

Home Equity Mitigates the Financial and Mortality Consequences of Health Shocks: Evidence from Cancer Diagnoses

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1. **Do wealth shocks affect health outcomes among insured households?**

- Strong correlation between household wealth and socioeconomic status.
- Skepticism in literature about causal relationship.
 - Schwandt (2018), Cesarini et al. (2016), Erixson (2017), Finkelstein et al. (2012)

1. Do wealth shocks affect health outcomes among insured households?
2. **Do health events have large effects on extreme financial outcomes—such as foreclosure and bankruptcy—among insured households?**
 - Dobkin et al. (2018) find small effects on bankruptcy from hospital admissions.
 - Less is known about more severe health shocks like cancer, 40% lifetime prevalence.

1. Do wealth shocks affect health outcomes among insured households?
2. Do health events have large effects on extreme financial outcomes, such as foreclosure and bankruptcy?
3. **Are credit markets an important substitute for health insurance among households with incomplete coverage?**
 - Dobkin et al. (2018) observe a decline in credit market access following health events, likely due to health-related job loss.

Our Contribution: Cancer Mortality Rates Vary with Access to Credit Markets

1. Do wealth shocks affect health outcomes among insured households?

- Mortality hazard rates are **17 percentage points higher** for households without no home equity relative to those with substantial equity.
- Use a variety of different identification strategy using exogenous shocks to house prices.

Our Contribution: Cancer Mortality Rates Vary with Access to Credit Markets

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2. **Do health events have large effects on extreme financial outcomes—such as foreclosure and bankruptcy—among insured households?**
 - **>90% increase** in mortgage default and foreclosure rates (during 5 years post-diagnosis)
 - **>50% increase** in bankruptcy rate.
 - These effects are driven by highly-leveraged households without home equity.

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 - High-equity borrowers **extract equity** following diagnosis.

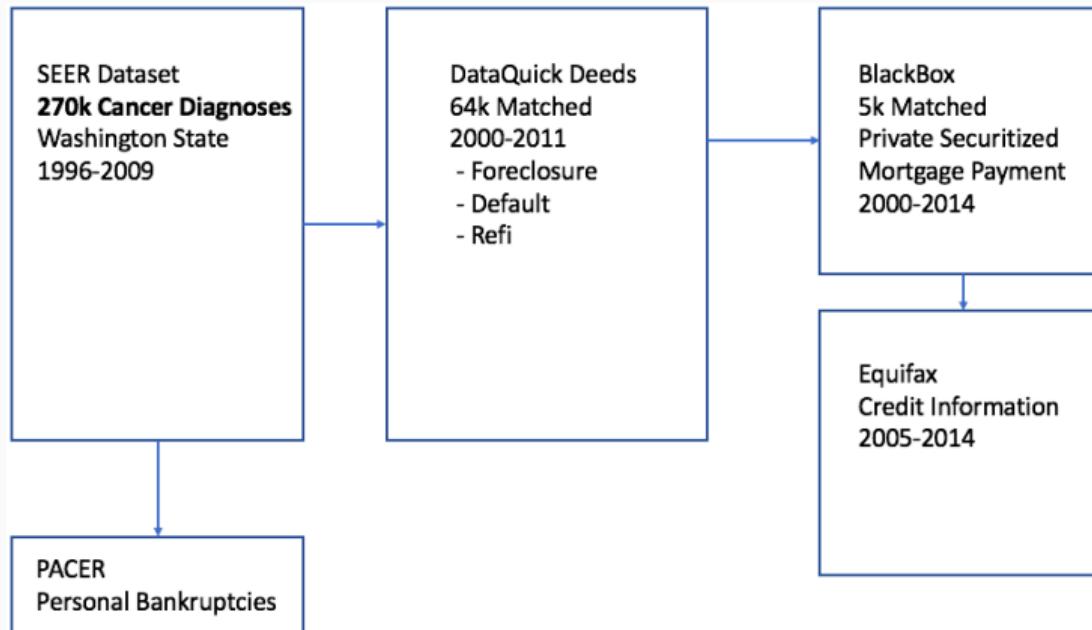
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 - High-equity borrowers extract equity following diagnosis.
 - Are more likely to accept recommended therapy.
 - Are **more likely to survive at least five years following diagnosis.**

Novel Linkage of Administrative Cancer Records and Personal Financial Information



For Chris Palmer

	Mean	Income	Mean Vantage Score	SD Vantage
Age	58			
Married	65%			
Non-White	14%			
Occupations:				
-Professional	21%	\$82k	837	124
-Clerical	18%	\$73k	807	123
-Laborer	23%	\$61k	764	121
-Unemployed	6.5%	\$77k	812	125
N	63,893			

$$\text{Corr}(\text{Income}, \text{Credit Score}) = 0.71$$

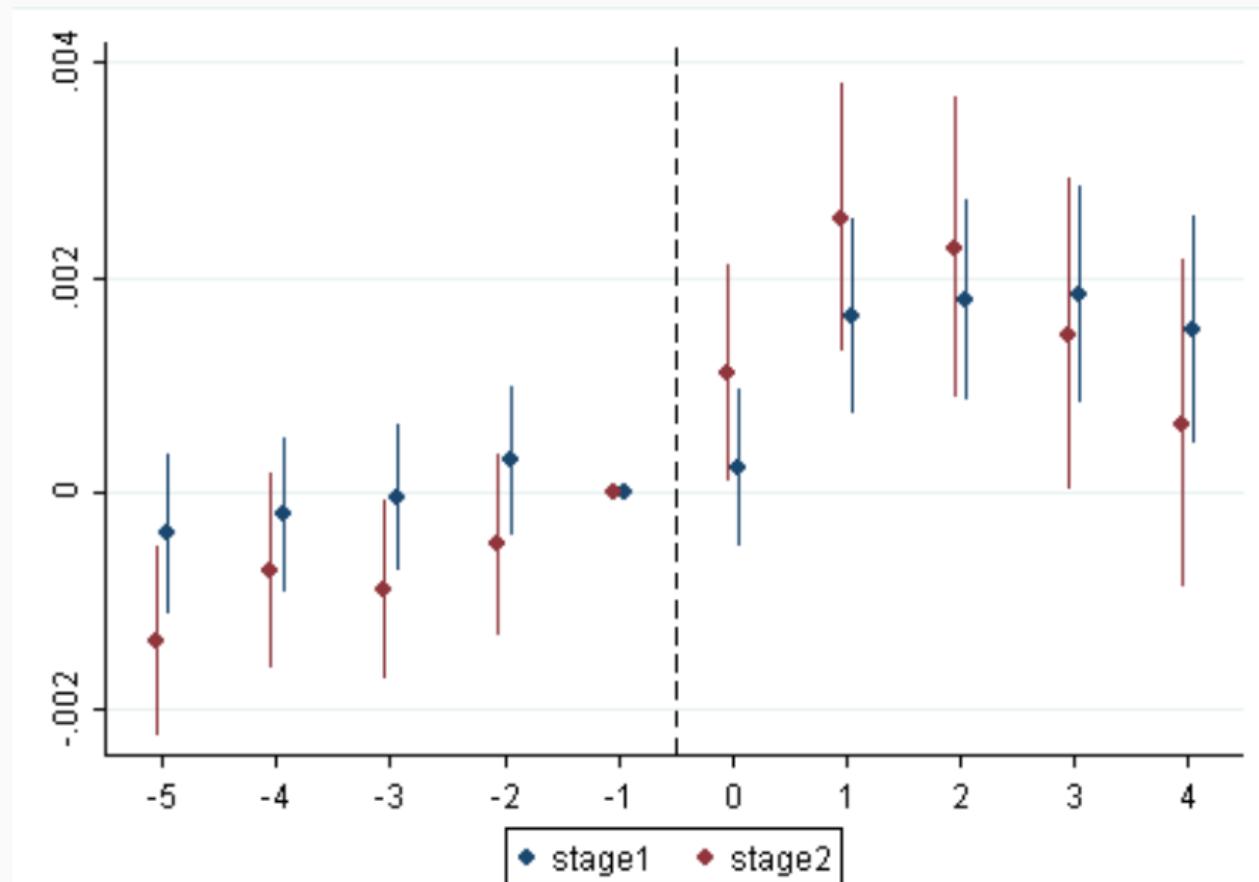
$$D_{it} = \alpha + \sum_{k=-5}^4 \mu_k \cdot \mathbf{1}[(t - T_i) = k] + \theta_t + \gamma_j + x_{it}'\beta + \varepsilon_{it}$$

- D_{it} = Foreclosure or default in year t for person i
- T_i = year of diagnosis for individual
- θ_t = year fixed effect
- μ_k = Impact of year relative to diagnosis on default
- γ_j = county fixed effect
- x_{it} = other controls of patient (cancer type, stage), property, mortgage
- Restrictions: five years kept before/after diagnosis; year before is excluded category. Aged 21–80. Censored at mortality.
- **Timing of diagnosis assumed conditionally exogenous:**

$$E(\varepsilon_{it} | x_{it}, \theta_t, \gamma_j) = 0$$

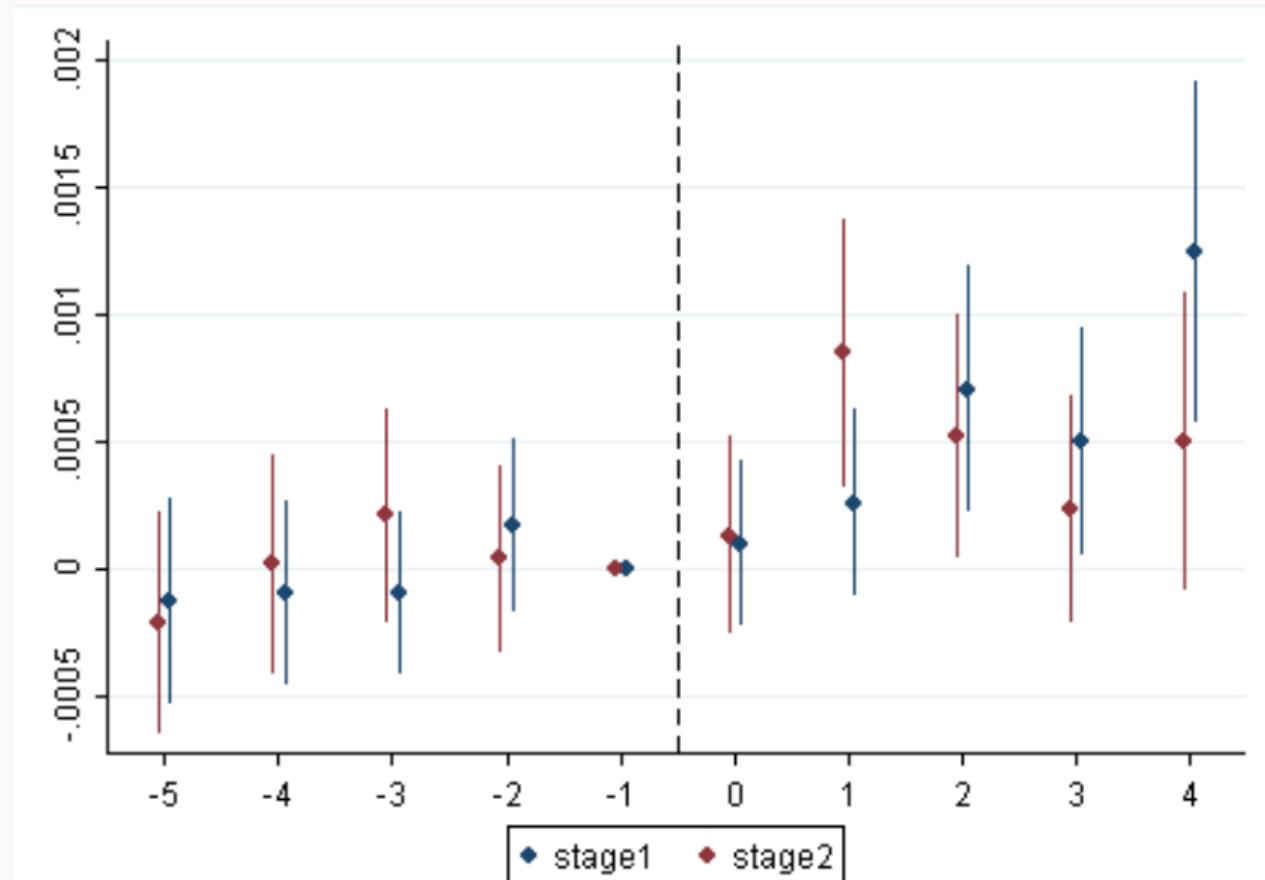
Evidence of Mortgage Default Response to Diagnosis

Go to Insured



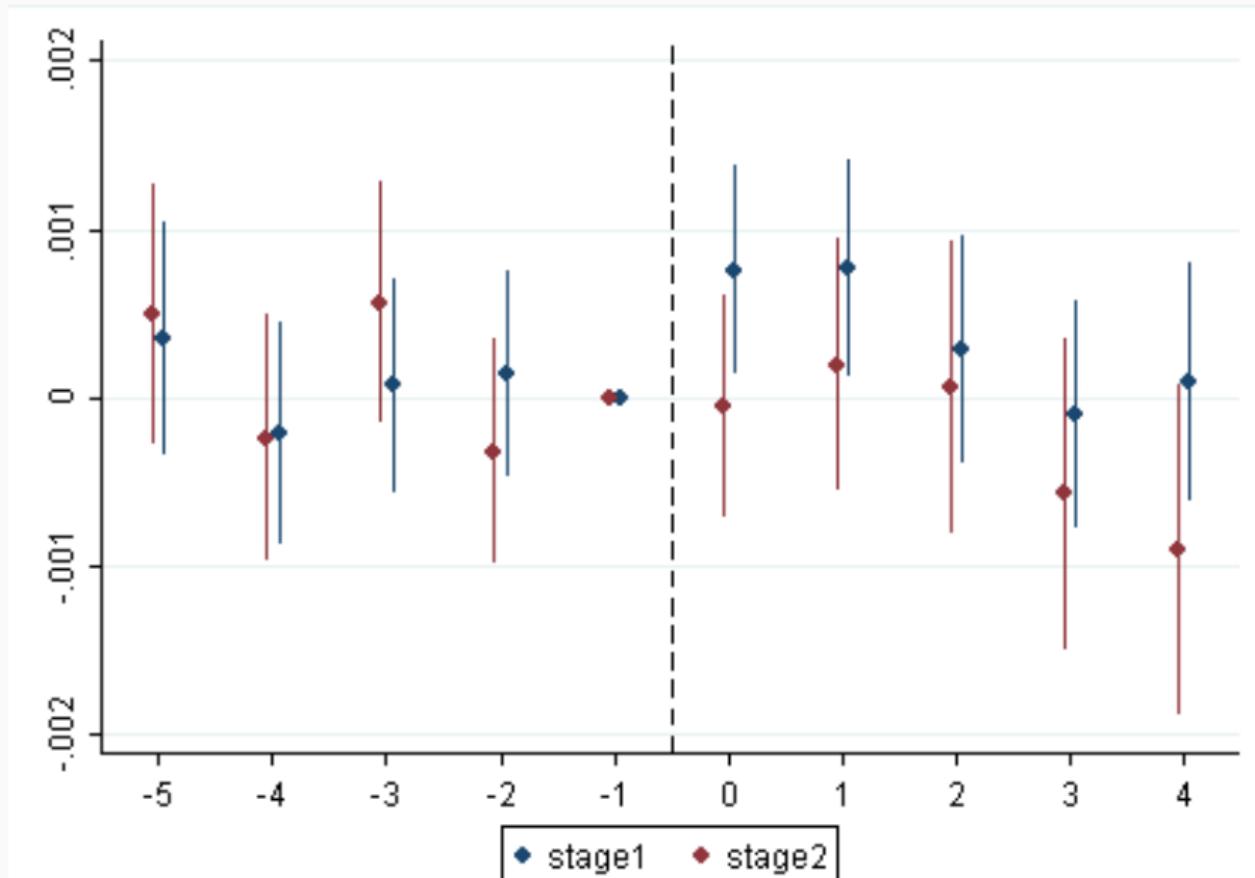
Translates to Foreclosures

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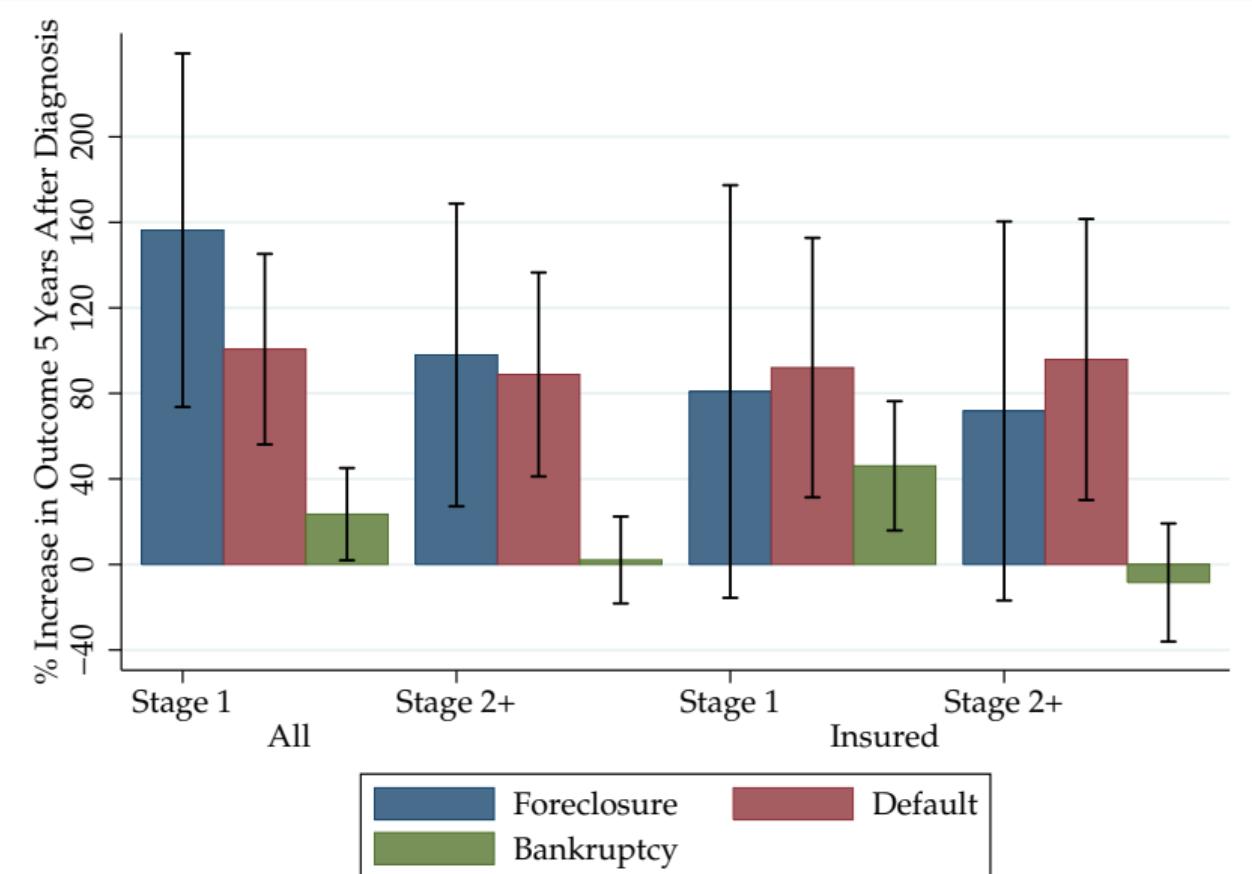
Less Evidence of Bankruptcy Response

Go to Insured



Effects Persist Among Medically Insured

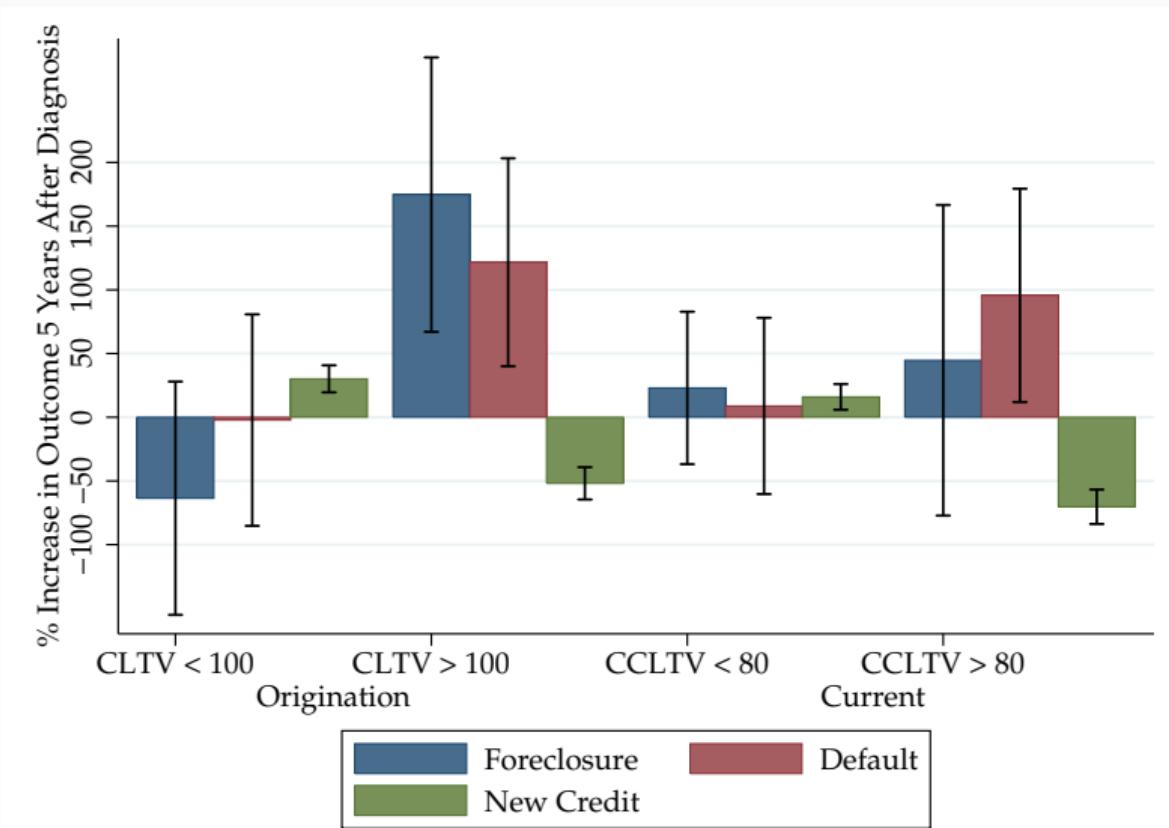
Regressions



Effects are Driven by Negative Equity Households

Positive Equity Households Avoid Distress by Accessing New Credit

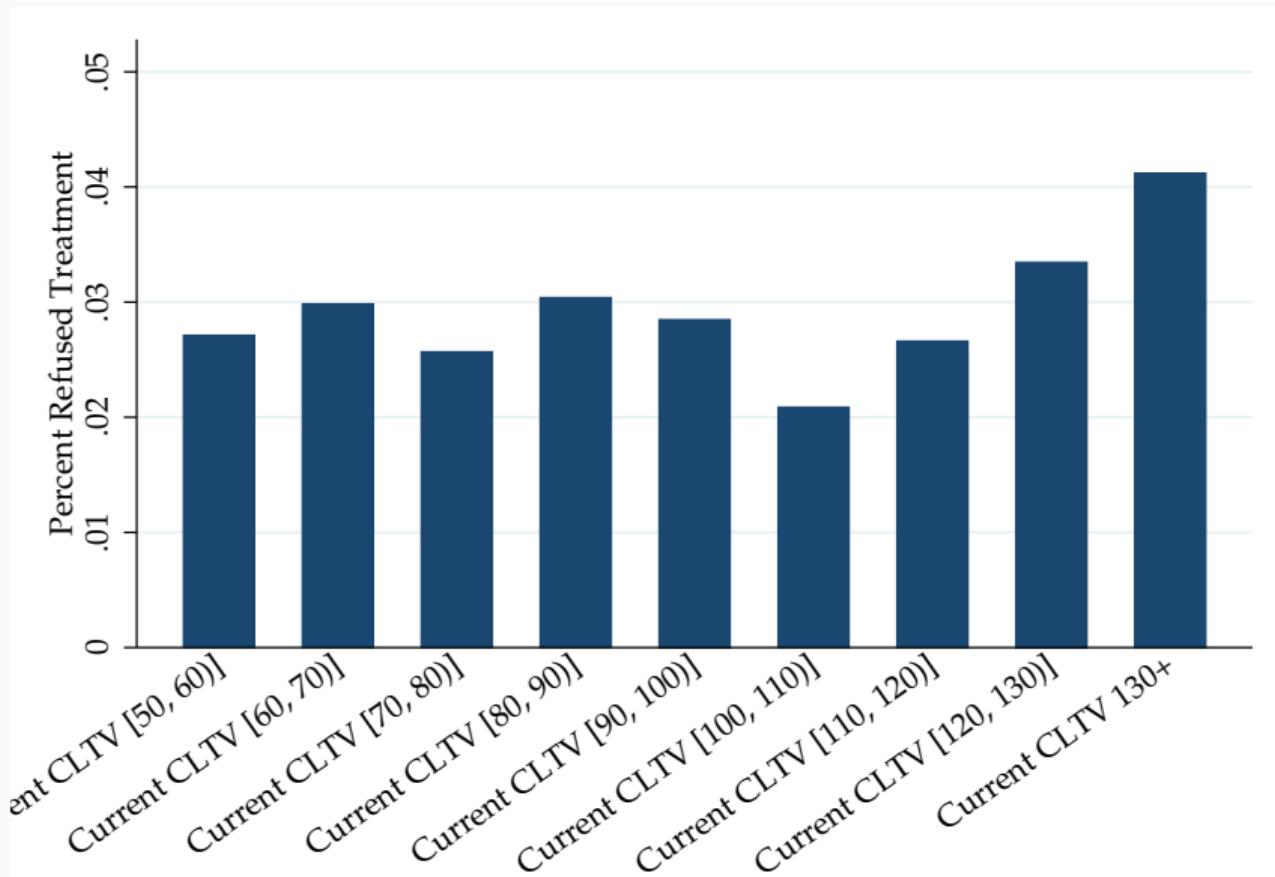
Regressions



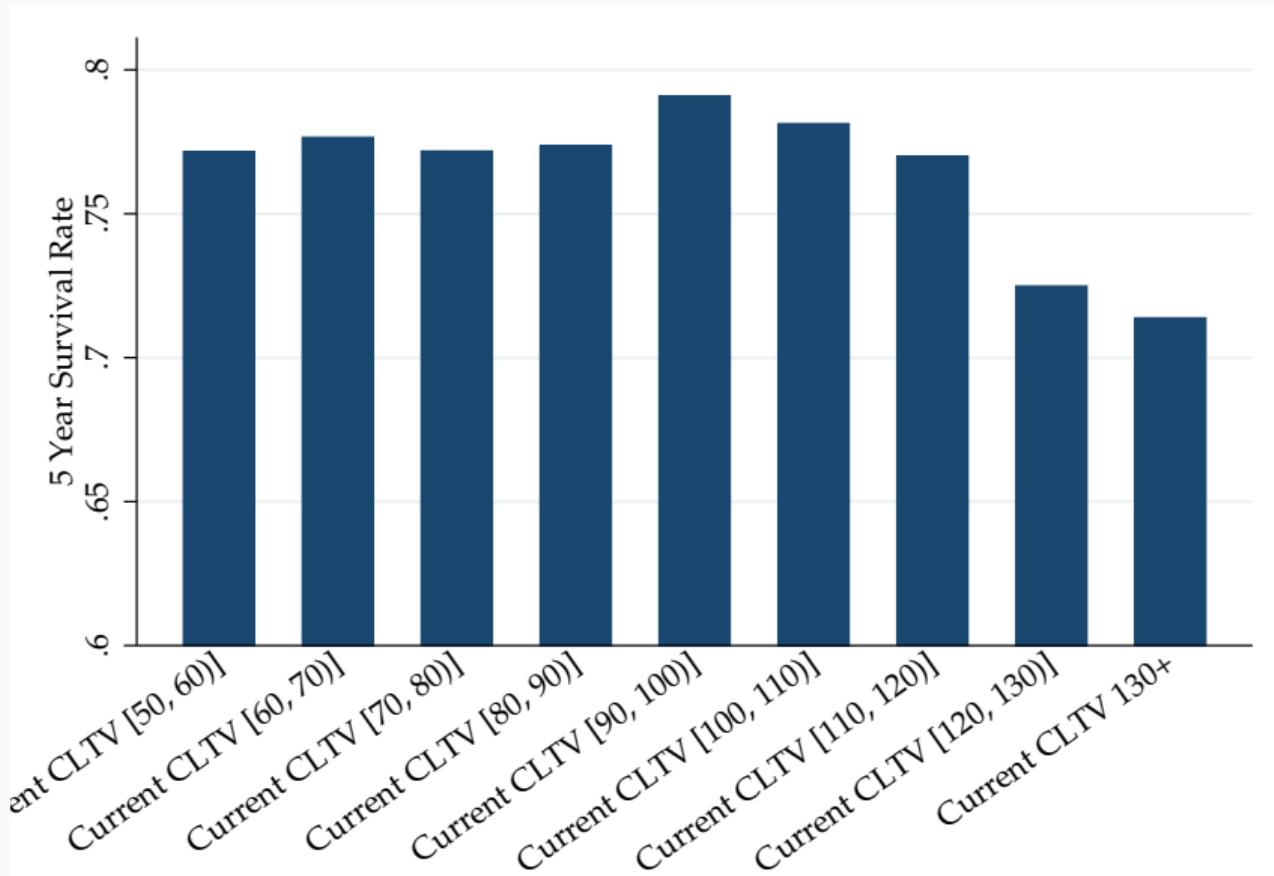
Demand for Unsecured Credit Increases, but Durables Consumption Does Not

	Has Auto	Credit Score	Card Balance	Credit Limit	# Revolving Accts
Year -3	-0.0023 (-0.18)	-3.07 (-0.98)	400.8 (0.73)	209.3 (0.08)	-0.073 (-0.18)
Year -2	-0.0099 (-1.12)	0.76 (0.37)	-209.7 (-0.68)	189.3 (0.11)	0.14 (0.53)
Year +1	-0.0069 (-0.89)	-3.01 (-1.69)	152.6 (0.55)	1149.1 (0.72)	0.54* (2.62)
Year +2	-0.016 (-1.56)	-11.7** (-4.36)	10.0 (0.03)	1497.0 (0.73)	0.53 (1.93)
Year +3	-0.0099 (-0.84)	-13.9** (-4.55)	388.4 (0.98)	1663.6 (0.71)	0.15 (0.50)
N	1339760				

Underwater Borrowers more likely to Refuse Treatment

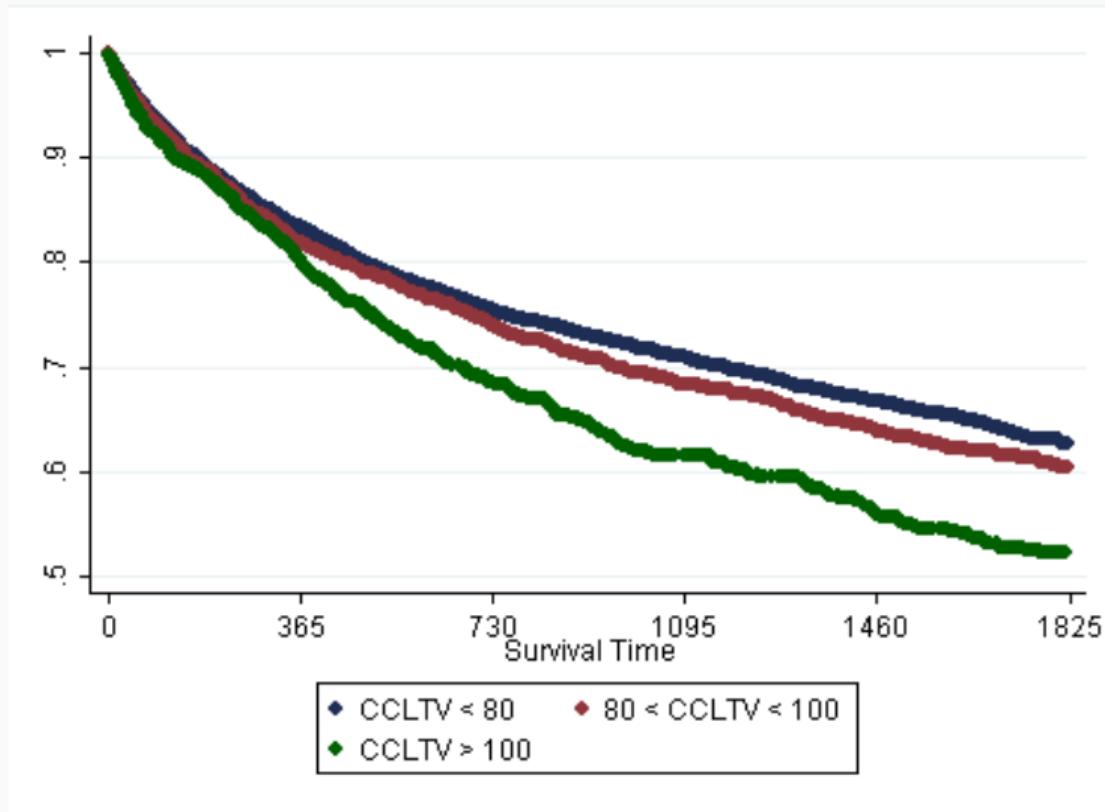


Underwater Borrowers have Worse Mortality



Underwater Borrowers have Worse Mortality

With Controls



Additional Controls for Variation in LTV

1. Loan age controls
2. Region \times Cohort: **variation from timing**
3. Cohort \times Time: Addresses sorting across different cohorts,
variation across geography

Similar to Struyven (2015) or Bernstein (2016)

Outcomes on Refused Treatment (OLS)

Current CLTV \leq 60	Excluded		
60 < Current CLTV \leq 80	0.0018 (0.50)	0.0027 (0.69)	0.0018 (0.47)
80 < Current CLTV \leq 100	0.0040 (0.91)	0.0022 (0.48)	0.0039 (0.89)
100 < Current CLTV	0.0084 (1.75)	0.0086 (1.65)	0.0084 (1.74)
Avg	0.039		
Loan Age	Yes	Yes	Yes
Region · Cohort	No	Yes	No
Cohort · Time	No	No	Yes

* $p < 0.05$, ** $p < 0.01$

Outcomes on Mortality (Hazard Ratio)

Current CLTV \leq 60	Excluded		
60 < Current CLTV \leq 80	0.073 (1.52)	0.069 (1.23)	0.072 (1.49)
80 < Current CLTV \leq 100	0.100 (1.80)	0.12 (1.81)	0.10 (1.88)
100 < Current CLTV	0.17** (3.01)	0.15* (2.36)	0.18** (3.10)
Loan Age	Yes	Yes	Yes
Region · Cohort	No	Yes	No
Cohort · Time	No	No	Yes

* $p < 0.05$, ** $p < 0.01$

Home Prices to Extraction to Treatment

	$\Delta HP \rightarrow$ Extraction	Extraction \rightarrow Performed	$\Delta HP \rightarrow$ Performed	$\Delta HP \rightarrow$ Extraction \rightarrow Performed
ΔHP	0.15** (10.52)		0.036** (4.17)	
Extracted		0.015** (5.87)		0.24** (3.99)
N	50881	50881	50881	50881
Specification:	First Stage	Second Stage	Reduced Form	IV
Controls	Yes	Yes	Yes	Yes
F-Stat				111

ΔHP = change in home prices in 36 months prior to diagnosis

Extraction = Equity extraction in period after diagnosis

Performed = Recommended treatment was performed

Robustness

- Delinquency on Non-Mortgage Debts [Link](#)
- Marital Status [Link](#)
- Cancer Site [Link](#)
- Distribution by Year [Link](#)
- Bankruptcy Chapter [Link](#)
- Urban [Link](#)
- Main Estimates by LTV Controls [Link](#)

Mechanisms of Results

1. Treatment costs, some of which borne out of pocket
2. Loss of work
3. Change in life horizon

1. Effects by Treatment Choice

	Surgery	Radiation	Chemo	Hormone	Transplant Bankruptcy	Endo	Other	Not Performed
5-Year Effect	0.000094	0.010*	0.00056	0.0065	0.0018		0.011	0.0011
S.E.	0.0032	0.0050	0.0039	0.0038	0.021		0.013	0.0056
Ref. Prob.	0.024	0.021	0.028	0.021	0.024		0.028	0.024

	<i>Default</i>						
5-Year Effect	0.0049*	0.013**	0.0094*	0.0072**	-0.015	0.025	0.0086
S.E.	0.0023	0.0031	0.0031	0.0026	0.019	0.013	0.0051
Ref. Prob.	0.0078	0.0069	0.0089	0.0079	0.0091	0.0087	0.0073

	<i>Foreclosure</i>						
5-Year Effect	0.0026**	0.0034**	0.0023	0.0045**	-0.017	-0.0013	0.0012
S.E.	0.0011	0.0013	0.0012	0.0011	0.012	0.0023	0.0018
Ref. Prob.	0.0022	0.0013	0.0024	0.0015	0.0036	0.0044	0.0019

* $p<0.05$, ** $p<0.01$

2. Higher Social Class Protective Against Defaults

	Professional	Clerical	Laborer	Unemployed	Other
<i>Panel A: Notice of Default</i>					
5-Year Effect	0.0057	0.015**	0.014**	-0.0047	-0.00087
S.E.	0.0030	0.0042	0.0051	0.0082	0.0048
Ref. Prob.	0.0017	0.0036	0.0042	0.0049	0.0042
<i>Panel B: Foreclosure</i>					
5-Year Effect	-0.0013	0.0054**	0.0065**	0.00060	0.0038
S.E.	0.0021	0.0018	0.0020	0.0044	0.0018
Ref. Prob.	0.00087	0.00078	0.00088	0.0017	0.00094
<i>Panel C: Bankruptcy</i>					
5-Year Effect	0.0050	-0.00089	0.0080*	0.0081	-0.00086
S.E.	0.0031	0.0043	0.0040	0.0055	0.0036
Ref. Prob.	0.022	0.037	0.045	0.032	0.035

3. Mortgage Default Chosen by Low Survival Horizon; Bankruptcy by Long

	Full Sample		Aged 26–60	
	High Survival	Low Survival	High Survival	Low Survival
<i>Notice of Default</i>				
5-Year Effect	0.0057**	0.010**	0.0052**	0.013**
S.E.	0.0016	0.0023	0.0023	0.0047
Ref. Prob.	0.0074	0.0087	0.0084	0.012
<i>Foreclosure</i>				
5-Year Effect	0.0022**	0.0031**	0.0019	0.0064**
S.E.	0.00078	0.00082	0.0012	0.0017
Ref. Prob.	0.0019	0.0022	0.0023	0.0028
<i>Bankruptcy</i>				
5-Year Effect	0.0046*	0.000083	0.0058	-0.0014
S.E.	0.0023	0.0028	0.0033	0.0062
Ref. Prob.	0.022	0.026	0.027	0.039

* $p < 0.05$, ** $p < 0.01$

Takeaway: Wealth Affects Health and Health Affects Wealth

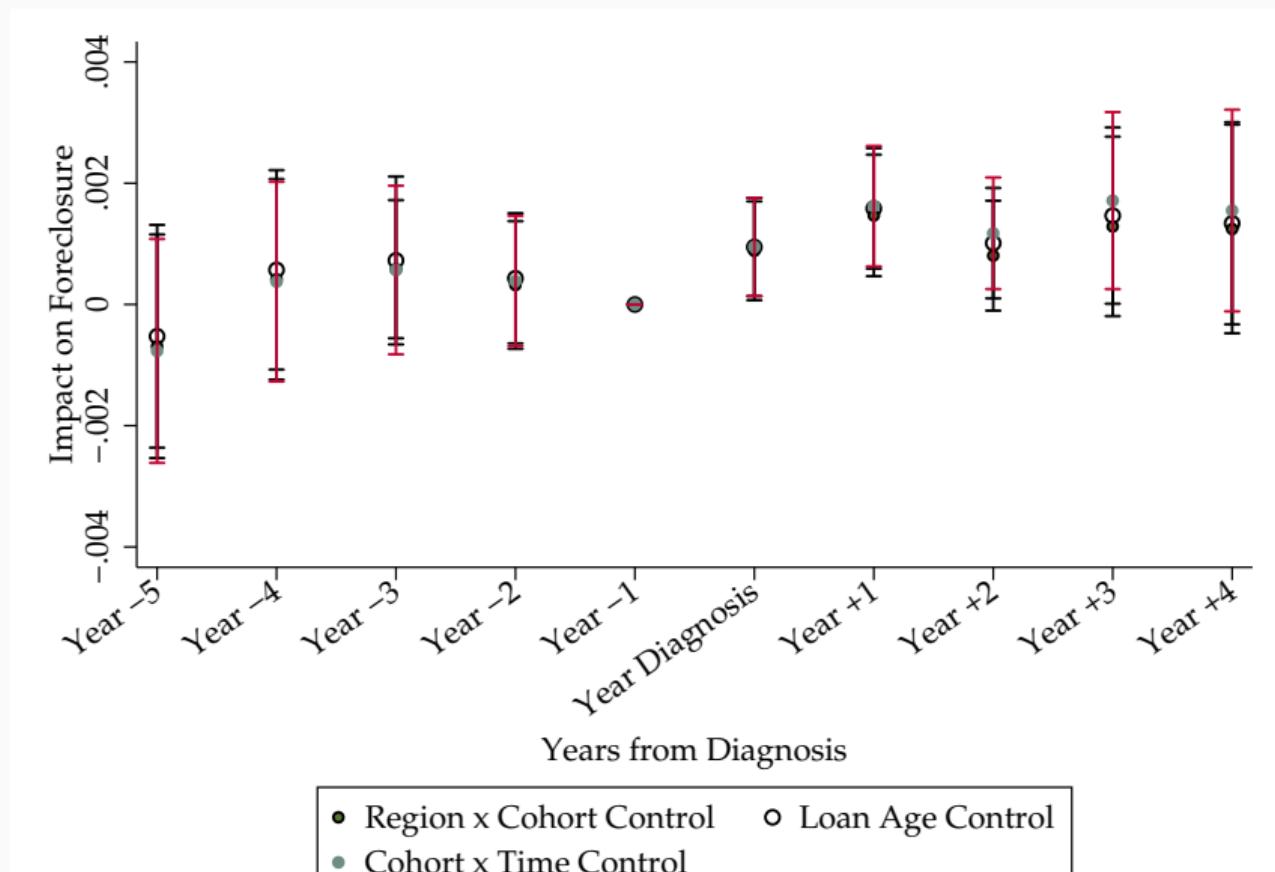
- Find strong evidence that **cancer diagnosis leads to financial distress** as measured by foreclosures, delinquencies.
 - Effect is present even for those with health insurance.
- **Wealth shocks impact longevity of cancer patients.**
- Credit markets, especially real estate, buffer against idiosyncratic shocks:
 - Individuals with equity: extract equity, do more treatments, live longer.
 - Negative equity: wind up in default/bankruptcy.
- Policy Implications: suggests **incompleteness in health insurance**
 - Could be met by additional supplementary health insurance.
 - Second best: macro-prudential policy to limit leverage.

Thanks!

Appendix

Effects Persist Under Cohort Controls

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Effects Persist Among Medically Insured

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	All		Insured	
	Stage 1	Stage 2+	Stage 1	Stage 2+
<i>Notice of Default</i>				
5-Year Effect	0.0070**	0.0081**	0.0071**	0.0086**
S.E.	0.0016	0.0022	0.0024	0.00097
Ref. Prob.	0.0070	0.0091	0.0077	0.0090
<i>Foreclosure</i>				
5-Year Effect	0.0028**	0.0022*	0.0016	0.0016
S.E.	0.00076	0.00083	0.00097	0.00099
Ref. Prob.	0.0018	0.0023	0.0020	0.0022
<i>Bankruptcy</i>				
5-Year Effect	0.0050*	-0.0058	0.0070**	-0.0019
S.E.	0.0023	0.0028	0.0023	0.0032
Ref. Prob.	0.021	0.027	0.012	0.021

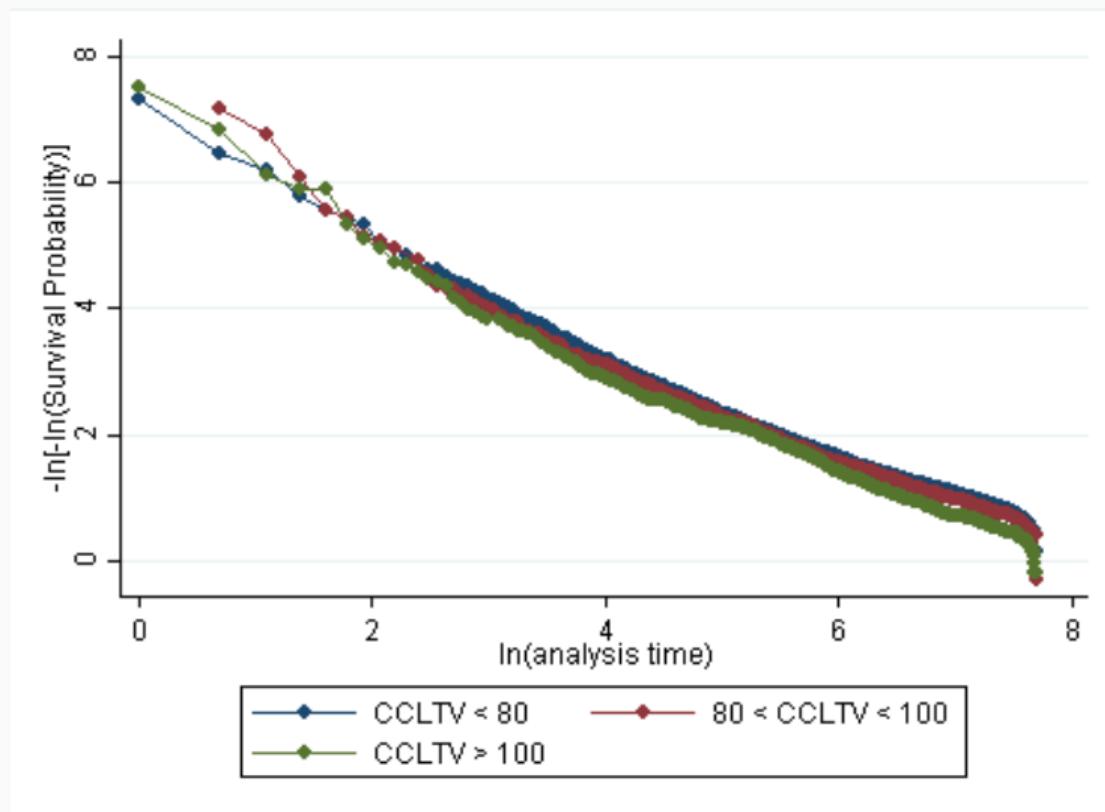
By Cancer Site

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	Breast	Colon	L/L	Lung	Prostate	Skin	Thyroid	Uterine	Other
<i>Panel A: Notice of Default</i>									
5-Year Effect	0.0060	0.0012	0.0061	0.014	0.0041	-0.00012	0.016	0.0055	0.013
S.E.	0.0030	0.0051	0.0044	0.0050	0.0022	0.0046	0.0074	0.0058	0.0033
Ref. Prob.	0.0087	0.0076	0.0078	0.0098	0.0051	0.0079	0.010	0.0099	0.0082
<i>Panel B: Foreclosure</i>									
5-Year Effect	0.0018	0.0022	0.0031	0.0029	0.00030	0.0023	0.0034	0.0025	0.0044
S.E.	0.0014	0.0024	0.0019	0.0013	0.0014	0.0021	0.0034	0.0020	0.0011
Ref. Prob.	0.0019	0.0025	0.0021	0.0023	0.0012	0.0029	0.0019	0.0016	0.0022
<i>Panel C: Bankruptcy</i>									
5-Year Effect	0.0086	-0.0039	0.0061	0.00040	0.00034	-0.0059	0.030	0.015	-0.0014
S.E.	0.0038	0.0062	0.0060	0.0066	0.0037	0.0066	0.012	0.0093	0.0042
Ref. Prob.	0.022	0.022	0.026	0.028	0.016	0.023	0.024	0.026	0.028

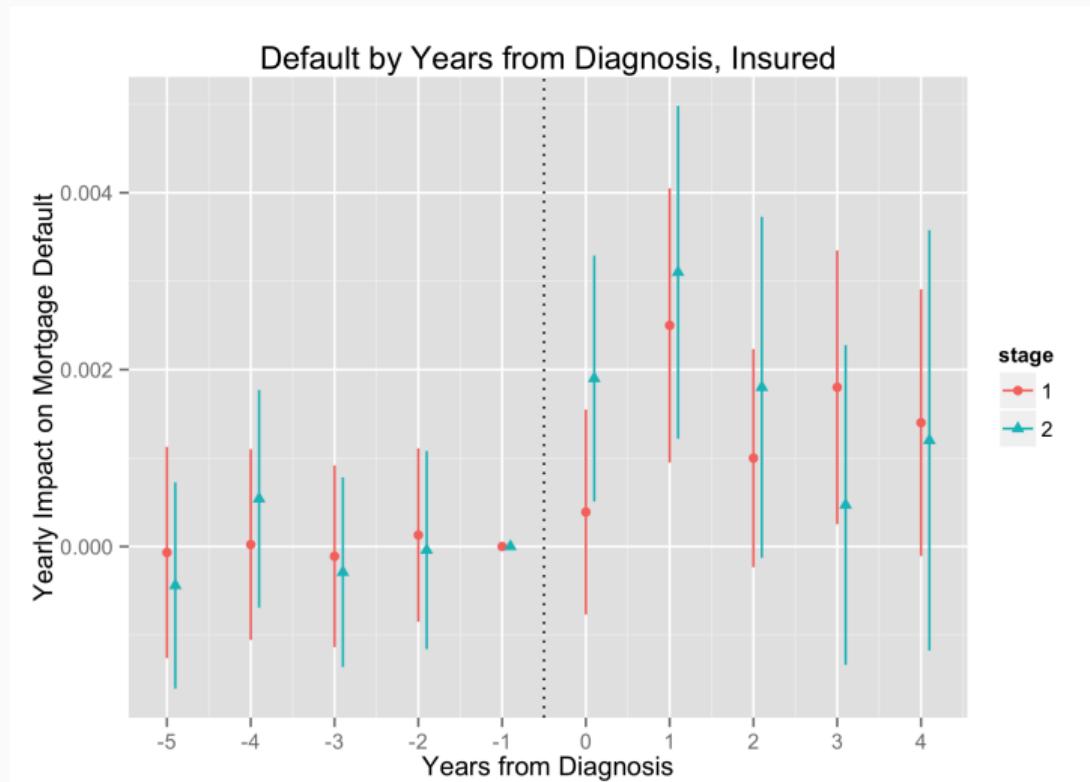
Underwater Borrowers have Worse Mortality

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Evidence of Mortgage Default Response to Cancer Diagnosis

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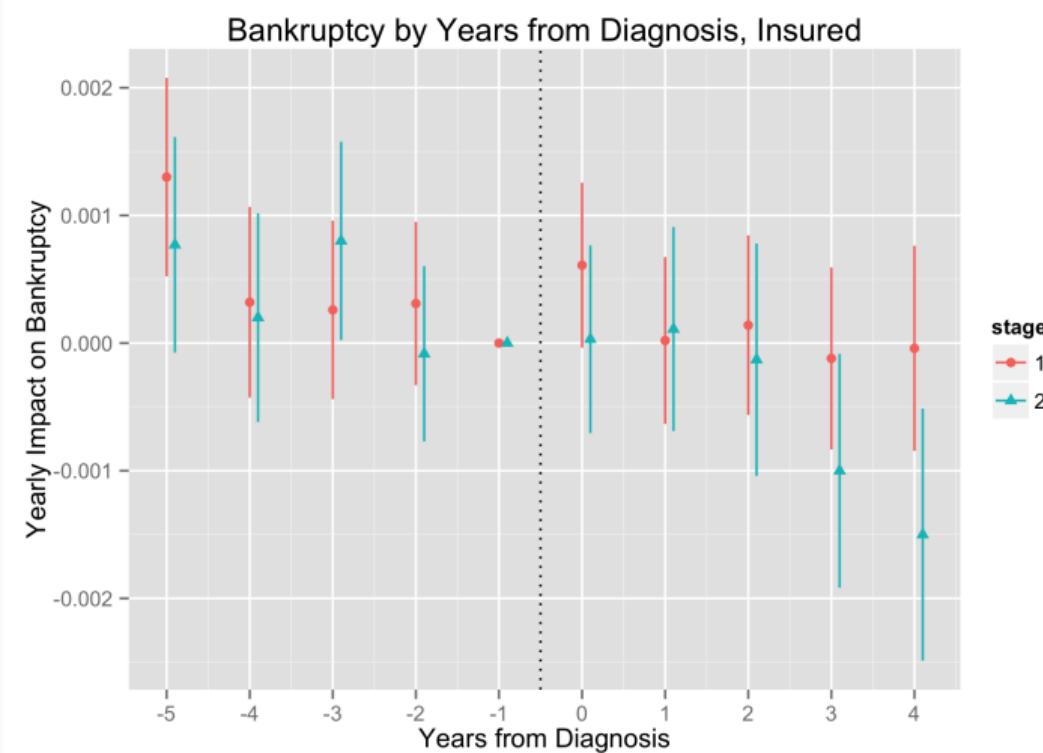


Translates to Foreclosures

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Less Evidence of Bankruptcy Response

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Summary Statistics

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	Full Sample		Deeds Sample	
	Mean	SD	Mean	SD
Age	60.926	12.8	58.086	12.8
Married	0.604	0.49	0.650	0.48
Marriage Missing	0.091	0.29	0.096	0.29
Male	0.505	0.50	0.497	0.50
Non-White	0.118	0.32	0.141	0.35
Occupation:				
– Professional	0.184	0.39	0.211	0.41
– Clerical	0.169	0.37	0.186	0.39
– Laborer	0.256	0.44	0.236	0.42
– Other	0.064	0.25	0.056	0.23
– Unemployed	0.061	0.24	0.065	0.25
– Self-Pay	0.003	0.052	0.003	0.051
Insurance:				
– Private Insured	0.095	0.29	0.147	0.35
– Medicare	0.449	0.50	0.341	0.47
– Medicaid	0.012	0.11	0.011	0.10
– Other	0.009	0.093	0.008	0.089
– Missing	0.432	0.50	0.491	0.50
Has Mortgage			0.221	0.41
Origination CLTV			94.127	48.9
Current CLTV			78.263	51.1

Strong Evidence of Mortgage Responses Among Borrowers with Negative Equity

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	CLTV<100	CLTV \geq 100	CCLTV<80	CCLTV \geq 80
<i>Notice of Default</i>				
5-Year Effect	-0.0045	0.077**	0.0098	0.046*
S.E.	0.0071	0.027	0.0059	0.022
Ref. Prob.	0.013	0.032	0.012	0.034
<i>Foreclosure</i>				
5-Year Effect	-0.0024	0.020*	0.0058	0.0052
S.E.	0.0031	0.0098	0.0031	0.0079
Ref. Prob.	0.0051	0.010	0.0054	0.0092

* $p<0.05$, ** $p<0.01$

Positive Equity Individuals can Access New Credit

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	CLTV<100	CLTV \geq 100	CCLTV<80	CCLTV \geq 80
<i>Bankruptcy</i>				
5-Year Effect	0.00014	0.034*	0.0088	0.0099
S.E.	0.0058	0.016	0.0061	0.012
Ref. Prob.	0.022	0.044	0.022	0.043
<i>New Credit</i>				
5-Year Effect	0.17**	-0.28**	0.093	-0.28**
S.E.	0.050	0.088	0.050	0.078
Ref. Prob.	0.57	0.84	0.65	0.70

* $p<0.05$, ** $p<0.01$

	Localized	Regional	Distant	Unstaged	Total
1996	1460	600	634	208	2902
1997	1644	660	702	222	3228
1998	1719	666	743	213	3341
1999	1870	757	791	197	3615
2000	2013	832	793	151	3789
2001	2171	991	953	123	4238
2002	2348	1098	1055	87	4588
2003	2464	1137	1086	112	4799
2004	2599	1208	1100	87	4994
2005	2640	1169	1222	113	5144
2006	2784	1135	1209	126	5254
2007	2989	1355	1299	138	5781
2008	3116	1386	1270	92	5864
2009	3269	1394	1336	264	6263
Total	33086	14388	14193	2133	63800
Observations	63800				

BlackBox Summary

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	Mean	N
Original balance	\$290k	3k
Origination LTV	81%	3k
FICO	689	2k
Interest Rate	6.98%	2k
Type:		3k
- Jumbo Prime	55%	
- Subprime	25%	
- Alt A	15%	
Purpose:		3k
- Purchase	31%	
- Refinance	26%	
- Cash-out-Refi	37%	

Equifax Summary

	Mean	N
Months of Credit	12	1447
Current CLTV	65%	1273
Credit Utilization	34%	1446
Vantage	800	1550
Income	\$71k	1551

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Panel Regression, OLS, among Married by Gender

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Dep Var:	Foreclosure		Notice of Default		Bankruptcy	
	Male	Female	Male	Female	Male	Female
Year 5 Before Diagnosis	-0.000041 (-0.22)	-0.00020 (-0.69)	-0.00028 (-0.63)	-0.0011* (-2.09)	0.00064 (1.51)	0.000029 (0.06)
Year 4 Before Diagnosis	0.00019 (0.99)	-0.000070 (-0.24)	-0.00031 (-0.77)	-0.00061 (-1.17)	-0.00011 (-0.27)	-0.00059 (-1.34)
Year 3 Before Diagnosis	0.00013 (0.78)	0.00023 (0.82)	-0.00023 (-0.58)	-0.00051 (-1.05)	0.00032 (0.84)	0.00011 (0.24)
Year 2 Before Diagnosis	0.000080 (0.54)	-0.000073 (-0.33)	-0.000023 (-0.06)	-0.00026 (-0.54)	-0.00021 (-0.59)	0.00065 (1.52)
Year 1 After Diagnosis	0.00037 (1.83)	-0.00014 (-0.67)	0.00093* (2.01)	0.00023 (0.45)	0.00099 ** (2.63)	0.00053 (1.28)
Year 2 After Diagnosis	0.00063 * (2.53)	0.00030 (1.11)	0.0015 ** (2.80)	0.0017 * (2.57)	0.00047 (1.19)	0.0016 *** (3.36)
Year 3 After Diagnosis	0.00022 (1.14)	0.0011 ** (2.99)	0.0011 (1.95)	0.0021 ** (3.01)	0.00040 (0.93)	0.00076 (1.55)
Year 4 After Diagnosis	0.00014 (0.69)	0.00060 (1.96)	0.0022 ** (3.14)	0.0015* (2.14)	0.00012 (0.27)	0.00028 (0.55)
Year 5 After Diagnosis	0.00087* (2.39)	0.00069 (1.85)	0.00096 (1.46)	0.0026 ** (2.95)	0.00025 (0.54)	0.00044 (0.83)
5-Year Treatment Effect	0.0022	0.0025	0.0066	0.0080	0.0022	0.0036
S.E.	0.00078	0.00098	0.0019	0.0023	0.0015	0.0017

Panel Regression, OLS, Choice of Bankruptcy Chapter

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Sample:	Full Sample		Deeds Sample		Low Survival		High Survival	
	Ch.:	Ch. 7	Ch. 13	Ch. 7	Ch. 13	Ch. 7	Ch. 13	Ch. 7
Y 5-		0.00042 (1.64)	0.000026 (0.23)	-0.00011 (-0.26)	-0.000071 (-0.33)	0.00047 (1.24)	-0.000020 (-0.12)	0.00037 (1.05)
Y 4-		-0.00019 (-0.76)	-0.000100 (-0.93)	-0.00061 (-1.43)	-0.00041* (-2.08)	-0.00028 (-0.77)	-0.00026 (-1.73)	-0.00011 (-0.33)
Y 3-		0.00038 (1.59)	-0.00010 (-1.01)	-0.00049 (-1.21)	-0.000020 (-0.10)	0.00045 (1.28)	-0.00019 (-1.27)	0.00030 (0.92)
Y 2-		-0.000030 (-0.13)	-0.00014 (-1.36)	-0.00066 (-1.73)	-0.00022 (-1.15)	-0.00042 (-1.29)	-0.00036** (-2.58)	0.00034 (1.06)
Y 1-		0.00038 (1.70)	-0.000071 (-0.72)	0.00042 (1.04)	-0.00012 (-0.63)	0.00000093 (0.00)	-0.00025 (-1.76)	0.00077* (2.43)
Y 2+		0.00055* (2.23)	-0.00015 (-1.45)	0.0011* (2.37)	-0.000050 (-0.24)	-0.00019 (-0.53)	-0.00029 (-1.89)	0.0011*** (3.39)
Y 3+		0.00032 (1.21)	-0.00014 (-1.25)	0.00059 (1.24)	-0.00011 (-0.49)	-0.00038 (-0.92)	-0.00038* (-2.22)	0.00079* (2.27)
Y 4+		-0.00015 (-0.56)	-0.00027* (-2.31)	0.00036 (0.73)	-0.00019 (-0.79)	-0.0011** (-2.62)	-0.00048** (-2.73)	0.00041 (1.17)
Y 5+		-0.00018 (-0.63)	0.000017 (0.13)	0.00011 (0.23)	0.00020 (0.73)	-0.0012** (-2.58)	-0.00023 (-1.07)	0.00038 (1.03)
5-Year		0.00093	-0.00062	0.0026	-0.00026	-0.0029	-0.0016	0.0035
S.E.		0.00093	0.00041	0.0017	0.00083	0.0014	0.00062	0.0013
Ref. Filing		0.024	0.0043	0.023	0.0052	0.025	0.0041	0.024
N		1604812	1604812	486438	486438	728182	728182	876435

Panel Regression, OLS, By Urban

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	Urban	Rural	Urban	Rural	Urban	Rural
Year 5 Before Diagnosis	-0.000077*	-0.000099*	-0.000025	-0.00000083	0.000013	0.000040
	(-2.07)	(-2.04)	(-1.42)	(-0.03)	(0.34)	(1.06)
Year 4 Before Diagnosis	-0.000031	-0.000062	-0.000014	0.000010	-0.000039	-0.000010
	(-0.82)	(-1.26)	(-0.84)	(0.37)	(-1.09)	(-0.29)
Year 3 Before Diagnosis	-0.000037	-0.000058	-0.0000015	0.0000057	0.000011	0.000034
	(-1.10)	(-1.25)	(-0.09)	(0.25)	(0.32)	(0.97)
Year 2 Before Diagnosis	-0.0000052	-0.000013	-0.000011	0.000042	-0.0000077	-0.0000068
	(-0.15)	(-0.29)	(-0.77)	(1.74)	(-0.23)	(-0.21)
Year 1 After Diagnosis	0.000091*	0.000032	0.0000065	0.000018	-0.0000080	0.000074*
	(2.30)	(0.61)	(0.41)	(0.84)	(-0.25)	(2.19)
Year 2 After Diagnosis	0.0018**	0.0023**	0.00047*	0.00066*	0.00035	0.00074*
	(3.91)	(3.51)	(2.31)	(2.35)	(0.99)	(2.04)
Year 3 After Diagnosis	0.0016**	0.0026**	0.00053*	0.00078*	0.00011	0.00029
	(3.24)	(3.57)	(2.52)	(2.54)	(0.28)	(0.75)
Year 4 After Diagnosis	0.0019**	0.0014*	0.00030	0.00044	-0.00031	-0.00033
	(3.51)	(1.98)	(1.50)	(1.54)	(-0.78)	(-0.83)
Year 5 After Diagnosis	0.0010*	0.0017*	0.00011	0.0021**	-0.00030	-0.00018
	(1.96)	(2.01)	(0.55)	(4.09)	(-0.73)	(-0.43)
Treatment 3 Years	0.0043	0.0053	0.0011	0.0016	0.00038	0.0018
S.E.	0.0010	0.0014	0.00042	0.00059	0.00085	0.00085
Treatment 5 Years	0.0072	0.0084	0.0015	0.0042	-0.00023	0.0013
S.E.	0.0016	0.0023	0.00066	0.0010	0.0014	0.0014
Ref. Prob. 1 Year	0.0022	0.0030	0.00044	0.00050	0.0049	0.0052
Ref. Prob. 5 Years	0.0074	0.0087	0.0015	0.0028	0.023	0.026