Consumer Durables and the Distributional Effects of Credit Supply Shocks

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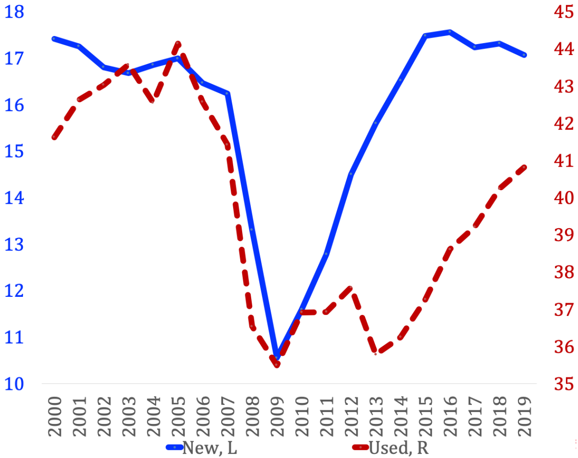
Motivation

The Great Recession featured

1. severely worsened liquidity in various financial markets
2. a large decline in the expenditure on consumer durable goods

U.S. Auto Sales (Millions of Vehicles)



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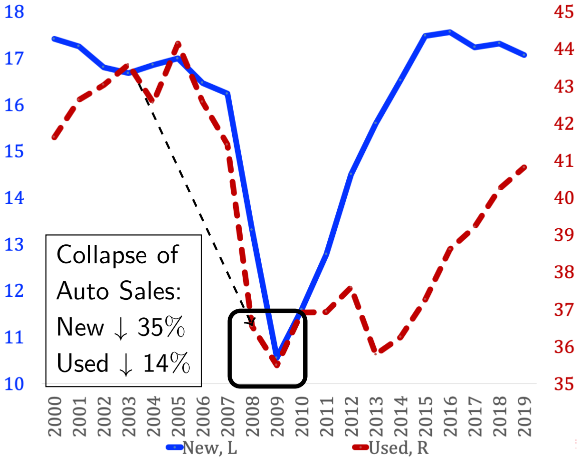

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Why Cars? Why the Great Recession? Why auto credit?

- CD: a large, highly volatile, and procyclical component of GDP: $\downarrow \Delta(\text{CD}) = 24\% \downarrow \Delta(rGDP)$ the GR
- auto: **biggest, most volatile** component of CD
- not the cause of the credit crunch during the GR
- relatively higher frequency of trading
- straightforward to measure quality

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Why Cars? **Why the Great Recession?** Why auto credit?

- Narrowly defined durables consumption $\downarrow$ 14.2% 2007Q4 - 2009Q2, $>>$ 9.7% average across all US post-war recessions
- sharper decline in the availability of credit compared to other recessions

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Why Cars? Why the Great Recession? **Why auto credit?**

- most auto sales are financed (>50% used, >80% new)
- heterogeneity among auto lenders:
  banks v.s. nonbank financial institutions

Nonbanks. v.s. Banks as Auto Lender

	Nonbanks	**Banks**
✎Market Share 2006	44.3%	55.7%
✎Primary Fund Source	Asset Backed Securities (ABS)	Deposits
✎Repossession Costs	Lower	Higher
✎Example	Carmax	Wells Fargo
✎Median Fico Score	655 Fair	703 Good
✎Median Loan Rate	10%	8.5%

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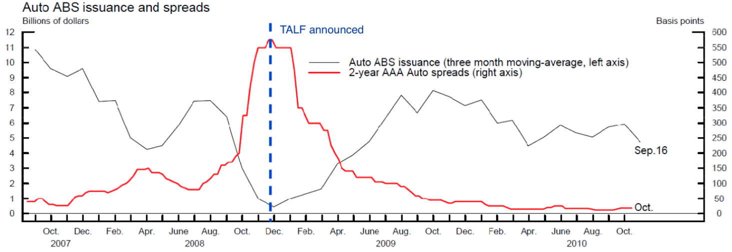
collapse of the ABS market → **dramatic increase** in the nonbank fund cost.

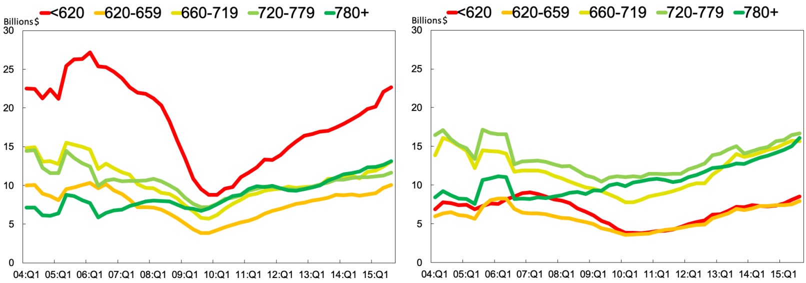


Source. JPMorgan Chase for spreads and Bloomberg for issuance.

Costs in GR

Suggestive Evidence of Distributional effects

Figure 1: Auto Loan Origination by Riskscore



(a) Auto Finance Company (b) Banks & Credit Unions

Source: New York Fed Consumer Credit Panel/Equifax. Billions

- subprime lending concentrated on nonbanks Delinquency
- more severe shrinkage of credit provided to subprime from nonbanks.

Applicants

What I do in this paper: Facts

1. Empirical: document novel facts
So far, in the auto loan market

- subprime lending is concentrated on nonbanks
- nonbank lending to the subprime shrank dramatically v.s. banks

Later:

- auto purchase behavior: liquidation $\uparrow$ Retention $\uparrow$ Replacement $\downarrow$
- auto loan market: individual auto loan characteristics by lender type, pre and during GR

What I do in this paper: Theory

2. Theoretical develop a dynamic equilibrium model with heterogeneous households and lenders

- **Lenders** differ in fund costs and repossession/foreclosure costs
- **Households** face uninsurable income and car quality shocks
  - choice of car qualities
  - saving borrowing decision **with the choice of lender** *new*
  - default option → endogenous auto loan rate schedules based on individual default risk
- Car markets clear

Main Mechanism: **Asymmetric** Ability to Borrow

When **nonbank** credit supply shock occurs,

Safe Household	Risky Household
easily switch to bank loans $\rightarrow$ limited increase in loan rate $\rightarrow$ little impact on car purchase decision	nowhere else to borrow from $\rightarrow$ big increase in loan rate if borrowing from bank $\rightarrow$ big impact:buy no car, or buy a cheaper car

When **bank** credit supply shock occurs,
Being a bank borrower means safe $\rightarrow$ little impact on car purchase decision

What I do in this paper: Quantitative Analysis

3. Estimation of the structural model by Simulated Method of Moments
4. Counterfactual: quantify the contribution of credit supply shocks by comparing Scenario 1, 2, 3
S1 only income shocks
S2 income shocks + nonbank credit supply shocks
S3 income shocks + bank credit supply shocks

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$S2 - S1 \rightarrow$ contribution of Nonbank credit supply shocks

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S3 income shocks + bank credit supply shocks

$S3 - S1 \rightarrow$ contribution of Bank credit supply shocks

Preview of Findings

- the estimated model generates **21**% decline in auto sales
  - very close to 22 % actual decline documented in Johnson et al. (2014).
- contribution of **nonbank** shock: **37**%
  - close to 33% in Benmelech et al. (2017)
  - Policy: Term Asset-backed securities Loan Facility (TALF)
- contribution of **bank** shock: **merely 0.28**%
- bank v.s. nonbank shocks: different distributional implications

Relation to the Literature

- Dynamics of Durable Expenditures
  e.g. Mankiw (1982) Bernanke (1985) Eberly (1994) Leahy and Zeira (2005) Berger and Vavra(2015) Guerrieri and Lorenzoni (2017)
- Role of Secondary Markets of Durable Goods
  e.g. Chen et al (2013), Gavazza et al (2014), Oh (2019)
- Aggregate Dynamics of Automobile Sales
  e.g. Attanasio (2000), Adda and Cooper (2006), Dupor et al. (2018)

Despite the richness of auto financing, not enough attention paid to

- Consumer credit and Auto Purchase

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Despite the richness of auto financing, not enough attention paid to

- Consumer credit and Auto Purchase
  - Benmelech et al. (2017) :the illiquidity of nonbank lenders contributed to $\frac{1}{3}$ of the decline in auto sales: no structural model, missing distributional implications
  - Gavazza and Lanteri (2020) provide a model to study how consumers respond to credit tightening shocks: the distinction between banks and nonbanks is missing

Facts

Facts

- auto purchasing
- auto loan

Auto Purchasing and the Loan Market during GR

- **substitution from new to used cars**
  - $\frac{\textit{new car sales}}{\textit{total sales}} 32\% \xrightarrow{\downarrow 25\%} 24\%$
- **less replacement with new cars**
  - % hh replacing used car with new $7\% \xrightarrow{\downarrow 43\%} 4\%$
- **more liquidation and retention**
  - % hh liquidation $7\% \xrightarrow{\uparrow 21\%} 8.5\%$
  - % hh retention 4-15 yrs old car $40\% \xrightarrow{\uparrow 6pp} 46\%$

Calculated from CEX

- nonbank market share declined during GR
- nonbank loans to the subprime group dropped dramtically during the Great Recession: shift to safer borrowers

Calculated from Equifax Data Table

Stylized Facts in the Auto Loan Market

November 2006

	Nonbank					Bank				
Rating	w	R%	FICO	y	b	w	R%	FICO	y	b
Exceptional	8%	6.0	813	55	19.6	12%	6.9	813	54	17.5
Very Good	15%	6.1	771	57	23.9	24%	7.1	771	55	20.1
Good	21%	7.6	702	46	26.1	31%	7.9	704	45	19.8
Fair	34%	11.2	626	37	26.6	25%	10.1	633	36	18.4
Poor	22%	14.2	526	30	22.8	7%	12.9	537	31	16.0
Average		10.0	656	41.6	24.6		8.5	703	45.1	19.0

y:annual income, b:loan amount in 10k dollars, R:loan rate, w:fraction of each group within bank/nonbank borrower

Source: Equifax Archive.

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1. Nonbank borrowers riskier than banks: average nonbank loan rate > bank loan rate

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2. within group, nonbank and bank borrowers similar income level
3. $corr(y, FICO) = 0.4712$

Stylized Facts in the Auto Loan Market

November 2006

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4. Nonbank borrowers: higher loan amount (higher $\frac{b}{y}$)

How do Loan Rates Depend on Ind. Characteristics

$$R^B = x\beta^B + u^B \quad (1)$$
$$R^N = x\beta^N + u^N \quad (2)$$
$$y_1 = \mathbb{I}(R^B < R^N) \quad (3)$$

Table 1: the Poor: Selected Results

	(1) Probit	(2) Bank	(3) Nonbank
y	0.009^{***}	-0.515^{*}	-0.195^{***}
	(0.002)	(0.216)	(0.017)
b	-0.009^{***}	0.375	-0.009
	(0.001)	(0.229)	(0.006)
FICO	0.004^{***}	-0.228^{*}	-0.074^{***}
	(0.000)	(0.099)	(0.007)
N	6810	1874	4756

Standard errors in parentheses $^{*}(p < .10)$, $^{**}(p < .05)$, $^{***}(p < .01)$

In addition to y, b and FICO, X includes: length of loan contract, bank pct (county), cash pct (county), constant

Model

Environment

Time is discrete and infinite.
Agents in the model:

1. Households
2. Auto lender: banks and nonbanks
3. New car producer

Clearing markets:

1. auto loan market: perfect competition
2. car market:

Car Age	Quality	Supply	Demand
≤ 4 yrs old	high(H)	hh + producer	hh
$4-14$ yrs old	middle(M)	hh	hh
> 15 yrs old	low(L)	hh	hh

Environment: Households

1. Observe state s_t, h_t and ϵ_t

$s_t \equiv (e_t, d_t, l_t)$

e_t idio. earning shock,

$d_t \in \{0, H, M, L\}$ car ownership ,

l_t level of net wealth

$h_t \in \{0, 1\}$ default record

ϵ_t EV1 shock

Environment: Households

1. Observe state s_t, h_t and ϵ_t
2. For each car choice $\hat{d}$

$\rightarrow$If can borrow ($h_t = 0$, no default record): Default or Repay

- **default**: current debt clears, car taken away, default record $h_{t+1} = 1$
- **Repay**: choose l_{t+1} and financial institution

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$\rightarrow$If cannot borrow ($h_t = 1$, with default record): choose saving amount $l_{t+1} > 0$

3. car choice prob formed
4. (flag goes away next period w.p. λ for $h = 1$)

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e_t idio. earning shock,

$d_t \in \{0, H, M, L\}$ car ownership ,

l_t level of net wealth

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Environment: Financing Choices

Borrowing

Competitive Financial market: bank (B), nonbank (NB)

- Date t, Lend $q^I(l', s)l', I \in \{B, NB\}$ at cost r^I $r^B < r^{NB}$
- Date t+1, receive l' if repay, $\theta^I P_{d'}$ if default $\theta^B < \theta^{NB}$

Saving

through a safe bond at risk free r_f.

Flag 1 households: with default record

$$V_1(e,l,d,\epsilon) = \max_{\hat{d}\in\{0,H,M,L\}} \{v_1(e,l,d,\hat{d}) + \sigma_\epsilon \epsilon(\hat{d})\} \quad (4)$$

Flag 1 households: with default record

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where

$$v_1(e,l,d,\hat{d}) = \max_{l'\geq 0} u(c^1, \hat{d}+\xi) + \beta\mathbb{E}_{e',d'|e,\hat{d}}\{\lambda \underbrace{EV^1(e',l',d')}_{\text{Value if flag remains}} + (1-\lambda) \underbrace{EV^0(e',l',d')}_{\text{value if flag disappears}} \} \tag{5}$$

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$$c^1 = l + (1-\Gamma)e - \underbrace{\frac{1}{r_f}l'}_{\textit{saving}} + P_d - P_{\hat{d}} - \underbrace{\kappa(d,\hat{d})}_{\textit{trans. cost}} \tag{6}$$

Γ : loss of income due to credit flag
$EV^i(e',l',d') \equiv E_{\epsilon'} V_i(e',l',d',\epsilon')$
$\kappa(d,\hat{d}) = \begin{cases} \lambda_1 P_d + \lambda_0, \textit{ if } d \neq 0 \textit{ and } \hat{d} \neq d \\ 0, \textit{ Otherwise} \end{cases}$

Flag 0 households: no default record

$$V_0(e,l,d,\epsilon) = \max_{\hat{d}\in\{0,H,M,L\}} \{v_0(e,l,d,\hat{d}) + \sigma_\epsilon \epsilon(\hat{d})\} \quad (7)$$

Flag 0 households: no default record

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$$v_0(e,l,d,\hat{d}) = \max\{ v_0^B(e,l,d,\hat{d}) , v_0^{NB}(e,l,d,\hat{d}) , v_0^S(e,l,d,\hat{d}) , v_0^{def}(e,l,d,\hat{d}) \}$$

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$\forall I \in \{B, NB\}$

$$v_0^I(e,l,d,\hat{d}) = \max_{l'<0} u(c^I, \hat{d}+\xi) + \beta \mathbb{E}_{e',d'|e,\hat{d}} EV^0(e',l',d') \quad (8)$$

$$c^I = l + e - q^I(l',s)\, l' + P_d - P_{\hat{d}} - \underbrace{\kappa(d,\hat{d})}_{\textit{trans. cost}}$$

$$EV^i(e',l',d') \equiv E_{\epsilon'} V_i(e',l',d',\epsilon')$$

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$$v_0^S(e,l,d,\hat{d}) = \max_{l'\geq 0} u(c^S, \hat{d}+\xi) + \beta \mathbb{E}_{e',d'|e,\hat{d}} EV^0(e',l',d') \tag{8}$$

$$c^S = l + e - \frac{1}{r_f} l' + P_d - P_{\hat{d}} - \underbrace{\kappa(d,\hat{d})}_{\textit{trans. cost}}$$

$$EV^i(e',l',d') \equiv E_{\epsilon'} V_i(e',l',d',\epsilon')$$

Flag 0 households: no default record

$$V_0(e,l,d,\epsilon) = \max_{\hat{d}\in\{0,H,M,L\}} \{v_0(e,l,d,\hat{d}) + \sigma_\epsilon \epsilon(\hat{d})\} \tag{7}$$

$$v_0(e,l,d,\hat{d}) = \max\{ v_0^B(e,l,d,\hat{d}),\ v_0^{NB}(e,l,d,\hat{d}),\ v_0^S(e,l,d,\hat{d}),\ v_0^{def}(e,l,d,\hat{d}) \}$$

$$v_0^{def}(e,l,d,\hat{d}) = u(c^{def}, 0+\xi) + \beta \mathbb{E}_{e',d'|e,0} EV^1(e',0,d') \tag{8}$$

$$c^{def} = (1-\Gamma)e - P_{\hat{d}}$$

Γ : loss of income due to default $\quad EV^i(e',l',d') \equiv E_{\epsilon'} V_i(e',l',d',\epsilon')$

Financial Institutions

Competitive Financial market: $I \in \{$ bank (B), nonbank (NB) $\}$

- Date t, Lend $q^I(l', s)l'$ at cost r^I $r^B < r^{NB}$
- Date t+1, receive l' if repay, $\theta^I P_{d'}$ if default $\theta^B < \theta^{NB}$

Loan Contract, for $l' < 0$,

$$\underbrace{q^I(l', s)l' r^I}_{\textit{total fund cost}} = \underbrace{\mathbb{E}_{s'|s}(1 - \mathbb{D}(s'))\, l'}_{\textit{repay}} + \underbrace{\mathbb{E}_{s'|s}\{\mathbb{D}(s')\, \theta^I P_{d'}\}}_{\textit{value covered from repossessed car}}, \quad (9)$$

$\mathbb{D}(s') \equiv \mathbb{E}_\epsilon \mathbb{I}(s' \in \Psi)$, Ψ the default set

Auto Market Clearing

- New Car Producers: perfect competition, linear technology, $P_H = mc$. New production x

$\forall \tilde{d} \in \{H, M, L\}$,

$$\underbrace{\int \mathbb{I}(g_d(s) = \tilde{d}, d \neq \tilde{d})\mu(s)ds}_{\text{demand of } \tilde{d} \text{ cars}} = \underbrace{\int \mathbb{I}(g_d(s) \neq \tilde{d}, d = \tilde{d})\mu(s)ds}_{\text{supply of } \tilde{d} \text{ cars}} + x_{\hat{d}} \tag{10}$$

$$x_{\hat{d}} = \begin{cases} x, \text{ if } \hat{d} = H \\ 0, \text{ Otherwise} \end{cases}$$

$g_d(s)$ policy function of car choice for s household

$\mu(s)$ measure of s households

A Recursive Stationary Competitive Equilibrium

is (i) a value function $V(\mathbf{s}, h) \equiv EV_h(\mathbf{s})$ and associated policy functions $\hat{d} = g_d(\mathbf{s}, \epsilon)$, $l' = g_l(\mathbf{s}, \epsilon)$, $I_{def} = g_{def}(\mathbf{s}, \epsilon)$, $I_{fi} = g_{fi}(\mathbf{s}, \epsilon)$ (ii) a stationary distribution $\mu^*(e, l, d, h)$, (iii) a vector of prices $\mathbf{P}^* \equiv (P_M^*, P_L^*)$, and (iv) loan rate schedules $q^I(l', \mathbf{s}), I \in \{N, NB\}$ such that

1. Individual Optimization: $V(\mathbf{s}, h)$ satisfies (7) and (4) with policy functions $\hat{d} = g_d(\mathbf{s}, \epsilon)$, $l' = g_l(\mathbf{s}, \epsilon)$, $I_{def} = g_{def}(\mathbf{s}, \epsilon)$, $I_{fi} = g_{fi}(\mathbf{s}, \epsilon)$
2. Consistency of Loan Rates: the loan rate schedules $q^I(l', \mathbf{s})$ satisfy (9), where the lenders' perceived default set is consistent with households policy function: $\tilde{g}_{def}(s, \epsilon) = g_{def}(s, \epsilon)$
3. Stationarity and Consistency of Beliefs $\mu^*(e, l, d, h)$ is consistent with exogeneous processes and policy functions $l' = g_l(s, \epsilon)$, $I_{def} = g_{def}(s, \epsilon)$, $I_{fi} = g_{fi}(s, \epsilon)$: $\mu^*(e, l, d, h) = H(\mu^*(e, l, d, h))$
4. Car markets clear: (10) determines the flow x of production of new cars and holds for $\hat{d} \in \{M, L\}$.

Estimation

Taking the Model to the Data

- Income Processes: high v.s. low education groups estimated from PSID *a la* Guvenen (2007) detail
- parameters calibrated outside of the model detail
- parameters estimated in the structural model

Utility Function:

$$u(c,d) = \begin{cases} log(c^{\alpha}d^{1-\alpha}) & \text{if } \gamma = 1 \\ \frac{\{c^{\alpha}d^{1-\alpha}\}^{1-\gamma}-1}{1-\gamma} & \text{if } \gamma \geq 0, \gamma \neq 1 \end{cases} \tag{11}$$

Calibrated Parameters

σ_ϵ	0.0500	scale of taste shock ϵ	literature
λ	0.9000	Prob. default record remaining	Chp 7
p_H	$\frac{1}{3}$	prob. $H \to M$	Gavazza and Lanteri (2020)
p_M	0.1000	prob. $M \to L$	Gavazza and Lanteri (2020)
p_L	0.5000	prob. $L \to 0$	Gavazza and Lanteri (2020)
δ	0.0300	prob. car loss	CEX
P_H	$21675	price of H car	VA regist. record
r^B	1.0600	bank, fund cost	equifax data
r^{NB}	1.0624	nonbank, fund cost	equifax data
r_f	1.0200	risk free rate	literature
$\bar{\theta}$	0.98	nonbank recovery	repo cost $200

$$\Pi_{i,j} = \begin{pmatrix} 1 - p_H - \delta & p_H & 0 & \delta \\ 0 & 1 - p_M - \delta & p_M & \delta \\ 0 & 0 & 1 - p_L & p_L \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

back

Calibrated Parameters

β_h	0.9450	discount factor, hi edu	Gavazza and Lanteri (2020)
γ	1	risk aversion	literature
d_H	1	util from H car	normalization

- moments less responsive to these parms compared to estimated ones
- later robustness check table

back

Estimation

$\Theta \equiv (\beta_l, \alpha, \Gamma, d_M, d_L, \xi, \underline{\theta}, P_H, P_L)$ solves:

$$\Upsilon = min_{\Theta}(M^s(\Theta) - M^d)' W (M^s(\Theta) - M^d) \qquad (12)$$

Moments (match pre-crisis):

- Financial: wealth-to-income, debt-to-income Ratio
- Car stock: fraction of $\tilde{d}$ car owners, car ownership rates
- loan rate: dependence of loan rate on y by lender type
- delinquency: fraction of loans flowing into delinquency
- nonbank market share

Full Table of Moments

Selected Moments

	Data	Model
nonbank share	0.4433	0.4206
Med wi ratio	0.0045	0
% hh indebt	0.3479	0.3740
% default	0.0196	0.0221
Med b/y ratio, all	0.2870	0.2894
Med b/y ratio, B	0.2053	0.1549
Med b/y ratio, N	0.2517	0.5061
B, coef y	-0.7366	-0.1202
N, coef y	-0.0941	-0.0369

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Estimation Results

Table 2: Estimated Parameters

	Estimated Parameters	
β_l	0.8965	discount factor, low education group
α	0.9520	weight of non-durable consumption in the utility function
Γ	0.0007	fraction of income loss due to default or default record
d_M	0.6869	utility flow from middle quality car
d_L	0.3060	utility flow from low quality car
ξ	0.0139	utility flow from alternative ways of transportation
P_M	0.2652	the price of a middle quality car
P_L	0.0976	the price a of low quality car
$\underline{\theta}$	0.5387	bank fraction of recovery from foreclosure

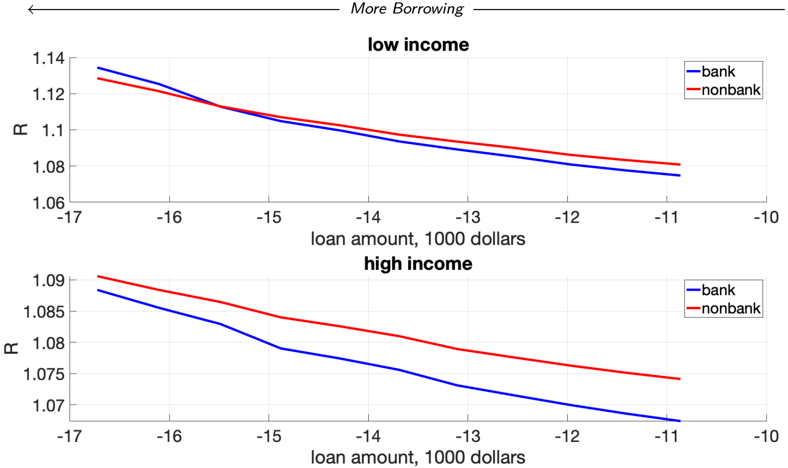
Identification

Model Implications

Model Implications

- Loanrate Schedules
- Lender Choices
- Evaluation of credit supply shocks

Endogenous Loan Rates

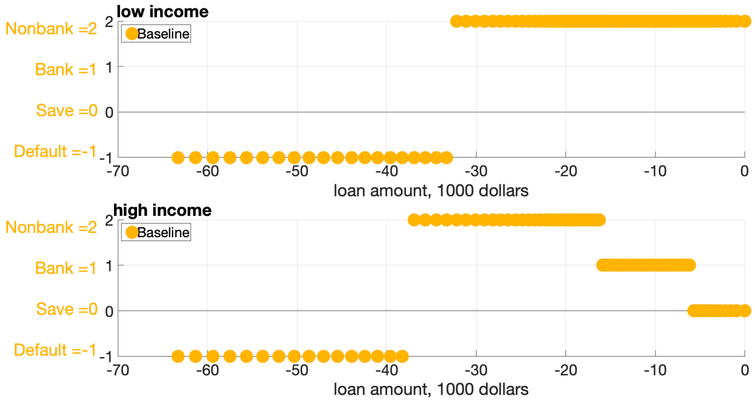


both B and NB lower loan rate for higher income today

bank needs more compensation for risk

Choice of Lenders

HH with same d, $\hat{d} = M$ in ss. eqm:



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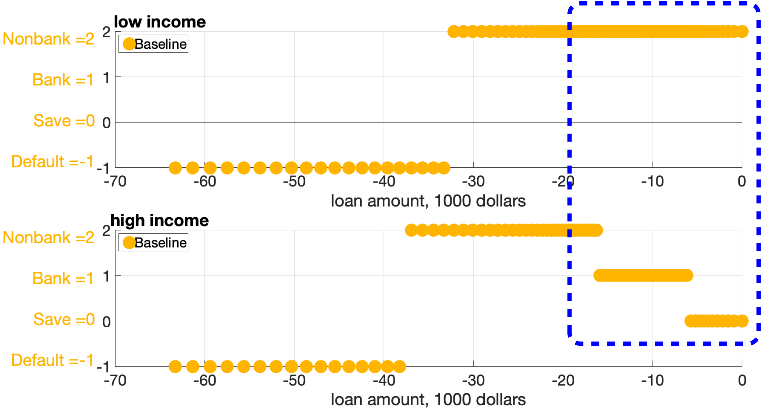

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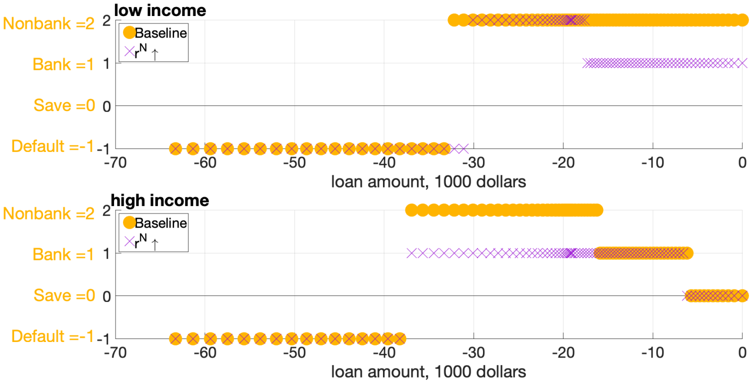

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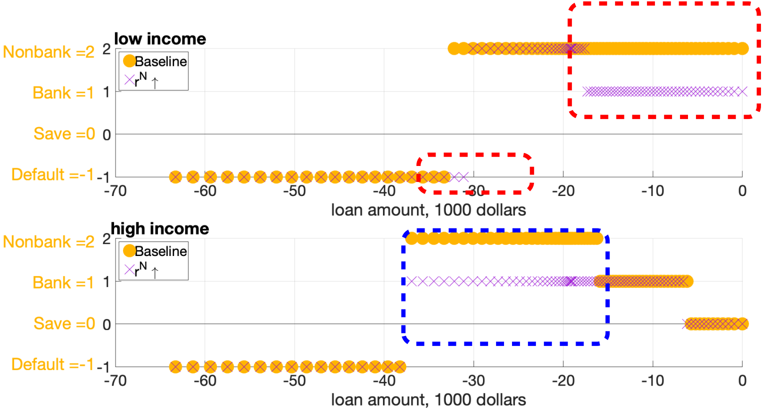

Credit Supply Shocks

Table 3: Timeline, Shocks and μ

t	0	1	2	3	...
shocks	no	yes	no	no	...
hh exp. P'	P^*	P^*	P^*	P^*	..
actual P	$P(\mu^*)$	$P(\mu_1)$	$P(\mu_2)$	$P(\mu_3)$	..

S1 income shocks

S2 income shocks + nonbank credit supply shocks

S3 income shocks + bank credit supply shocks

Credit Supply Shocks

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$S2 - S1 \rightarrow$ **contribution of Nonbank credit supply shocks**

Credit Supply Shocks

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S1 income shocks

S2 income shocks + nonbank credit supply shocks

S3 income shocks + bank credit supply shocks

$S3 - S1 \rightarrow$ **contribution of Bank credit supply shocks**

Contribution of Credit Supply Shocks

Table 4: Percentage Changes in Auto Sales and Prices

	S1 income only	S2 income & nonbank	S3 income & bank
Sales (H)	-13.21%	**-20.88%**	-13.25%
	(0.336%)	(0.297%)	(0.353%)
Price M	-1.10 %	-2.97%	-1.08 %
	(0.085%)	(0.084%)	(0.085%)
Price L	-3.25 %	-4.08%	-3.24 %
	(0.254%)	(0.262%)	(0.249%)
		nonbank	bank
Contribution		**36.74%**	**0.28%**

Contribution of Credit Supply Shocks

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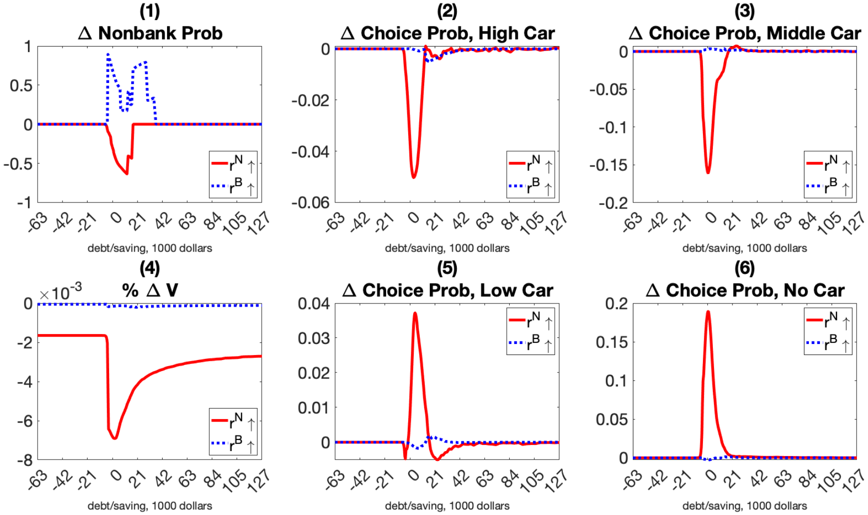
		nonbank	bank
Contribution		**36.74%**	**0.28%**

- inaction↑: 69.2% s.s. → 73.5% S2
- substitution↓: replacement with new purchase 8.3% s.s. → 6.9% S2
- liqudation↑: 15.4% more hh disposed M cars

Distributional Effects: bank v.s. nonbank shock only



low income hh with no car today

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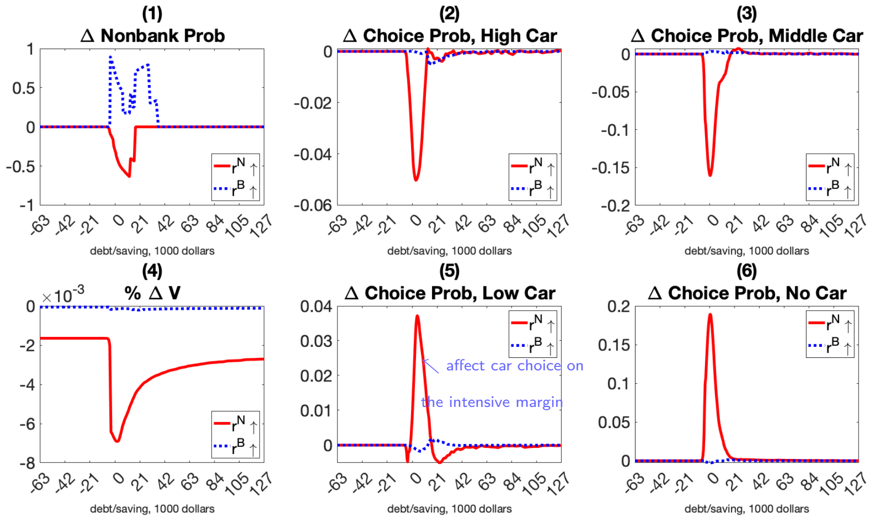

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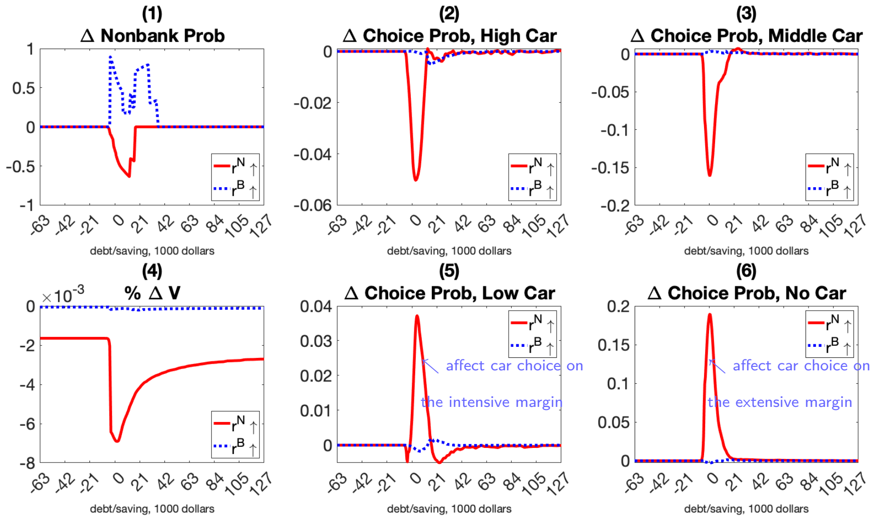

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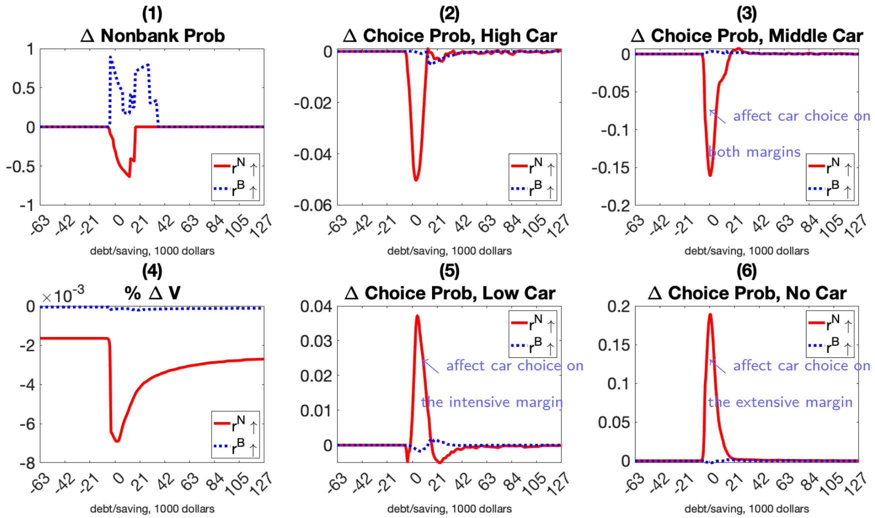
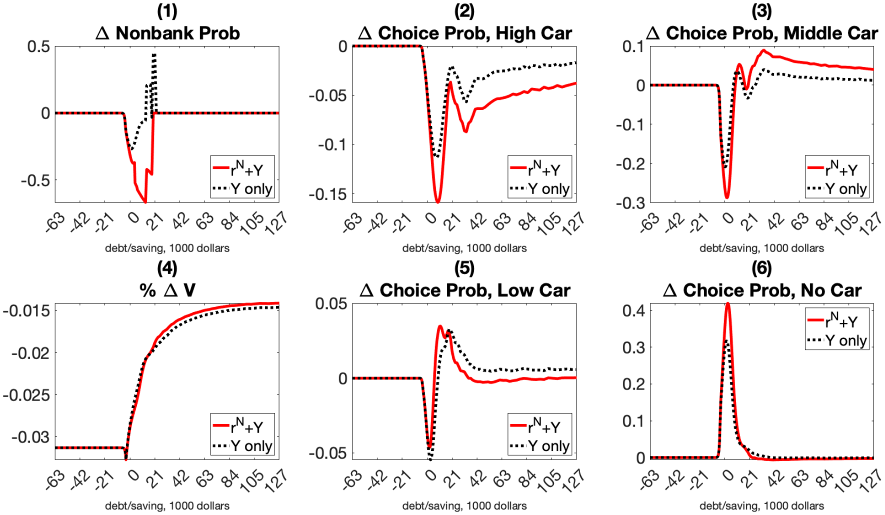


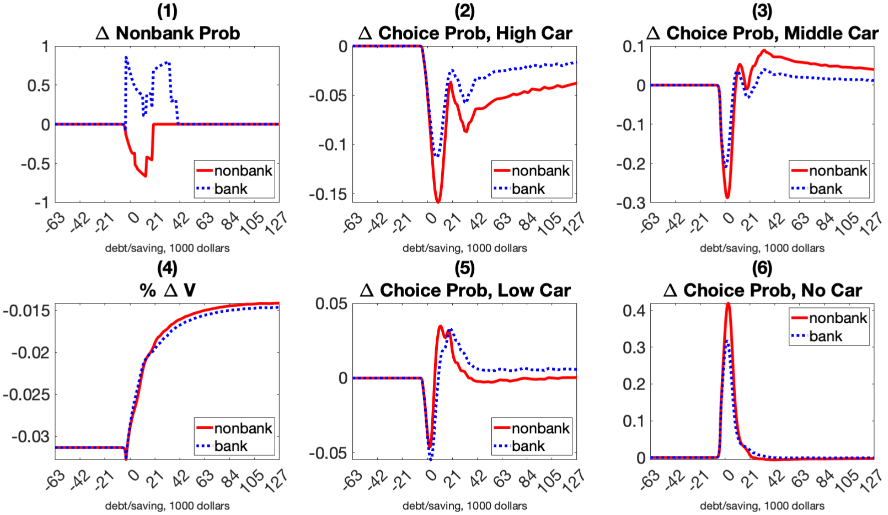
low income hh with no car today

Distributional Effects: bigger real effects with **nonbank** shock



low income hh with no car

Distributional Effects: trivial real effects with **bank** shock



low income hh with no car

Conclusions

Facts: rich heterogeneity between bank v.s. nonbank borrowers

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Equilibrium model with hetero. hh and lenders

- asymmetric ability to borrow

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- the estimated model generates **21**% decline in auto sales
  - very close to 22 % actual decline documented in Johnson et al. (2014).

Conclusions

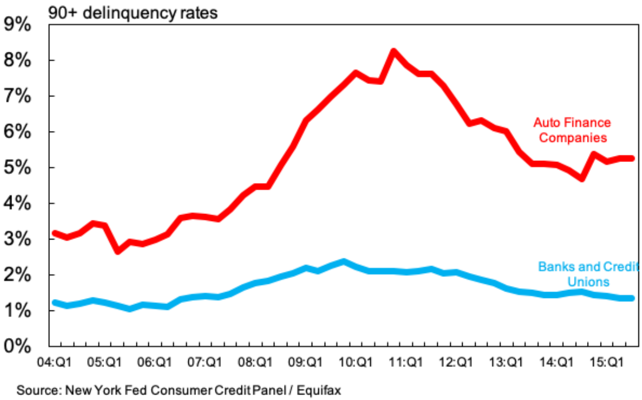
Facts: rich heterogeneity between bank v.s. nonbank borrowers
Equilibrium model with hetero. hh and lenders

- asymmetric ability to borrow
- the estimated model generates **21**% decline in auto sales
  - very close to 22 % actual decline documented in Johnson et al. (2014).
- contribution of **nonbank** shock: **37**%
  - close to 33% in Benmelech et al. (2017)
  - Policy: Term Asset-backed securities Loan Facility (TALF)
- contribution of **bank** shock: **merely 0.28**%
- bank v.s. nonbank shocks: different distributional implications

Appendix

Auto Finance Co. v.s. Banks

Figure 3: Flow into 90+ delin



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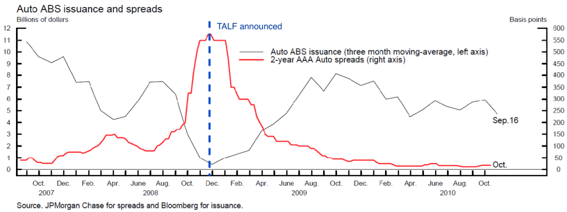
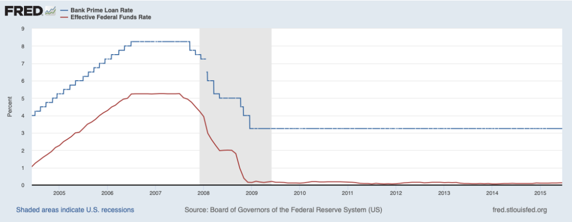
Costs Bank v.s. Nonbank

Figure 4: Auto ABS spreads; Bank Prime Loan Rates and Federal Funds Rates





Not just a Demand Side Story

Despite the relatively **stable demand** for auto loans:

- Survey of Consumer Finance 07-09 panel
- "What type of credit did you apply for?"
- 2007: all 19.67% vehicle loan 4.36% (in the past 5 years)
- 2009: all 14.73% vehicle loan 3.48% (in the past 2 years)

Nonbank auto loan originated to the subprime **drop dramatically**

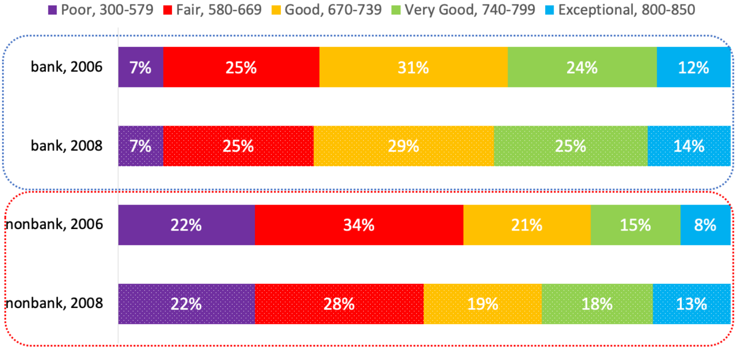
Table 5: % Change in Total Amount of Loan Originated

	Nonbank	Bank
Exceptional	35%	8%
Very Good	7%	-1%
Good	-28%	-11%
Fair	-47%	-15%
Poor	-45%	-15%

Back

Nonbank Credit Shrinkage to the Subprime

Figure 5: Compostion of Borrower by Lender and Time

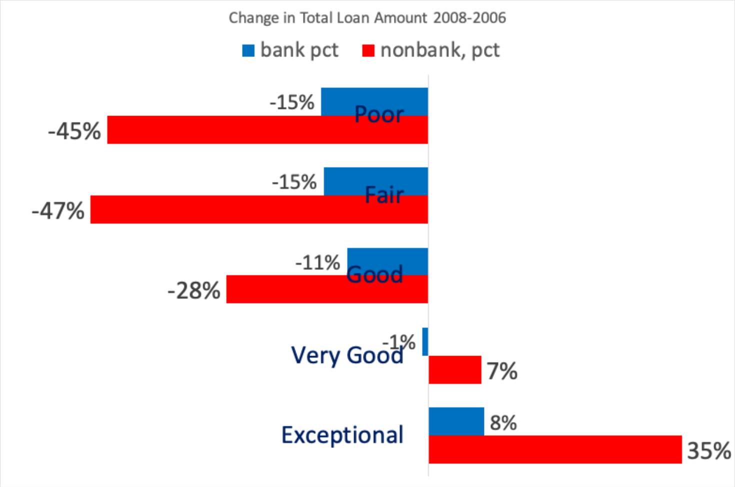


1. Cross Sectional: more Fair and Poor in Nonbanks
2. Over Time: obvious shift from riskier to safer for Nonbank
3. Market Share of Nonbank :

   # consumers: $44.3\% \rightarrow 41\%$;

   \$ loan origination: $51\% \rightarrow 45\%$

Source: Equifax Archive. Back


Change in Total Loan Amount 2008-2006
bank pct
nonbank, pct
-15%
Poor
-45%
-15%
Fair
-47%
-11%
Good
-28%
Very Good
-1%
7%
Exceptional
8%
35%

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Data Description

- 2 periods from Equifax Archive: 2006 November and 2008 November
- Each period, 50k individuals are randomly drawn from records if she opened an auto loan within 30 Days
- City, State, Zip code, Lender industry code, Loan amount, Loan terms, Loan rate, Income and Fico

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Income Process

$$y_t^i = \bar{y}_t^i + \tilde{y}_t^i$$
$$\bar{y}_t^i = \gamma_0 + \gamma_{11} a_t^i + \gamma_{12} a_t^{i,2} + \gamma_2 t + \gamma_3 X_i$$

$$\tilde{y}_t^i = z_t^i + \eta_t^i \quad (13)$$
$$z_t^i = \rho_z z_{t-1}^i + \epsilon_{z,t}^i \quad (14)$$

δ_{eu}	0.1453	probability of being separated from current job
δ_{ue}	0.9683	probability of finding a job computed
ρ_z^h	0.8865	persistence parameter of the permanent shock, high education group
ρ_z^l	0.8681	persistence parameter of the permanent shock, low education group
$\sigma_{\epsilon_z}^h$	0.1784	std parameter of the innovation to the permanent shock, high education group
$\sigma_{\epsilon_z}^l$	0.1662	std parameter of the innovation to the permanent shock, low education group
σ_η^h	0.0615	std parameter of the transitory shock, high education group
σ_η^l	0.0590	std parameter of the transitory shock, low education group

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Model Fit

Table 6: Moments: Model v.s. Data

	All		High Edu		Low Edu	
	data	**model**	**data**	**model**	**data**	**model**
wi	0.0045	0	0.0650	0.1475	0	0
f_H	0.3201	0.1704	0.3964	0.2739	0.2849	0.1211
f_M	0.6069	0.6916	0.5641	0.6058	0.6267	0.7325
f_L	0.0730	0.1380	0.0395	0.1203	0.0884	0.1464
f_0	0.1091	0.1714	0.0649	0.1097	0.0649	0.1982
wi_{p10}	-0.6569	-0.4884	-0.6784	-0.2197	-0.6424	-0.5420
wi_{p25}	-0.1777	-0.1557	-0.1894	-0.0447	-0.1727	-0.2487
wi_{p75}	0.1812	0.3334	0.5593	0.5109	0.0685	0.2271
$f_{l<0}$	0.3479	0.3740	0.3501	0.2907	0.3465	0.4097
$\bar{di}^m$	0.2870	0.2894	0.2570	0.2074	0.3326	0.3338

Model Fit: 2

Table 7: Moments: Model v.s. Data 2

		data			**model**	
$\bar{R}_B$		1.0853			1.0721	
$\bar{R}_B^m$		1.0777			1.0656	
$\bar{R}_{NB}$		1.1000			1.1304	
$\bar{R}_{NB}^m$		1.0906			1.1222	
$\bar{di}_B^m$		0.2053			0.1549	
$\bar{di}_{NB}^m$		0.2517			0.5061	
r_{def}		0.0196			0.0221	
Nonbank Share		0.4433			0.4206	
	$\hat{\rho}_0$	$\hat{\rho}_y$	$\hat{\rho}_b$	$\hat{\rho}_0$	$\hat{\rho}_y$	$\hat{\rho}_b$
Probit Equation	-0.7052	0.7044	-0.6314	0.3514	2.0079	-8.7463
Heckit Bank	2.9221	-0.7366	0.6073	1.1338	-0.1202	0.4098
Heckit Nonbank	1.0996	-0.0941	0.0128	1.2576	-0.0369	-0.2581

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Percentage Changes in Auto Sales and Contribution of Nonbank Shocks

	S2 % H Sales	Contribution	
	Benchmark	-20.88 %	36.74%
		Calibrated Parameters	
$\beta_h = 0.898$	0.945	-22.51%	32.67%
$\gamma = 1.500$	1	-19.24%	37.37%
$d_H = 0.900$	1	-22.13%	31.49%
$\bar{\theta} = 0.882$	0.98	-20.86%	21.97%
		Estimated Parameters	
$\underline{\theta} = 0.5925$	0.5383	-21.54%	33.19%
$\beta_l = 0.9427$	0.8965	-17.22%	26.18%
$\alpha = 0.9055$	0.9520	-10.96%	30.40%
$d_M = 0.6176$	0.6869	-21.63%	32.90%
$d_L = 0.2742$	0.3060	-21.39%	33.33%
$\xi = 0.0151$	0.0139	-21.73%	32.90%
$\Gamma = 7.4e(-3)$	$6.73e(-3)$	-21.65%	34.20%

back

The Auto Loan Market pre v.s. during GR

- nonbank market share declined during GR
- nonbank loans to the subprime group dropped dramtically during the Great Recession: shift to safer borrowers

% total loan amount change

	Nonbank Share		loan amount Δ_{08-06}	
Category (FICO)	2006	2008	Nonbank	Bank
Exceptional (800-850)	35.2%	39.4%	+35%	+8%
Very Good (740-799)	32.3%	33.4%	+7%	-1%
Good (670-739)	35.1%	31.3%	-28%	-11%
Fair (580-669)	51.5%	43.9%	-47%	-15%
Poor (300-579)	70.6%	67.7%	-45%	-15%

back