporate default crisis. Interestingly, however, we find that bank lending increases significantly shortly after a corporate default crisis. In contrast, the opposite is not true after a banking crisis. Thus, these results strongly suggest that large corporate bond issuers are able to substitute sources of credit after a corporate default crisis, thereby mitigating the impact of the credit channel mechanism. This finding is consistent with Ivashina and Scharfstein (2010) who find that large corporate borrowers increased their bank borrowing significantly in the wake of the 2008 Lehman crisis in the capital markets by drawing on their existing banking lines of credit. These results are also consistent with Gertler and Gilchrist (1994), Chari, Christiano, and Kehoe (2007), and many others who argue that large firms have greater access to capital during a crisis than do small firms. In an important and closely-related paper, Schularick and Taylor (2011) demonstrate that bank loan growth has predictive power in explaining future banking crises. Our results complement theirs by showing that a corporate default crisis can lead to an increase in bank lending.

Focusing next on the collateral channel, we explore the implications of Kiyotaki and Moore (1997) by examining whether negative shocks in the values of major classes of collateral map into subsequent contractions in lending. We find that declines in housing and stock market values both result in significant declines in subsequent bank lending. In contrast, negative shocks in housing and stock market values have no apparent effect on the subsequent amount of corporate bond issuance. Since bank lending is typically collateralized while corporate bond issuance is not, these results support the Kiyotaki and Moore argument that the link between collateral values and credit availability is central to understanding the macroeconomic impact of banking crises.

Finally, using a vector-autoregression (VAR) framework, we compare the real and financial effects of banking and corporate default crises on GDP growth, industrial production, and inflation. We find that corporate default crises do not have a significant effect on output, measured either by GDP or by industrial production. In contrast,

banking crises have longlasting effects on both GDP growth and industrial production. Friedman and Schwartz (1963), Reinhart and Rogoff (2009), and others show that banking crises tend to be followed by periods of lower inflation or even deflation. We extend this literature by showing that the same is also true following corporate default crises. These results are important since they highlight the unique role played by banks. In particular, banking crises are followed by both real and monetary effects while other types of financial crises are followed only by monetary effects.

Taken together, these results provide strong support for the implications of current theoretical models about the macroeconomic effects of banking crises. In particular, these models imply that corporate default crises should have less severe macroeconomic consequences since the credit and collateral mechanisms are largely absent in default crises. As support for this latter point, we show that corporate borrowers are more able to substitute sources of credit after a crisis, and that negative shocks to asset or collateral values have little or no effect on the amount of corporate bond indebtedness. Consistent with theory, we confirm that banking crises have more severe effects on the macroeconomy than do default crises.

I. The Data

Although banking crises in the U.S. have been the focus of many studies, relatively little attention has been given to corporate default crises in the literature. The primary reason for this may simply be that historical data on corporate default crises have not been as readily available to researchers.

Corporate bond markets, however, have historically played almost as important a role in providing capital in the U.S. as the banking sector. To illustrate this, Figure 1 plots the total amount of corporate bonds outstanding during the 1900–2010 period alongside the total amount of bank loans in the U.S. (as reported by Schularick and Taylor (2011)), where both series are normalized by GDP. The sources for all the data used in the paper are described in the Appendix.

As shown, the size of the corporate bond market has rivaled the total amount of bank loans throughout much of the sample period. The ratio of bank loans to GDP averages 33.2 percent during the study period, while the same measure is 19.2 percent for corporate bonds. During the 1933–1940 period, corporate bonds actually represented a larger fraction of GDP than did bank loans. After World War II, however, bank lending grew more rapidly than corporate bonds, and is currently about twice as large a fraction of GDP.

The role of the corporate bond market in raising capital has evolved significantly during the past 150 years. To illustrate this, Table 1 provides some summary information about the number of bond issuers listed in the historical record by industry

or sector. Since the definitions of the categories shown in Table 1 have changed over time in the historical sources, care should be taken in interpreting the growth rates of individual categories.

During the 1866–1890 period, corporate bonds were issued primarily to finance the rapid growth of the capital-intensive railroad and canal industries. Even during this early period, however, the bond markets were used to provide funding for new technology. For example, Western Union Telegraph bonds appear as early as 1867, and American Bell Telephone bonds appear in 1890. Beginning in the 1890s, electric, gas, street railways, and water utilities began to raise significant amounts of capital through the corporate bond market.

By the early 1900s, it became increasingly common for broader classes of industrial firms such as oil, coal, steel, natural resource, and manufacturing firms to issue public debt as well. Familiar names that appear in the historical record include Proctor and Gamble in 1891, General Electric in 1894, American Telephone and Telegraph in 1901, and U.S. Steel in 1902.

During the Great Depression, the corporate bond market also became a major source of capital for financing large real estate projects such as hotels and office buildings as bank financing became less available. For example, bond issues for the Chrysler Building, the Waldorf Astoria, and the Schubert Theater in New York appear in the 1933 *Commercial and Financial Chronicle*. Interestingly, it was not until the 1970s that banks and other financial firms began to raise significant amount of funds in the corporate bond markets.[5]

In this paper, we make use of an extensive data set that we have recently constructed to study the effects of major crises in the corporate bond markets on the macroeconomy (see Giesecke, Longstaff, Schaefer, and Strebulaev (2011)). Specifically, the data set includes the annual percentage default rates for all U.S. nonfinancial corporate bonds during the 1866–2010 period along with estimates of the annual growth rates in the corporate bond market for much of this period. The data set is composed of both handcollected data extracted from historical financial records such as the *Commercial and Financial Chronicle* as well as tabulated data from a variety of sources including Hickman (1953, 1958, 1960), Friedman and Schwartz (1963), Atkinson (1967), Homer and Sylla (1991), and Moody's Investors Service (2011). Note that while industry sources provide data on corporate default rates dating back to 1970 (and some limited data back to 1920), our data set extends the historical record on corporate defaults by nearly a century. Furthermore, our default rates are value-weighted because they are based on the outstanding par amount of corporate bonds that default each year. Thus, our value-weighted average default rates differ from the default rates provided by industry sources which are typically issuer weighted. This

[5]See Giesecke, Longstaff, Schaefer, and Strebulaev (2011) for a discussion of the history of the U.S. corporate bond market.

distinction is important since smaller firms are more likely to default, potentially inflating issuer-weighted default rates.[6] The advantage of value-weighted default rates is that it reflects the loss rates of a representative bond investor.

Figure 2 plots the annual U.S. corporate bond default rate from 1866 to 2010. There are clearly many years in which the U.S. capital markets suffered heavy losses as the result of widespread corporate bond defaults. The maximum default rate during the study period is 16.25 percent. The average default rate is 1.52 percent and the median default rate is 0.55 percent.

It is interesting to observe that there are a number of firms that have defaulted more than once during the sample period. For example, the worst "repeat offender" in the sample is the Seaboard Air Line Railway which either defaulted or underwent a corporate reorganization six times during the study period in 1905, 1908, 1921, 1928, 1939, and 1944. Another example is the Chicago, Peoria, and St. Louis Railway that defaulted a total of five times in 1893, 1898, 1906, 1914, and 1919. These examples illustrate that, as is often the case in sovereign debt markets, corporate debt issuers are frequently able to return quickly to the capital markets after a default or reorganization.

To contrast the effects of corporate default crises with those of banking crises, we use a variety of sources to identify banking crises in the U.S. during the 1870 to 2008 period. These sources identify the following years as U.S. banking crises: 1873, 1884, 1893, 1907, 1930–1933, 1984–1991, and 2007–2008. Table A1 in the Appendix lists the sources for these dates. Following Schularick and Taylor (2011), we construct an indicator variable that takes value one for banking crisis years, and zero otherwise. Finally, the other macroeconomic and financial variables used in the study are also described in the appendix.

II. Corporate Default Crises

As a working definition of a corporate bond market crisis, we characterize a crisis as a set of consecutive years during which the default rate is in excess of 2.5 percent, which is roughly five times the median default rate. While there are many other possible ways of defining corporate default crises, this approach at least has the virtue of simplicity. We note that the results are very robust to how a default crisis is defined.[7]

[6]That smaller firms are more likely to default follows from the evidence that issuer-weighted default rates tend to be much higher than value-weighted default rates. See the discussion in Giesecke, Longstaff, Schaefer, and Strebulaev (2011).

[7]For example, we also use alternative thresholds of corporate default crises in which the default rates are in excess of 1.5 percent, in excess of 2.0 percent, etc. The results

Furthermore, the results are very similar when we simply use the annual default rate in the analysis rather than using an indicator variable to identify specific crisis periods.

Table 2 provides summary statistics for the 13 corporate default crises identified during the study period. As shown, there have been extended crises in which corporate capital markets were battered by severe levels of default. For example, more than 50 percent of all outstanding bonds in the U.S. defaulted during the 1871–1879 period as many railroads found themselves overextended in the wake of their rapid expansion during the post Civil-War era. The second most-severe crisis during the 1891–1896 period resulted in more than 25 percent of all bonds defaulting. Surprisingly, the corporate default crisis during the Great Depression was only the third most-severe crisis in terms of total defaults, and only the sixth most-severe crisis in terms of average default rate.

Table 2 also shows that the average length of a corporate default crisis is 2.69 years, and the median length is 2.00 years. This contrasts starkly with the average length of 1.48 years for the 31 NBER-defined business downturns during the 1865–2010 period. Thus, while default crises are less frequent than business downturns, they are almost twice as persistent.

On the other hand, corporate default crises appear to occur more frequently than banking crises. Schularick and Taylor (2011) (as well as the other sources listed in Table A1 of the Appendix) identify seven different banking crises in the U.S. during the 1870–2008 period. In total, these banking crises cover about 13 percent of the 1870–2008 period. This is roughly consistent with Reinhart and Rogoff (2009) who argue that the U.S. has spent 18 percent of the time from 1800 to 2008 in a banking crisis. In contrast, our definition implies that the U.S. spent about 24 percent of the time from 1866 to 2010 in a corporate default crisis.

To provide some sense for the relation between the different types of crisis periods, we compute the correlation of indicator variables that take value one during a corporate default crisis and one during a banking crisis, respectively, and zero otherwise. The correlation between the corporate default indicator and the banking indicator is only 0.04. This low correlation suggests that a corporate default crisis is a distinct phenomenon from a banking crisis. As one has to be cautious about interpreting simple correlations, however, we will proceed with a more in-depth analysis of the data in subsequent sections.

Although not shown, we also investigate whether there is a significant lead/lag relation between corporate default and banking crises. In essence, we test for potential contagion effects. The results indicate, however, that there is little or no lead/lag relation between the two types of crises.

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are very similar to those we report.

III. Credit Substitution

As discussed, one possible explanation for why banking crises might lead to more severe consequences for the macroeconomy than corporate default crises could be the credit channel mechanism. In particular, shocks to the banking sector may accelerate economic downturns as small and midsized bank borrowers face restricted access to credit. On the other hand, large corporate bond issuers might be able to find alternative sources of credit after a shock to the capital markets. Thus, differences in the macroeconomic effects of the two types of crises might be attributable to heterogeneity in the ability of firms to substitute sources of credit.

To explore this issue, we use a VAR framework to look for evidence of credit substitution after corporate default and banking crises. Specifically, we examine the effects of crises on subsequent growth in the amount of bank loans and corporate bonds outstanding. The results from the analysis are reported in Table 3. Note that while each VAR is estimated as a three-equation specification, only the results for the equation with the indicated dependent variable are reported for each of the VAR specifications. Similarly, for the other VAR specifications reported in the paper.

Not surprisingly, the results show that when a banking crisis occurs, the growth rate of bank loans declines significantly the next year. Similarly, a corporate bond market crisis results in a significant decline in the growth rate of the corporate bond market the subsequent year. A number of economic mechanisms can be put forward to explain such a relationship. For example, a negative shock to asset values increases the propensity of corporate bond crises, and at the same time drives firms further away from refinancing, resulting in a lower growth rate of the bond market (Strebulaev (2007)). In any case, these results illustrate that financial crises are typically associated with credit contractions.

Turning to the issue of credit substitution, the results illustrate that there is an important asymmetry between the two types of crises. In particular, a corporate default crisis results in a significant increase in the growth rate of bank loans in the second subsequent year. In fact, the growth in bank loans in the second year more than offsets the decline in bonds. This result is consistent with a scenario in which large firms are able to turn to bank lending as an alternative source of credit after a crisis in the corporate bond market. This result also parallels Ivashina and Scharfstein (2010) who show that while most types of bank lending declined during the recent financial crisis, there was a significant increase in the amount of commercial and industrial loans provided to large corporate borrowers in the wake of the Lehman default crisis. They show that this increase in commercial and industrial lending was due largely to large corporations drawing on their existing banking lines of credit as the capital markets seized up after the defaults/reorganizations of Lehman, AIG, Fannie Mae, Freddie Mac, etc. In contrast, there is no evidence of credit substitution effects after

a banking crisis. In summary, the results support the view that the credit channel mechanism described by Bernanke (1983) may be present in banking crises, but not in default crises.

IV. The Role of Collateral

The earlier discussion suggested that collateral may play a much smaller role in the corporate bond market than it does in the banking sector. To explore this possibility, we estimate VAR specifications in which we examine the effects on lending activity of shocks in two important asset classes: housing and the stock market. There are several reasons for focusing on these two asset classes. For example, real estate and securities have often been used as collateral in secured lending transactions. In addition, historical data is available for stock returns and housing values for most of our study period. While there are other types of assets that may be used as collateral in bank lending, we note that these two asset classes together represent a major portion of the total amount of assets in the economy.[8] The stock returns are based on the CRSP value-weighted index while the housing returns are based on the nominal housing index reported in Shiller (2005). The results are reported in Table 4.

As shown, there is a highly significant relation between the growth rate of bank lending and the stock market return during the previous year. In particular, negative stock market returns are associated with a decline in bank lending during the subsequent year. The t statistic for the lagged stock market return is in excess of seven. Similarly, there is a significant (at the ten percent level) relation between changes in housing values and the growth rate of banking lending the next year. The positive sign of the coefficient implies that declines in housing values map into lower subsequent availability in bank credit or a reduction in demand. These results are consistent with standard collateral-based macroeconomic models such as Kiyotaki and Moore (1997), which imply that bank lending may decrease precipitously in the wake of a major declines in collateral values.[9]

In contrast, Table 4 shows that there is no relation between stock market and

[8]To illustrate the importance of these two asset classes, we observe that the value of household real estate represented 21.66, 26.76, and 22.74 percent of total household wealth in the years 1950, 1980, and 2010, respectively (based on Federal Reserve Board Flow of Funds Data (Release Z.1)). Similarly, the value of corporate equity and mutual fund holdings represented 11.85, 8.71, and 18.21 percent of total household wealth in the same three years, respectively.

[9]Note also that Kiyotaki and Moore (1997) illustrate the collateral channel mechanism using the example of real estate values.

housing returns and the subsequent growth rate in corporate bonds outstanding. This result, of course, is not all that surprising given that the vast majority of corporate bonds are issued on an uncollateralized basis. Thus, corporations are typically able to obtain credit on the basis of their future cash flows rather than being limited to their current asset holdings. Nevertheless, confirming that there is little link between corporate debt issuance and the values of major asset classes is important since it allows us to attribute differences in the macroeconomic effects of banking and default crises more directly to the role of the collateral channel. In summary, the results lend support to the view that the collateral channel may play a much larger and direct role in banking crises.

V. Macroeconomic Effects

We now turn to the central issue of whether there is a difference in the nature of the macroeconomic effects resulting from banking and corporate default crises. In examining this issue, our approach will again be to use a VAR framework. Specifically, we estimate VAR specifications in which both the corporate default crisis and banking crisis indicator variables are used to forecast macroeconomic variables. By including the corporate default crisis indicator, we can examine the effects of a major disruption in the corporate debt markets. By including the banking crisis indicator, we can also contrast the effects of the two types of crises.

To study the macroeconomic effects resulting from a crisis, we focus on three variables for which data are available from 1870: the annual growth rate in per capita real GDP, the annual growth rate in industrial production, and the annual inflation rate. Table 5 reports the results from the VAR specification using three lagged values of the variables.

The VAR results indicate that corporate default crises do not have any significant effects on output. In particular, the lagged values of the capital market crisis do not forecast subsequent changes in GDP or industrial production. Thus, corporate default crises do not appear to have real effects on the economy. These results are consistent with the implications of the banking crisis literature discussed earlier.

In sharp contrast, banking crises have significant predictive power for both subsequent GDP and industrial production growth rates. In particular, the coefficient for the first lagged banking crisis indicator is significant in both the GDP and industrial production VARs. Furthermore, these significant coefficients are both negative in sign, indicating that banking crises are followed by declines in real output. This latter result is also consistent with the extensive literature documenting that banking crises have large negative effects on the macroeconomy.

As an alternative way of illustrating these results, Figures 3 and 4 plot the impulse

response functions for the response of GDP growth and industrial production to the corporate default and banking crisis indicator variables, respectively. As shown, a corporate default crisis has little or no cumulative effect on either GDP growth or industrial production growth. In contrast, a banking crisis has a significant immediate effect on both of these measures.

The third macroeconomic variable is the annual inflation rate. We again estimate a VAR with three lagged values of the crisis variables and report the results in Table 5 and plot the impulse response functions in Figure 5. As shown, the first lagged value of both the capital market and banking crisis indicators are significant and the coefficients are roughly comparable in terms of their magnitude. In addition, both of these significant values are negative in sign, indicating that the two types of crises tend to be followed by a decline in the inflation rate. These results complement previous research on the monetary effects of banking crises such as Garcia-Herrero (1997), Calomiris and Mason (2003b), Kaehler (2010), Qian, Reinhart, and Rogoff (2011), and others.

VI. Discussion

Bank debt is a major constituent of private debt contracts, while corporate bonds are major examples of public debt contracts. As such, they differ along a number of important dimensions that can help articulate the economic mechanisms that determine why these types of debt and their associated crises have different macroeconomic real effects.

First, bank debt has covenants that are both more numerous and tighter than corporate bonds.[10] Long-term corporate bonds have mainly negative covenants (i.e., covenants preventing firms from engaging in certain types of activities), while short-term corporate debt (such as commercial paper) has very few covenants at all. At the same time, bank (and nonbank private) debt typically also has affirmative covenants (requiring firms to maintain certain financial metrics such as new worth or interest coverage ratio covenants) in addition to negative covenants. The macroeconomic implication is that a relatively small decrease in asset and collateral values is sufficient for firms to violate bank covenants and enter default or renegotiate their obligations, while a large decline in asset values is needed for firms to default on corporate bonds.

Second, bank debt is typically of short-term maturity while corporate bonds typically of long-term maturity. For example, James (1987) reports that the average maturity of U.S. nonfinancial bank debt is 5.6 years, while the average maturity of

[10]For example, see Kahan and Tuckman (1995) who compare covenants of privately placed debt and public bonds.

publicly listed debt (mostly corporate bonds) is 18 years at issuance. Moreover, a large fraction of bank debt is in the form of short-term (less than one year) credit lines. In the earlier part of our sample, it is likely that the maturity of corporate bonds is even larger as they were issued mostly to finance long-duration enterprises such as railroads. In terms of macroeconomic implications, at the time of the crises when a large fraction of bank debt is needed to be refinanced, liquidity becomes an all-important issue. This might lead to snowball effects. As public debt has longer maturity, liquidity issues are much less important.

Third, bank debt is typically collateralized, while public debt is not. Furthermore, bank debt is typically senior to public debt if firms have both bank debt and public debt outstanding. Clearly, this means that a decline in collateral values has a larger impact on firms that have bank debt outstanding than those with public debt.

These three features need to be considered together. Small firms, which predominantly have access to bank debt, face shorter maturities, tighter covenants, and pledge higher collateral than their large counterparts. Thus, they are more likely to be affected by the collateral and related channels, and large firms less effected. This may have important implications for macro policy although it is important to take into account the advantages of bank debt for small firms in terms of long-term relationships and monitoring.

VII. Conclusion

Even though the size of the corporate bond market over the past 150 years is on the same order of magnitude as the bank lending market, we find that banking crises have much graver implications for the macroeconomy than do corporate default crises. Banking crises are followed by decreased output and lower inflation rates. Corporate bond market crises, however, appear to have little or no effect on GDP and industrial output.

These results provide a new perspective on the importance of the banking credit channel in the propagation of economic downturns. Current theory suggests that the reason why banking crises have such large real effects is that small and medium borrowers become credit constrained during a crisis. The flip side of this argument is that a crisis in a credit market that is only accessed by large borrowers should have much smaller effects. Not only do we find that the macroeconomic effects of a corporate default crisis are much less severe, we also find evidence consistent with a scenario in which large borrowers are able to tap the bank lending market when the corporate capital market is experiencing severe distress. Clearly, however, it would be desirable to have additional direct evidence that the differences in results are due to the relative sizes of borrowers in the banking and corporate bond markets.

Similarly, these results also provide support for the importance of the collateral channel in banking crisis. This is because collateral plays a much smaller role in corporate bond markets than in the banking sector. Thus, another reason why banking crises have much larger effects on the macroeconomy than default crises may simply be that the shocks to the value of collateral may restrict the access of bank borrowers to obtain credit, but not the ability of large firms to issue corporate bonds.

Appendix

This appendix briefly describes the variables used in the paper along with the source of the data. In addition, Table A1 lists the sources for the dates identified as banking crisis years.

Corporate Bond Default Rates. The value-weighted U.S. nonfinancial corporate bond default rates from 1866 to 2010 are in an online appendix. The data sources, default definitions, and empirical approach used to construct the time series of corporate bond default rates are documented in detail in the appendix of Giesecke, Longstaff, Schaefer, and Strebulaev (2011).

Corporate Bond Market Crisis Dates. These dates are given in Table 2 of the paper.

Bank Crisis Dates. The dates of banking crises are taken from a variety of sources that are summarized in Table A1 of this appendix.

Corporate Bond Market Growth Rates. Annual growth rates in the notional size of the U.S. corporate bond market are based on three sources. The size of the corporate bond market from 1900–1944 is given in Table A-6 of Hickman (1953) (straight bonds, large issues only). The size of the corporate bond market from 1945–1965 is given in Table 21 of Atkinson (1967). The size of the corporate bond market from 1970–2008 is based on total amount of nonfinancial corporate bonds reported as line 2 of Table L.212 of the Flow of Funds Accounts of the United States reported by the Board of Governors of the Federal Reserve Systems (Release Z.1). Values for missing dates are linearly interpolated from available data for the closest matching dates.

Bank Loan Growth Rates. Annual bank loan growth rates are based on the bank loan data provided in the online data appendix to Schularick and Taylor (2011).

Stock Market Returns. The annual stock market return time series is given by first using the monthly stock return data for 1802–1929 provided by Schwert (1990) to compute annual returns for this period, and then using the Center for Research in Security Prices (CRSP) annual value-weighted stock market return index for the subsequent period.

Housing Values. Percentage changes in housing values for 1890–2008 are based on the nominal home price index data given in Figure 2.1 of Shiller (2005) (updated data available on Robert Shiller's website http://www.econ.yale.edu/ shiller/data.htm).

GDP Growth Rate. Annual GDP growth rates are based on the real GDP estimates for the U.S. for 1870–2008 provided in the online data appendix to Schularick and Taylor (2011).

Industrial Production Growth Rate. Annual industrial production growth rates are based on data from three sources. Industrial production data for the 1865–1915

period are given in Davis (2004). For the 1916–1920 period, we use the total physical production data provided by the NBER as macroeconomic series a01008a. Data for the 1921–2008 period are obtained from the Federal Reserve Board, series G17.

Inflation. Annual inflation rates for 1871–2008 are based on the CPI data given in Chapter 26 of Shiller (2005) (updated data available on Robert Shiller's website http://www.econ.yale.edu/ shiller/data.htm).

Table A1

Dates of U.S. Banking Crises. This table lists the dates of U.S. banking crises. Also listed are the key references documenting these dates.

Years	References
1873	Benmelech and Bordo (2011) Schularick and Taylor (2011) Wicker (2000) Tallman and Wicker (2010)
1884	Bordo, Eichengreen, Klingebiel, and Martinez-Peria (2001) Schularick and Taylor (2011)
1893	Bordo, Eichengreen, Klingebiel, and Martinez-Peria (2001) Schularick and Taylor (2011)
1907	Bordo, Eichengreen, Klingebiel, and Martinez-Peria (2001) Schularick and Taylor (2011)
1930–1933	Bordo, Eichengreen, Klingebiel, and Martinez-Peria (2001) Schularick and Taylor (2011)
1984–1991	Reinhart and Rogoff (2008) Laeven and Valencia (2008) Schularick and Taylor (2011)
2007–2008	Laeven and Valencia (2008) Schularick and Taylor (2011)

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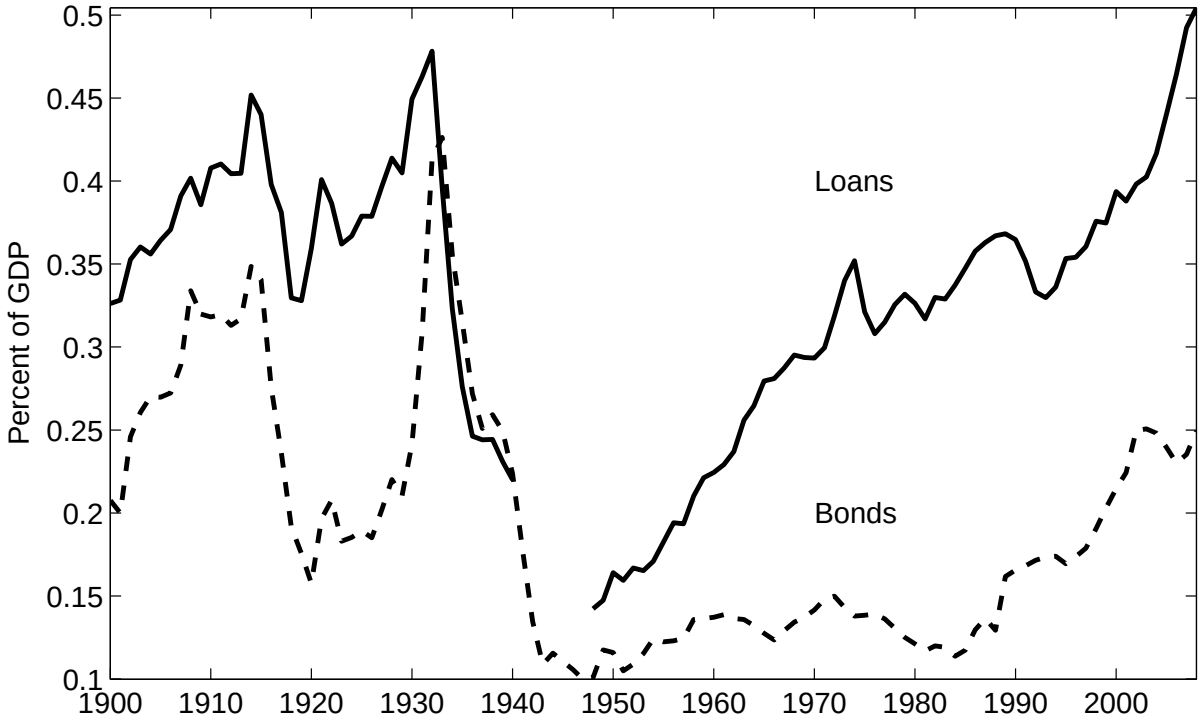

Figure 1. Outstanding Bank Loans and Corporate Bonds as a Fraction of GDP.. This graph plots the ratio of total outstanding bank loans to GDP and the ratio of total outstanding corporate bonds to GDP.

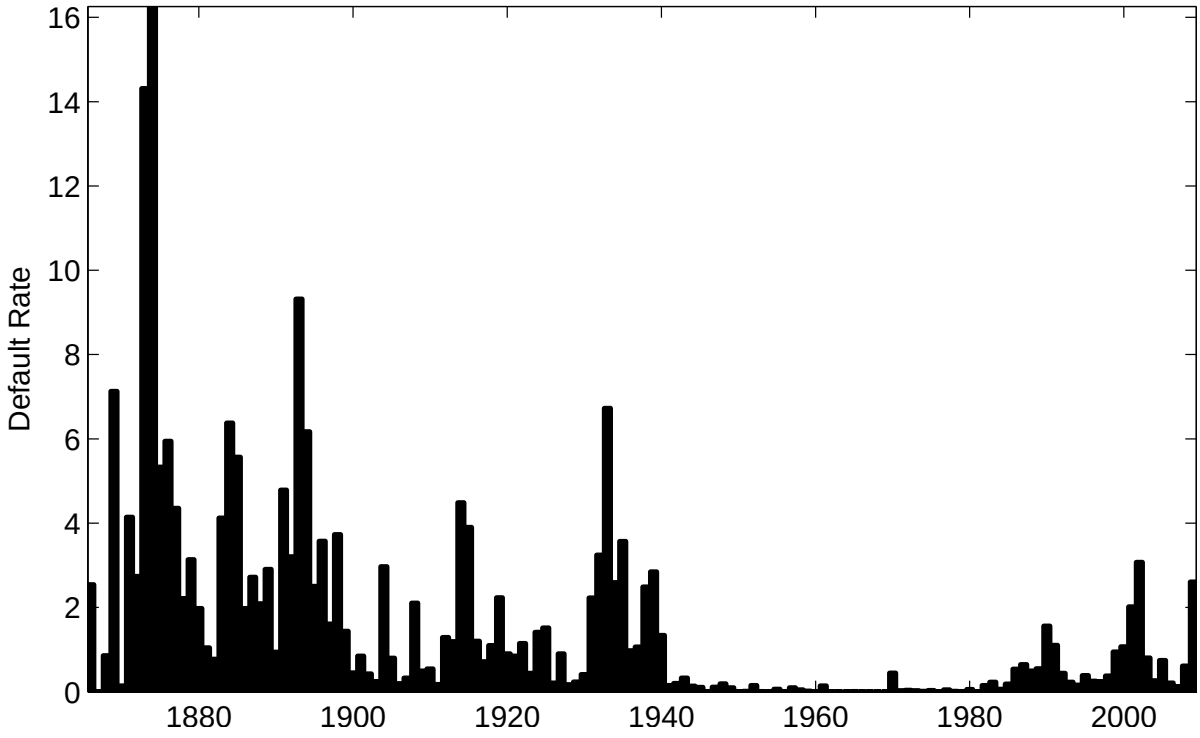

Figure 2. Corporate Bond Default Rates from 1866 to 2010. This graph plots the percentage weighted average default rate for all U.S. nonfinancial corporate bonds.

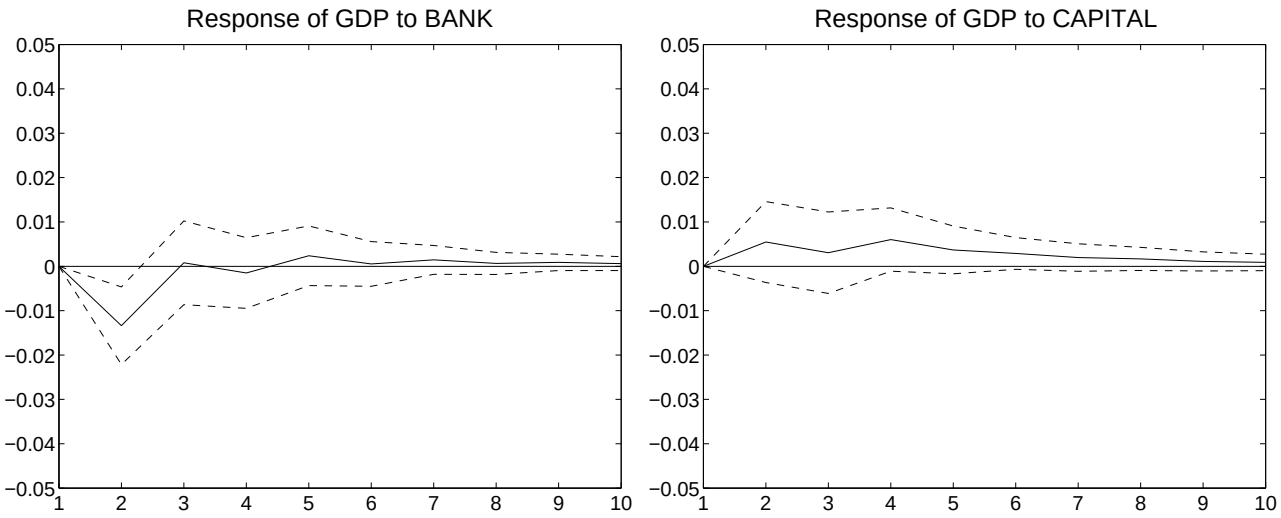

Figure 3. GDP Growth Impulse Response Functions. The left graph plots the impulse response function from a banking crisis. The right graph plots the impulse response function from a corporate default crisis.

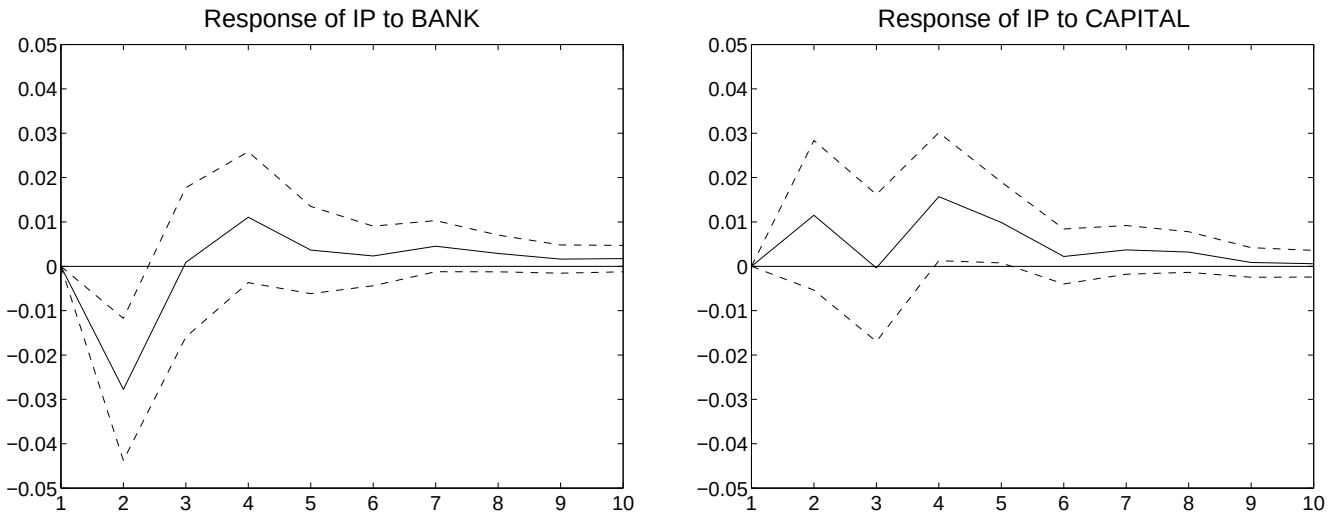

Figure 4. Industrial Production Growth Impulse Response Functions. The left graph plots the impulse response function from a banking crisis. The right graph plots the impulse response function from a corporate default crisis.

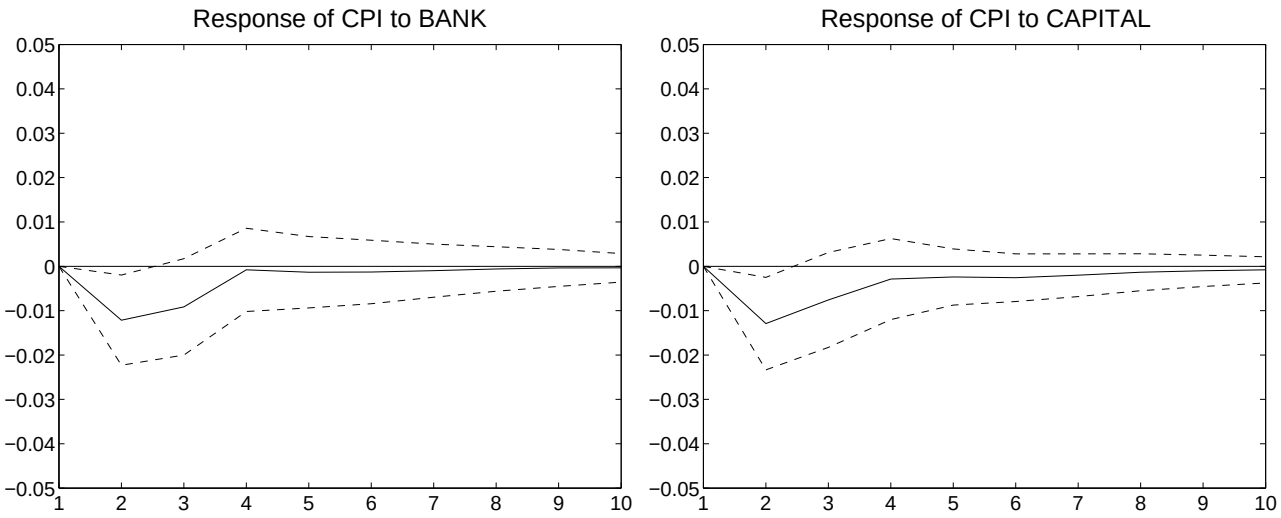

Figure 5. Inflation Rate Impulse Response Functions. The left graph plots the impulse response function from a banking crisis. The right graph plots the impulse response function from a corporate default crisis.

Table 1

Corporate Bond Issuers. This table lists the total number of U.S. nonfinancial corporate bond issuers in the historical records by industry category for the dates shown. The source data is obtained from *The Commercial and Financial Chronicle*, Hickman (1953, 1958, 1960), Atkinson (1967), and Moody's Investor Services, Inc. and are described in the appendix. Because the data are obtained from different historical sources, the definitions of the respective categories may not be fully comparable over time.

Year	Railroad	Canal	Real Estate	Industrial	Utility	Transport	Total
1870	147	14		5	1		167
1880	339	12		11	1		363
1890	369	4		26	3		402
1900	344			193	276		813
1910	331			134	552		1017
1920	306			206	659		1171
1930	574		111	491	930		2106
1940	519		231	680	976		2406
1950	335		137	219	366		1057
1960	121			169	73		363
1970				297	229	89	615
1980				592	285	108	985
1990				1596	337	142	2075
2000				2059	528	126	2713
2010				2520	603	104	3227

Table 2

Corporate Default Crises. This table lists the dates for the corporate bond market default crises during the 1866–2010 sample period where a crisis is identified as a contiguous period during which annual default rates generally exceed 2.5 percent. The annual default rates are the annual percentage default rates of U.S. nonfinancial corporate bonds for the 1866–2010 period. Average default rate denotes the average annual default rate during the corporate default crisis. Total default rate denotes the sum of the annual default rates during the corporate default crisis. The length of crises is measured in years. Default rates are expressed as percentages.

Date of Crisis	Length of Crisis	Average Default Rate	Total Default Rate	Historical Background
1866	1	2.54	2.54	Post Civil War adjustment
1869	1	7.13	7.13	Linking of coasts by railroad
1871–1879	9	6.49	58.43	Railroad boom and crash
1883–1885	3	5.36	16.06	Bank panic of 1884
1887–1889	3	2.57	7.71	Railroad boom and crash
1891–1896	6	4.93	29.95	Bank panic of 1893
1898	1	3.73	3.73	Spanish-American War
1904	1	2.97	2.97	Roosevelt, Panama Canal
1914–1915	2	4.19	8.39	First World War
1932–1935	4	4.03	16.13	Great Depression
1938–1939	2	2.67	5.34	Great Depression
2002	1	3.07	3.07	Dot-com crisis
2009	1	2.60	2.60	Global Financial Crisis
Average	2.69	4.68	12.59	

Table 3

VAR Estimation of the Credit Effects of Corporate Default and Banking Crises. This table reports results from the estimation of the indicated VAR specification. Although each VAR specification includes three equations, only the results for the indicated equations are reported in the table. Thus, each column reports the results from a separate VAR specification. Loan growth rate denotes the annual percentage change in the amount of bank loans. Bond growth rate denotes the annual percentage change in the par amount of corporate bonds outstanding. Bond is an indicator variable that takes value one during a corporate default crisis, and zero otherwise. Bank is an indicator variable that takes value one during a banking crisis, and zero otherwise. Standard errors are reported in parentheses under each VAR coefficient. The superscripts ***, **, and * denote significance at the one, five, and ten percent levels, respectively.

VAR Specification	VAR 1	VAR 2
Dependent Variable Y:	Loan Growth Rate	Bond Growth Rate
Y_{t-1}	0.48271***	0.14312
	(0.1107)	(0.1040)
Y_{t-2}	−0.00070	0.04533
	(0.1165)	(0.0964)
Y_{t-3}	0.24941	0.25774***
	(0.1071)	(0.0918)
Bond_{t-1}	−0.00793	−0.03756**
	(0.0243)	(0.0169)
Bond_{t-2}	0.05389**	−0.00765
	(0.0255)	(0.0185)
Bond_{t-3}	−0.01826	−0.02232
	(0.0247)	(0.0181)
Bank_{t-1}	−0.07652***	0.01555
	(0.0228)	(0.0173)
Bank_{t-2}	0.00309	0.00266
	(0.0299)	(0.0219)
Bank_{t-3}	0.03375	−0.01090
	(0.0263)	(0.0192)
Adj. R^2	0.4104	0.2737
N	100	100

Table 4

VAR Estimation of the Credit Effects of Shocks in Collateral Values. This table reports results from the estimation of the indicated VAR specification. Although each VAR specification includes three equations, only the results for the indicated equations are reported in the table. Thus, each column reports the results from a separate VAR specification. Loan growth rate denotes the annual percentage change in the amount of bank loans. Bond growth rate denotes the annual percentage change in the par amount of corporate bonds outstanding. Rm denotes the annual return on the CRSP value-weighted stock index. Housing denotes the annual percentage change in the Shiller (2005) nominal Standard errors are reported in parentheses under each VAR coefficient. The superscripts ***, **, and * denote significance at the one, five, and ten percent levels, respectively.

VAR Specification	VAR 1	VAR 2
Dependent Variable Y:	Loan Growth Rate	Bond Growth Rate
Y_{t-1}	0.56029***	0.25481**
	(0.1090)	(0.1045)
Y_{t-2}	−0.01239	0.09667
	(0.1158)	(0.0987)
Y_{t-3}	0.11499	0.22106
	(0.0917)	(0.0964)
Rm_{t-1}	0.17797***	0.03045
	(0.0249)	(0.0229)
Rm_{t-2}	0.00528	−0.01966
	(0.0306)	(0.0227)
Rm_{t-3}	−0.03312	0.04253
	(0.0305)	(0.0233)
$\mathrm{Housing}_{t-1}$	0.17426*	0.02257
	(0.0962)	(0.0870)
$\mathrm{Housing}_{t-2}$	0.00576	0.06848
	(0.0971)	(0.0877)
$\mathrm{Housing}_{t-3}$	0.01424	0.05412
	(0.0893)	(0.0789)
Adj. R^2	0.5836	0.2387
N	100	100

Table 5

VAR Estimation of the Macroeconomic Effects of Corporate Default and Banking Crises. This table reports results from the estimation of the indicated VAR specification. Although each VAR specification includes three equations, only the results from the indicated equations are reported in the table. Thus, each column reports the results from a separate VAR specification. Bond is an indicator variable that takes value one during a corporate default crisis, and zero otherwise. Bank is an indicator variable that takes value one during a banking crisis, and zero otherwise. GDP denotes the annual percentage change in real GDP. Industrial production denotes the annual percentage change in industrial production. Inflation denotes the annual percentage change in the consumer price level. Standard errors are reported in parentheses under each VAR coefficient. The superscripts ***, **, and * denote significance at the one, five, and ten percent levels, respectively.

VAR Specification	VAR 1	VAR 2	VAR 3
Dependent Variable: Y	GDP	Industrial Production	Inflation
Y_{t-1}	0.25266***	−0.00076	0.19790**
	(0.0938)	(0.0889)	(0.0930)
Y_{t-2}	0.06082	−0.15844*	0.02440
	(0.0952)	(0.0871)	(0.0951)
Y_{t-3}	−0.10688	0.05884	0.04196
	(0.0877)	(0.0853)	(0.0917)
Bond $_{t-1}$	0.01722	0.03405	−0.03971**
	(0.0141)	(0.0248)	(0.0158)
Bond $_{t-2}$	0.00022	−0.01543	0.00034
	(0.0155)	(0.0272)	(0.0170)
Bond $_{t-3}$	0.00399	0.03755	−0.00048
	(0.0141)	(0.0250)	(0.0156)
Bank $_{t-1}$	−0.05157***	−0.10459***	−0.04657**
	(0.0165)	(0.0295)	(0.0193)
Bank $_{t-2}$	0.04200**	0.05406	0.00506
	(0.0189)	(0.0340)	(0.0213)
Bank $_{t-3}$	−0.00548	0.03752	0.02730
	(0.0178)	(0.0315)	(0.0192)
Adj. R^2	0.1228	0.1187	0.1578
N	138	138	137