Price Discrimination and Mortgage Choice

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Views are solely those of the authors and so cannot be taken to represent those of the Bank of England.

This paper

Housing is most people's primary asset.
$\rightarrow$ Mortgage choice is a high-stakes financial decision.

Can see what a customer picked and what they could have picked.
$\rightarrow$ Sheds light on customer choices and lender behaviour.

Questions

1. How well do people choose mortgages?
2. Do some pick expensive mortgages?
3. How do banks design the menus they offer customers?

What we find

1. Most people face a daunting number of mortgages to choose from.

2. People don't pick particularly well on average, but cost implications are small.

3. Some (7%) leave a lot of money on the table.
   - High LTV & LTI customers $\rightarrow$ **Young, first-time-buyers**.
   - **Bad menus** $\rightarrow$ Expensive choices.

4. Evidence consistent with **price discrimination to profit from these customers' poor decisions or lack of alternatives**.

Literature

Product choice and shopping

Bhutta et al. (2021); Woodward & Hall (2012); Foà et al. (2019); Célérier & Vallée (2017); Agarwal et al (2016); Andersen et al (2020); Fisher et al. (2021); Keys et al. (2016); Allen et al. (2019); Allen & Li (2021).

UK mortgage market

Liu (2019); Iscenko (2020); Benetton (2020); Benetton, Gavazza & Surico (2022); Robles-Garcia (2020); Mysliwski & Rostom (2022).

Price dispersion

Huge literature, recently Menzio & Trachter (2018); Kaplan & Menzio (2015); Kaplan et al (2017).

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Product choice and shopping

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Price dispersion

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Our contribution

Novel mechanism: dial up price dispersion to price discriminate.

Data

Product Sales Database

- Data on universe of mortgages for 6 top UK banks
- 2009 - 2014
- Individual characteristics, loan details

Moneyfacts

- All mortgages on offer when mortgage was picked

Can see what customers picked, and what they could have picked.

Summary Stats

UK mortgage market

Most mortgages: fixed rate period of 2, 3, or 5 years.

Long period of floating rate.

People roll over their mortgage multiple times.

5 components: initial period, initial rate, upfront fee, reset rate, maximum LTV.

Customers face multi-product menus at multiple banks.

Choice Set

Customer Choice

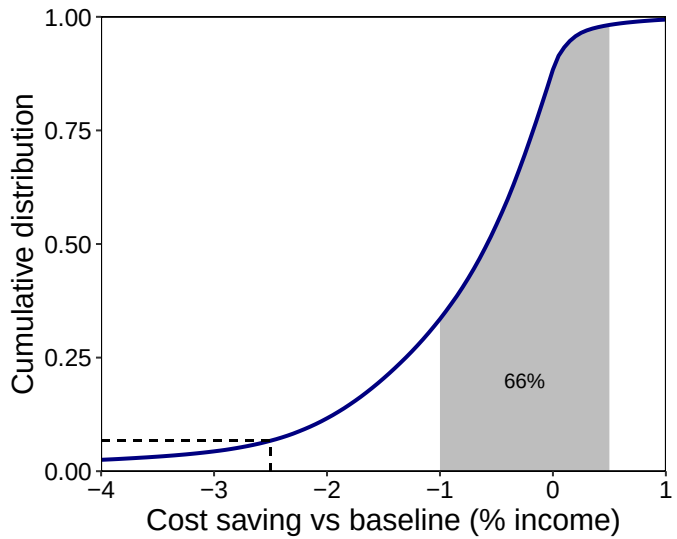
Evaluating choices

1. Find all mortgages on offer at given LTV for given loan amount and initial payment period.
   - Both **within** the chosen bank, and **across** all 6 banks.
2. Compute NPV of payment over first 7 years.
   $\rightarrow$ Function of upfront fee, initial interest rate & reset rate.
3. Rank NPVs.
4. Define baseline mortgage: 15^{th} percentile of choice set.

NPV calculations | Example | Within vs. Across Banks

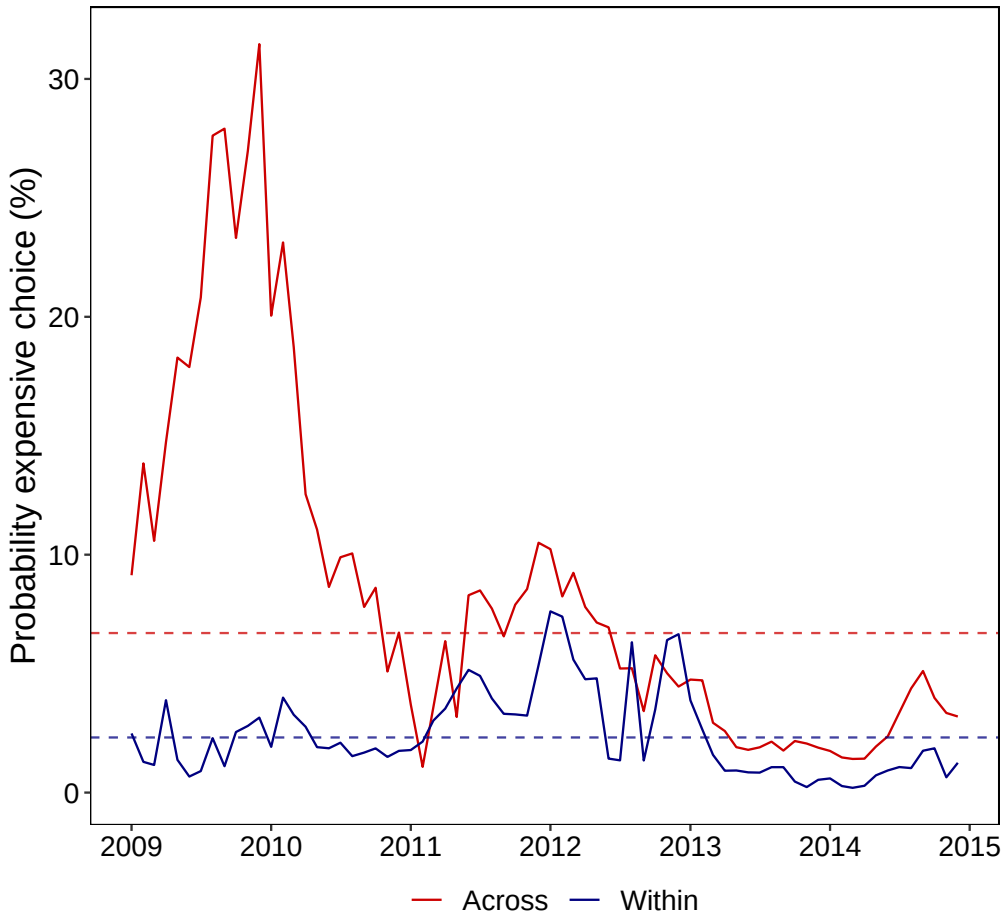
How well do people pick?

	Choice set size	Pctile chosen
25^{th} pctile	46	27
Median	73	47
75^{th} pctile	101	70



Expensive choice: costs $\geq 2.5\%$ of monthly net income. Within bank

Expensive choices

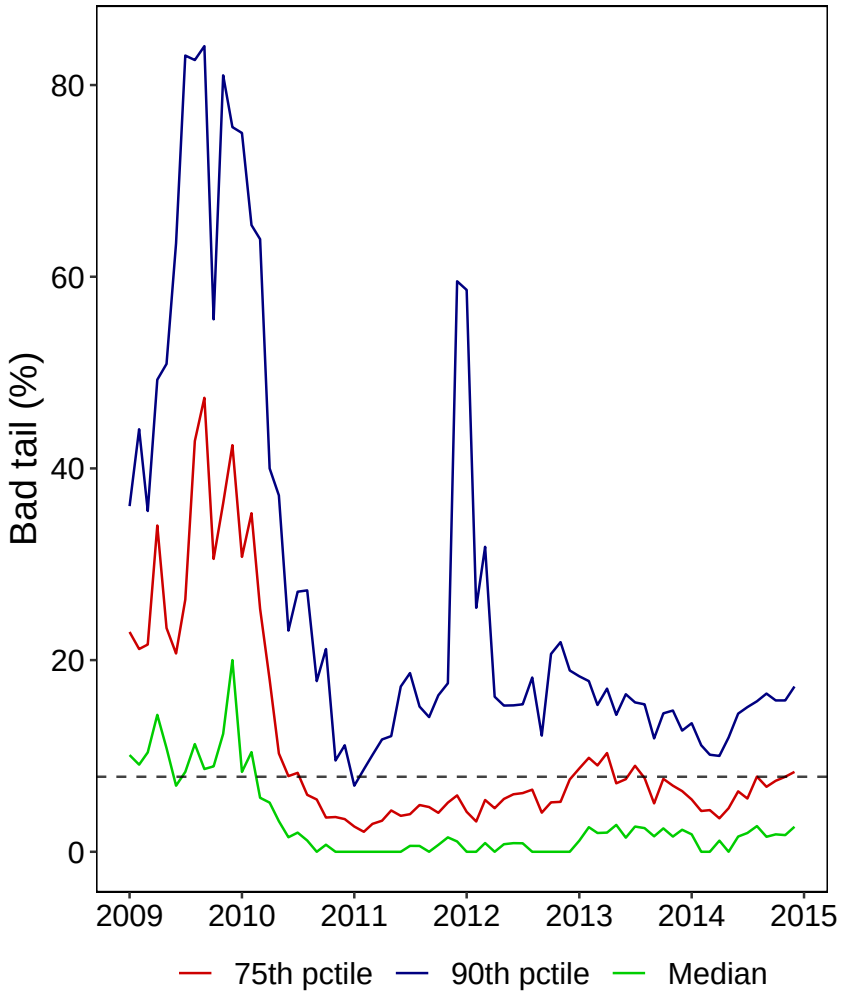


Where do expensive choices come from?

Two aspects to an expensive choice:

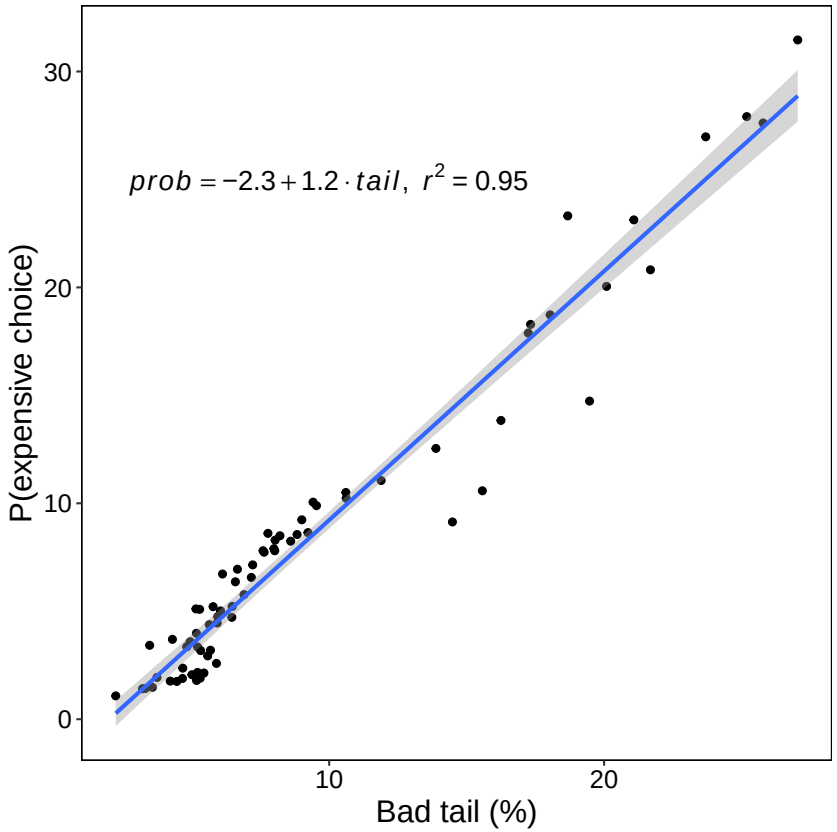
1. Quality of your choice: given your menu, did you pick well?
   - *choice* = percentile rank of choice you made.
2. **Quality of choice set:** how many bad choices were on offer?
   - *bad tail* = % of expensive mortgages on offer.

Menu variation



Menu prevents the median person from picking expensive option, but **sometimes the menu is filled with bad choices**. Within bank

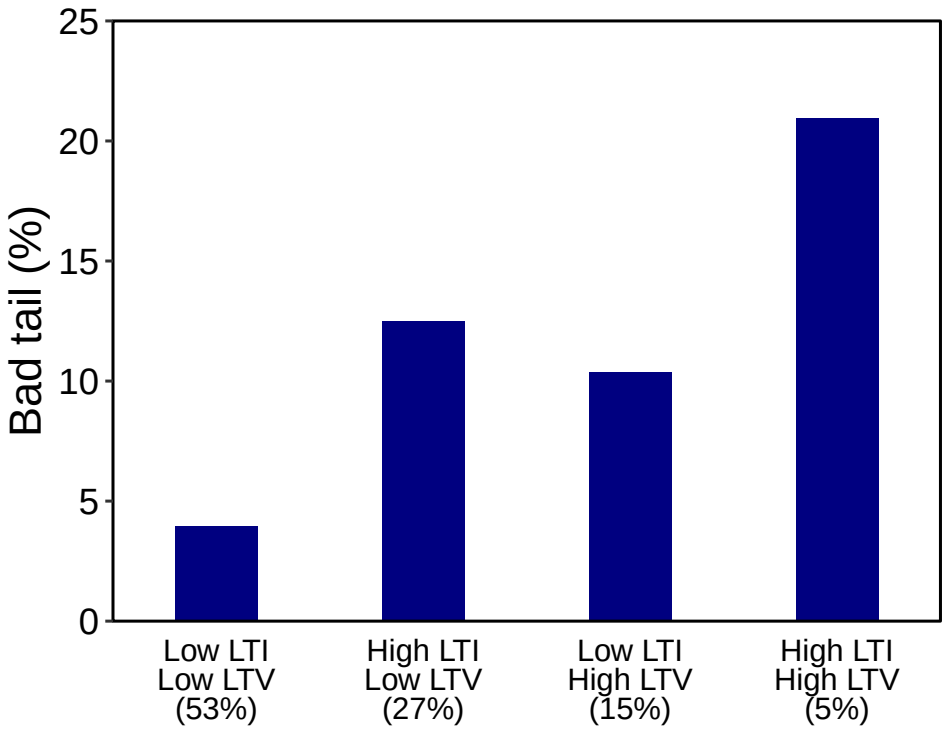
Menu quality and expensive choices



Menu quality is the key driver of expensive choices. Within bank

Menu Determination

Who gets bad menus?



Note: High LTV=LTV$>$ 85%. High LTI=LTI$>$ 4

Banks offer worse menus to high LTV & LTI customers.

Who chooses high LTV and LTI mortgages?

	Dependent variable:		
	High LTV MFX	High LTI MFX	High LTV & LTI MFX
Young	0.078^{***}	0.020^{***}	0.016^{***}
	(0.001)	(0.001)	(0.001)
Old	-0.098^{***}	-0.078^{***}	-0.035^{***}
	(0.002)	(0.001)	(0.001)
First-time buyer	0.246^{***}	0.018^{***}	0.040^{***}
	(0.001)	(0.001)	(0.001)
Poor	-0.071^{***}	0.070^{***}	-0.001^{***}
	(0.001)	(0.001)	(0.001)
Rich	0.030^{***}	-0.073^{***}	-0.016^{***}
	(0.001)	(0.001)	(0.001)
Bank dummies	No	No	No
Product dummies	Yes	Yes	Yes
Pseudo R-squared	0.09	0.03	0.05
Mean dependent variable	0.32	0.2	0.05
Observations	883,459	883,459	883,459
Note:			*p<0.1; **p<0.05; ***p<0.01

Young people & first-time buyers choose high LTV and high LTI mortgages.

Who chooses poorly?

	Dependent variable:	
	Expensive choice across MFX	MFX
Young	0.018^{***}	0.005^{***}
	(0.001)	(0.0004)
Old	-0.031^{***}	-0.006^{***}
	(0.001)	(0.001)
First-time buyer	0.005^{***}	-0.005^{***}
	(0.001)	(0.0004)
Poor	0.003^{***}	0.001^{**}
	(0.001)	(0.0004)
Rich	-0.006^{***}	-0.006^{***}
	(0.001)	(0.0004)
Bad tail		0.303^{***}
		(0.001)
Bank dummies	No	No
Product dummies	Yes	Yes
Pseudo R-squared	0.09	0.56
Mean dependent variable	0.067	0.067
Observations	883,459	883,459
Note:	*p<0.1; **p<0.05; ***p<0.01	

Young people & first-time buyers more likely to pick expensively.

$\rightarrow$ Driven by quality of menu. Within bank

Explanation

Potential explanations

Risk?

Potential explanations

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1. Default extremely rare.
2. Default patterns do not follow menu pattern.
3. Risk may cause average price to vary by LTV/LTI, but not **price dispersion**.

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Approval standards?

Cannot rule this out of our across-bank analysis, but **within lenders** and conditional on loan size and house value loan approvals do not typically vary across products.

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Refinancing?

Potential explanations

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1. Default extremely rare.
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3. Risk may cause average price to vary by LTV/LTI, but not **price dispersion**.

Approval standards?

Cannot rule this out of our across-bank analysis, but **within lenders** and conditional on loan size and house value loan approvals do not typically vary across products.

Refinancing?

Results are the same if we assume customers refinance as soon as the initial period ends.

Menu-based price discrimination

Suppose there are two types of customer:

1. **Sophisticated** customers: sample several mortgages at several banks and pick the cheapest product available.
2. **Randomizers**: walk into a random bank and pick a random option on the menu.

Menu design trade-off:

1. Cheap options to compete for sophisticated customers.
   $\rightarrow$ Competition disciplines the bank and protects the customer.
2. Expensive offers to profit from the randomizers.

Offer menu with **price dispersion that is increasing in the fraction of randomizers**.

Menzio and Trachter (2018) set out a model in this spirit.

Menu-based price discrimination

Young people and first-time-buyers:

- **Constrained**: can't afford a bigger mortgage; may not qualify at other lenders.
- **Less likely to pick well** (Lusardi & Mitchell, 2011; Agarwal et al, 2009).

As a consequence, these customers are prone to picking expensive mortgages.

Evidence consistent with **banks using the menu they offer to price discriminate** and profit from customers' poor decisions and/or lack of alternatives.

Conclusions

People face a large number of choices.

Most don't pick well, but cost implications are limited.

Those that make expensive choices do so because they were given menus with large price dispersion.
$\rightarrow$ Young, first-time buyers.

Evidence consistent with **banks using menu to price discriminate**.

Thanks!

Summary Statistics

	Mean	Std. dev.	25^{th} pctile	Median	75^{th} pctile
Demographics					
Young (%)	36	48	0	0	100
Old (%)	11	31	0	0	0
First-time buyer (%)	40	49	0	0	100
Net income (£000s)	42	26	28	37	50
Loan characteristics					
Loan value (£000s)	157	90	100	136	190
House price (£000s)	201	119	125	172	242
Loan-to-value (%)	79	8	74	80	85
Loan-to-income ratio	3.2	0.9	2.6	3.2	3.8
Prices					
Fee (£000s)	0.66	0.57	0.10	0.76	1.00
Initial rate (%)	4.0	1.0	3.2	3.9	4.7
Reset rate (%)	4.1	0.4	4.0	4.0	4.2

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The choice set

Virgin Money Fixed

Rate	APRC	Max LTV	Product Fees	Initial Payment	Total Over 3 Years
2.15% 2.15% Fixed to 01/03/2024 reverting to 4.34%	**3.8%**	**65%**	**£995.00**	**£767.53**	**£28,946.08**

Virgin Money Fixed

Rate	APRC	Max LTV	Product Fees	Initial Payment	Total Over 3 Years
2.39% 2.39% Fixed to 01/03/2024 reverting to 4.34%	**3.8%**	**65%**	**£0.00**	**£788.71**	**£28,713.56**

Coventry BS Fixed

Rate	APRC	Max LTV	Product Fees	Initial Payment	Total Over 3 Years
1.45% 1.45% Fixed to 31/12/2023 reverting to 3.99%	**3.8%**	**65%**	**£999.00**	**£707.71**	**£26,796.56**

Mortgages on offer via Moneyfacts for a given LTV

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Choice set example

- Customer borrows £150k; Deposit of £35k $\rightarrow$ LTV $= 77\%$.
- Choice set is all mortgage products where:
  1. Max loan-to-value is 80%.
  2. Max loan size is greater than £150k.

  $+$ the customer's chosen mortgage if not in this set.
- In principle, customers qualify for all mortgages with higher max LTV, but these would represent expensive choices and relatively few customers (8%) do this.
- We restrict the choice set to focus on the menus banks target at particular customer groups, and run a number of robustness checks.

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NPV calculation details

$$\text{NPV} = \text{fee} + \sum_{t=1}^{T_F} \frac{IP}{(1+i)^t} + \sum_{t=T_F+1}^{84} \frac{RP}{(1+i)^t}$$

where

- T_F is the fixation period;
- IP is the monthly payment in the initial period;
- RP is the monthly payment after the initial period; and
- the monthly discount rate i is computed using the 7yr LIBOR.

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Which comparison set: within or across?

They address different questions, and have different pros and cons.

Within

- Pros: Covers choices that were definitely available, and is informative about how banks price discriminate.
- Cons: Many people use brokers and/or comparison shop, so actual choice set is likely bigger.

Across

- Pros: Likely closer to the options people had and past work suggests even modest shopping leads to savings.
- Cons: Not sure if any particular person shopped or, if they did, what they saw. Indirectly related to price discrimination.

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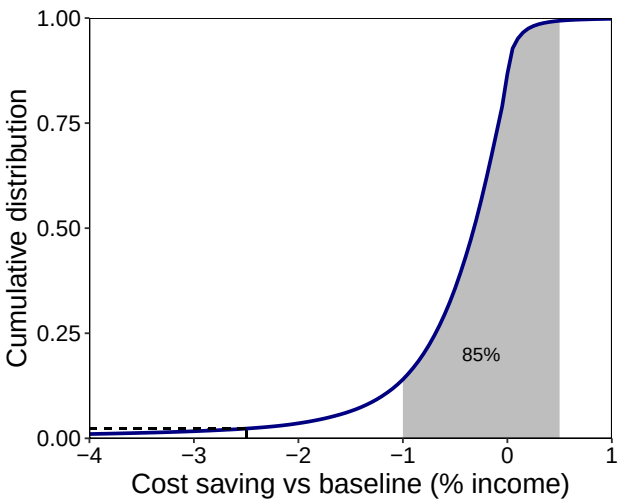
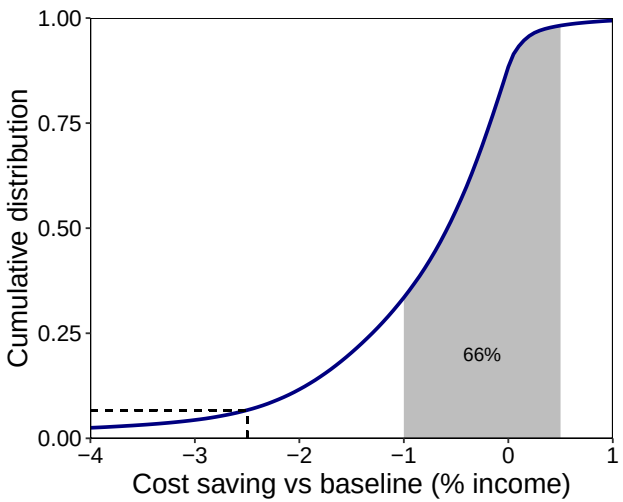
How well do people pick?

	Within		Across	
	Choice set size	Pctile chosen	Choice set size	Pctile chosen
25^{th} pctile	11	33	46	27
Median	16	53	73	47
75^{th} pctile	23	75	101	70



Cost savings within bank



Cost savings across banks

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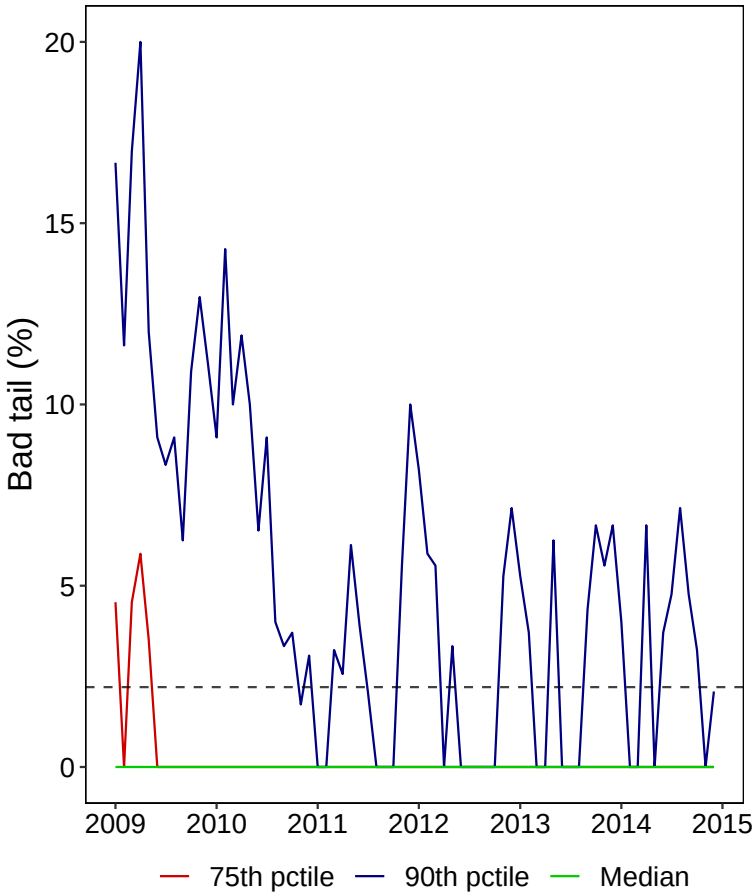
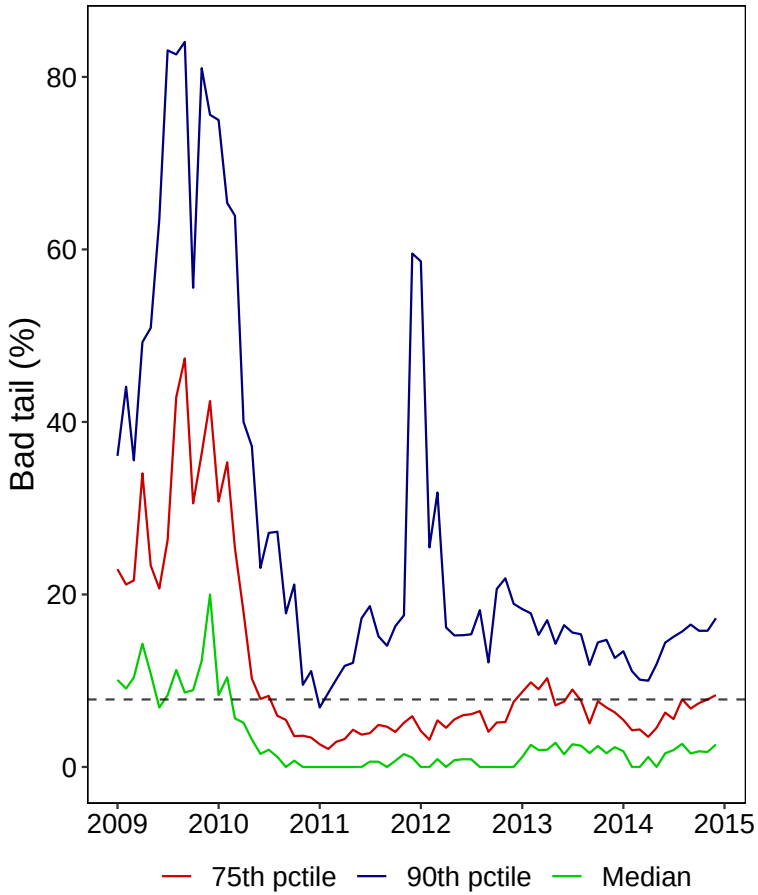
Menu variation



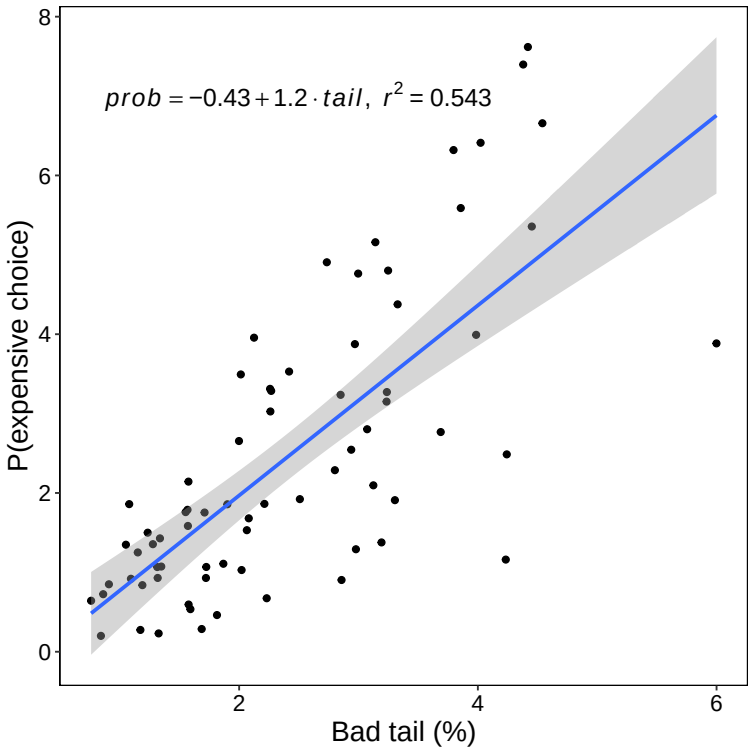
Bad tail within



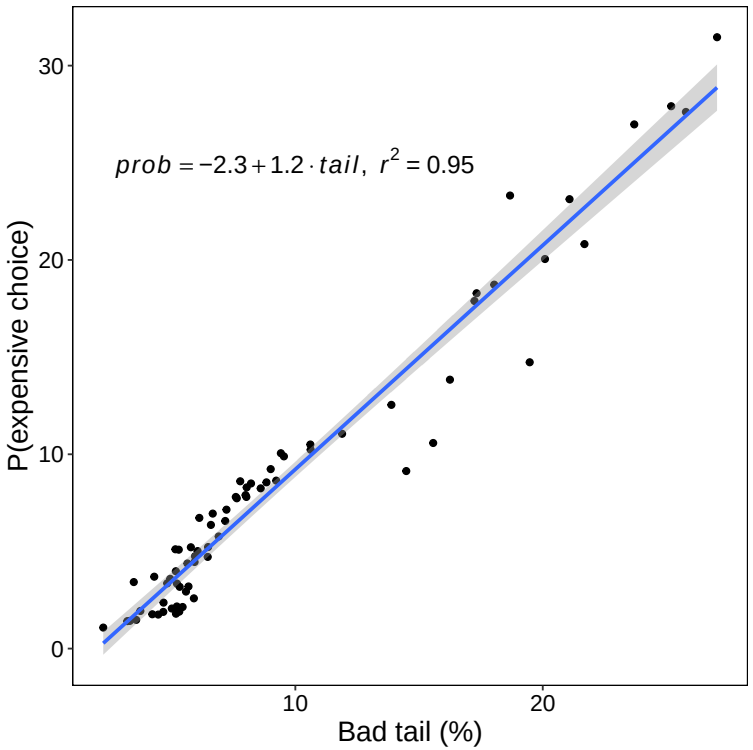
Bad tail across

Menu prevents the median person from picking expensive option, but **sometimes the menu is filled with bad choices**. Back

Menu Quality and Expensive Choices



Within bank



Across banks

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Who chooses poorly?

	Dependent variable:			
	Expensive choice within MFX		Expensive choice across MFX	
Young	0.005^{***}	0.001^{***}	0.018^{***}	0.005^{***}
	(0.0004)	(0.0002)	(0.001)	(0.0004)
Old	-0.008^{***}	-0.0003	-0.031^{***}	-0.006^{***}
	(0.0004)	(0.0003)	(0.001)	(0.001)
First-time buyer	0.006^{***}	-0.0003	0.005^{***}	-0.005^{***}
	(0.0004)	(0.0002)	(0.001)	(0.0004)
Poor	0.0005	0.001^{***}	0.003^{***}	0.001^{**}
	(0.0004)	(0.0002)	(0.001)	(0.0004)
Rich	-0.0001	-0.001^{***}	-0.006^{***}	-0.006^{***}
	(0.0003)	(0.0002)	(0.001)	(0.0004)
Bad tail		0.117^{***}		0.303^{***}
		(0.001)		(0.001)
Bank dummies	Yes	Yes	No	No
Product dummies	Yes	Yes	Yes	Yes
Pseudo R-squared	0.3	0.69	0.09	0.56
Mean dependent variable	0.023	0.023	0.067	0.067
Observations	894,901	894,901	883,459	883,459
Note:				*p<0.1; **p<0.05; ***p<0.01

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