Social Capital and Mortgage Delinquency

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Introduction

The financial crisis has drawn the attention of participants in mortgage markets and policymakers to the need for more accurate methods of assessing mortgage default risk

- in order to improve models of underwriting and pricing of mortgages and MBSs, and
- to develop effective public policy to reduce foreclosures.

A growing body of literature on default risk, from the perfective of:

- observable borrower- and market-specific variables, such as loan terms, borrower's characteristics, and macroeconomic variables (Doms, Furlong, and Krainer 2007; Gerardi, Shapiro, and Willen 2008; and Gerardi, Lehnert, Sherlund, and Willen 2009)

- the role of possible agency problems between loan originators and investors (Bubb and Kaufman 2009; Elul 2009; Krainer and Laderman 2009; Keys, Mukherjee, Seru, and Vig 2010; and Agarwal, Chang and Yavas, 2012)

- the decision to strategically default; herding behavior (Seiler et al. 2012, 2014).

Purpose of the paper

- Address mortgage delinquency outcomes from a new perspective:
  - the role of social capital as a determinant of default risk
  - how its impact varies over time.

- Offer both a theoretical model and empirical evidence

Social Capital - Definition

Social capital includes the norms, values, trust, and information common to a social network, which enable cooperative and shared actions (Woolcock, 1994 and 1998).

Hasan et al. (2017b) suggest that cooperative norms and close social networks in an area encourage a local environment that limits opportunistic behaviors.

Guiso, Sapienza, and Zingales (2013): when your peers adopt a philosophy or action, the idea is more likely to be deemed acceptable by those within the same neighborhood or social circle – 'social contagion.' People look to others before making decisions.

Thus, social norms and trusts can play an important role in the default activities in the local neighborhood.

Social Capital - Literature

It has been shown that social capital has an impact on financial and economic decisions

- + impact on corporate social responsibility (Jha and Cox, 2015)

- + impact on corporate innovation (Gupta et al. 2016)

- - impact on cost of equity (Gupta and Raman, 2016)

- - impact on bank loan spreads (Hasan et al., 2017a, 2017b)

Conjecture

- Consistent with the findings of previous studies that emotional attributes and social network affect borrower's default decision, we conjecture that areas with a higher level of social capital will have lower levels of mortgage delinquency rates.

- Distressed homeowners weight the 'moral costs' against the strong financial incentives when deciding whether to walk away from a substantially underwater mortgage.

- When more borrowers in the neighborhood default strategically, the sense that 'everyone is doing it' grows, and the resulting shift in the cultural environment may cause decay in moral aversion to default, and make strategic default less stigmatizing.

- On the contrary, when a homeowner lives in a community with a higher level of social capital, the shared actions and altruism in a social network is more likely to discourage strategic default.

Simple Theoretical Model

Consider a competitive lending market with risk-neutral lenders and borrowers.

- Let L be the loan amount, and i be the interest rate.

- In the first period, the borrower obtains L to purchase an asset of value Po, $Po > L$.

- In the second period, the borrower sells the asset and pays the lender the loan balance, the principal plus interest, $B = (1 + i) \, L$.

- For simplicity, we will focus on FRMs where i is fixed.

- Each borrower has a current income of Y, at which he/she qualifies for the mortgage offered.

- The borrower will enjoy income Y in the second period as well.

- The second-period value of the asset, P, is a random variable with marginal density $f(Po)$ and cumulative density $F(Po)$ on the interval.

The Model

If the borrower defaults, s/he suffers the default disutility of $D>0$.

- Default disutility captures social and psychic effects of default and damage to the borrower's credit rating, as well as the transaction costs of default.

- We assume that default disutility also increases with social capital; homeowners in areas with higher social capital suffer more disutility from defaulting and imposing negative externalities on their neighbors.

- The borrower will choose to default if the value of the asset plus the default utility is less than the mortgage balance: $P+D< B$.

The Model

Let δ<1 be the borrower's discount factor. The borrower's utility function is given by:

$$Y + L - P_0 + \delta \int_{\underline{P}}^{B-D} (Y - D) f(P) dP + \delta \int_{B-D}^{\bar{P}} (Y + P - B) f(P) dP$$

Let β<1 be the lender's discount factor The lender's problem is to choose an interest rate, i, to maximize expected profits:

$$-L + \beta \int_{\underline{P}}^{B-D} P f(P) dp + \beta \int_{B-D}^{\bar{P}} B f(P) dP$$

The Model

Borrower's probability of default, θ, is captured by the first integral term of utility function,

$$\theta = \int_{\underline{P}}^{B-D} (Y - D) f(P) dP$$

It is straightforward to obtain the main prediction of the model:

Proposition 1: Higher social capital, hence higher default disutility, leads to lower probability of

default. $\dfrac{\partial \theta}{\partial D} = -[F(B - D) - F(\underline{P})] - (Y - D) f(B - D) < 0$.

The Model

We next consider the impact of a downturn in house prices, as observed in the recent financial crisis. We capture this by reducing the lower bound of the price distribution from $\underline{P}$ to $\underline{P} - \alpha$, thus changing the support of the distribution to $[\underline{P} - \alpha, \overline{P}]$. The new probability of default is:

$$\theta = \int_{\underline{P}-\alpha}^{B-D} (Y - D) f(P) dP.$$

Proposition 2: A deterioration in the house price distribution (higher α) amplifies the negative marginal impact of social capital on the probability of default. $\dfrac{\partial^2 \theta}{\partial D \partial \alpha} < 0.$

Data

Sample: county-year data for 2220 counties in US from 1999 to 2011

Social Capital Variable

- county level social capital index constructed using principal component analysis (Rupasingha et al. 2006)
  - factors: associational density of civic, religious, and sports organizations, voter turnout rate, Census response rate, and per-capita non-profit organizations
- measures county level cooperation, trust, and social networks among local people as well as the level of collective action.
- Their measure has been widely used by recent studies in finance literature and other disciplines (e.g., Jha and Chen, 2015; Jha and Cox, 2015; Gupta and Raman, 2016; Gupta et al., 2016; and Hasan et al., 2017b).

Data

- Consistent with the recent literature, we use their dataset to measure local level social capital and use interpolations of the data for the years without available data.
  - Rupasingha et al. (2006) social capital index provides an updated data for the years 1990, 1997, 2005, 2009, and 2014 on the data website (http://aese.psu.edu/nercrd/community/social-capital-resources). We use interpolation for the years without available data.

- The related literature has widely employed the interpolation method when using local factors, such as demographic, religious, and other cultural factors, to examine the impact of local factors on financial and economic outcomes in their studies (e.g. Kumar et al., 2011; Hilary and Hui, 2009; Alesina and Ferrara, 2000; Hasan et al., 2017a, 2017b).

Empirical Test

- The following setup is our baseline model to estimate the impact of social capital on mortgage delinquency rate.

- $MortgageDelinquency = \alpha_0 + \alpha_1 SocialCapital + \sum_{i=1}^{n} \beta_i X_i + \varepsilon$

MortgageDelinquency: the percent of mortgage debt balance 90+ Days Delinquent

The data source for the *MortgageDelinquency* is the FRBNY (Federal Reserve Bank of New York) Consumer Credit Panel / Equifax. FRBNY states that the "mortgage debt includes first mortgages, home equity loans, and home equity lines of credit."

SocialCapital is the measure of the local level of social capital at the county level.

X is a vector of control variables at the county level, including

Change in real Income; Change in Unemployment; Change in real MedianHouseValue; Mortgage: mortgage debt balance per capita; *SubprimeCredit:* "percentage of the population with a credit score below 660" (provided by St. Louis Fed website), *LocalSeniors:* fraction of individuals who are 65 years old or above, *Population; Education:* fraction of individuals 25 years and over holding college degrees; *PoliticalAffliation:* fraction of local Republican votes in Presidential elections; *Minority:* fraction of minority (non-white) ethnic groups.

We control for year fixed effects,

Table 2. Baseline Test

Dependent Variable	MortgageDelinquency
SocialCapital	-0.2819***
	(-5.37)
SubprimeCredit	0.0109**
	(2.14)
Change in Income	-0.0001***
	(-11.49)
Education	-0.0212***
	(-5.45)
Population	0.0000***
	(2.86)
Change in Unemployment	0.2326***
	(11.94)
Change in MedianHouseValue	-0.0500***
	(-14.87)
Political Affiliation	-0.0153***
	(-7.53)
Minority	1.2823***
	(6.95)
LocalSeniors	4.3994***
	(4.42)
Constant	1.1665***
	(4.09)
Year fixed effects	Yes
Observations	28,683
R-squared	0.396

Table 2. Baseline Test

A one-standard-deviation increase in *SocialCapital* leads to almost a 0.13 standard-deviation decrease in the mortgage delinquency rate, consistent with our hypothesis.

This change corresponds to almost 12.1% (16.5%) of the sample average (median) mortgage delinquency rate.

Close to impact of *Change in Unemployment* and *Change in MedianHouseValue.*

Table 3. Pre- vs. Post-Financial Crisis

Subsample:	Pre-Crisis	Post-Crisis
Dependent Variable:	MortgageDelinquency	MortgageDelinquency
SocialCapital	-0.0694***	-0.5387***
	(-4.38)	(-3.44)
SubprimeCredit	0.0353***	0.0095
	(11.51)	(0.88)
Change in Income	-0.0000***	-0.0001***
	(-7.34)	(-8.28)
Education	-0.0336***	-0.0199**
	(-17.43)	(-2.17)
Population	0.0000	0.0000***
	(0.57)	(2.75)
Change in Unemployment	0.0234*	0.3499***
	(1.85)	(11.77)
Change in MedianHouseValue	-0.0251***	-0.1973***
	(-14.05)	(-7.29)
Political Affiliation	-0.0118***	-0.0183***
	(-7.91)	(-4.09)
Minority	0.0896	2.3516***
	(0.71)	(6.04)
LocalSeniors	0.2552	11.8891***
	(0.60)	(4.56)
Constant	1.1941***	0.1078
	(7.42)	(0.17)
Year fixed effects	Yes	Yes
Observations	17,650	11,033
R-squared	0.229	0.295

Table 3. Pre- vs. Post-Financial Crisis

- Supports Proposition 2 that the negative impact of social capital on mortgage delinquency rates should be more pronounced after the financial crisis.

Table 4. Pre- vs. Post-Financial Crisis: Additional Test (with interactive term)

Dependent Variable	MortgageDelinquency
SocialCapital	-0.1579***
	(-4.02)
PostCrisis	2.4617***
	(33.95)
SocialCapitalxPostCrisis	-0.3561***
	(-3.97)
SubprimeCredit	0.0127**
	(2.48)
Change in Income	-0.0001***
	(-11.38)
Education	-0.0204***
	(-5.05)
Population	0.0000***
	(2.82)
Change in Unemployment	0.2144***
	(11.95)
Change in MedianHouseValue	-0.0512***
	(-15.52)
Political Affiliation	-0.0169***
	(-7.42)
Minority	1.2838***
	(6.86)
LocalSeniors	4.7353***
	(4.48)
Constant	1.1654***
	(4.08)
Year Fixed Effects	Yes
Observations	28,683
R-squared	0.402

Table 5. Low (lower than median) vs. High (higher than median) Social Capital

Subsample:	Low Social Capital	High Social Capital
Dependent Variable:	MortgageDelinquency	MortgageDelinquency
SocialCapital	-0.5244***	-0.1277***
	(-7.12)	(-2.65)
SubprimeCredit	-0.0014	0.0380***
	(-0.21)	(6.59)
Change in Income	-0.0001***	-0.0001***
	(-8.03)	(-8.43)
Education	-0.0152**	-0.0152***
	(-2.36)	(-4.05)
Population	0.0000**	0.0000***
	(2.26)	(4.12)
Change in Unemployment	0.2329***	0.1960***
	(8.93)	(8.92)
Change in MedianHouseValue	-0.0721***	-0.0301***
	(-20.18)	(-8.79)
Political Affiliation	-0.0274***	-0.0052**
	(-9.19)	(-2.35)
Minority	1.2994***	0.2281
	(5.72)	(0.96)
LocalSeniors	6.1849***	4.0156***
	(4.33)	(3.45)
Constant	1.6227***	-0.1105
	(3.67)	(-0.33)
Year fixed effects	Yes	Yes
Observations	14,342	14,341
R-squared	0.388	0.417

social capital has a more pronounced effect on areas with a lower level of social capital

Identification Tests and Instrumental Variable (IV) Approach

- One does not expect big population movements from one county to another county in search of factors related to social capital in a short period of time, such as our sample period.

- Yet, it can be argued that there might be an omitted variable that affects both current levels of social capital and mortgage delinquency.

- To address this concern, we first use an alternative social capital measure used in the related literature and re-examine our main results as a first step.

Identification Tests and Instrumental Variable (IV) Approach

- We use an alternative measure which might not be subject to the endogeneity problem and re-examine our main results. Earlier studies (e.g., Hasan et al. 2017b; Guiso et al., 2004; and Buonnanno et al., 2009) use organ donation per capita as an alternative proxy for social capital.

- Consistent with the literature we use the state-level organ donation per capita, *OrganDonation,* as an alternative measure for social capital and re-run our baseline test in Table 6. There is a negative and statistically significant coefficient for *OrganDonation*. Our alternative measure of social capital provides a result similar to our earlier results in Table 6.

Table 6. Test with an Alternative Social Capital Measure

Dependent Variable	MortgageDelinquency
OrganDonation	-14.2951***
	(-6.44)
SubprimeCredit	0.0180***
	(3.84)
Change in Income	-0.0001***
	(-11.51)
Education	-0.0305***
	(-7.93)
Population	0.0000***
	(3.06)
Change in Unemployment	0.2296***
	(11.63)
Change in MedianHouseValue	-0.0481***
	(-15.31)
Political Affiliation	-0.0135***
	(-6.73)
Minority	1.4267***
	(7.40)
LocalSeniors	2.1425**
	(2.21)
Constant	1.9035***
	(5.76)
Year fixed effects	Yes
Observations	28,683
R-squared	0.389

2SLS Analysis with IV Approach

- Next, we provide a more direct test to address potential endogeneity concern: we use a two-stage least square (2SLS) analysis with an instrumental variable (IV) approach.

- We utilize three IVs

- IV 1: Consistent with the previous studies (e.g., Hilary and Hui, 2009), we use the social capital lagged by three years as an IV (Panel A, Column 1), and alternatively lagged by five years (Panel A, Column 2).

  - The social capital lagged by 3 or 5 years can be considered correlated with the current level of social capital. However, one expects that the social capital lagged by 3 or 5 years is not correlated with any omitted variables in the current year settings.

2SLS Analysis with IV Approach

- IV 2: We use a different IV (Panel B): The average social capital of the neighboring counties within a 100-mile radius as an IV (Jha and Cox (2015).

- This is a strong IV because the social capital of neighboring counties is similar to the one in the given county. One can expect that it is unlikely that the scope of the mortgage delinquency in a given county influences the average social capital of the neighboring counties within a 100-mile radius.

2SLS Analysis with IV Approach

- **IV 3**: The prior literature suggests that distance to the Canadian border is an important and strong predictor of the social capital for the locations in the US (e.g., Putnam 2001; and Hasan et al., 2017). We construct the IV, *log(BorderDistance)*, by taking log of the distance to the Canadian border (Panel C).

Table 7. 2SLS Analysis with IV Approach

	(1)	(2)
Panel A.		
IV	SocialCapital$_{t-3}$	SocialCapital$_{t-5}$
Dependent Variable:	MortgageDelinquency	MortgageDelinquency
SocialCapital	-0.3357***	-0.3988***
	(-5.71)	(-5.47)
Controls	Yes	Yes
Year fixed effects	Yes	Yes
Observations	26,475	22,059
R-squared	0.390	0.386
Panel B.		
IV	Avg. Social Capital of Neighbors	
Dependent Variable:	MortgageDelinquency	
SocialCapital	-0.5064***	
	(-12.26)	
Controls	Yes	
Year fixed effects	Yes	
Observations	28,683	
R-squared	0.390	
Panel C.		
IV	Log (BorderDistance)	
Dependent Variable:	MortgageDelinquency	
SocialCapital	-0.6656***	
	(-6.41)	
Controls	Yes	
Year fixed effects	Yes	
Observations	28,683	
R-squared	0.379	

Conclusion

- We empirically establish that an increase in social capital leads to a statistically and economically significant decreases in mortgage delinquency rate.

- This result is stronger after the financial crisis.

- The result is stronger for neighborhood with lower level of social capital.

Policy Implications:

- Government: programs reinforcing a strong neighborhood social connection and trust ex-ante.

- Lenders: improving models of pricing borrower's risk by incorporating the social capital measure as a contributing risk factor.

Summary Statistics

Variable	Mean	25th percentile	Median	75th percentile	Std. dev.	N
MortgageDelinquency (%)	2.38	0.94	1.74	3.11	2.29	28,683
SocialCapital (index)	-0.32	-0.99	-0.39	0.26	1.02	28,683
SubprimeCredit (%)	33.00	27.17	32.24	38.57	7.75	28,683
Income ($)	36,340.29	30,057.82	34,599.10	40,406.61	9,313.18	28,683
LocalSeniors	0.14	0.12	0.14	0.16	0.04	28,683
Education (%)	19.39	12.88	16.90	23.55	9.07	28,683
Population	102,058.7	17,700	31,900	79,100.00	271,657.4	28,683
Unemployment(%)	6.32	4.40	5.70	7.70	2.81	28,683
MedianHouseValue ($000)	112,737.3	71,700	92,580.65	126,783	70,480.41	28,683
PoliticalAffliation (%)	55.48	47.85	56.10	64.10	12.32	28,683
Minority	0.20	0.06	0.13	0.30	0.18	28,683

Min and Max Social Capital index for the US are -3.93 and 17.44, respectively,