Bank Suspensions and Firm Bankruptcies:
Evidence from the Federal Reserve's Formative Years

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Questions

- Did suspensions of banks trigger bankruptcies of firms during the Federal Reserve's formative years, 1900 to 1932?
- Did the commercial credit system possess vulnerabilities of the type envisioned by the founders of the Federal Reserve System?
- Did the Federal Reserve System fix those problems?

Answers

- Questions 1: Yes

  Bank suspensions triggered bankruptcies of bank-dependent firms, particularly small manufacturing and trading firms.

- Question 2: Yes

  Yes, the US financial system had the vulnerabilities envisioned by the founders of the Fed.

- Question 3: No

  No, the founding of the Fed does not appear to have solved the problems with the availability of commercial credit during and after banking panics.

Bank Suspensions and Firm Bankruptcies
VAR with Original Data in Levels, Quarterly 1900 to 1932

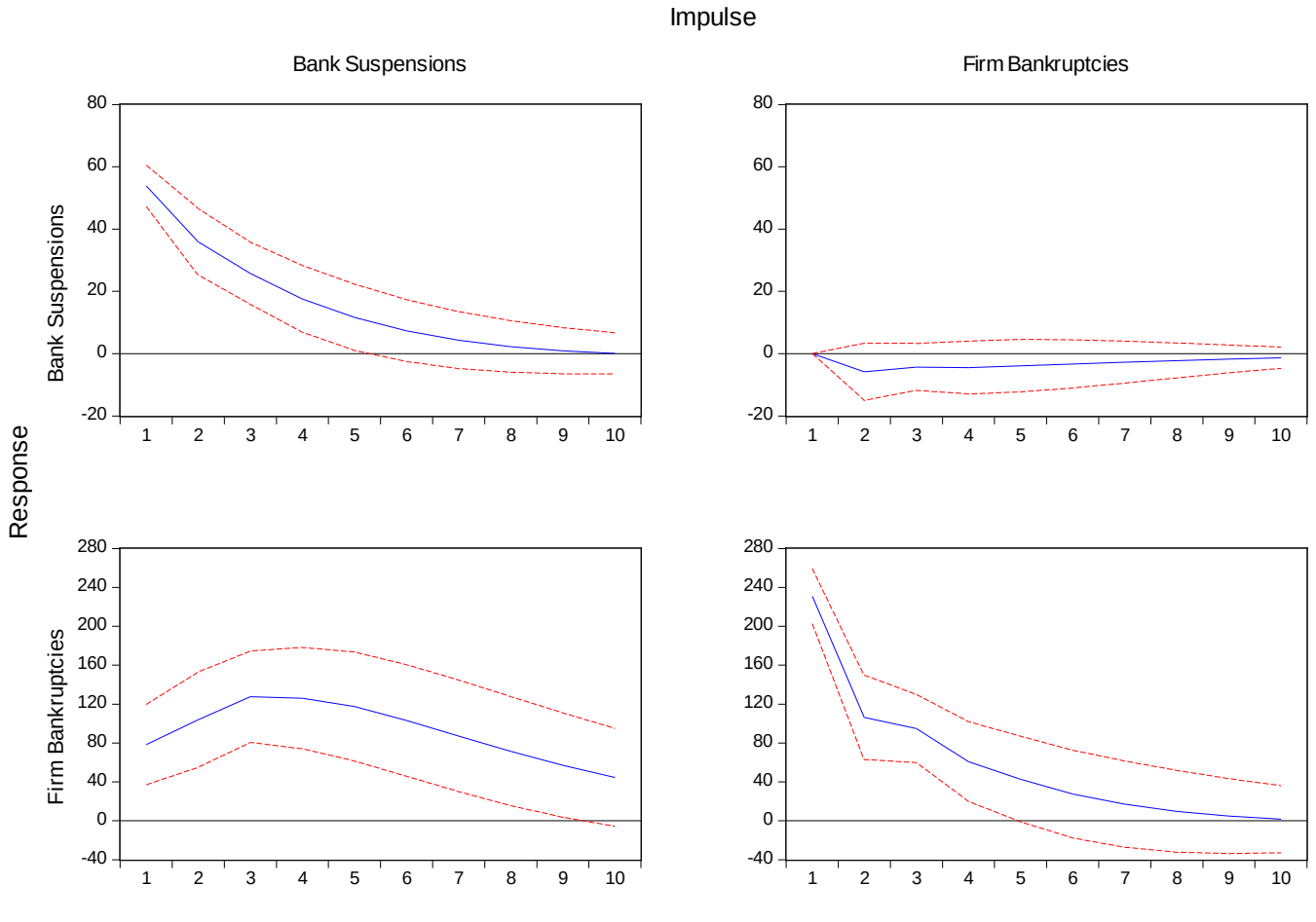


Figure 9

Monthly, 1922 to 1932, Data differenced t-12, 2 Lags

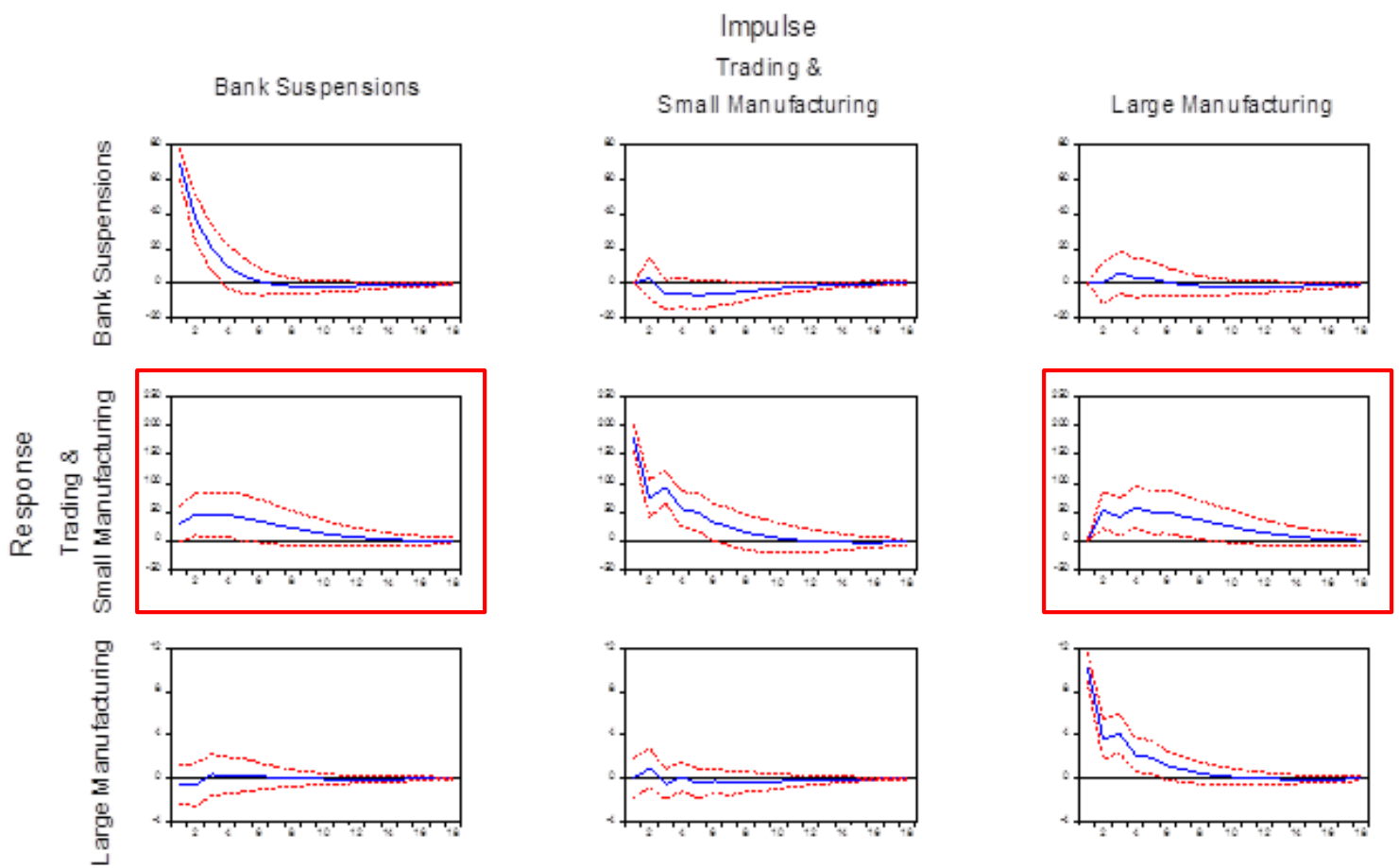
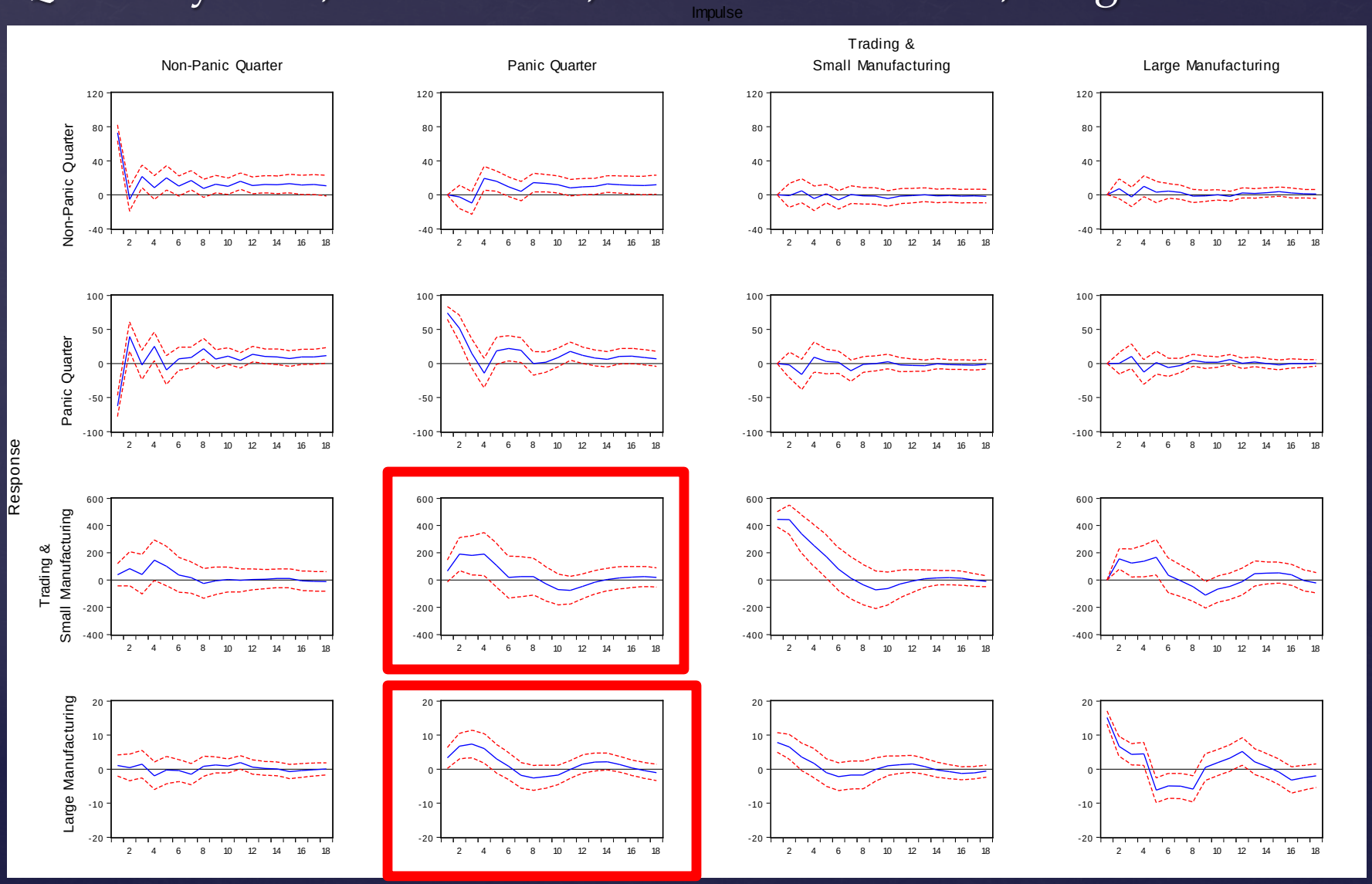
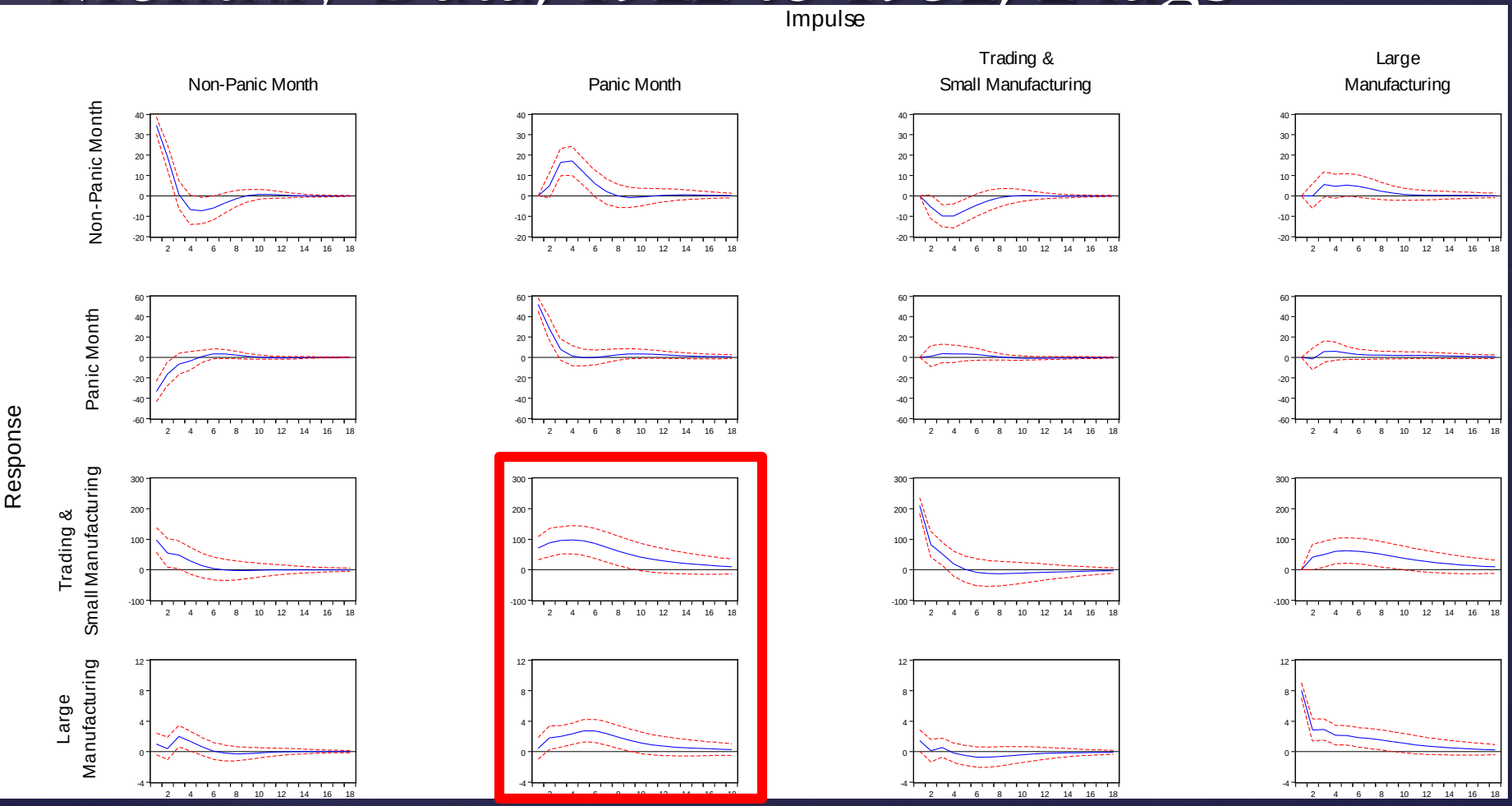


Figure 8:

Quarterly Data, 1900 to 1932, data differenced t-4, 4 lags



Monthly Data, 1922 to 1932, 2 lags



Outline

1. Introduction and Literature
2. Structure of Economy
3. Data
4. Methods
5. Results

Literature

Banks Matter

- History – Bagehot 1873, Gerschenkron 1952
- Theory – Fischer 1933, Diamond-Dybvig 1983, Mankiw 1986
- Empirics – Friedman and Schwartz 1963, Bernanke & Blinder 1988, Bernanke and Gertler 1990
- Early Fed and Great Depression

Banks Don't Matter

- Theory
  - General Equilibrium Models Without Financial Markets
    - Arrow-Debreu 1953 & 1957
  - Composition of Financing
    - Modigliani and Miller 1958
- Empirics – many macro papers written from 1980s through 2010s
- Early Fed and Great Depression

Why the Debate Continues

- Changes in Structure of the
  - Financial system (in 1913 , 1930s, and ~1990s)
  - Use of credit by commerce and industry
  - Bankruptcy and bank failures
- Lack or difficulty of acquiring data
- Lack of convincing identification strategies

Identification for Fed's Early Years

- Time Series
  - Jalil
  - Davison and Ramirez
- Cross Sectional
  - Richardson and Troost
  - Fyrdman, Hilt, and Zhou
  - Ziebarth
  - Calomiris and Mason

Our Essay Overcomes Obstacles

- Focus on Period When Commercial Credit System Clearly Links Banks, Businesses, and Bankruptcies
  - 1900 to 1932
  - Commercial banks and commercial credit
- Analyze New Data
  - Business bankruptcies by month, sector, and branch (Richardson and Gou 2011)
  - Bank suspensions and Panics (Chung and Richardson 2006; Richardson 2006, 2007a, 2007b; Davison and Ramirez 2013; Jalil 2011)
- Identification strategies
  - Treatment and Control (bank dependent and independent firms)
    - Inspired by Gertler and Gilchrist 1992; Kashyap, Stein, Wilcox 1993
  - Exogeneity (Bank panics)
    - Inspired by Romer and Romer, Jalil 2011
    - Richardson and Troost 2009

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Structure of the Economy

Principal Players in Commercial Credit Cycle

- Banks
- Manufacturers
- Trading firms
  - Wholesalers
  - Retailers
- Consumers

Figure 1: Bank Creditors and Debtors

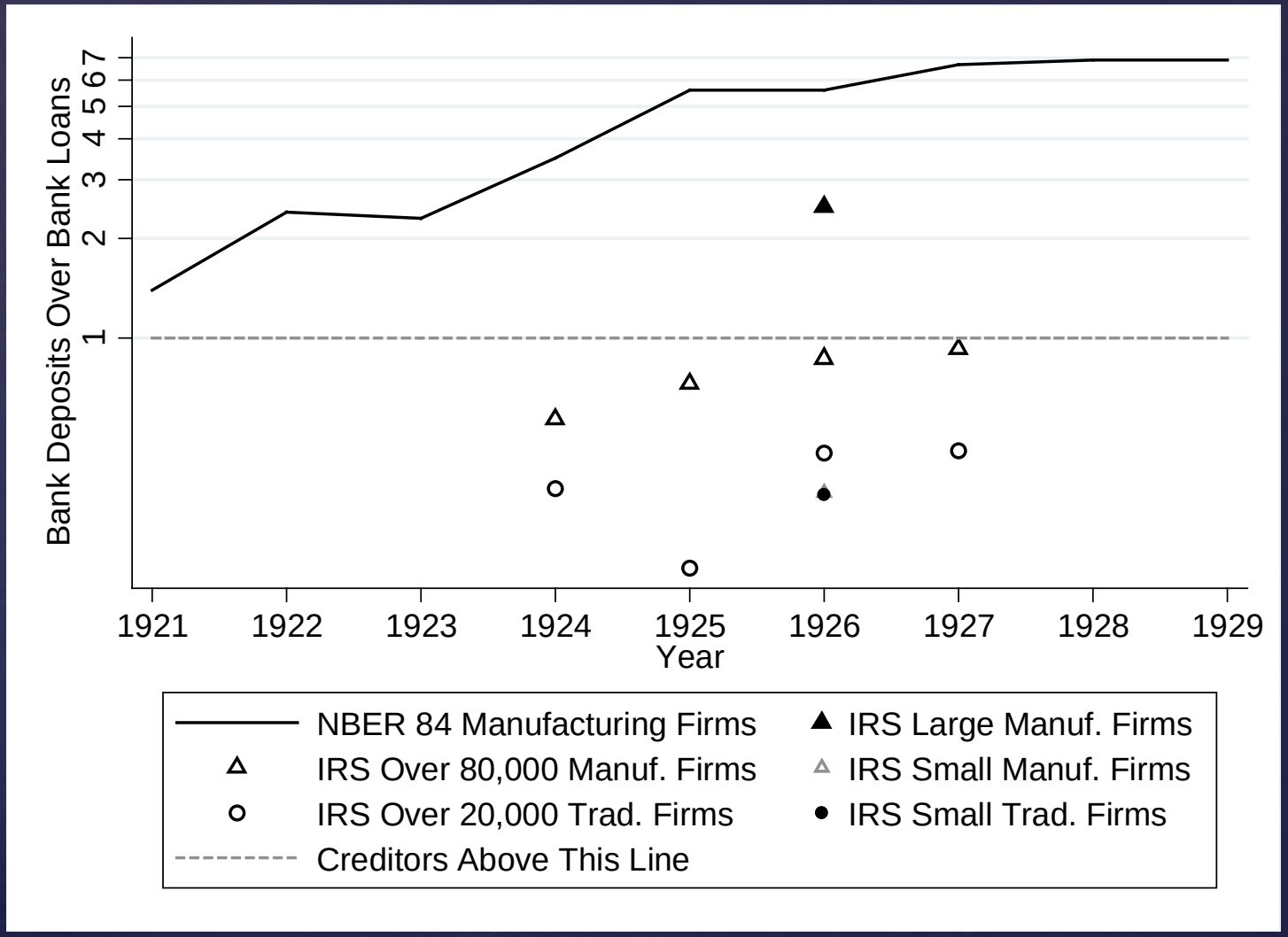

Table 1: Firms and Banks 1926

Size of Net Income	Manufacturers					Traders				
	#	Deposits $ million	Loans $ million	Assets $ million	Ratio D/L	#	Deposits $ million	Loans $ million	Assets $ million	Ratio D/L
No Net Income	32,401	319	1,543	11,813	0.21	34,647	172	890	4,093	0.19
Under $5,000	26,042	98	287	2,115	0.34	42,881	145	428	2,731	0.34
$5,000 to $10,000	6,112	55	126	1,099	0.44	8,543	66	167	1,103	0.40
$10,000 to $50,000	11,723	237	416	4,466	0.57	10,912	198	445	3,239	0.44
$50,000 to $100,000	3,228	153	210	2,884	0.73	1,878	93	188	1,507	0.50
$100,000 to $250,000	2,595	267	260	4,343	1.03	1,014	122	197	1,760	0.62
$250,000 to $500,000	1,039	217	174	3,815	1.25	298	70	78	1,036	0.90
$500,000 to $1,000,000	569	248	157	4,363	1.58	119	52	55	870	0.95
$1,000,000 to $5,000,000	439	584	311	10,321	1.88	91	124	122	1,821	1.02
Over $5,000,000	103	1,347	541	19,511	2.49	12	121	6	981	21.63
Total Firms Reporting Net Income	51,850	3,208	2,481	52,914	1.29	65,748	991	1,684	15,048	0.59
Total All Firms	84,251	3,527	4,024	64,727	0.88	100,395	1,164	2,574	19,140	0.45

Source: IRS (1929) Table 18.

Notes: Columns for deposits indicate the sum of firms' holdings of bank deposits and notes. Loans indicates firms' notes payable to commercial banks. Assets indicates firms' total assets. Ratio D/L indicates deposits divided by loans. Ratios below 1 indicate firms that were net borrowers from banks. Ratios above 1 indicate firms which were net creditors of banks.

Figure 2: Commercial Credit Cycle

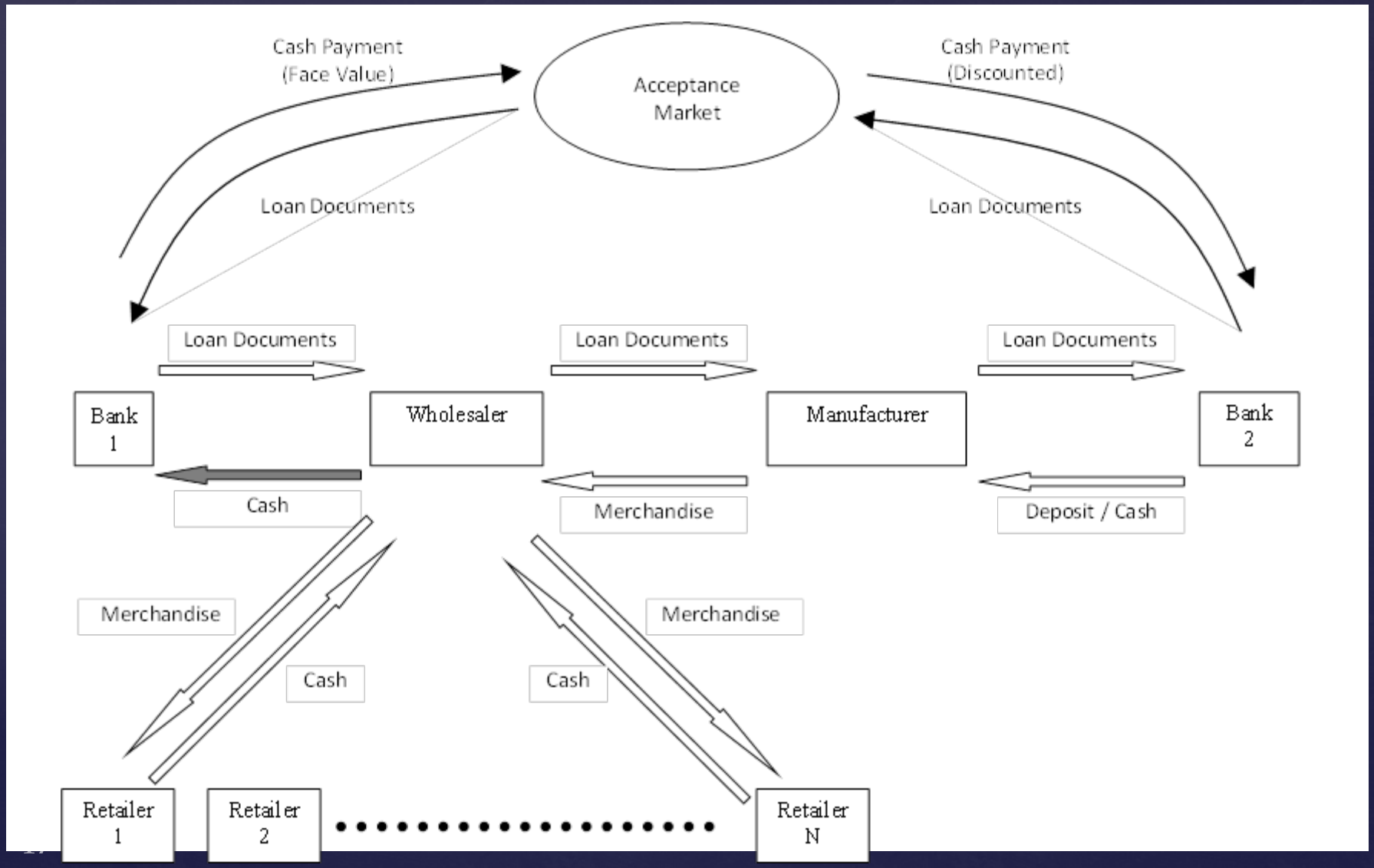

Table 2: Credit Difficulties, NICB, 1932

Size	Employees (1929)	#	Bank Borrower %	Credit Difficulty %	Credit Rating % High + Good	Capital (1932) in $1,000	#	Bank Borrower %	Credit Difficulty %	Credit Rating % High + Good
Very Small	1 to 100	587	65.2	31.1	47.1	< 50	176	71.6	41.3	50.0
Small	101 to 250	872	68.0	21.8	45.7	50 to 500	1,350	67.3	22.2	63.9
Medium	251 to 500	486	55.3	19.0	41.2	500 to 1,000	328	60.0	12.5	72.7
Large	501 to 1,000	239	49.4	10.2	66.7	Over 1,000	1,124	50.5	9.7	80.0
Very Large	Over 1,000	446	48.0	6.5	64.3					
Unclassifiable		808	66.7	26.2	53.2		350	71.7	49.4	11.3
Total						Total				

Notes: Bank borrowers indicates fraction of firms that reported regularly borrowing working capital from commercial banks. Credit difficulty indicates fraction of bank-borrowing firms that report refusals, restrictions, or difficulties acquiring bank credit which they would have received in normal times. Credit rating column indicates the percentage of firms reporting credit difficulties in each size bracket which had either a high or good rating in Dun's credit reports in 1932.

Source. National Industrial Conference Board, 1933, Tables 17, 19, and 37

Table 3: Credit Difficulties, 1934

Typical Source of Capital	Working Capital		Longer Term Requirements	
	% of Firms	% in Credit Difficulty	% of Firms	% in Credit Difficulty
Banks	85.9	43.7	18.1	57.6
Other Financial Institutions	4.1	61.5	1.9	55.6
Bonds or Stocks	2.4	60.2	17.0	61.3
Total # of Firms	4,089		1,877	

Notes: The total number of firms is the number of firms which reported their customary sources of working or long-term capital. Approximately 300 firms reported customarily raising working capital from multiple sources. The categories reported in the table, therefore, need not be mutually exclusive. Other financial institutions include factors, finance companies, trust companies, and merchant creditors. The columns % of firms indicates the percent of respondents indicating that the customarily in 1929 relied on that source for either working capital, longer-term capital, or both. The columns % in credit difficult indicate the fraction of firms that reported using source x for capital y which faced credit difficulties.

Source: Department of Commerce (1935) Table 26

Table 4: Credit Difficulties and Firm Size, Small Manufacturers, 1934

		Percent in Credit Difficulties Weighted by			Percent of Firms in Credit Difficulties whose		
Wage Earners Per Establishment	# Borrow	# of Firms	Value of Manufacturing Production	Annual Pay Roll	Current Ratio > 2	Equity-debt Ratio > 2	Current Ratio > 2 Equity-debt Ratio > 2 Credit Rating High or Good
21 to 50	1364	50.9	41.5	47.3	57.4	60.2	9.2
51 to 100	1715	43.7	35.9	40.2	63.4	66.5	9.2
101 to 250	1308	39.8	33.9	36.7	63.7	68.8	8.3

Notes: Number of borrowers is the total number of firms in survey reporting to be borrowers of working capital. The percent of firms in credit difficulties is the number of firms in credit difficulties divided by the number of firms borrowing working capital calculate without weights (# of firms) or by weighting the firms by value of manufacturing production or annual pay roll. The current ratio is the current assets including cash, inventories, and receivables divided by current liabilities including short-term obligations to banks and all other liabilities payable within 1 year. The equity to debt ratio equals net worth (current assets plus fixed assets minus total liabilities) divided by total liabilities.

Source: Department of Commerce (1935) Tables 7, 8, 9, 10, 19, and 25.

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Data (1)

Project began with this question. What time-series information exists for agents at the core of the commercial credit cycle from the Federal Reserve's formative years?

(1) Bank Suspensions

(2) Firm Bankruptcies

(3) Commercial, Industrial, and Credit Aggregates

(4) Prices

Data: Bank Suspensions

Data measured consistently by professionals from 1890s through early 1930s, with growing information about types and causes of suspensions

Bank Suspension Data

- Original Source: suspensions and receiverships compiled by state and national regulators
- 1929 to 1933
  - Richardson 2006, 2007a, 2007b.
  - Monthly, type of suspension and cause of failure
- 1921 to 1929
  - Chung and Richardson 2007, Davison and Ramirez 2013
  - Monthly, Type of Suspension
- 1895 to 1921
  - NBER Macrohistory Database
  - Quarterly

Data: Business Failures

- Original Source: court filings compiled by R.G. Dun
- Tabulated in Richardson and Gou, 2011. Some series also in NBER Macrohistory Database
- Breakdown
  - All Failures
  - Large/Small Failures
  - Trading/Manufacturing Failures
  - Further cross-tabs and subdivisions available for some periods
  - Monthly, 1895 to early 1930s

Table 6 – Quarterly Data

	Date		Dickey-Fuller					
	Begin	End	Test Statistics	Mean	Median	Max	Min	Std Dev
Bank Suspensions	1895	1936	**-10.8**	89	30	1055	0	137
Business Failures	1895	1940	-2.66	4076	3696	9141	1393	1583
Large[a]	1900	1935	-1.90	117	82	453	12	87
Small[a]	1900	1935	**-3.14**	4086	3698	8688	539	1585
Manufacturing Failures	1895	1940	-2.28	986	927	1932	409	373
Large[a]	1900	1933	-2.71	59	45	210	8	38
Small[a]	1900	1933	-2.44	973	930	1744	141	347
Trading Failures	1895	1940	**-2.93**	2897	2579	6705	874	1131
Large[a]	1900	1935	-2.68	40	22	179	2	38
Small[a]	1900	1935	**-3.53**	2929	2581	6530	352	1173

Note: **Boldface** indicates a rejection of the null hypothesis of stationarity by the DF test at the 5% level. (a) The data starts in First Quarter 1900

Sources: For 1893 to 1920, quarterly data on bank suspensions comes from the NBER Macrohistory database and originates from R.G. Dun and Co., Dun's Review. For 1921 to 1932, Quarterly data on bank suspensions comes from the Federal Reserve Bulletin, September 1937.

Table 7 – Monthly Data

	Date		Dickey-Fuller test statistic		Summary Statistics				
	Begin	End	Begin to End	1922 to 1932	Mean	Median	Max	Min	S Dev
Bank Suspensions	1921	1936	**-12.8**	**-4.90**	78	58	522	12	73
Business Failures	1895	1940	**-3.67**	-0.78	1987	1924	3458	1226	406
Large	1900	1935	-2.31	-2.18	70	59.5	161	33	28
Small	1900	1935	-2.54	-0.81	1917	1837	3302	1175	387
Manufacturing Failures	1895	1940	-2.30	**-3.15**	484	481	688	324	76
Large	1900	1933	**-2.90**	-2.32	33	29.5	76	16	12
Small	1900	1933	-2.11	**-3.33**	451	452	628	297	68
Trading Failures	1895	1940	**-4.01**	-1.06	1394	1323	2595	828	326
Large	1900	1935	-2.70	-2.41	27	23	74	7	13
Small	1900	1935	**-2.89**	-0.74	1375	1290	2529	812	315
Quantity Indices									
Industrial Production	1919	1940	-2.30	-1.61	97	102	127	58	15.7
Retail Trade Index	1919	1939	-1.79	0.33	98.8	101	113	66	11.1
Wholesale Index	1919	1940	-2.13	0.23	90.5	94.4	104.4	63	11.6
Price Series									
Baa-Aaa	1919	1940	-2.10	**-4.37**	1.83	1.46	6.27	0.86	1.1
NY Discount Rate	1914	1940	-1.64	-1.94	3.7	4	6	1.5	.97
NY Acceptance Rate	1917	1940	0.65	-1.67	3.2	3.4	5.5	0.4	1.2
Credit Series									
Dollar Acceptances	1925	1940	-1.87	-1.64	1012	975	1732	555	313
Commercial Paper	1918	1940	-1.64	-0.05	555.5	578	925	81	242

Table 5 – Banking Panics

Year	Quarters	Source and Notes
1907	4	Jalil
1908	1	Jalil
1920	3,4	Jalil
1921	1	Jalil
1926	3	Jalil
1927	1	Jalil
1929	3	Jalil, Richardson
1930	4	Richardson
1931	2, 4	Richardson. Q1 and Q3 near to inclusion.
1932	1	Richardson. Q3 near to inclusion.

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Methods

- Basic Time Series Statistics
  - VAR
  - Granger Causality
  - Impulse Response Functions

- What I'm trying to do. Use intuition of microeconomic identification in macroeconomics.
  - Compare treated and untreated
  - Put exogenous shocks in VAR

Two Variable VAR

$$(1) \quad B_t = \alpha_0 + \alpha_1 B_{t-1} + \cdots + \alpha_l B_{t-l} + \beta_1 F_{t-1} + \cdots \beta_l F_{t-l} + \epsilon_t$$

$$(2) \quad F_t = \alpha_0 + \alpha_1 F_{t-1} + \cdots + \alpha_l F_{t-l} + \beta_1 B_{t-1} + \cdots + \beta_l B_{t-l} + \mu_t$$

B = number of bank Suspensions.

F = number of firm bankruptcies.

t = time {1895.1, ….., 1932.12}

l = lag {usually 2}

Three Variable VAR

$$(3)\quad B_t = \alpha_0 + \alpha_1 B_{t-1} + \cdots + \alpha_l B_{t-l} + \beta_1 W_t + \cdots \beta_l W_{t-l} + +\beta_1 M_t + \cdots \beta_l M_{t-l} + \epsilon_t$$

$$(4)\quad W_t = \alpha_0 + \alpha_1 W_{t-1} + \cdots + \alpha_l W_{t-l} + \beta_1 M_t + \cdots + \beta_l M_{t-l} + \beta_1 B_t + \cdots + \beta_l B_{t-l} + \mu_t$$

$$(5)\quad M_t = \alpha_0 + \alpha_1 M_{t-1} + \cdots + \alpha_l M_{t-l} + \beta_1 W_t + \cdots + \beta_l W_{t-l} + \beta_1 B_t + \cdots + \beta_l B_{t-l} + \mu_t$$

B = number of bank Suspensions.

W = number of bank-dependent firm bankruptcies.

M = number of bank-independent firm bankruptcies

t = time {1895.1, ….., 1932.12}

l = lag {usually 2}

"Causality" Tests

Standard Granger causality tests on coefficients from VAR

- H_0: $\beta_1 = \cdots = \beta_l = 0$,
- H_1: $\beta_1 = \cdots = \beta_l \neq 0$
- $for\ both\ equation\ (1) and\ (2)$

Granger Causality / Block Exogeneity Wald Tests

- H_0: $\propto_1 = \cdots = \propto_l = \beta_1 = \cdots = \beta_l = 0$,
- H_1: $\propto_1 = \cdots = \propto_l = \beta_1 = \cdots = \beta_l \neq 0$
- $for\ both\ equation\ (3) and\ (4)\ and\ (5)$

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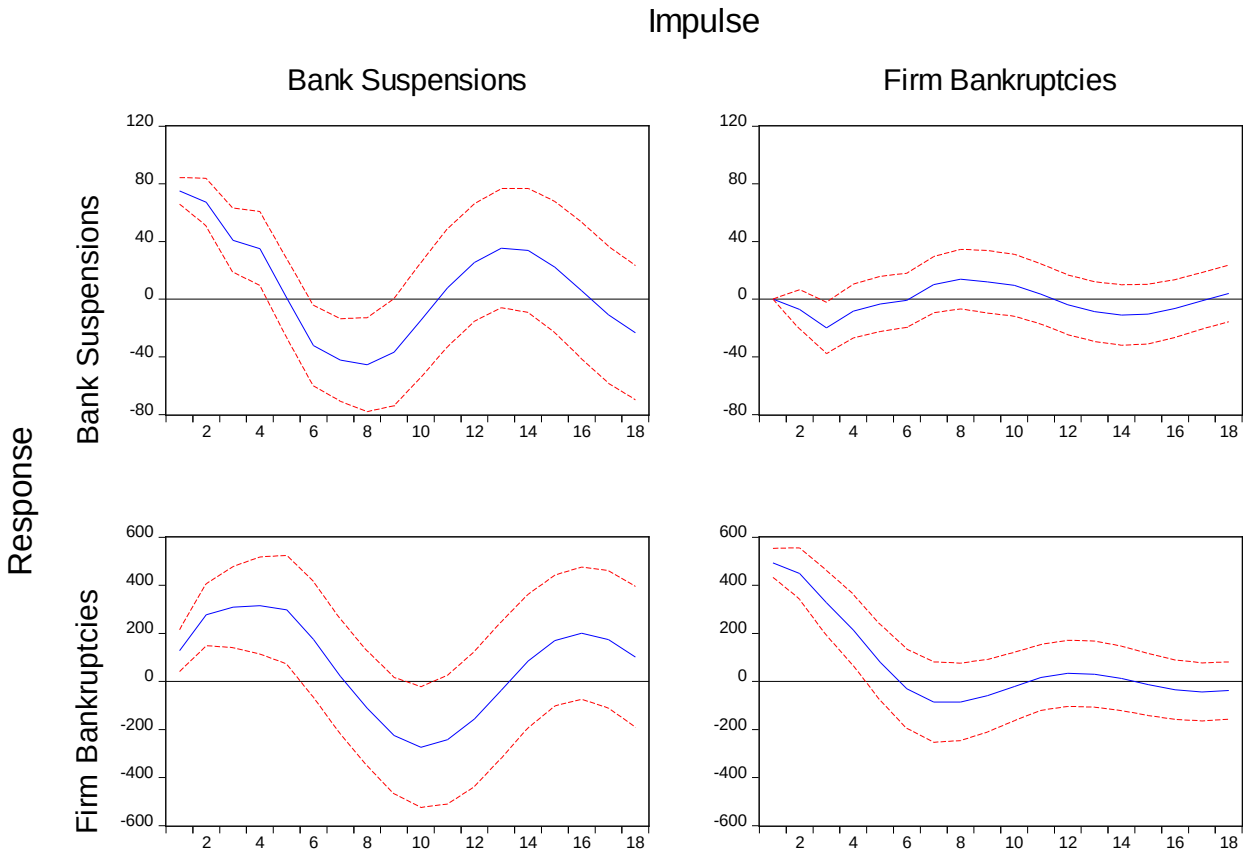
- Results, Quarterly, 1896-1932
- Results, Monthly, 1922-1932

Figure 6
Quarterly, 1900 to 1932, Data differenced t-4, 4 Lags



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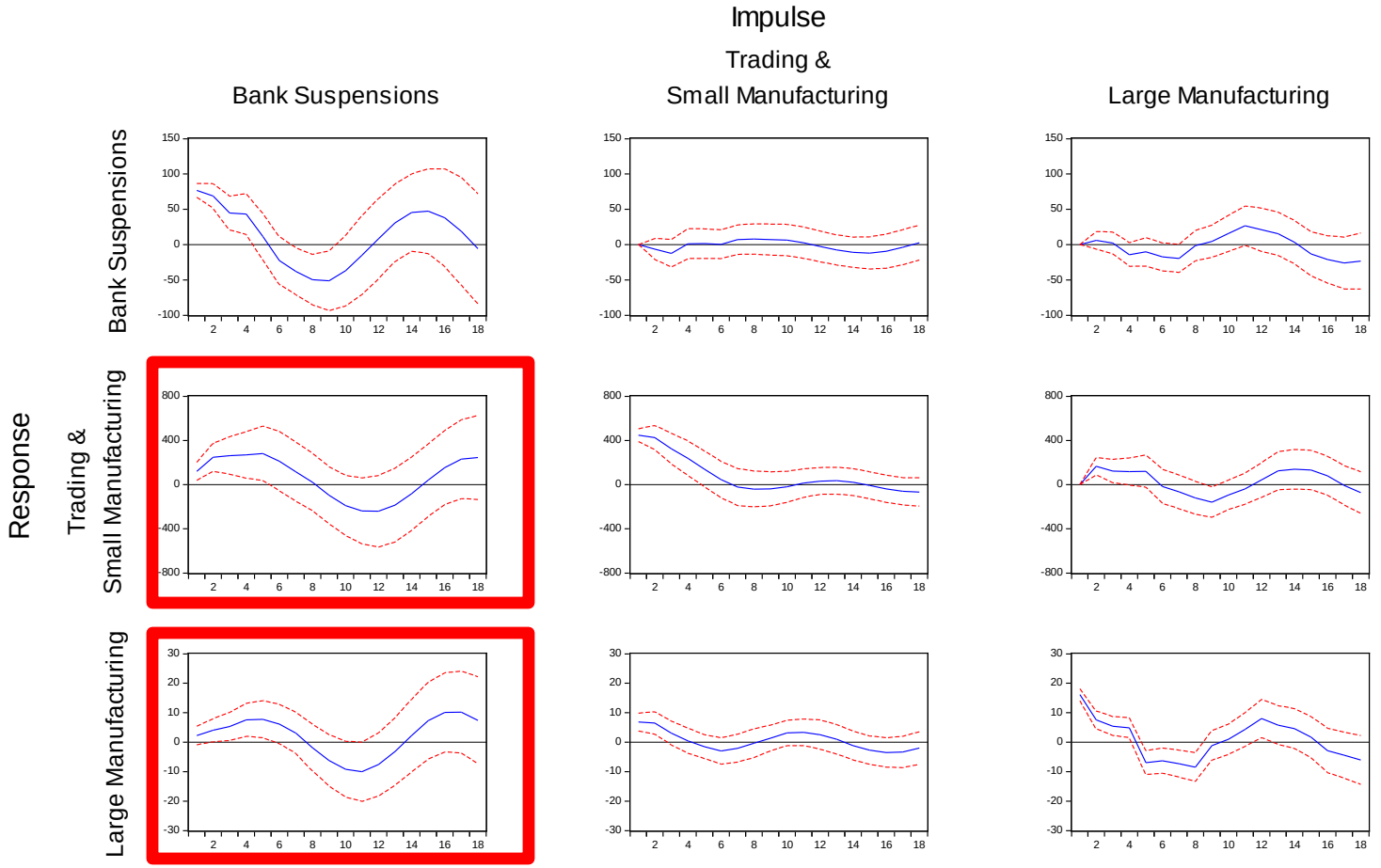
Quarterly, 1900 to 1932, Data differenced t-4, 4 Lags



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Monthly, 1922 to 1932, Data difference t-12, 2 Lags

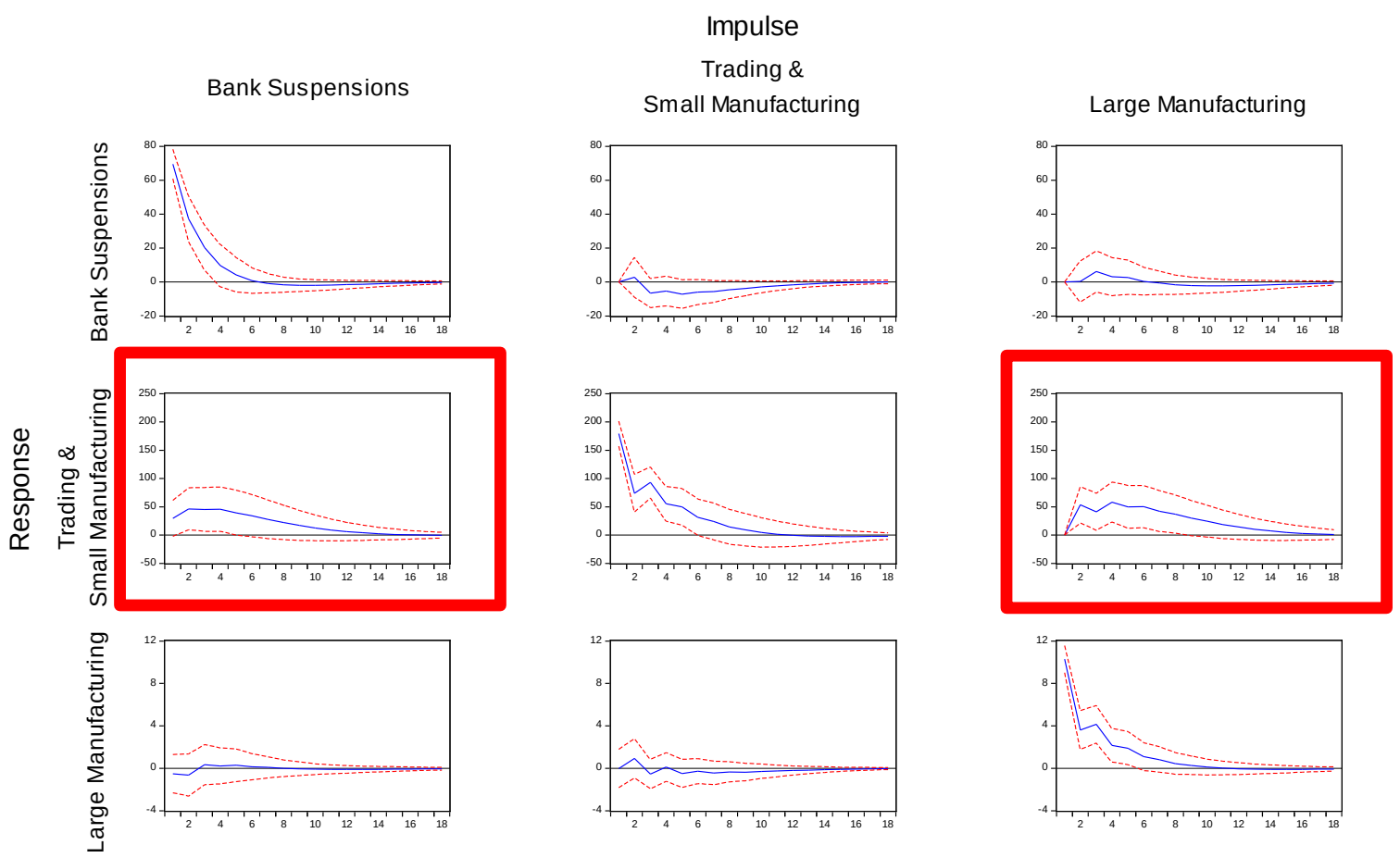

Table 8: Bank Failures Impact on Firm Bankruptcies (numbers)

Variables in System		2	3		3		3	
		All	Trade	Manuf.	Small	Large	Trading & Small Manufacturing	Large Manufacturing
Response of What Type of Firms								
A. t-12 Differenced								
Monthly, 1922-1932	Granger P-Value	0.01	0.06	0.24	0.02	0.18	0.03	0.58
	Variance Decomp	30.5	16.4	9.0	17.4	2.2	13.9	0.6
Quarterly, 1895-1932	Granger P-Value	0.01	0.01	0.47	0.07	0.04	0.08	0.06
	Variance Decomp	54.3	52.2	26.9	43.6	46.5	47.3	46.1
B. HP-Filtered								
Monthly, 1922-1932	Granger P-Value	0.01	0.00	0.08	0.00	0.19	0.00	0.17
	Variance Decomp	29.5	31.2	16.6	28.4	9.0	29.5	4.57
Quarterly, 1895-1932	Granger P-Value	0.00	0.00	0.02	0.00	0.04	0.00	0.00
	Variance Decomp	21.5	22.1	13.3	16.4	13.7	24.6	23.7
D. HP-Filtered, SA								
Monthly, 1922-1932	Granger P-Value	0.24	0.09	0.36	0.12	0.51	0.11	0.96
	Variance Decomp	10.3	18.3	11.8	8.2	0.6	12.8	0.88
Quarterly, 1895-1932	Granger P-Value	0.01	0.00	0.15	0.03	0.00	0.00	0.02
	Variance Decomp	25.6	27.7	14.5	29.5	26.4	31.0	16.9

Table 9: Bank Failures Impact on Firm Bankruptcies (liabilities)

Variables in System		2	3		3		3	
		All	Trade	Manuf.	Small	Large	Trading & Small Manufacturing	Large Manufacturing
Response of What Type of Firms								
A. t-12 Differenced								
Monthly, 1922-1932	Granger P-Value	0.11	0.03	0.85	0.02	0.05	0.05	0.18
	Share of R2	7.7	10.6	0.35	17.2	7.3	10.9	4.1
Quarterly, 1895-1932	Granger P-Value	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	Variance Decomp	68.8	82.3	61.8	66.3	56.1	80.8	46.9
B. HP-Filtered								
Monthly, 1922-1932	Granger P-Value	0.03	0.00	0.14	0.0	0.27	0.0	0.17
	Variance Decomp	10.9	20.7	5.6	17.7	5.6	18.9	4.6
Quarterly, 1895-1932	Granger P-Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Variance Decomp	25.7	30.9	13.0	23.2	15.8	26.6	9.9
D. HP-Filtered, SA								
Monthly, 1922-1932	Granger P-Value	0.78	0.15	0.51	0.04	0.98	0.14	0.70
	Variance Decomp	2.3	8.7	1.2	9.5	0.2	8.9	1.2
Quarterly, 1895-1932	Granger P-Value	0.00	0.00	0.00	0.00	0.01	0.00	0.01
	Variance Decomp	29	36.6	11.4	38.3	21.7	24.4	8.4

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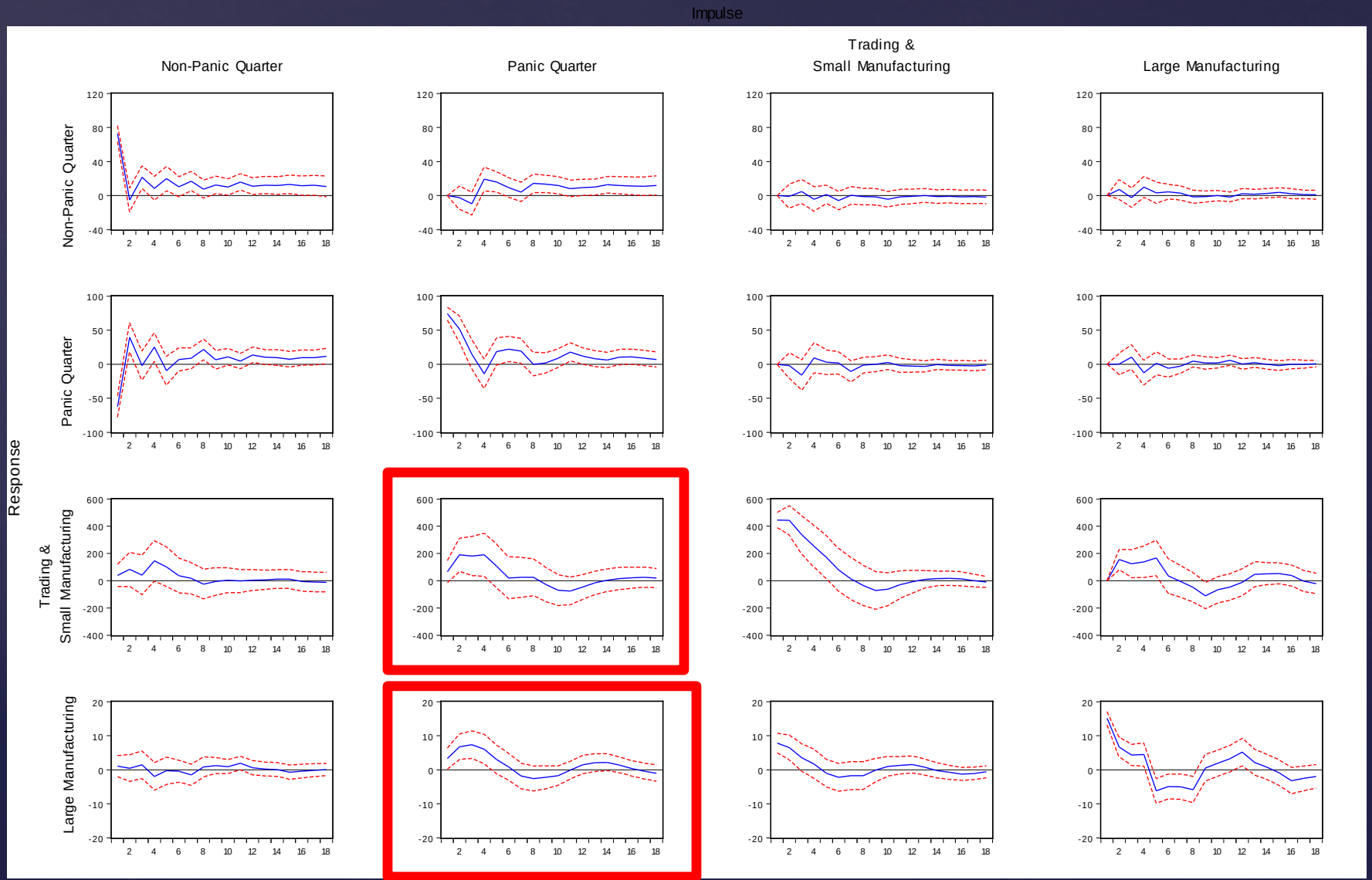


Figure 10

Monthly Data, 1922 to 1932, data differenced t-12, 2 lags

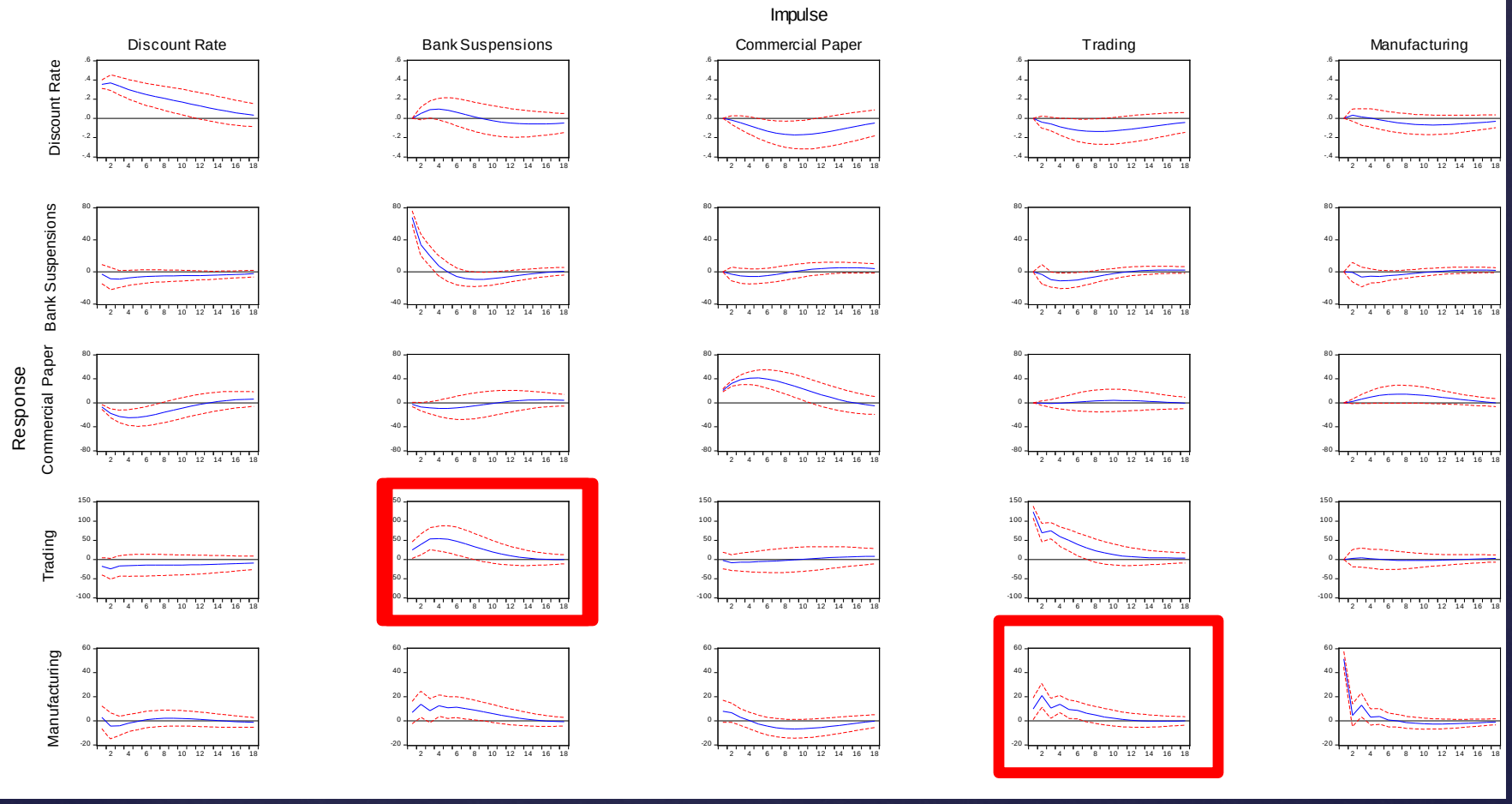


Figure 11

Monthly Data, 1922 to 1932, data differenced t-12, 2 lags

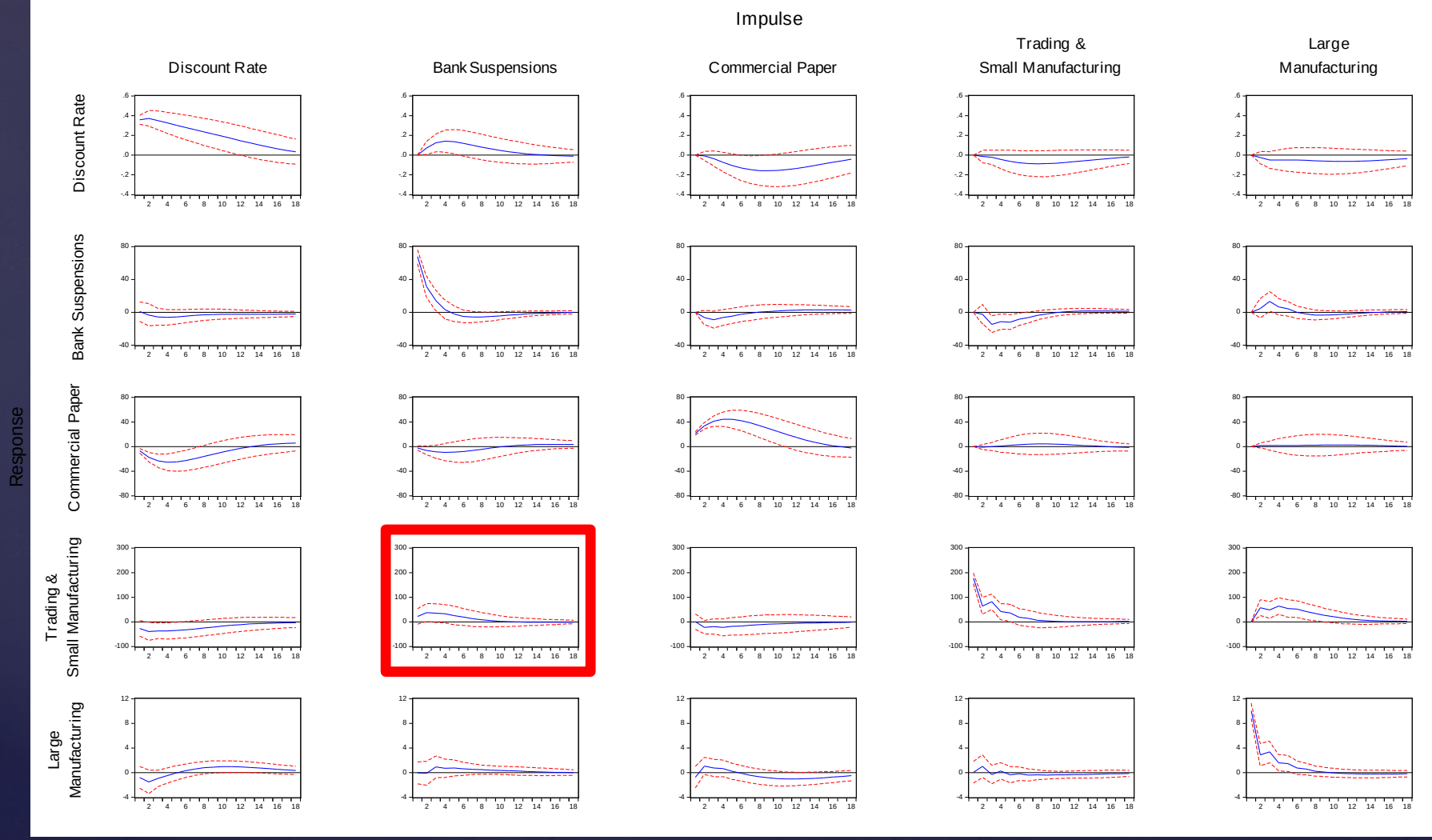


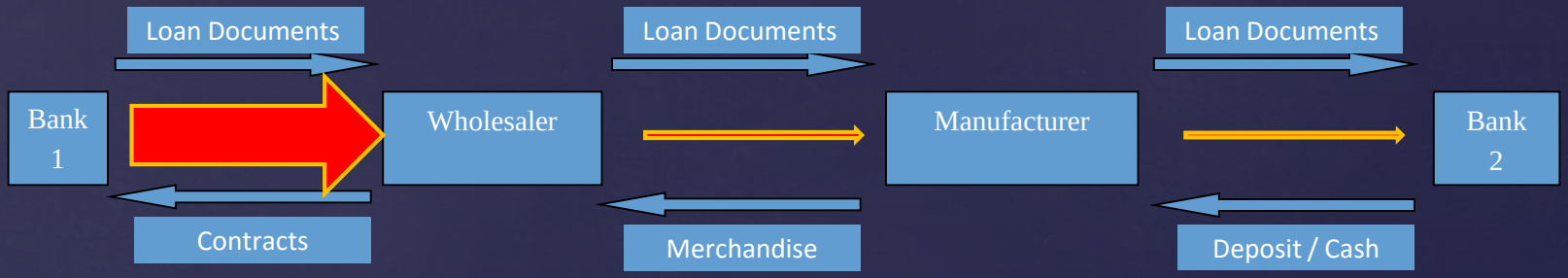
Table 10: Bank Failures Impact on Firm Bankruptcies in Broader Model (numbers)

Variables in System	2	3		3			
Response of What Type of Firms	All	Trade	Manuf.	Small	Large	Trading & Small Manufacturing	Large Manufacturing
A. t-12 Differenced							
Granger P-Value							
Including Discount Rate	0.00	0.02	0.14	0.02	0.15	0.03	0.46
Including Commercial Paper	0.02	0.08	0.19	0.03	0.18	0.07	0.45
Including Discount Rate and Commercial Paper	0.01	0.04	0.14	0.05	0.14	0.11	0.33
Variance Decomp							
Including Discount Rate	30.6	13.5	15.4	12.8	6.54	10.0	3.06
Including Commercial Paper	30.9	16.2	10.0	17.5	2.85	14.1	0.92
Including Discount Rate and Commercial Paper	29.1	13.3	11.1	9.74	3.40	6.50	2.00
B. HP-Filtered							
Granger P-Value							
Including Discount Rate	0.00	0.00	0.06	0.00	0.11	0.00	0.06
Including Commercial Paper	0.14	0.07	0.31	0.01	0.30	0.03	0.19
Including Discount Rate and Commercial Paper	0.07	0.04	0.25	0.00	0.17	0.01	0.09
Variance Decomp							
Including Discount Rate	30.7	31.2	19.7	28.9	11.9	29.3	6.3
Including Commercial Paper	24.4	26.0	12.4	23.8	7.46	25.3	4.3
Including Discount Rate and Commercial Paper	25.1	25.9	13.9	25.1	10.5	24.5	6.6

Table 11: Bank Failures Impact on Firm Bankruptcies in Broader Model (liabilities)

Variables in System	2	3		3			
	All	Trade	Manuf.	Small	Large	Trading & Small Manufacturing	Large Manufacturing
Response of What Type of Firms							
A. t-12 Differenced							
Granger P-Value							
Including Discount Rate	0.05	0.01	0.91	0.00	0.00	0.01	0.00
Including Commercial Paper	0.06	0.05	0.74	0.02	0.02	0.06	0.04
Including Discount Rate and Commercial Paper	0.01	0.03	0.77	0.00	0.00	0.02	0.00
Variance Decomp							
Including Discount Rate	11.6	8.47	0.27	22.3	10.3	14.2	7.66
Including Commercial Paper	8.80	9.98	0.39	19.3	7.66	19.1	5.17
Including Discount Rate and Commercial Paper	13.2	7.87	0.46	18.6	11.4	12.2	8.82
B. HP-Filtered							
Granger P-Value							
Including Discount Rate	0.01	0.00	0.02	0.00	0.13	0.00	0.05
Including Commercial Paper	0.09	0.01	0.09	0.03	0.30	0.03	0.15
Including Discount Rate and Commercial Paper	0.03	0.01	0.02	0.01	0.15	0.01	0.05
Variance Decomp							
Including Discount Rate	14.1	24.7	7.5	22.0	6.9	23.2	5.6
Including Commercial Paper	10.6	21.1	5.8	18.2	5.7	18.4	4.7
Including Discount Rate and Commercial Paper	13.5	23.3	8.02	21.4	6.9	19.8	6.1

Results Compared to the Commercial Credit Cycle



- Suspensions of banks triggered failures of bank-dependent firms.
- Failures of creditors preceded failures of debtors.
- Bank-wholesaler relationship crucial but vulnerable.

Extra Old Slides

Outline

1. Introduction (just finished)
2. Literature
3. Structure of Economy
4. Data
5. Methods

- Results, Quarterly, 1896-1932
- Results, Monthly, 1922-1932

Figure 5: Bank Suspensions and Firm Bankruptcies, VAR with Differenced Data to Remove Trend and Seasonality

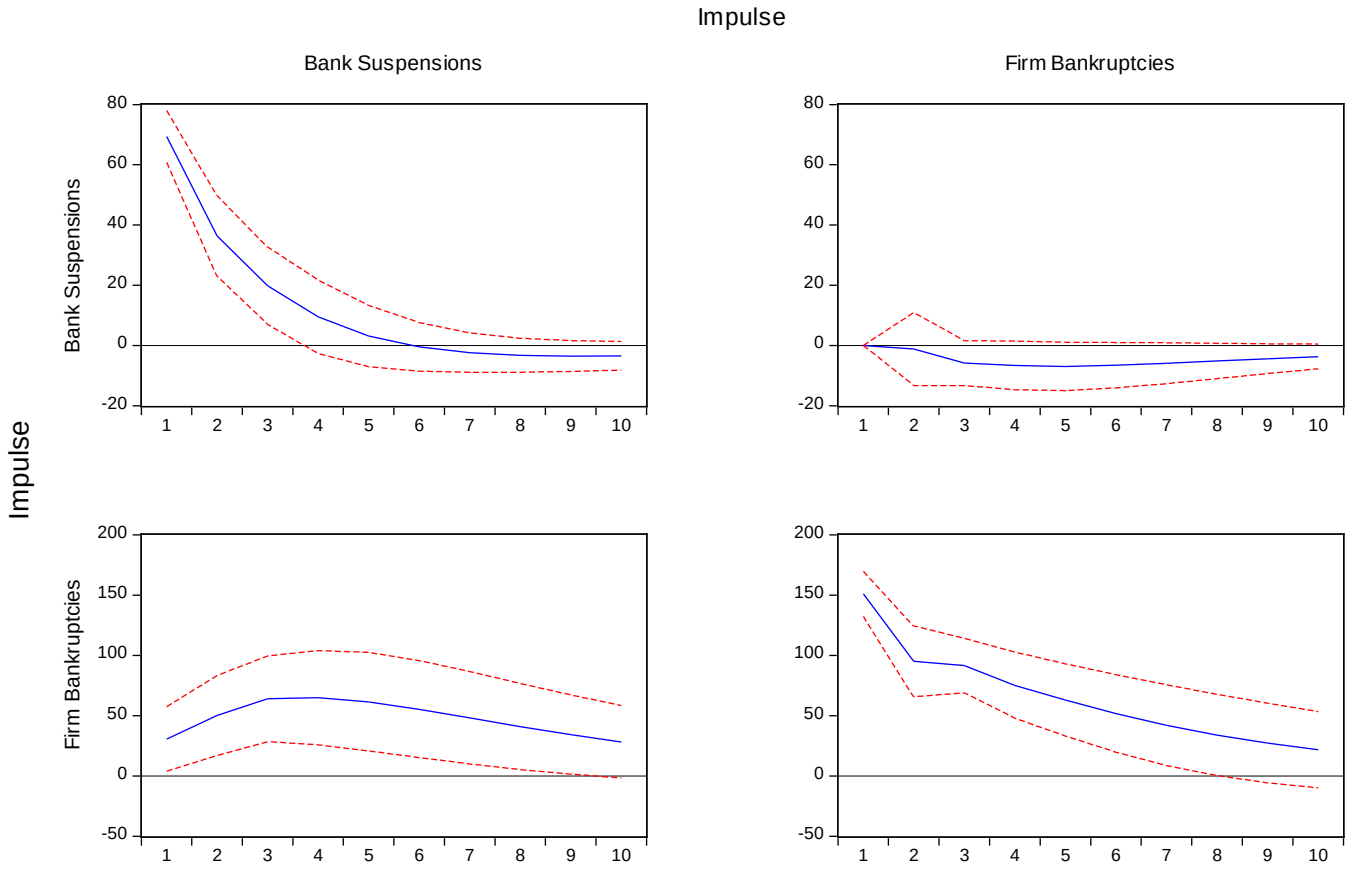


Table 1: Pairwise Granger-Causality Tests: Bank Suspensions and Firm Bankruptcies with Original Data in Levels

	Granger-Causality Test	
	Dependent Variables	
Independent variables	Bank Suspensions	Firm Bankruptcies
A. Levels		
Bank Suspensions		0.00
Firm Bankruptcies	0.42	

	Granger-Causality Test	
	Dependent Variables	
Independent variables	Bank Suspensions	Firm Bankruptcies
B. Differenced		
Bank Suspensions		0.01
Firm Bankruptcies	0.22	

Figure 6: Variance Decomposition Graphs Corresponding to VAR in Figure 5.

Forecasted variable	Bank Suspensions	Firm Bankruptcies
A. Levels		
Bank Suspensions	97.88	2.12
Firm Bankruptcies	53.22	46.77
B. Differenced		
Bank Suspensions	96.14	3.85
Firm Bankruptcies	30.23	69.76

Figure 7. Responses of Bank-Dependent and Bank-Independent Business to Increased Bank Suspensions

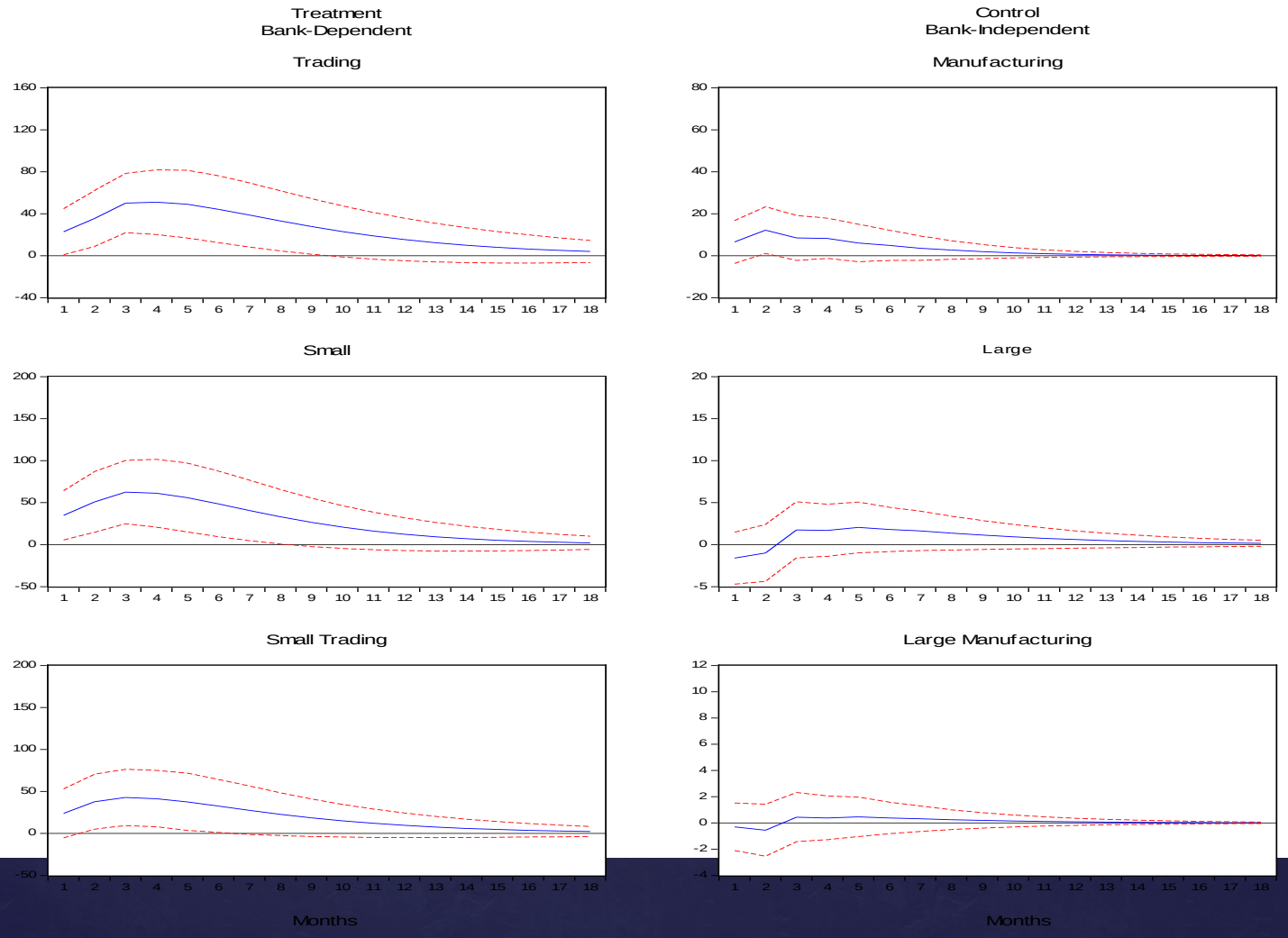


Table 3: Pairwise Granger Causality Tests: Control and Treatment Groups

Null Hypothesis: Bank Suspensions do NOT Granger cause …	F-Stat	P-Val
Trading Firm Bankruptcies	4.65	0.01
Manufacturing Firm Bankruptcies	2.02	0.14
Small Firm Bankruptcies	3.52	0.03
Large Firm Bankruptcies	1.95	0.15
Small Trading Firm Bankruptcies	2.72	0.07
Large Manufacturing Firm Bankruptcies	0.52	0.59

Table ***: Variance Decomposition Table Corresponding to VAR in Figure 7.

Forecasted variable	Own lags	Bank Suspensions
A. Bank-dependent Firms		
Trading Bankruptcies	29.48	70.5
Small Bankruptcies	26.16	73.8
Small Trading Bankruptcies	16.64	83.36
B. Bank-independent Firms		
Manufacturing Bankruptcies	8.11	91.9
Large Bankruptcies	4.5	95.5
Large Manufacturing Bankruptcies	.899	99.1

Figure 9: Bank Suspensions, Trading Bankruptcies, and Manufacturing Bankruptcies: Three Variable VAR.

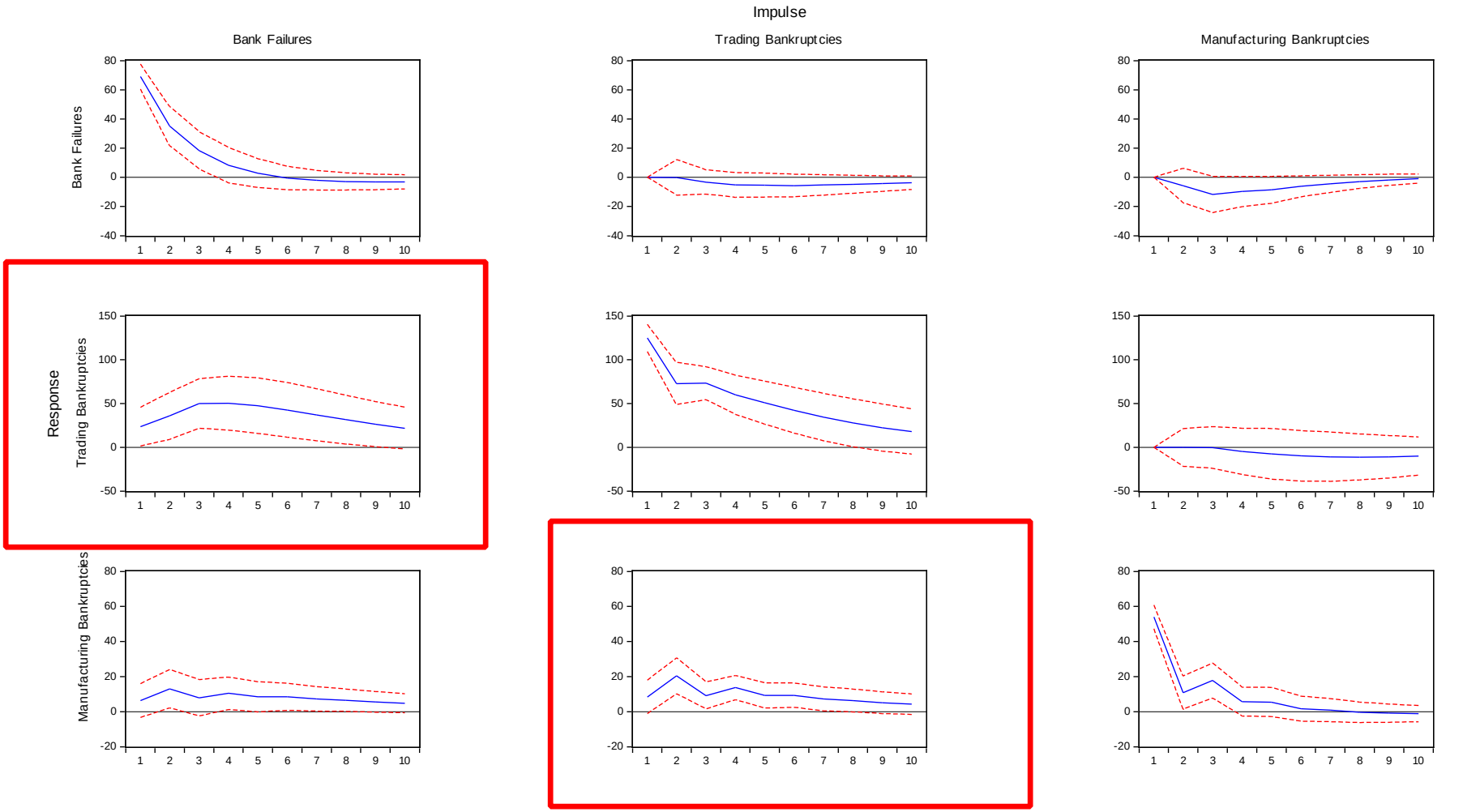


Table 4: VAR Granger Causality / Block Exogeneity Wald Tests, corresponding to the VAR presented in Fig. 9

	Granger-Causality Test		
	Dependent Variables		
Independent variables	Bank Suspensions	Trading Bankruptcies	Manufacturing Bankruptcies
Bank Suspensions		0.01	0.27
Trading Bankruptcies	0.99		0.00
Manufacturing Bankruptcies	0.16	0.99	

Table ***: Variance Decomposition Table Corresponding to the VAR presented in Figure 9

Forecasted variable	Bank Suspensions	Trading Bankruptcies	Manufacturing Bankruptcies
Bank Suspensions	91.5	2.61	5.83
Trading Bankruptcies	27.77	71	1.22
Manufacturing Bankruptcies	13	20.7	66.3

Figure 11: Bank Suspensions, Small Bankruptcies, and Large Bankruptcies: Three Variable VAR.

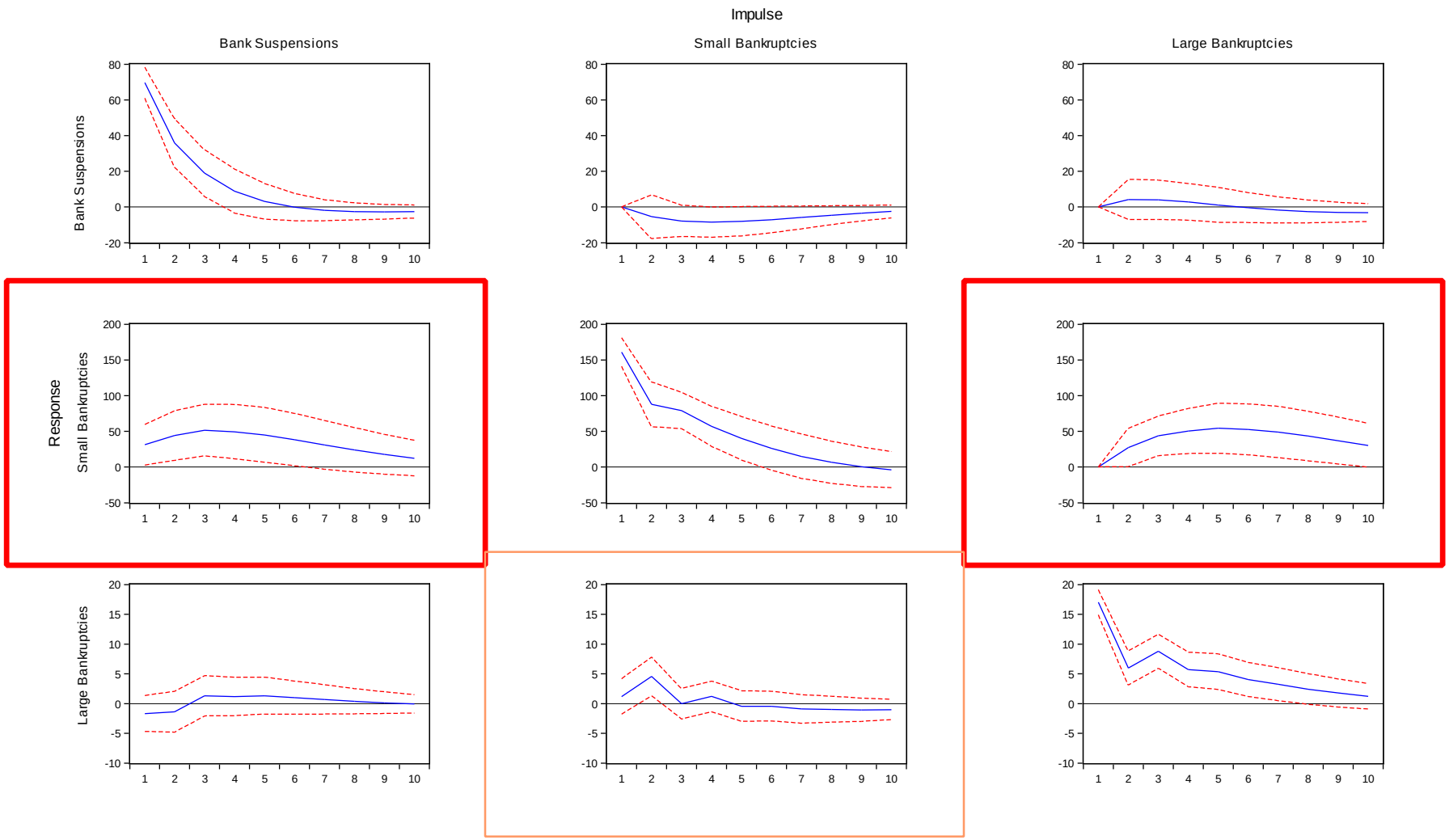


Table 5: VAR Granger Causality / Block Exogeneity Wald Tests, corresponding to the VAR presented in Fig. 10

	Granger-Causality Test		
	Dependent Variables		
Independent variables	Bank Suspensions	Small Bankruptcies	Large Bankruptcies
Bank Suspensions		0.02	0.63
Small Bankruptcies	0.14		0.01
Large Bankruptcies	0.63	0.01	

Table ***: Variance Decomposition Table Corresponding to the VAR presented in Figure 11

Forecasted variable	Bank Suspensions	Small Bankruptcies	Large Bankruptcies
Bank Suspensions	94	5	1
Small Bankruptcies	17.65	59.6	22.77
Large Bankruptcies	2.06	5.2	92.7

Figure **: Discount Rate, Bank Suspensions, Commercial Paper, Trading Bankruptcies, and Manu. Bankruptcies: Five Variable VAR.

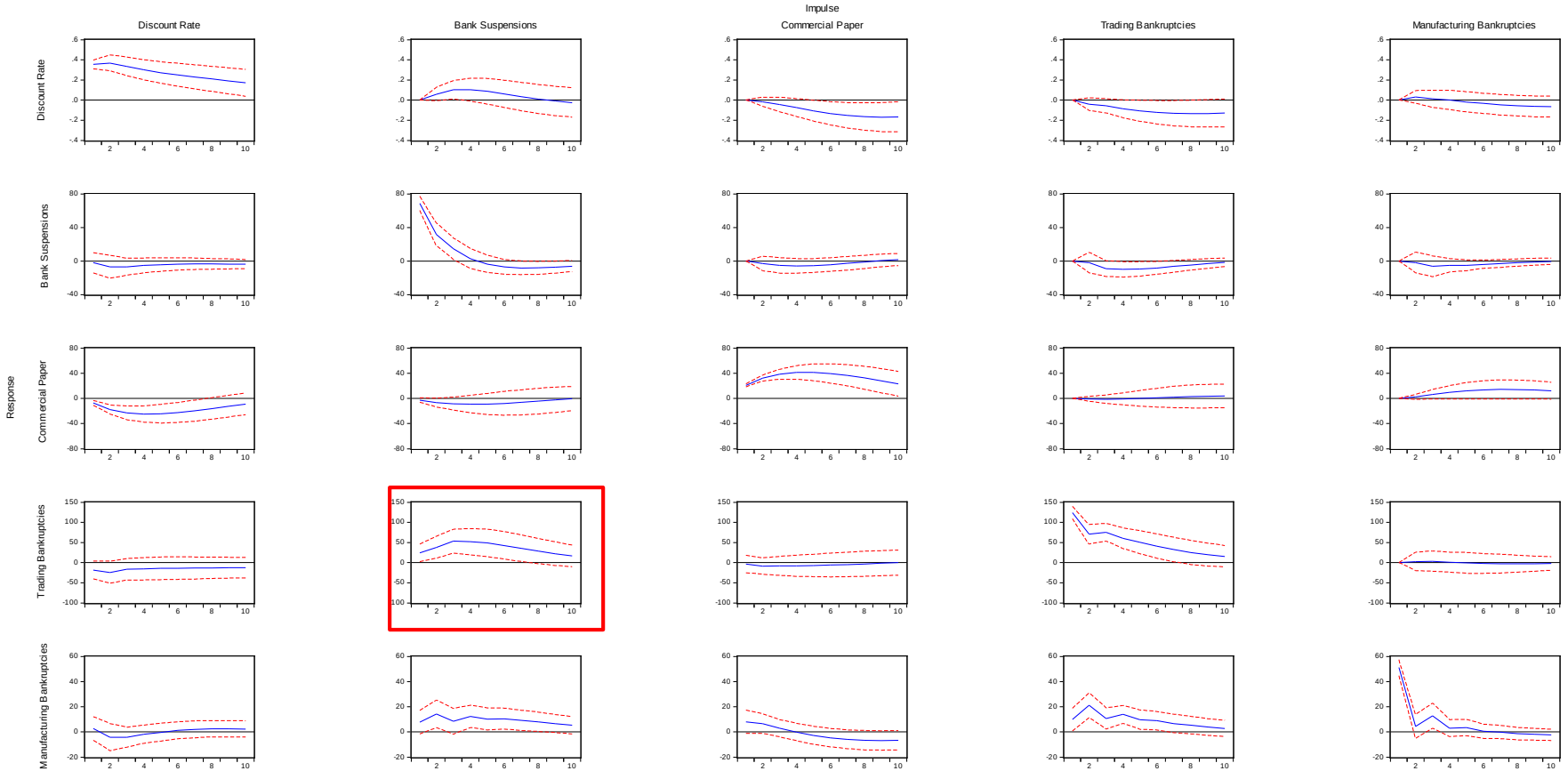


Table 5: VAR Granger Causality / Block Exogeneity Wald Tests, corresponding to the VAR presented in Fig. 10

	Dependent Variables				
Independent variable	Discount Rate	Bank Suspensions	Commercial Paper	Trading Bankruptcies	Manufacturing Bankruptcies
Discount Rate		0.08	0.00	0.31	0.50
Bank Suspensions	0.06		0.41	0.01	0.12
Commercial Paper	0.07	0.29		0.53	0.06
Trading Bankruptcies	0.22	0.39	0.30		0.00
Manufacturing Bankruptcies	0.57	0.68	0.08	0.88	

Figure **: Temporary Bank Suspensions, Terminal Bank Suspensions, Commercial Paper, Trading Bankruptcies, and Manu. Bankruptcies: Five Variable VAR.

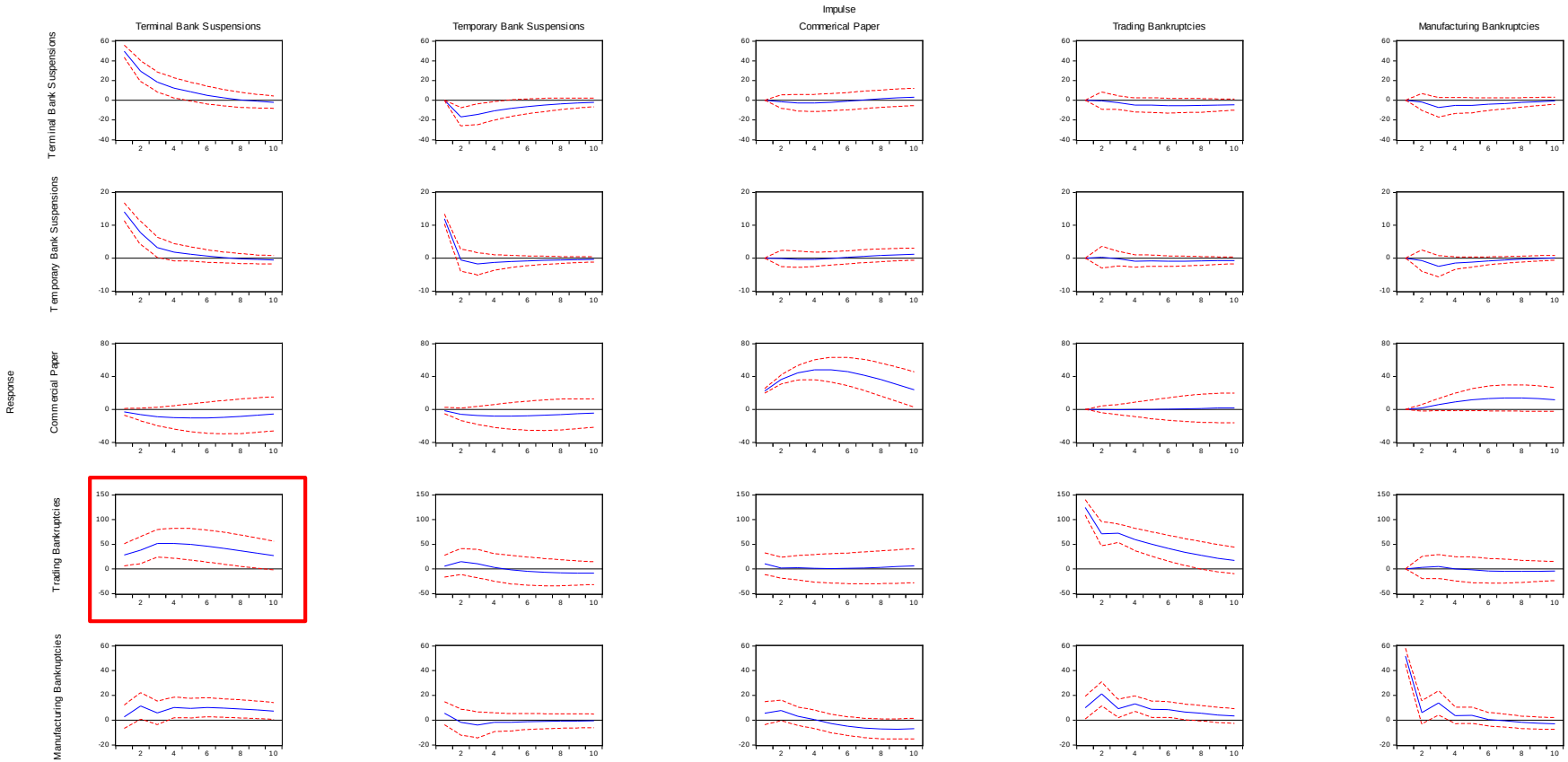


Table 5: VAR Granger Causality / Block Exogeneity Wald Tests, corresponding to the VAR presented in Fig. 10

	Dependent Variables				
Independent variable	Temporary Bank Suspensions	Terminal Bank Suspensions	Commercial Paper	Trading Bankruptcies	Manufacturing Bankruptcies
Temporary Bank Suspensions		0.00	0.15	0.53	0.62
Terminal Bank Suspensions	0.00		0.57	0.62	0.22
Commercial Paper	0.77	0.81		0.85	0.01
Trading Bankruptcies	0.82	0.99	0.59	0.88	0.00
Manufacturing Bankruptcies	0.29	0.24	0.23		

Figure **: Discount Rate, Bank Suspensions, Commercial Paper, Trading Bankruptcies, and Manu. Bankruptcies: Five Variable VAR, Four lags.

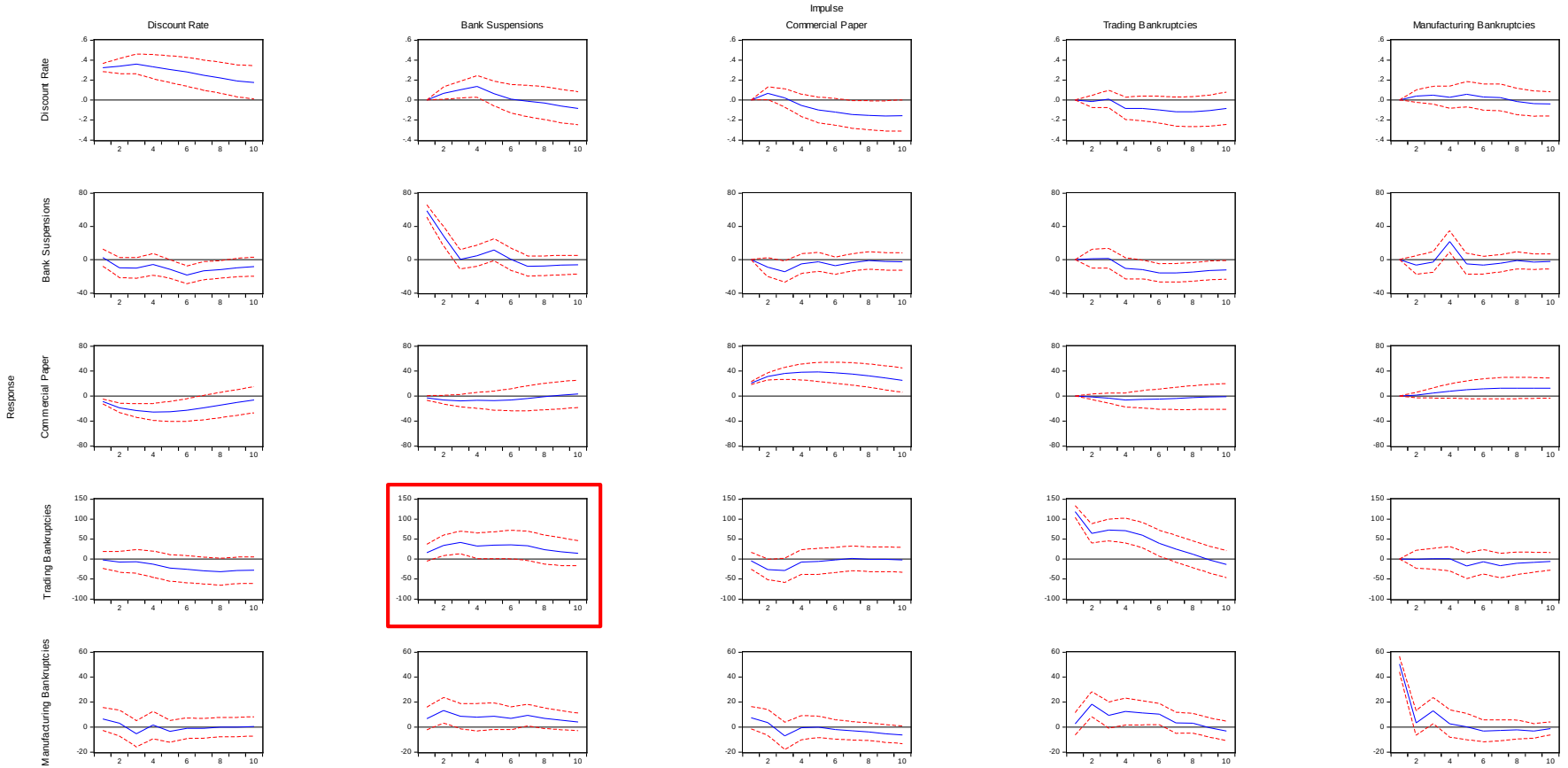
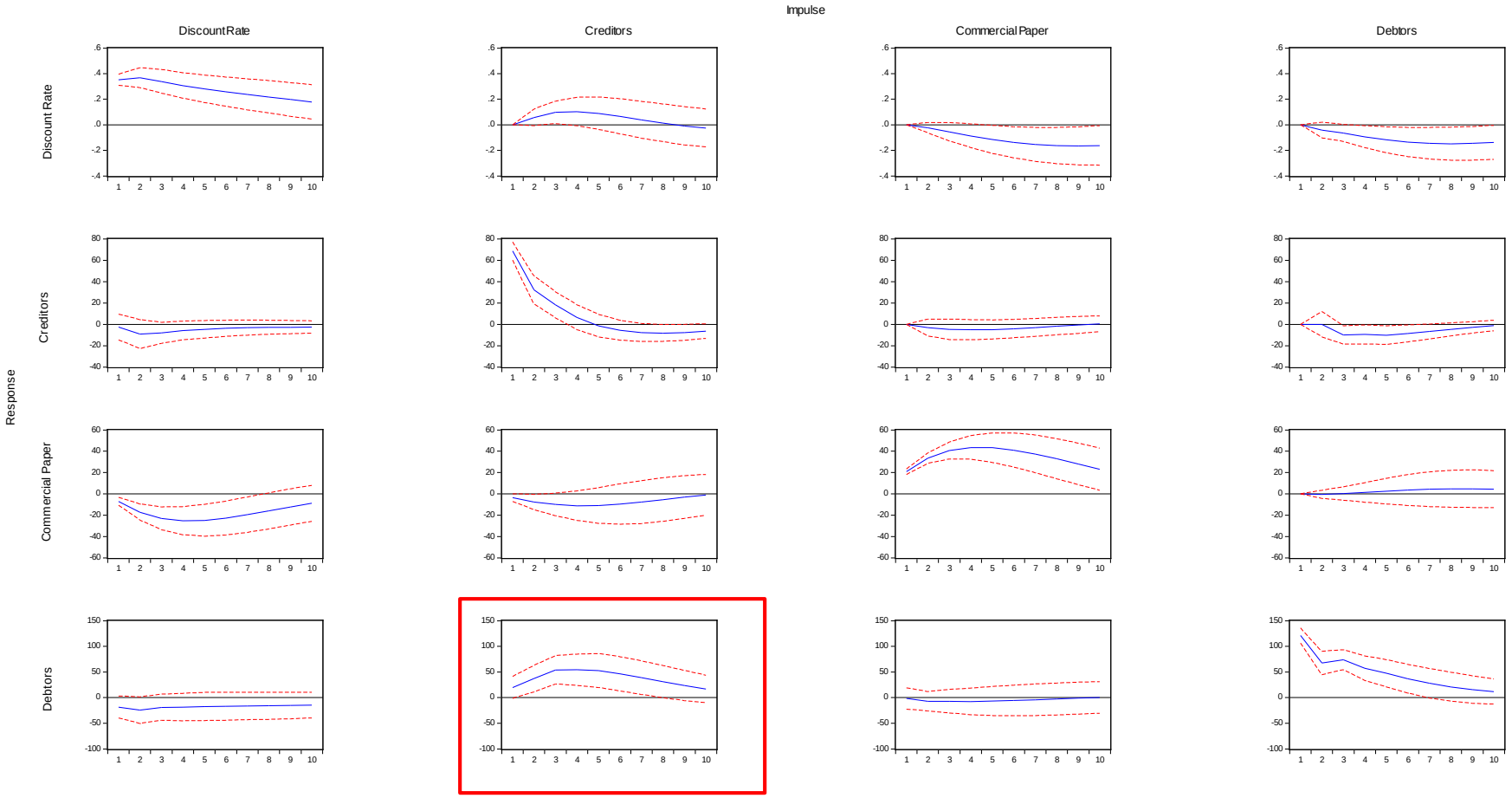


Figure **: Discount Rate, Creditors (Large Manu, Bank Suspensions), Commercial Paper, Debtors (Traders): Four Variable VAR.



Intuition – Issues of Interest

- Banks (indirect financial intermediation)
- Commercial Credit (circulating working capital, short term)
- Central Banks (discount lending)
- Causality in Micro vs. Macro Economic Analysis
  - Panels
    - Treatment and control
    - Exogenous explanatory variables (e.g. natural experiments)
    - Structure of industries (based on evidence of industrial structure and optimizing assumptions).
  - Time Series Statistics
    - Exogeneity (impulses statistically extracted from time series)
    - Structure of economy (based on assumptions of optimizing behavior)
    - A few studies use treatment and control (e.g. literature on bank lending)
    - A few studies examine exogenous shocks (Jalil) and policy changes (Romer,Romer)
  - Homonyms

Agents familiar to modern audiences, except banks. What is a bank?

Principal current operations include

a) Accepting demand deposits
b) Extending commercial loans (i.e. self liquidating transactions that finance working capital)

Bank balance sheet principally (a) and (b) but contains other liabilities and assets

Commercial Bank Balance Sheet

Liabilities

- Demand deposits
  - Majority of liabilities at commercial bank
  - Only chartered commercial banks accepted demand deposits.
- Savings and time deposits
- Capital

Assets

- Commercial loans – Largest class of assets (~50%)
- Other Assets
  - Cash and interbank deposits (~15%)
  - Bonds and securities (~25%)
  - Loans of longer term or to non-commercial customers (~10%)

Figure 2: Acceptance Market Completes Commercial Credit Cycle

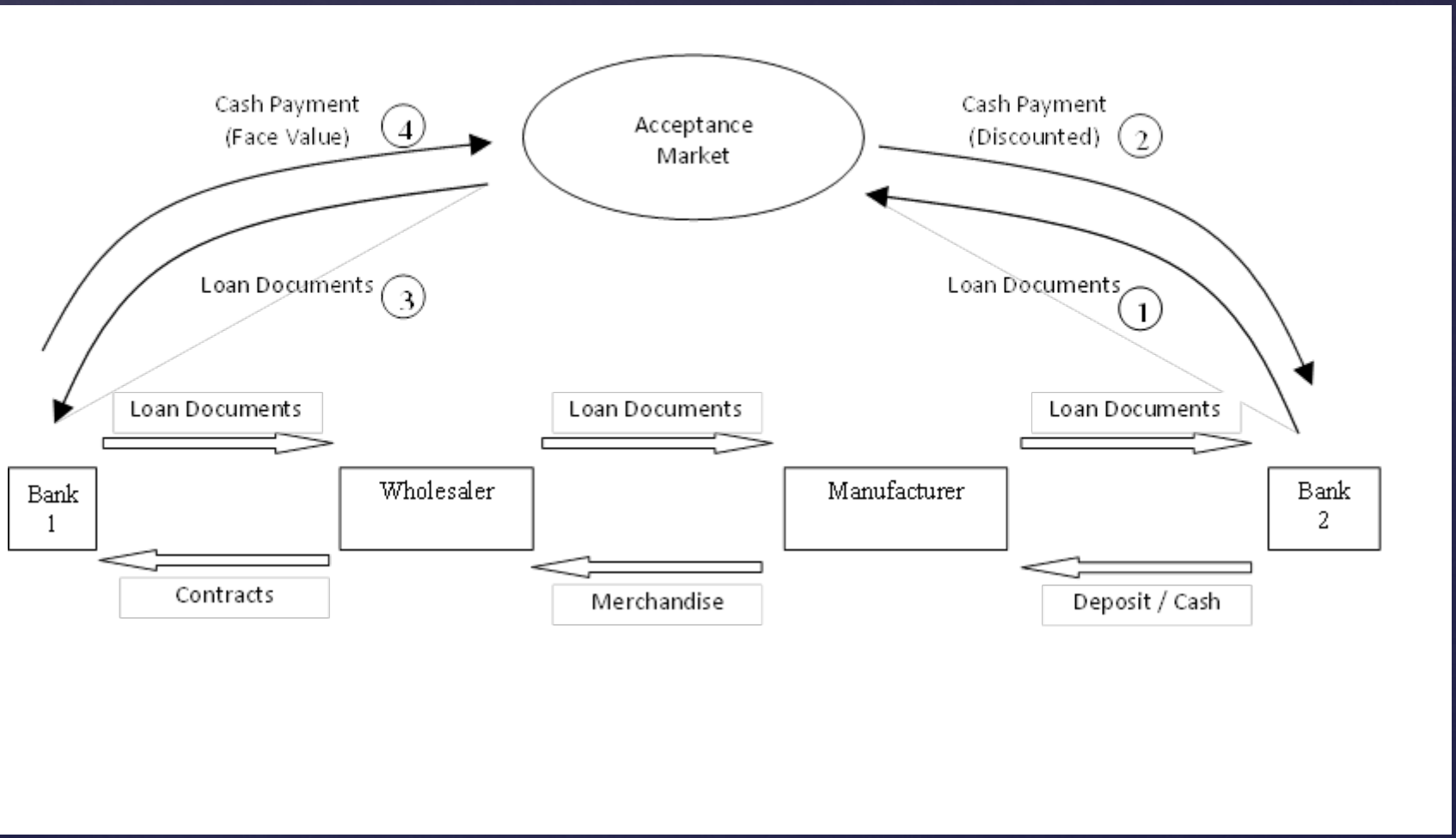
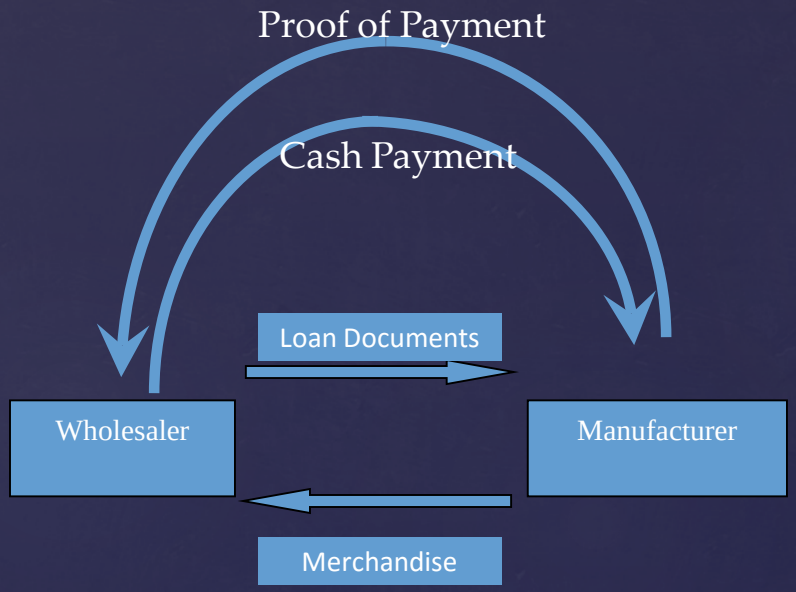
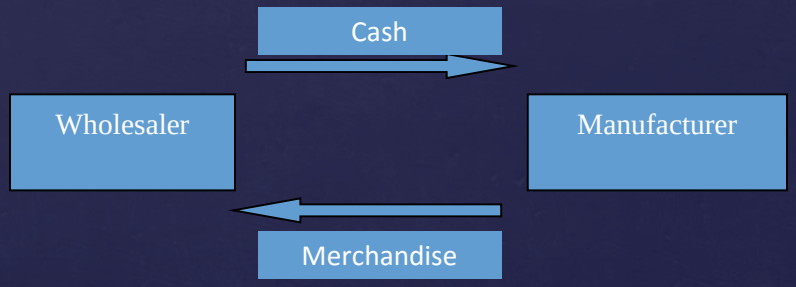


Figure 2: Wholesaler's Payment Choices



Credit, Loan from Manufacturer, Open Book or Acceptance



Cash, with Discount for Payment at Purchase

Figure 3: Cash Payment and Banks

Cash Payment

1. Small wholesalers
2. With particular manufacturer, small and infrequent trades
3. With all manufacturers, numerous and frequent trades

Banks

1. Often financed activities of local wholesalers with whom they had repeated relationships

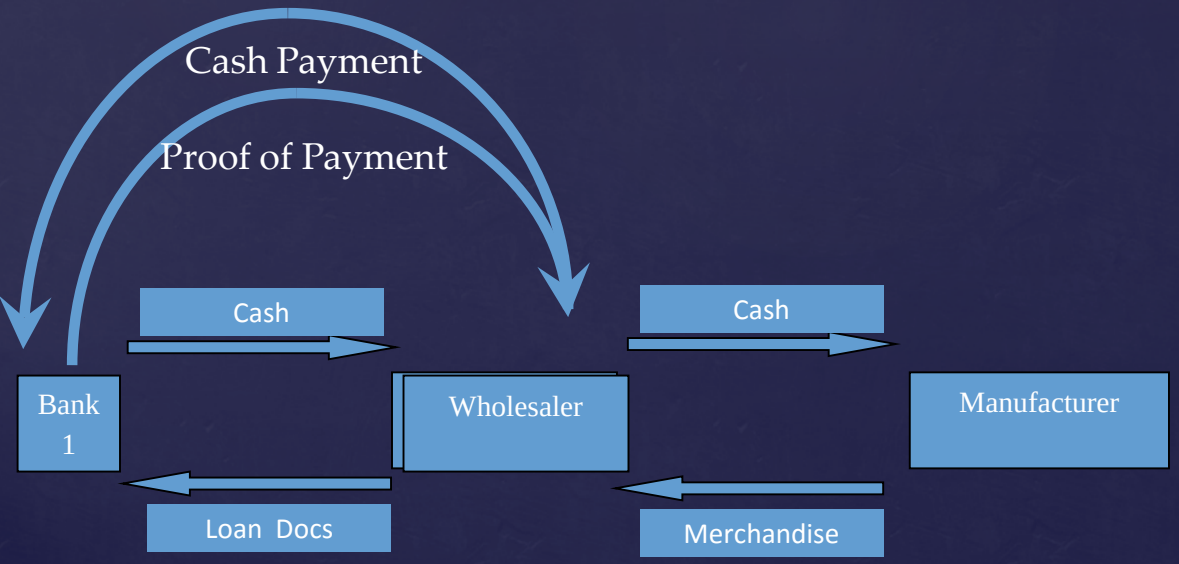
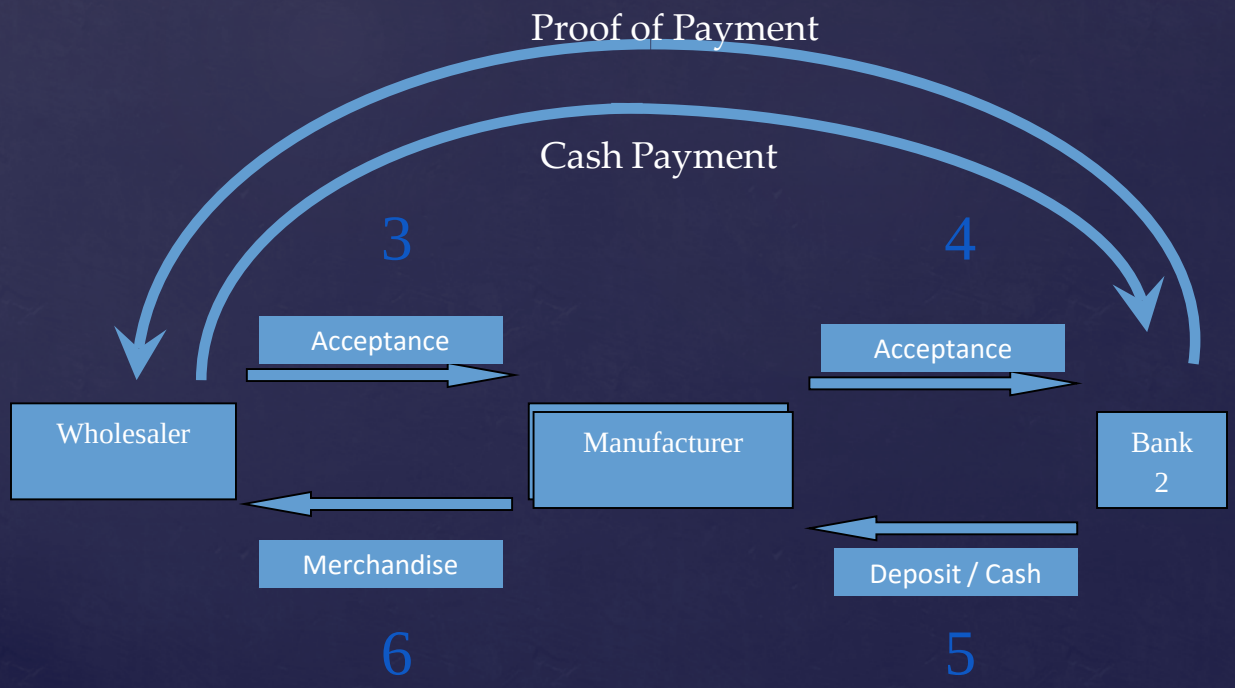


Figure 3: Credit Payment and Banks

Credit Payment

1. Wholesalers that repeatedly purchase substantial quantities from particular manufacturers
2. Large wholesalers with good national credit ratings



Basic Evidence: Three Variable VAR – (1) Bank Suspensions, (2) Trading Bankruptcies, and (3) Manufacturing Bankruptcies

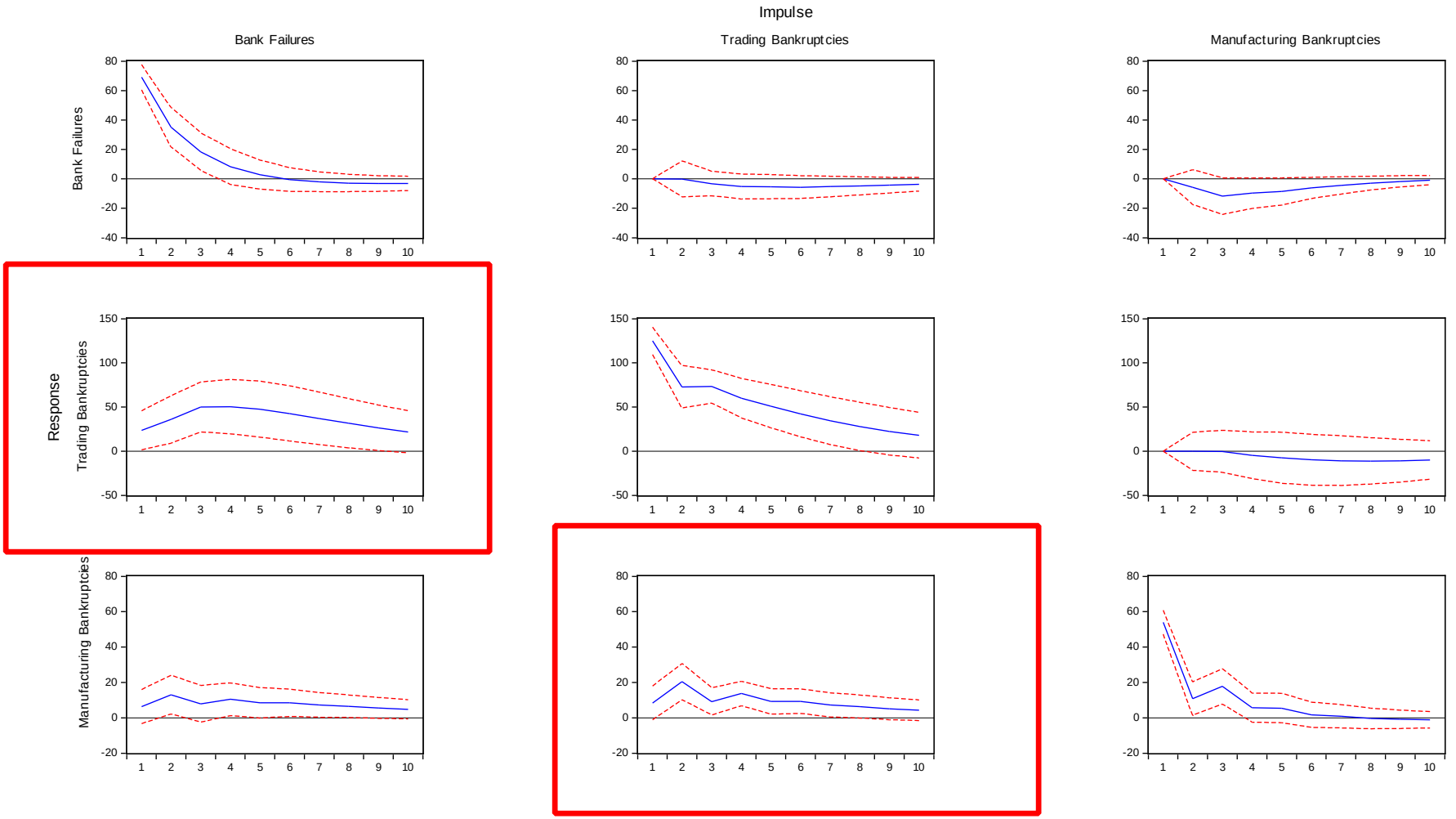
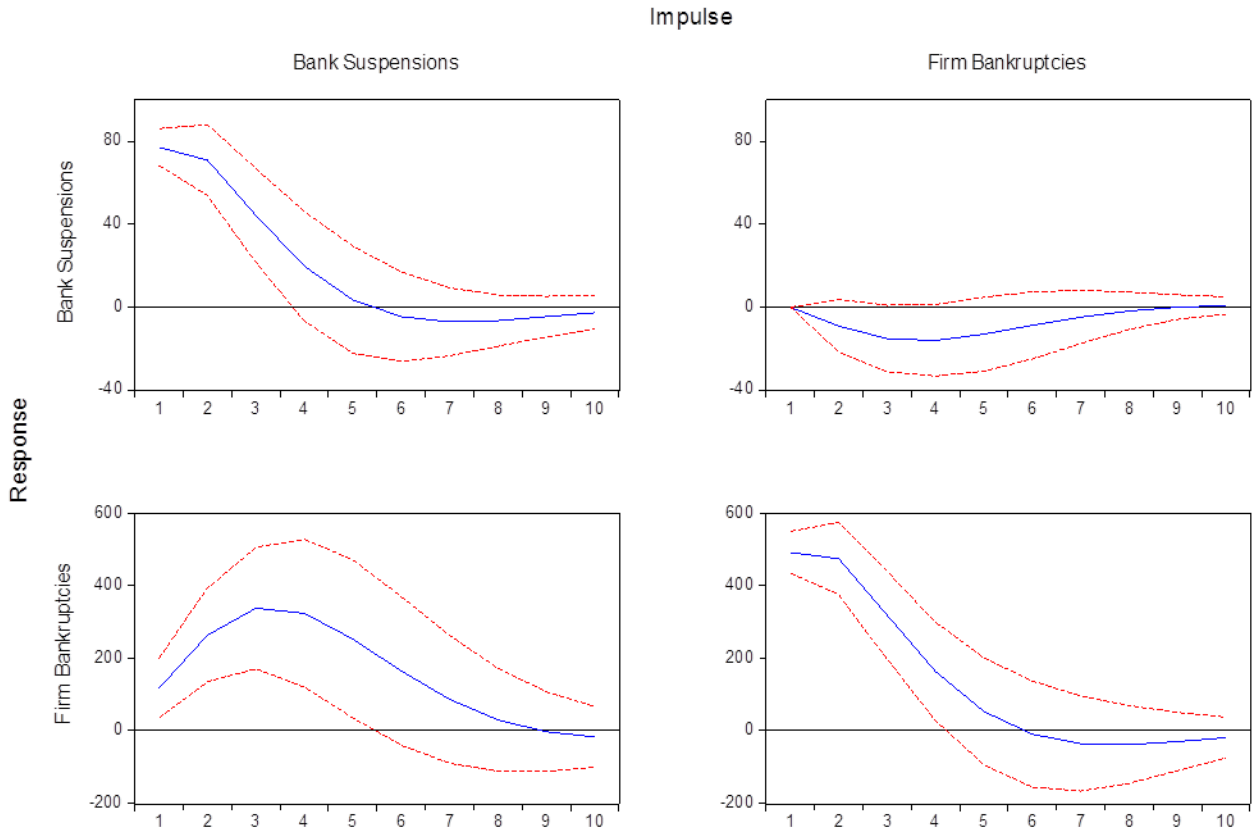
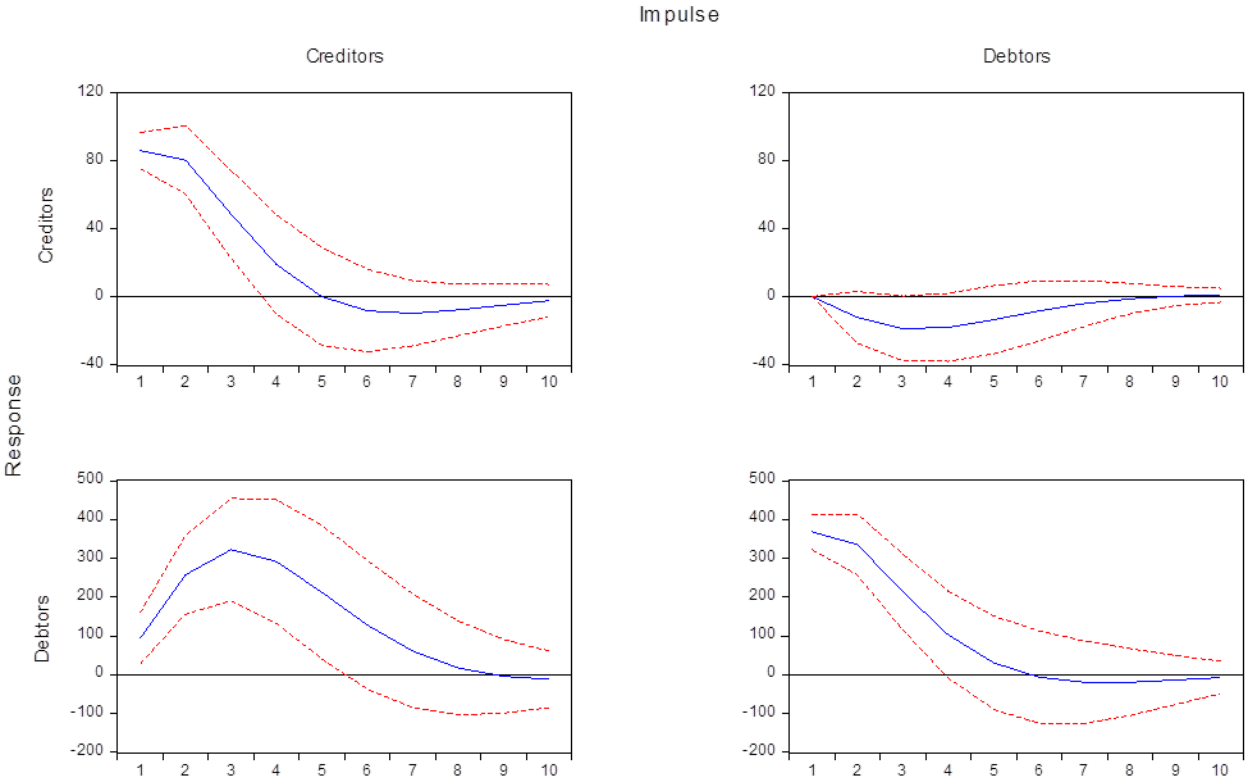


Figure A: VAR. Bank Suspensions and Firm Bankruptcies, Quarterly, Differenced t-4, 1896 to 1932



Add Quarterly Results Here

Figure B: Creditors and Debtors, Quarterly, Differenced t-4, 1896 to 1932



Granger-Causality Tables corresponding to Figure A and Figure B

	Granger-Causality Test	
	Dependent Variables	
Independent variables	Bank Suspensions	Firm Bankruptcies
Bank Suspensions		0.00
Firm Bankruptcies	0.14	

	Granger-Causality Test	
	Dependent Variables	
Independent variable	Creditors	Debtors
Creditors		0.00
Debtors	0.15	

Variance Decomposition Tables corresponding to Figure A and Figure B

	Independent Variables	
Dependent variable	Bank Suspensions	Firm Bankruptcies
Bank Suspensions	94.1	5.90
Firm Bankruptcies	40.1	59.9

	Independent Variables	
Dependent variable	Debtors	Creditors
Debtors	93.8	6.20
Creditors	51.9	48.1

Figure C: Bank Suspensions, Trading Bankruptcies, and Manufacturing Bankruptcies: 4 variable VAR, Quarterly, Differenced t-4, 1896 to 1932

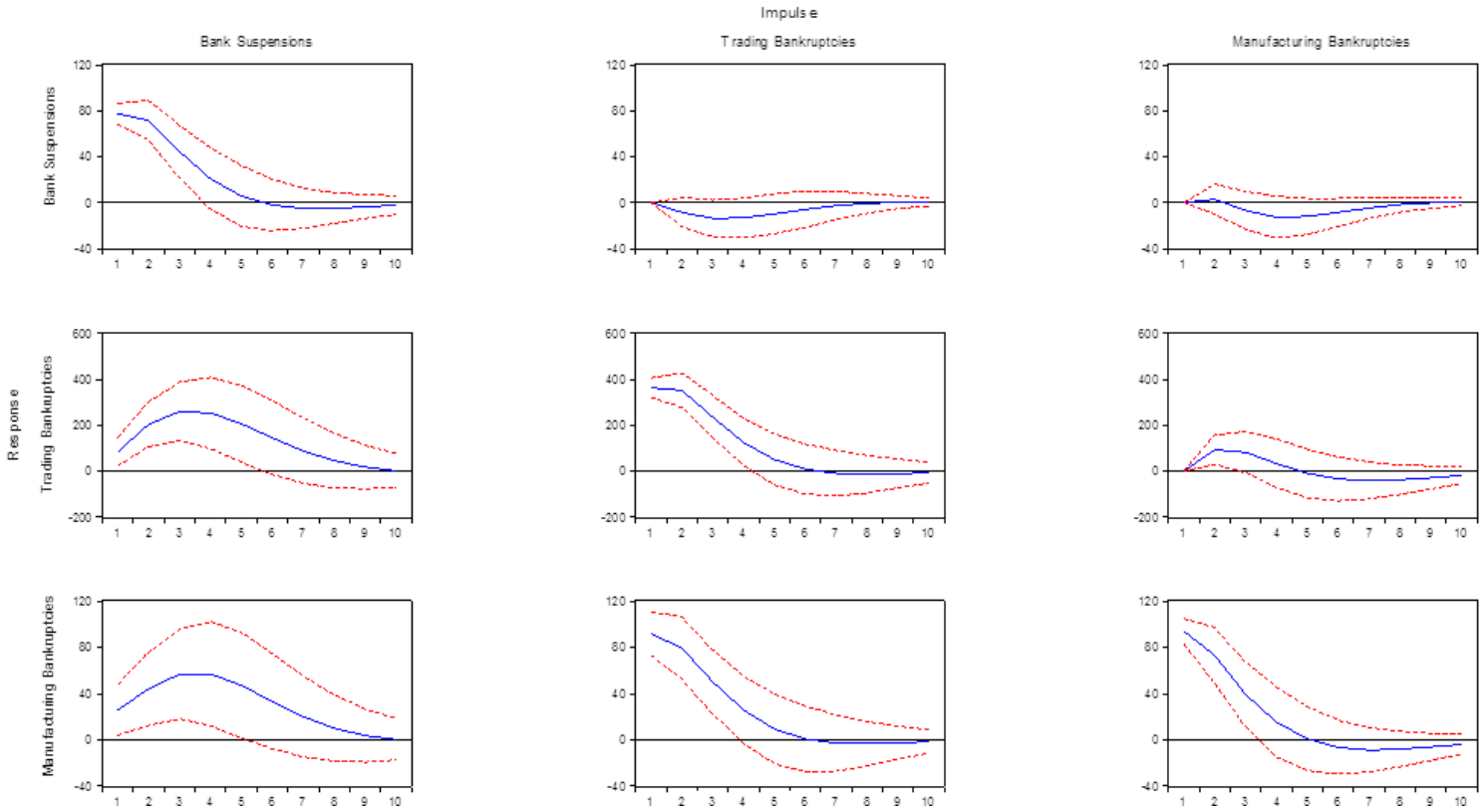
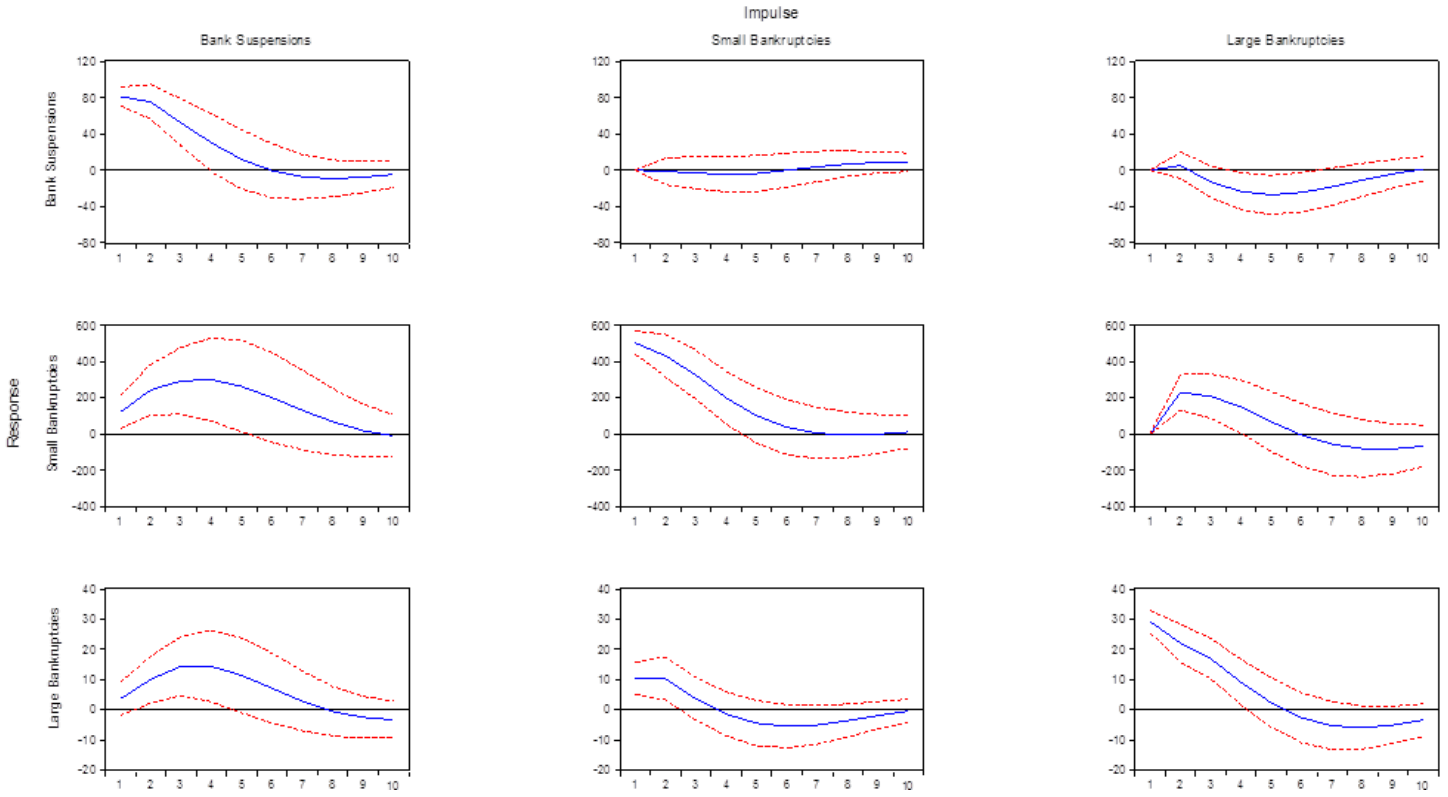


Figure D:Bank Suspensions, Small Bankruptcies, and Large Bankruptcies: 3 variable VAR, Quarterly, Differenced t-4, 1901 to 1932



Granger-Causality Tables corresponding to Figure C and Figure D

	Granger-Causality Test		
	Dependent Variables		
Independent variables	Bank Suspensions	Trading Bankruptcies	Manufacturing Bankruptcies
Bank Suspensions		0.00	0.085
Trading Bankruptcies	0.34		0.68
Manufacturing Bankruptcies	0.37	0.01	

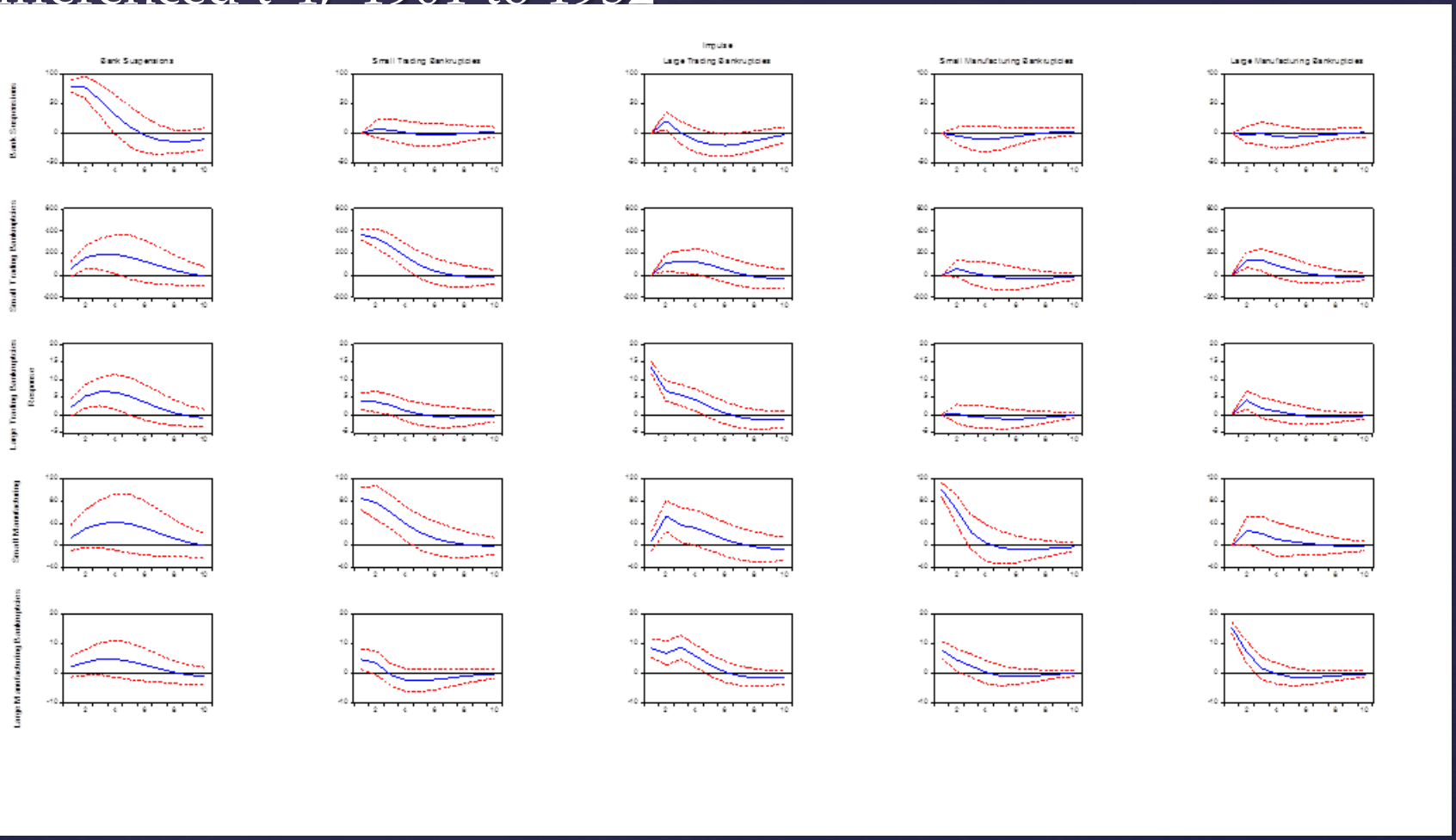
	Granger-Causality Test		
	Dependent Variables		
Independent variables	Bank Suspensions	Small Bankruptcies	Large Bankruptcies
Bank Suspensions		0.04	0.02
Small Bankruptcies	0.58		0.06
Large Bankruptcies	0.03	0.00	

Variance Decomposition Tables corresponding to Figure C and Figure D

	Independent Variables		
Dependent Variables	Bank Suspensions	Trading Bankruptcies	Manufacturing Bankruptcies
Bank Suspensions	92.8	4.00	3.20
Trading Bankruptcies	41.8	54.6	3.64
Manufacturing Bankruptcies	27.4	38.3	34.3

	Independent Variables		
Dependent variable	Bank Suspensions	Small Bankruptcies	Large Bankruptcies
Bank Suspensions	85.3	1.30	13.3
Small Bankruptcies	34.0	53.2	12.8
Large Bankruptcies	25.5	11.2	63.3

Figure E: Bank Suspensions, Small Trading Bankruptcies, Large Trading Bankruptcies, Small Manu. Bankruptcies and Large Manu. Bankruptcies: 5 variable VAR, Quarterly, Differenced t-4, 1901 to 1932



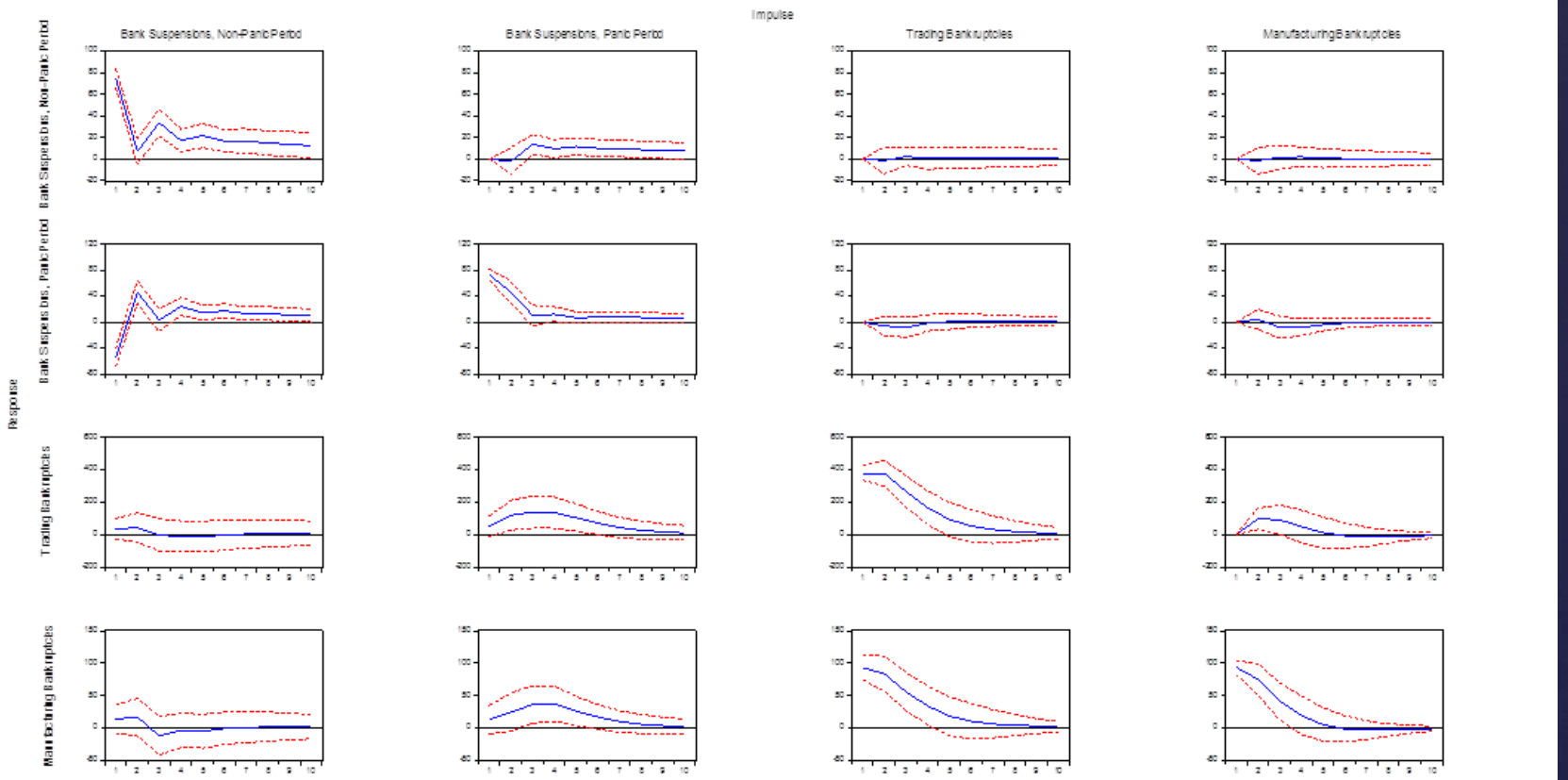
Granger-Causality Tables corresponding to Figure E

	Granger-Causality Test				
	Dependent Variables				
Independent variable	Bank Suspensions	Small Trading Bankruptcies	Large Trading Bankruptcies	Small Manu. Bankruptcies	Large Manu. Bankruptcies
Bank Suspensions		0.06	0.12	0.66	0.45
Small Trading Bankruptcies	0.85		0.26	0.26	0.23
Large Trading Bankruptcies	0.00	0.44		0.04	0.01
Small Manu. Bankruptcies	0.90	0.57	0.37		0.61
Large Manu. Bankruptcies	0.72	0.00	0.00	0.05	

Variance Decomposition Tables corresponding to Figure E

	Independent Variables				
Dependent variable	Bank Suspensions	Small Trading Bankruptcies	Large Trading Bankruptcies	Small Manu. Bankruptcies	Large Manu. Bankruptcies
Bank Suspensions	87.1	0.53	9.86	1.71	0.75
Small Trading Bankruptcies	24.7	57.0	9.1	1.20	8.04
Large Trading Bankruptcies	31.6	7.5	55.3	1.07	4.60
Small Manu. Bankruptcies	15.5	38.8	12.0	30.8	2.83
Large Manu. Bankruptcies	11.6	7.15	31.0	11.9	38.4

Figure F: Non-Panic Bank Suspensions, Panic Bank Suspensions, Trading Bankruptcies, and Manu. Bankruptcies: 4 variable VAR, Quarterly, Differenced t-4, 1896 to 1932



Granger-Causality Tables corresponding to Figure F

	Granger-Causality Test			
	Dependent Variables			
Independent variable	Non-Panic Bank Suspensions	Panic Bank Suspensions	Trading Bankruptcies	Manufacturing Bankruptcies
Non-Panic Bank Suspensions		0.00	0.22	0.29
Panic Bank Suspensions	0.00		0.11	0.43
Trading Bankruptcies	0.98	0.13		
Manufacturing Bankruptcies	0.83	0.14	0.00	0.24

Variance Decomposition Tables corresponding to Figure F

	Independent variable			
Dependent variable	Bank Suspensions Non-Panic Period	Bank Suspensions Panic Period	Trading Bankruptcies	Manufacturing Bankruptcies
Bank Suspensions Non-Panic Period	85.8	12.5	0.72	1.01
Bank Suspensions Panic Period	40.5	54.1	2.06	3.32
Trading Bankruptcies	1.41	13.5	80.6	4.50
Manufacturing Bankruptcies	2.66	8.96	52.5	35.8