

The Samurai Bond: Credit Supply and Economic Growth in Pre-War Japan

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Research question and motivation

- *how does credit supply affect economic activity?*
 - *what are the channels?*
 - *how persistent are the effects?*
- Mian and Sufi (QJE 2009): mortgage debt exacerbated recent financial crisis
- Jorda et al (NBER WP 2011): historical financial crises more severe and lasting when fueled by excess credit
- Schularick and Taylor (AER 2012): lagged credit indicators predict financial crises

The case of Meiji Japan: samurai bond issue

- 1876 samurai annuity conversion
 - large exogenous credit shock
 - ¥174 million in short-term government bonds
 - transmission via banking and direct investment
 - regional variation in population shares
 - 1875: 5.4% nationwide (between 0.3 and 26.3%)
- various measures of economic activity
 - industrial activity, regional output, labor shares
- short and long run effects

Preliminary findings

- Industrial activity
 - samurai share positively associated with per capita firms, capital investment, and firm capitalization
 - heterogeneous impact by sector
 - persistent over two decades (1883 to 1898)
- Output growth and labor allocation
 - positive impact only via early railway access
 - also heterogeneous by sector
 - persistent over six decades (1874 to 1940)

Related literature

- Finance-led growth
 - King and Levine (QJE 1993): financial development associated with real per capita income growth
 - Rajan and Zingales (AER 1998): sectors vary in external finance dependence
- Regional context
 - Mian et al (WP 2017): US credit supply shocks in 1980s
 - Jayaratne and Strahan (QJE 1996): differential bank branch deregulation by US state
 - Guiso et al (QJE 2004): structure of bank branching on Italian regional development

Related literature (cont.)

- Pre-war Japan
 - Rousseau (JWE 1999): financial intermediation and securitization predict economic growth
 - Tang (FHR 2013): financial sector growth predicts extensive growth in modern industrial firms
 - Shizume and Tsurumi (WP 2016): experimentation in banking systems during late 19th century
- Samurai contribution
 - Harootunian (JAS 1960): broader economic policies
 - Yamamura (JEH 1967): minor impact on banking
 - Jha et al: political coalitions

Historical context

- pre-war growth in income, investment, and trade
 - investment in military, infrastructure, education, health
 - wide-ranging reforms in taxation, banking, commerce
 - reductions in government expenses
- prefectural variation in concentration of industrial activity and firm measures (Tang 2014)
- increased differences in population and income among prefectures (Fukao et al 2015)
 - structural change away from primary production

Research design

- use samurai population share as proxy for exogenous credit supply shock to assess impact on local economic performance
 - H_0 : samurai population share increases economic growth through increased credit supply
 - heterogeneous impact on industries and regions
 - persistence over time
- stylized facts
 - samurai distribution exogenous in Meiji Period --> quasi-natural experimental setting
 - imperfect financial market integration --> localized investment behavior

Prefecture-level data sources

- *Nihon Teikoku Tokei Nenkan* (Japanese Statistical Association, 1962)
 - samurai population: 1880-1903
 - industry-level measures: 1883-1890
- *Regional Inequality and Industrial Structure* (Fukao et al 2015)
 - prefectural output: 1874-1940
- *Ekimei Jiten* (Chuo Shoin 1995)
 - rail station construction data: 1872-1912
 - cf Tang (2014, 2017)

Distribution of samurai, 1875-1898

Population shares (SD)	1875	1887	1898	Annual %
Japan	5.4	5.0	4.8	-0.027
Prefectural average	6.0 (5.5)	5.7 (5.6)	5.4 (5.5)	-0.029 (0.009)
Sample average	6.0 (5.1)	5.7 (5.2)	5.2 (5.3)	-0.030 (0.010)
Top quartile average	12.6 (6.1)	11.7 (6.7)	11.2 (7.4)	-0.055 (0.027)
Bottom quartile average	1.9 (0.8)	1.8 (0.7)	1.7 (0.6)	-0.011 (0.007)

Source: Authors' calculations. 1875 values extrapolated from 1880-1898 values. Robust standard errors reported for annual percentage change using 1880-1898 values.

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Prefectural industrial activity, 1885

Averages	Firms	Capital	Firm Capital
All prefectures	35.2	1,450.3	25.2
Sample prefectures	34.9	1,497.7	23.7
Primary sector	2.2	30.8	14.6
Secondary sector	14.0	280.6	15.5
Tertiary sector	18.7	1,186.2	41.7
National banks, prefecture average	3.0	1,117.8	370.1
Samurai ownership		58.5%	

Source: Japan Statistical Association (1962) and authors' calculations. Capital values in thousand nominal yen. National bank statistics for 1884.

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Prefectural output, 1874-1909

Averages	1874	1890	1909
Gross prefectural product, all	84.0	113.2	175.4
Primary sector share	61.4	50.1	42.6
Secondary sector share	10.3	14.8	19.6
Tertiary sector share	28.3	35.1	37.8
Gross prefectural product, sample	78.7	107.4	170.6
Primary sector share	63.2	51.4	43.1
Secondary sector share	10.0	14.5	19.3
Tertiary sector share	26.8	34.1	37.5

Source: Fukao et al (2015) and authors' calculations. In 1934-36 constant thousand yen.

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Industrial activity: panel FE regression model

- reduced form panel OLS model:

$$Y_{it} = \beta_0 + \beta_1 Samshr_{it} + \beta_n FE_{i,t} + z_{it}$$

- Y_{it} = industrial outcome measures by prefecture i and year t
 - $Samshr_{it}$ = samurai share by prefecture i and year t
 - $FE_{i,t}$ = fixed effects for prefecture i and year t
 - standard errors clustered by prefecture
- exclusions: non-stationary samurai share prefectures (8)

Industrial activity results, 1883-90 v 1883-98

DV:	Firms per 1000 pop	Capital per 1000 pop	Capital per firm
Samurai share, All sectors	2.2***	403.4***	568.2***
Primary sector	0.5***	19.2***	-564.6
Secondary sector	0.9***	75.9**	-45.9
Tertiary sector	0.7***	308.5***	1941.9***
Samurai share, All sectors	1.4***	237.5*	141.2
Primary sector	0.6***	21.4***	616.0
Secondary sector	0.7***	80.8***	340.3**
Tertiary sector	0.2	137.7	2252.9*

Significance: *10%, **5%, ***1%. Robust standard errors clustered by prefecture. All specifications include fixed effects for year and prefecture and use restricted sample prefectures (39). Capital values based on 1934-36 constant thousand yen.

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Prefecture growth: pooled FE regression model

- reduced form cross section OLS model:

$$\Delta GPPpc_{it} = \beta_0 + \beta_1 \ln GPPpc_{it-1} + \beta_2 Samshr_{i0} + \beta_3 Samshr_{i0} * Stations_{i1} + \beta_n FE_t + z$$

- Y_{it} = output by prefecture i and year t
 - $Samshr_{i0}$ = samurai share by prefecture i and year 1880
 - $Stations_{i1}$ = per capita rail stations by prefecture i and year 1885
 - FE_t = fixed effects for year t
 - standard errors clustered by prefecture
- exclusions: non-stationary samurai share prefectures (8) and those missing data (2)

Short run output growth regressions, 1874-1890

DV: $\Delta \ln(\text{GPP pc})$	All sectors	Primary sector	Secondary sector	Tertiary sector
Lag $\ln(\text{GPP pc})$	-0.433***	-2.542***	-1.174***	-0.666***
Samurai Share in 1880	-0.806	-1.399	-0.542	-1.085**
Rail stations per mil in 1885	-0.017***	0.029**	-0.015	-0.008
Interaction samurai*rail	0.734***	-1.559***	1.466***	0.315
Net samurai effect	6.735***	-17.414***	14.521***	2.153
R-squared	0.360	0.507	0.464	0.333
F-statistic	6.91***	18.52***	13.66***	9.93***

Significance: *10%, **5%, ***1%. Robust standard errors clustered by prefecture. All specifications include fixed effects for year and based on restricted sample prefectures with 37 observations. $\ln(\text{GPPpc})$ in constant 1934-36 yen.

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Long run output growth regressions, 1874-1940

DV: $\Delta \ln(\text{GPP pc})$	All sectors	Primary sector	Secondary sector	Tertiary sector
Lag $\ln(\text{GPP pc})$	-0.171**	-0.849***	-0.544***	-0.987***
Samurai Share in 1880	-0.461	0.066	-1.197**	-0.318
Rail stations per mil in 1885	-0.007**	0.018**	-0.011	-0.010***
Interaction samurai*rail	0.221**	-0.675**	0.462*	0.293**
Net samurai effect	1.814*	-6.867**	3.550	2.690*
R-squared	0.406	0.329	0.198	0.605
F-statistic	17.22***	15.35***	10.53***	44.58***

Significance: *10%, **5%, ***1%. Robust standard errors clustered by prefecture. All specifications include fixed effects for year and based on restricted sample prefectures with 185 observations. $\ln(\text{GPPpc})$ in constant 1934-36 yen.

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Short run labor share regressions, 1874-1890

DV: Δ SectorA/SectorB	Sec/Prim	Tert/Prim	Tert/Sec
Lag SectorA/SectorB	-0.539***	-0.351***	-0.414***
Samurai Share in 1880	-0.155	-1.268***	1.223
Rail stations per mil in 1885	-0.031***	-0.034***	-0.016***
Interaction samurai*rail	1.066***	1.176***	0.688***
Net samurai effect	10.792***	10.809***	5.848***
R-squared	0.778	0.609	0.574
F-statistic	33.89***	21.35***	25.37***

Significance: *10%, **5%, ***1%. Robust standard errors clustered by prefecture. All specifications include fixed effects for year and based on restricted sample prefectures with 37 observations.

Long run labor share regressions, 1874-1940

DV: Δ SectorA/SectorB	Sec/Prim	Tert/Prim	Tert/Sec
Lag SectorA/SectorB	0.004	-0.091**	-0.344***
Samurai Share in 1880	-0.296	-0.881***	-0.293
Rail stations per mil in 1885	-0.008	-0.021***	-0.007
Interaction samurai*rail	0.266	0.654***	0.269*
Net samurai effect	2.432	5.835***	2.478
R-squared	0.696	0.426	0.719
F-statistic	41.26***	23.61***	48.57***

Significance: *10%, **5%, ***1%. Robust standard errors clustered by prefecture. All specifications include fixed effects for year and based on restricted sample prefectures with 185 observations.

Conclusion and discussion

- credit supply associated with extensive firm growth and per capita investment in short run
 - large initial impact in tertiary sector
 - longer impact in primary and secondary sectors (to 1898)
- output and labor reallocation effects via productivity-enhancing investment
 - facilitated structural change (primary to secondary and tertiary sectors)
 - persistent for six decades (to 1940)

Conclusion and discussion (cont.)

- further work
 - other dependent variables (e.g., land prices)
 - other measures of credit variation (bond values)
 - other control variables for prefectures
 - quantile regression, 2SLS using bank ownership
 - longer term analysis (post-war)