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.

What we find

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

2. On average, people don't pick particularly well, but cost implications small.

3. A small percentage (7%) do pick expensive mortgages.
   - High LTV & LTI customers $\rightarrow$ Young, first-time-buyers.
   - Bad menus $\rightarrow$ Expensive choices.

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

Literature Data 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

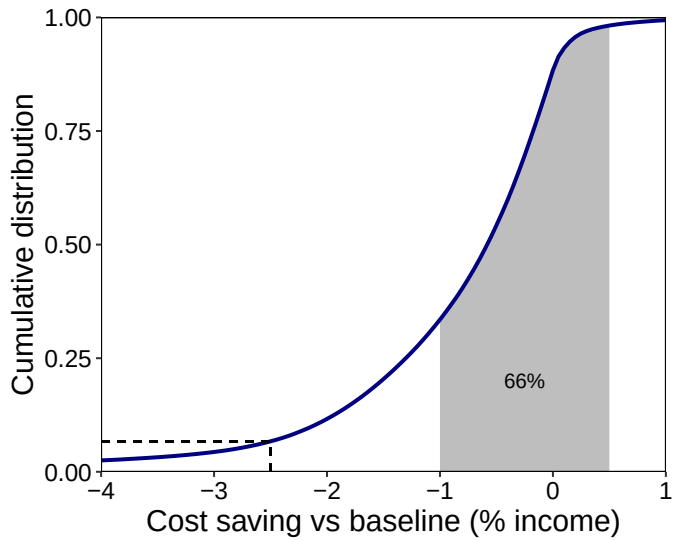
Evaluating choices

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.
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.

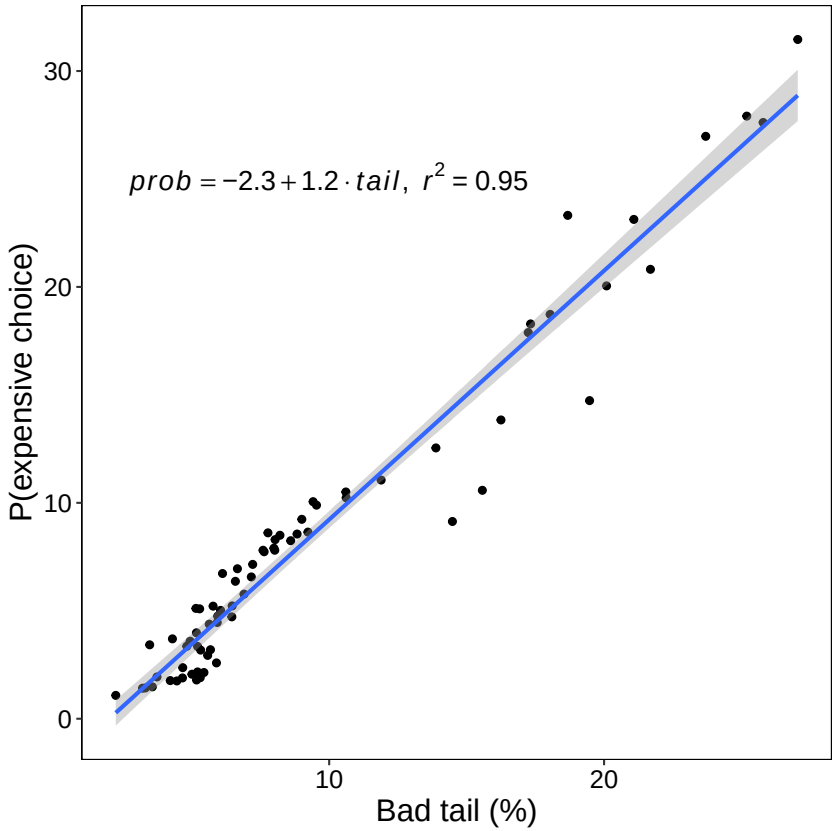
Within bank

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 Quality and Expensive Choices



- Plot probability of making expensive choice in a given month against average size of bad tails in menu offerings.
- Expensive choices happen when menu offering is worse.

Probability of expensive choice | Menu variation | Within bank

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 and FTB are more likely to pick expensively.
- Effects mostly driven by quality of menu.

Within bank | Menu by LTI/LTV | Choice by LTI/LTV

Menu-based Price Discrimination

Suppose there are two types of customers:

1. **Sophisticated** customers: go to all 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 entice sophisticated customers.
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, 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.

Conclusions

- People face a large number of mortgage choices.
- Most don't pick well, but cost implications low.
- Competition: Disciplines the banks and protects customers.
  - Offer attractice menu to entice customers to shop there.
- Small group face menu with huge price dispersion - young, first-time-buyers.
- Evidence consistent with banks using menu offering to price discriminate, profiting from customers' poor decisions or lack of alternatives.

Literature

UK mortage market

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

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).

Price dispersion

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

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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 at time of take-out
- Compare what they picked with what they could have picked

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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.

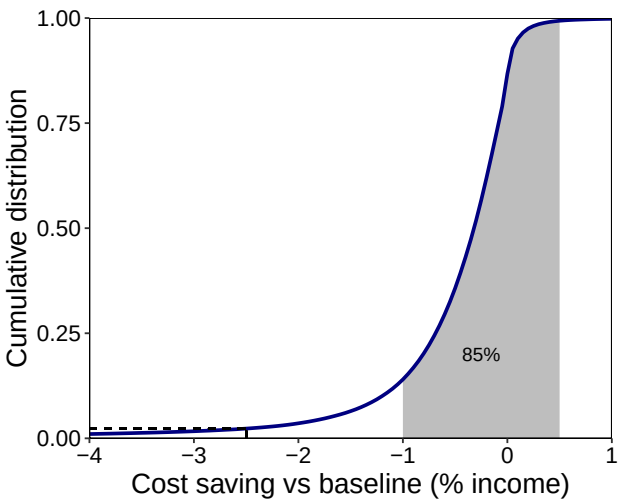
Across

- 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.

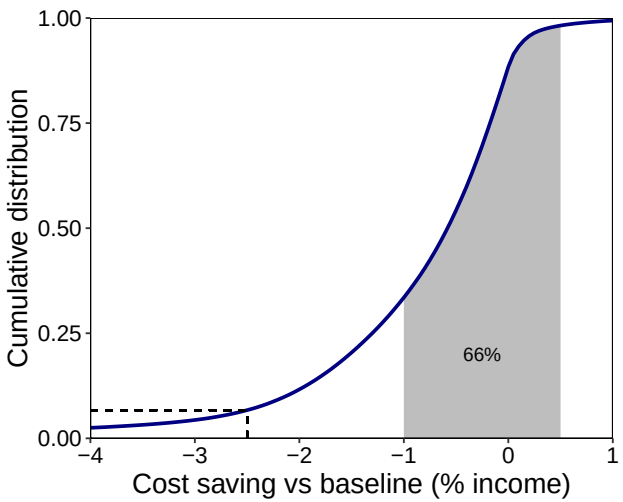
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How well do people pick?

	Within		Across	
	Choice set size	Pctile chosen	Choice set size	Pctile chosen
25^{th} pctile	11	33	46	27
Median	16	53	73	47
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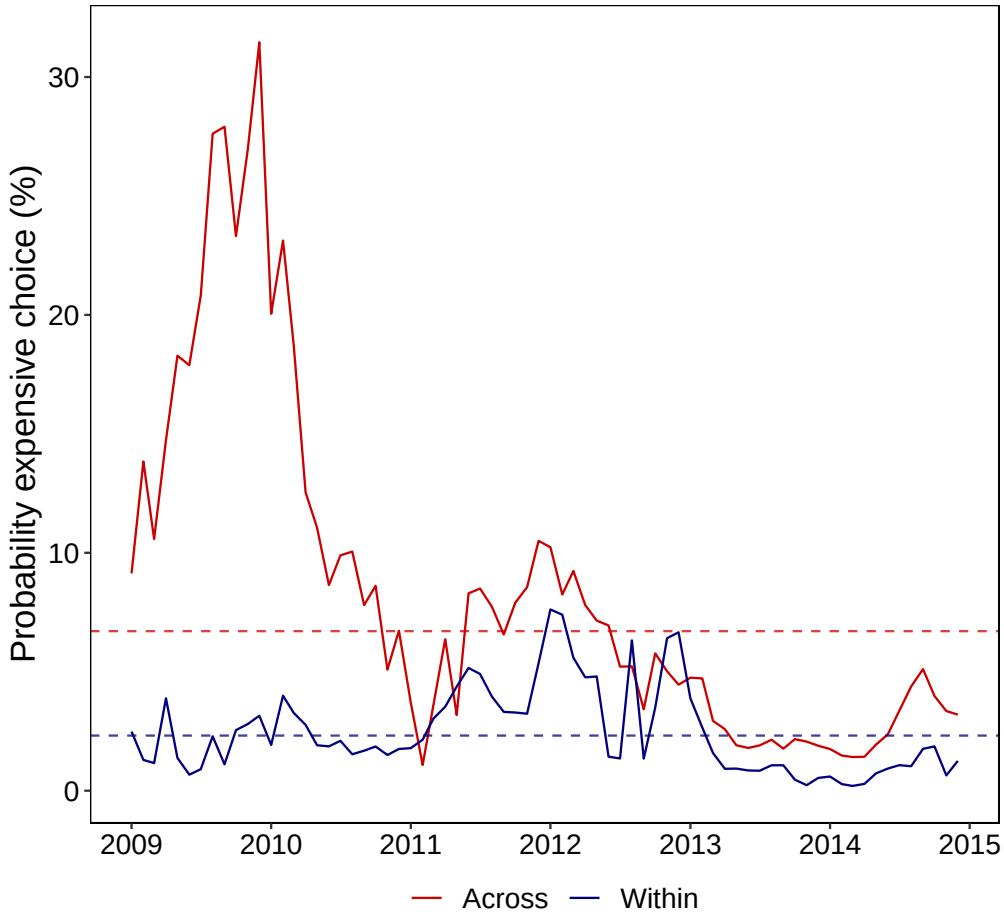
Cost savings within bank



Cost savings across banks

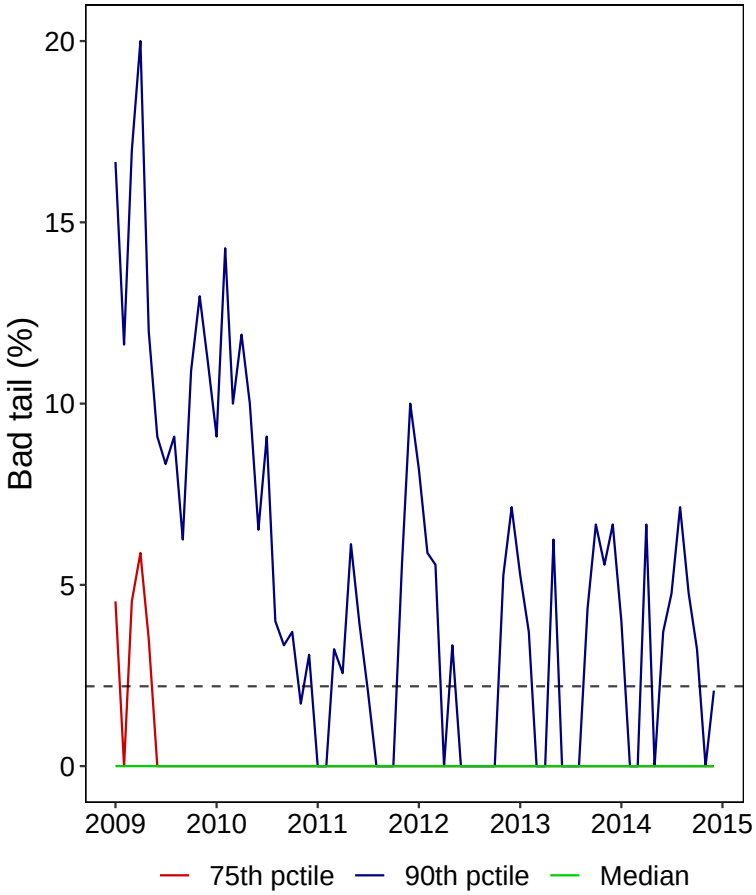
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Expensive choices

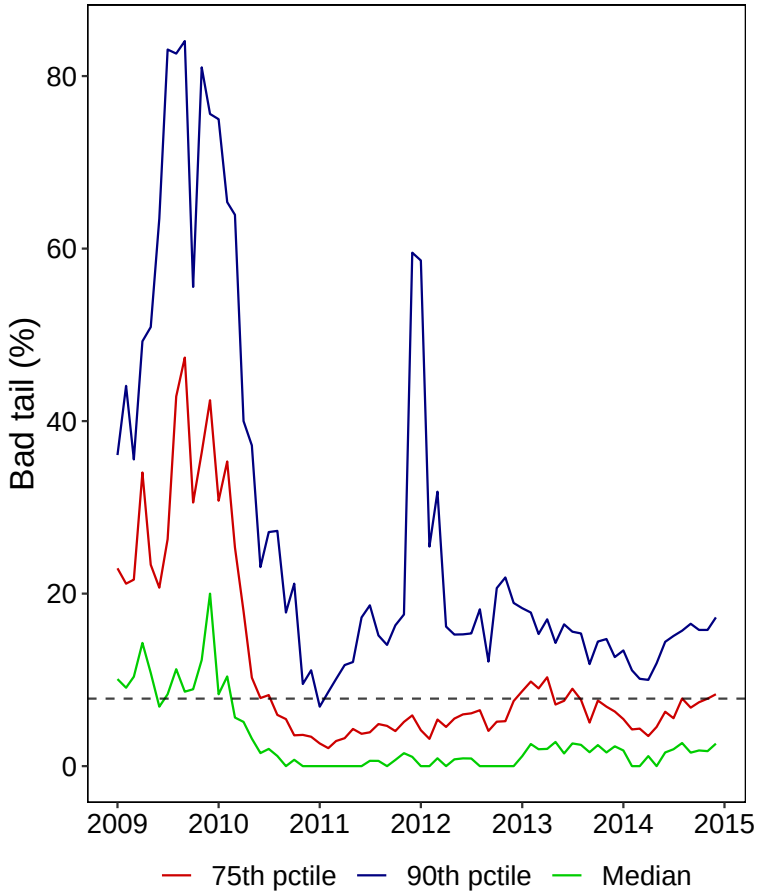


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Menu Variation



Bad tail within

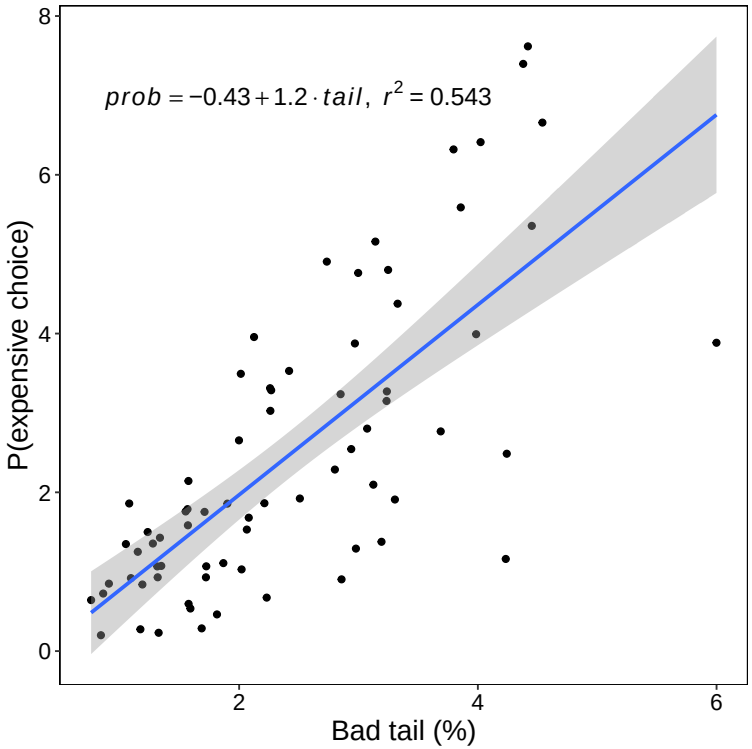


Bad tail across

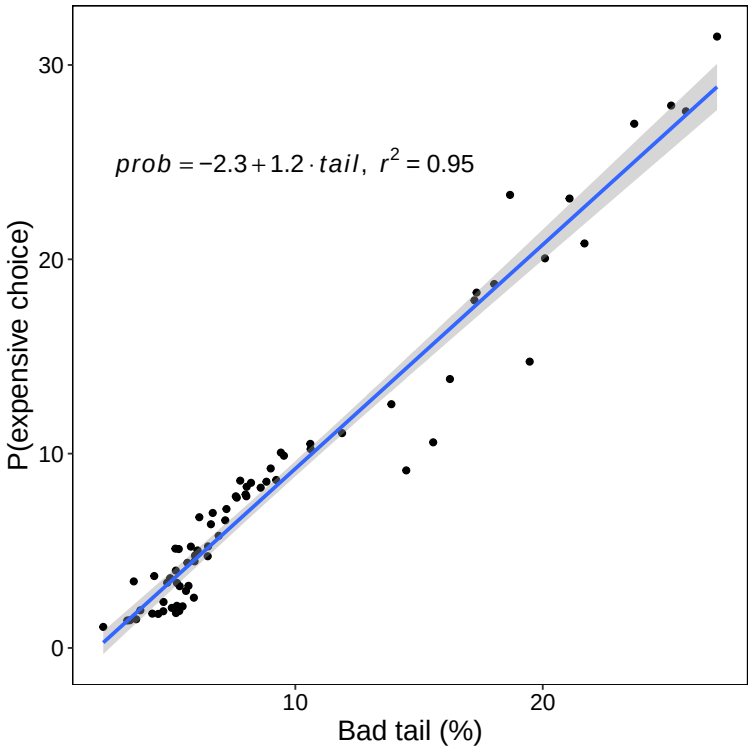
- Menu prevents the median person from picking expensive option.
- But sometimes the menu is filled with bad choices.

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Menu Quality and Expensive Choices



Within bank



Across banks

- Plot probability of making expensive choice in a given month against mean size of bad tails in menu offerings.

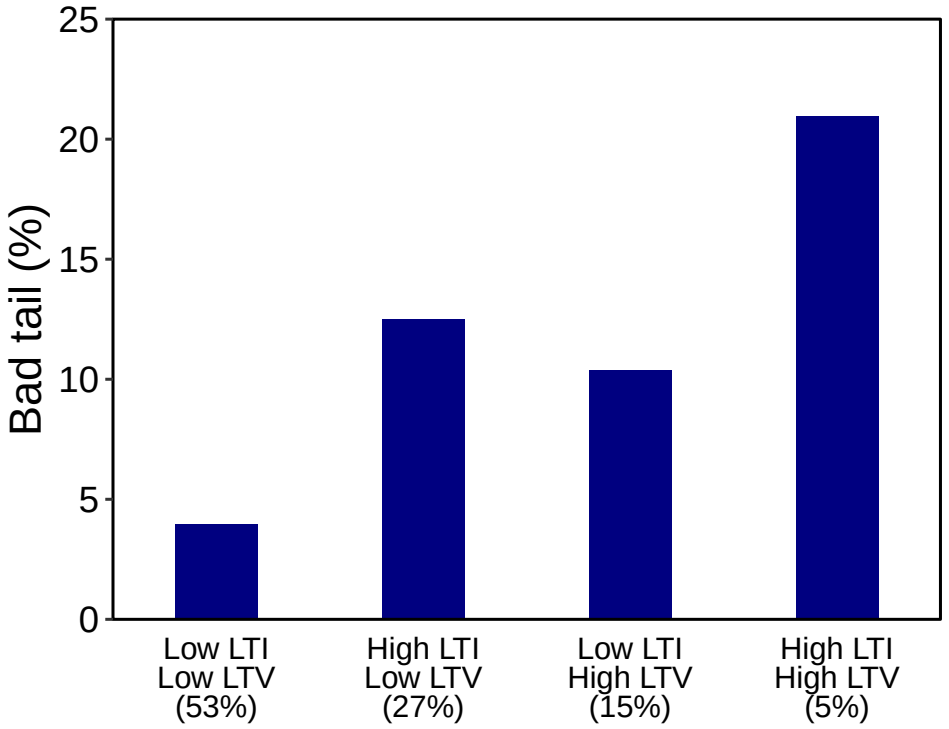
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Who chooses poorly?

	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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Who gets bad menus?



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

- Banks offer worse menus to high LTVs & LTI customers.
- Young & FTBs take high LTV & LTI mortgages $\rightarrow$ face worse menus

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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 and first-time buyers choose high LTV and high LTI mortgages, and face worse menus.

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