



Analyzing Consumer Decision Making Under Uncertainty Using Strategic Survey Questions

John Sabelhaus

Research and Statistics Division

Federal Reserve Board

The analysis and conclusions set forth are those of the author and do not indicate concurrence by the research staff or the Board of Governors. Many thanks to Wilbert van der Klaauw, Basit Zafar, and Olivier Armantier for help with the core Survey of Consumer Expectations data and developing and fielding the special module, to seminar participants at the Federal Reserve Board Applied Micro brown bag seminar for useful comments on an earlier version of this presentation, and to Peter Hansen for valuable research assistance on this project.

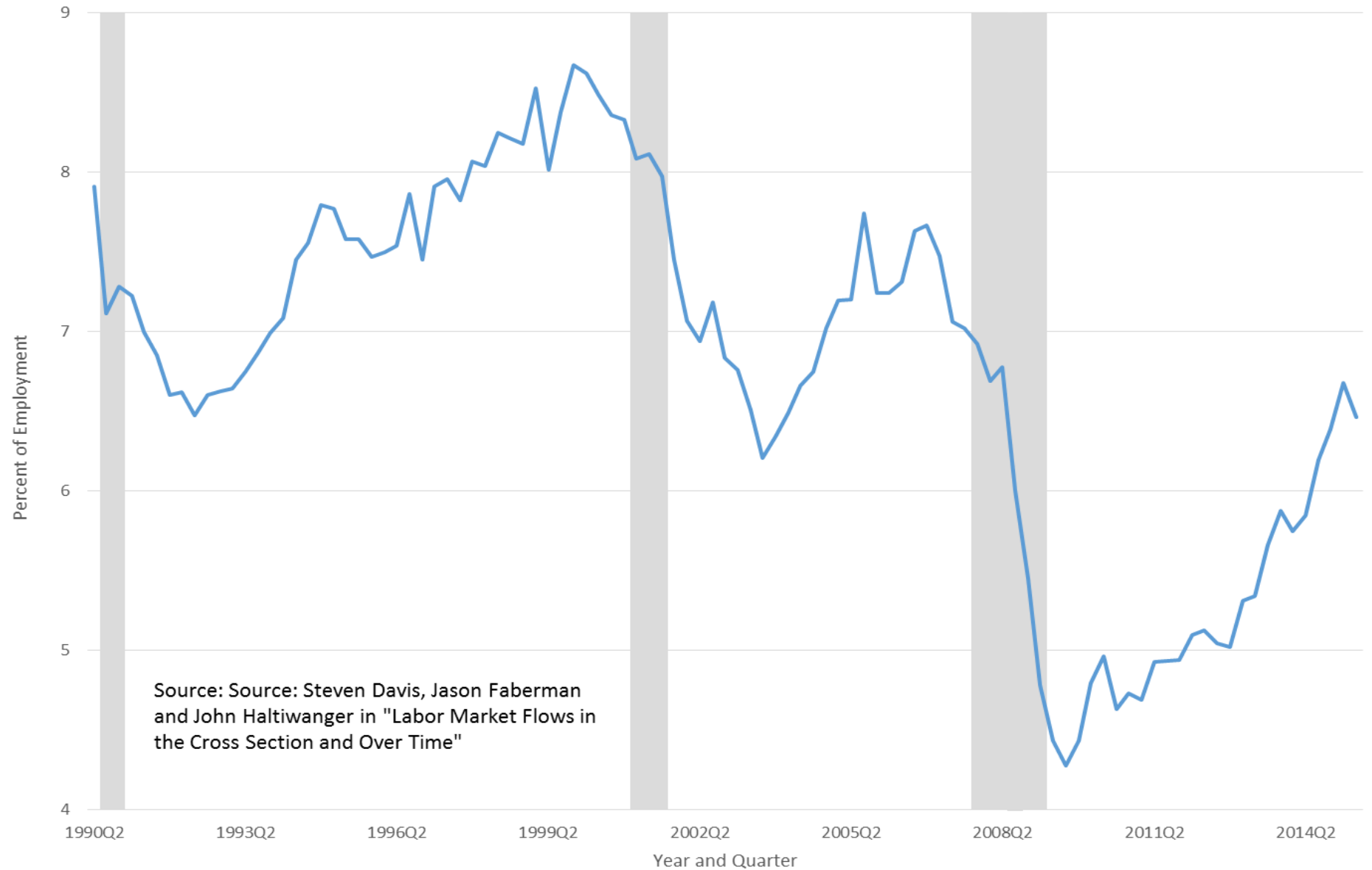


Motivation

- Business cycles generally marked by large swings in low-frequency (but key) lifecycle decisions, for example
 - Voluntary job leaving
 - Buying a house
 - Buying a new car
 - Question 1: Are decisions consistent with models based on typical utility functions and subjective expectations?
 - Question 2: Can we better predict turning points using observed shifts in subjective expectations?
-

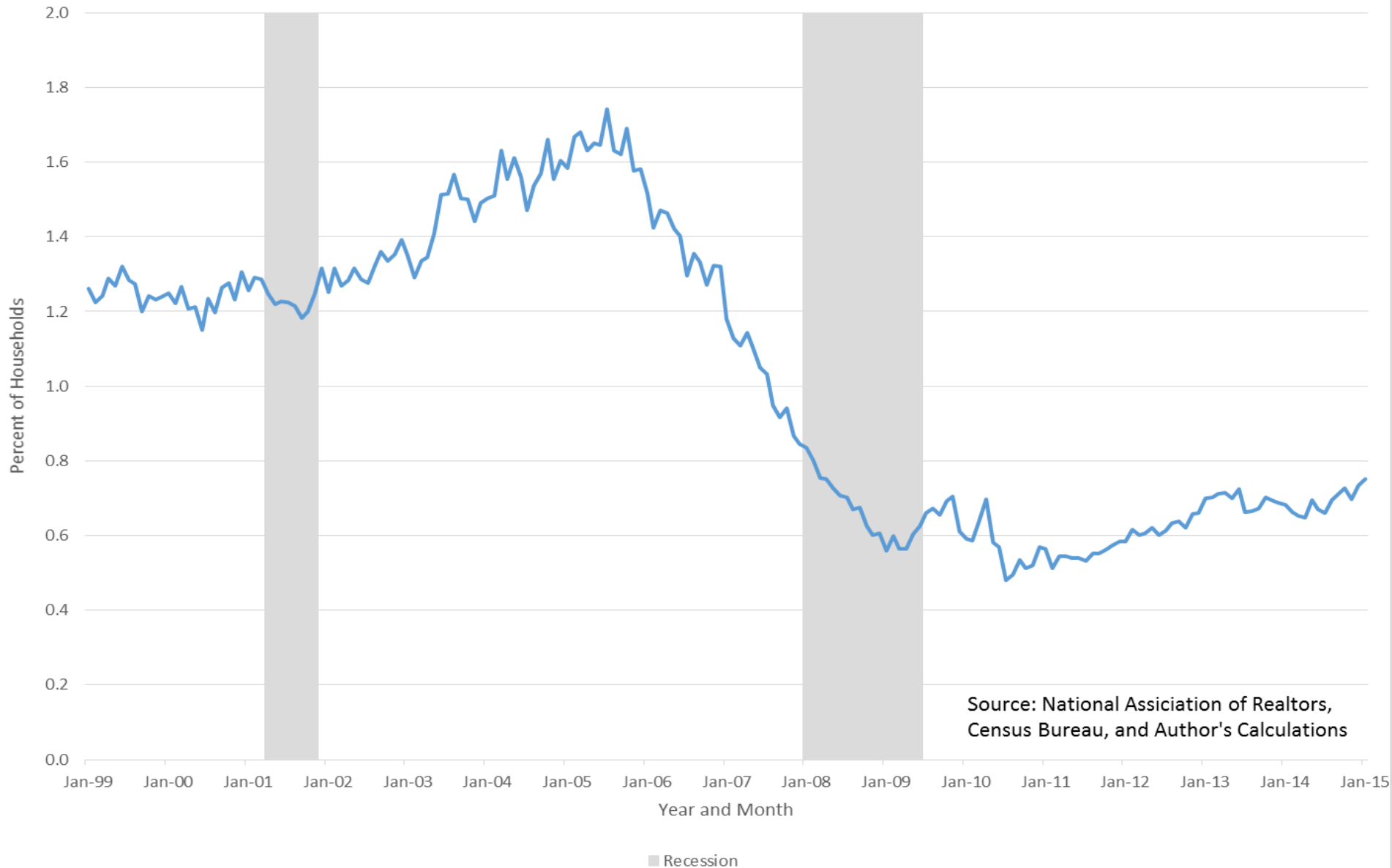


Quarterly Job Quit Rate



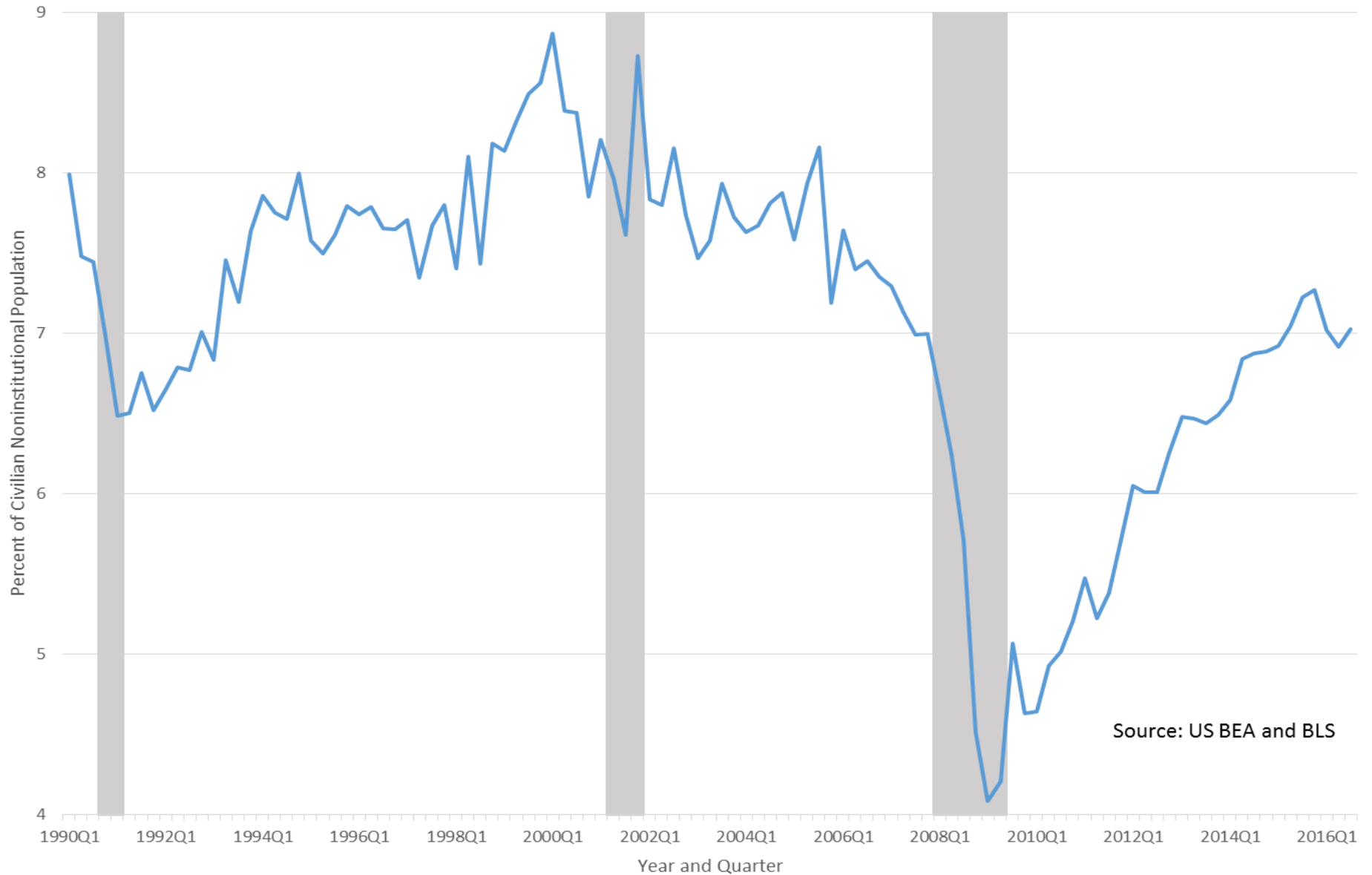


Combined Existing and New Home Monthly Purchase Rate





New Motor Vehicle Quarterly Purchase Rate



Source: US BEA and BLS



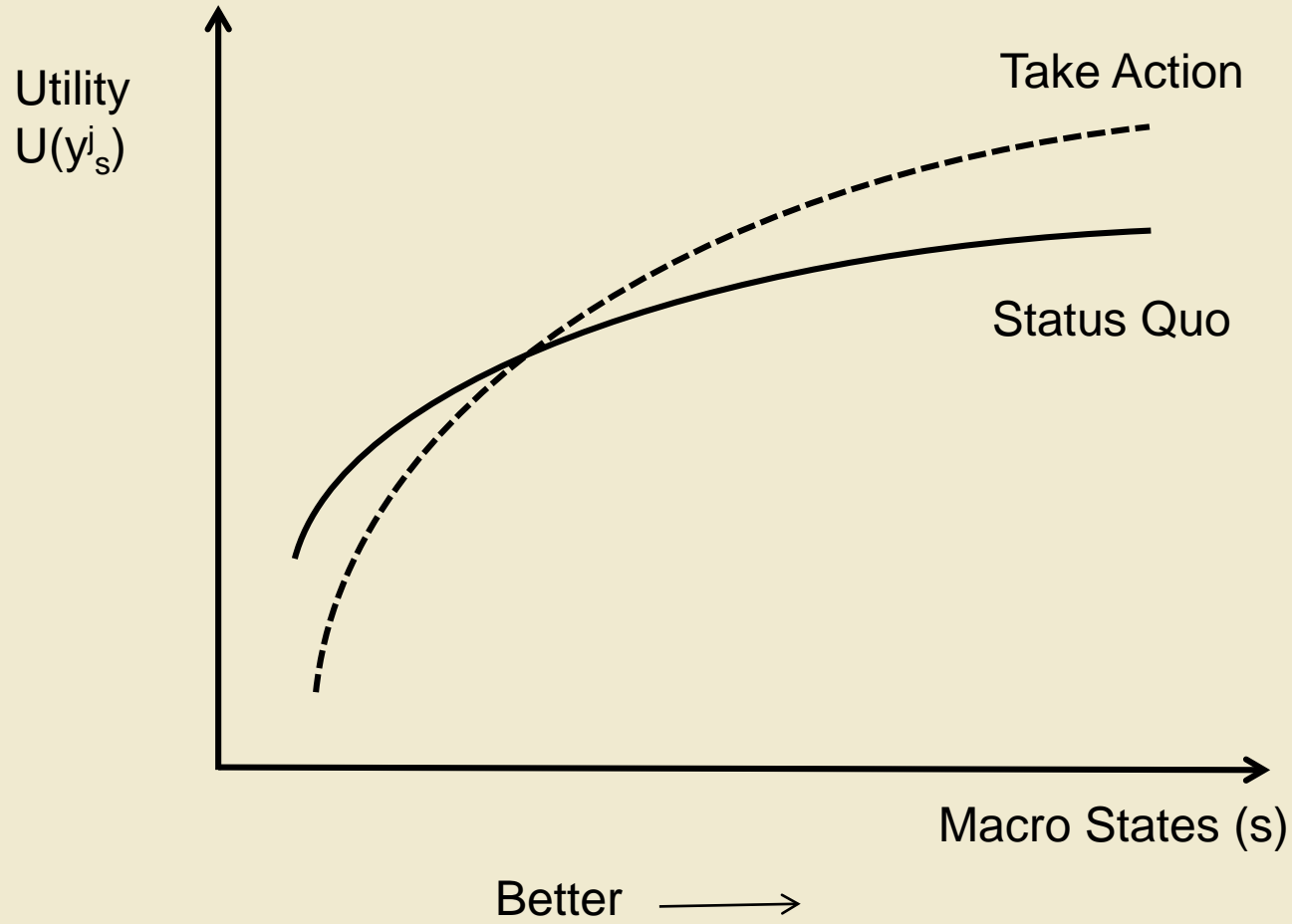
Modeling decisions under uncertainty

- Agents maximize expected utility, we need:
 1. Probability of each macro state s occurring: π_s
 2. Payoff under possible action plan j and state s : y_s^j
 3. Utility mapping of payoffs: $U(y_s^j)$
 4. A calculator: $\max_j U = E [\sum_s U(y_s^j) * \pi_s]$
 - Take action when $U^{\text{action}} > U^{\text{status quo}}$
 - Shifts in subjective probabilities or expected payoffs will lead to movements in probability of action
-



How does taking action affect expected utility?

- Assume taking action changes payoffs across all states ($y_s \rightarrow y_s^a$) but state probabilities (π_s) unchanged
 - In bad states, status quo payoff better ($y_s > y_s^a$)
 - In good states, action payoff better ($y_s < y_s^a$)
 - Utility mapping of payoffs $U()$ concave
 - Action \Rightarrow trading off risk of worse outcomes in bad states versus better outcomes in good states
 - NOT a typical mean-variance tradeoff
-





Experimental design

- Survey of Consumer Expectations (SCE)
 - On-line survey, $\approx 1,200$ observations (≈ 600 workers)
 - Respondent expectations on underlying macroeconomic states captured in monthly core
 - Module: one-time questions about big decisions
 - Behavior under uncertainty module run December 2015
 - Focus in this talk is on the voluntary job change, home buying, and car buying questions
 - Also ran questions on expanding a small business, investing in human capital, various portfolio decisions
-



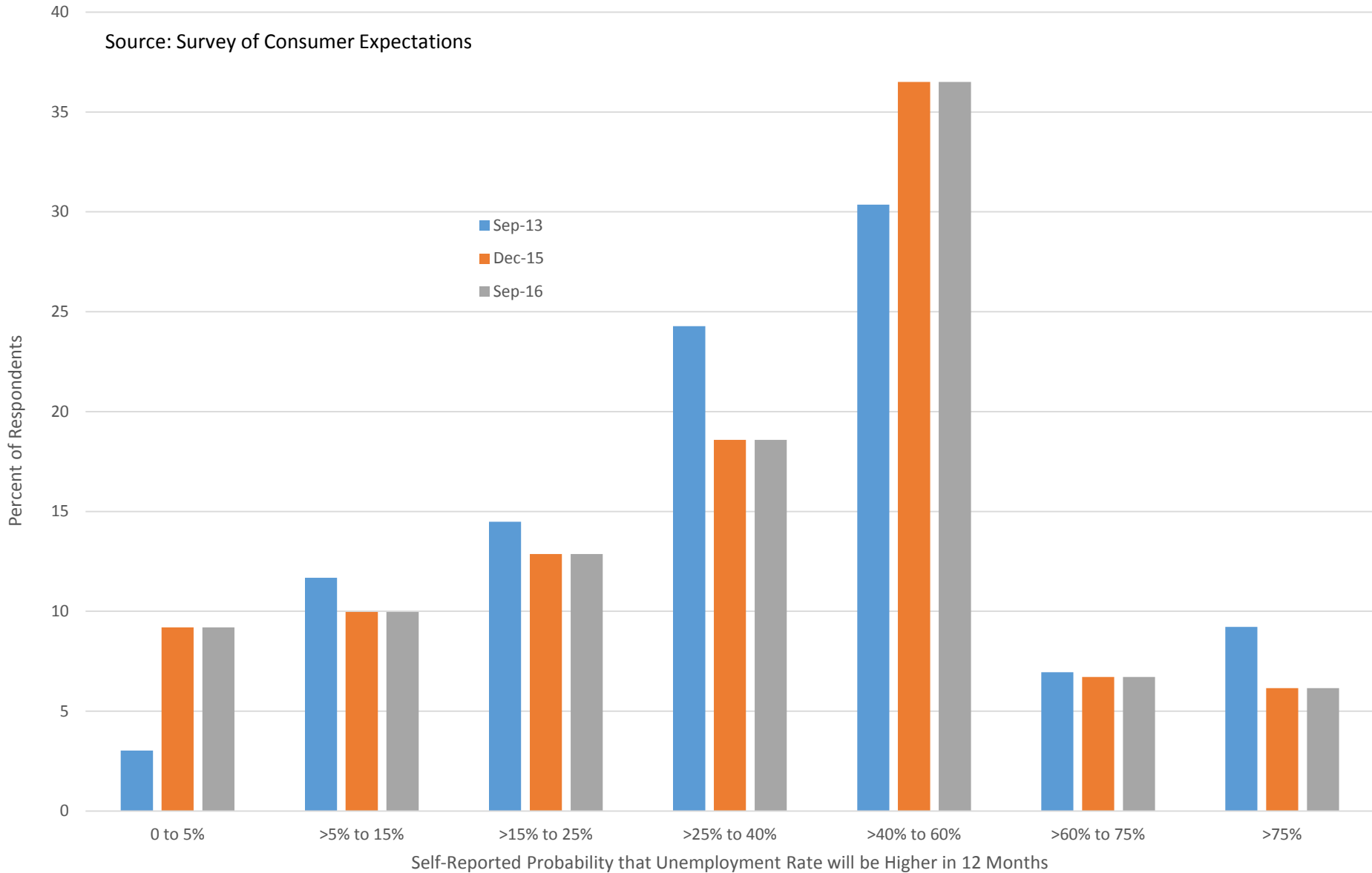
Subjective Expectations from Core SCE

- Look at distributions (histograms) for three periods: September 2013, December 2015, September 2016
 - Observe substantial variation across respondents in subjective expectations
 - Observe (mostly modest) changes in the densities for subjective probabilities over time
-



Distribution of Reported Probability that Unemployment Rate will Increase

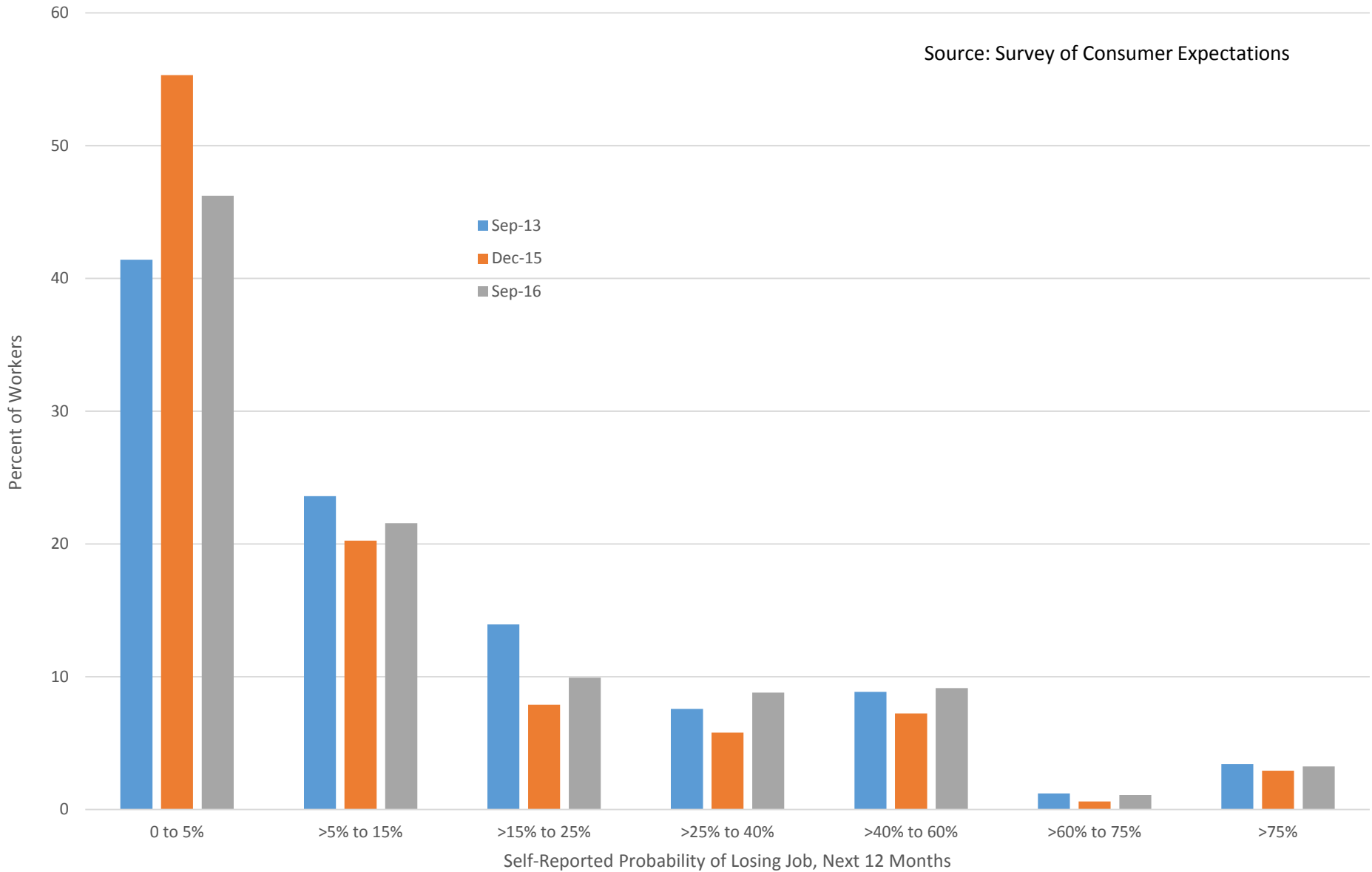
Source: Survey of Consumer Expectations





Distribution of Workers by Reported Probability of Losing Job

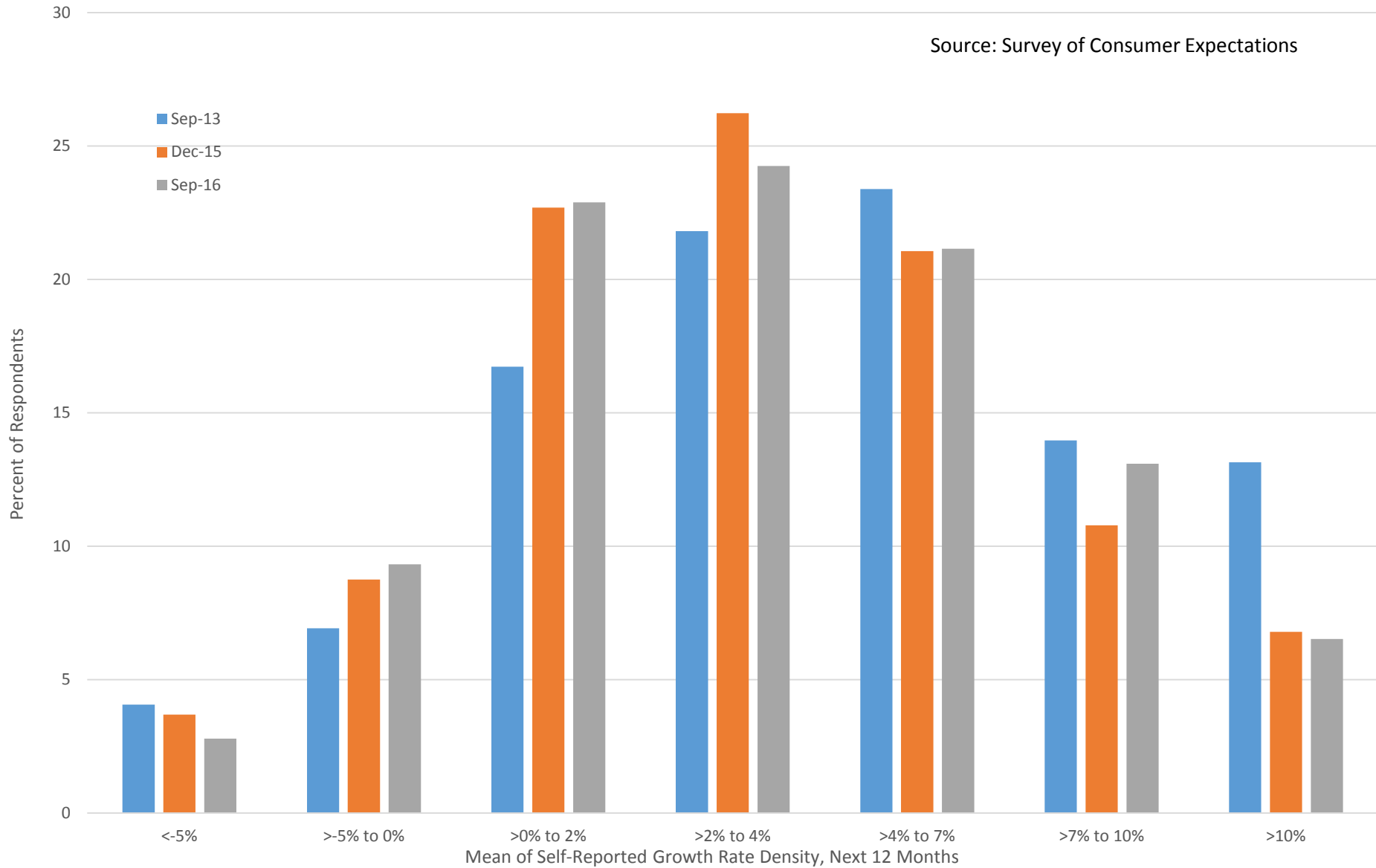
Source: Survey of Consumer Expectations





Distribution of Expected House Price Growth Rates

Source: Survey of Consumer Expectations





Experimental design

- Survey of Consumer Expectations (SCE)
 - On-line survey, $\approx 1,200$ observations (≈ 700 workers)
 - Respondent expectations on underlying macroeconomic states captured in monthly core
 - Module: one-time questions about big decisions
 - Behavior under uncertainty module run December 2015
 - Focus in this talk is on the voluntary job change, home buying, and car buying questions
 - Also ran questions on expanding a small business, investing in human capital, various portfolio decisions
-



Goal is to Measure Willingness to Take Risk

- At what competing wage offer is it a good idea to voluntarily move from one employer to another equivalent employer?
 - How much more should a renter be willing to commit to in regular monthly payments in order to stop renting and become a homeowner?
 - How much more (relative to regular repair costs) should the owner of an old car be willing to commit to in regular monthly payments in order to get a new car?
-



Return vs Risk Tradeoffs

- Changing jobs
 - Potential return is better pay, improved opportunities
 - Potential risks include getting stuck in a bad match and/or being the first to be let go in an economy with higher unemployment
 - Buying house
 - Potential return is gain in house price, pecuniary and non-pecuniary benefits of owning, including investing time in the house
 - Potential risks include getting stuck with the house in an economy with falling house prices and/or higher unemployment
 - Buying car
 - Potential return is higher consumption value because of the car itself and the time/hassle of dealing with fewer repairs
 - Potential risks include getting stuck with a higher car payment in an economy with higher unemployment, less income growth
-



Separating Idiosyncratic and Macroeconomic Risk

- Decisions are affected by idiosyncratic differences: disutility of a bad job match, preferences for renting versus owning, preference for old versus new car
 - Decisions also have macro risks: how a given respondent rates a given decision will vary with their expectations, and those expectations will vary over time
 - Experiment varies the payoff (or the cost if negative) of taking each risk in order to separate the (time-varying) effect of expectations from the idiosyncratic component
-



Four Payoffs, Decisions Increasingly Attractive

- At what competing wage offer is it a good idea to voluntarily move from one employer to another equivalent employer?
 - Payoffs: 0%, 5%, 15%, 25%
 - How much more should a renter be willing to commit to in regular monthly payments in order to become a homeowner?
 - Payoffs: 25%, 10%, 0%, -10%
 - How much more (relative to regular repair costs) should the owner of an old car be willing to commit to in regular monthly payments in order to get a new car?
 - Payoffs: 100%, 50%, 25%, 10%
-



Decision “Scoring” in On-Line Module

- Respondents asked to “score” specific decisions on a scale of 0 (very bad for me) to 100 (very good for me)
 - Score of 50 => not obviously bad or good (\approx indifference)
 - Respondents nudged on ordinal rankings across payoff levels
 - Out-of-bounds cases (generally 30%, varied by question) were asked for indifference points outside of the given range
 - Scale of 0 to 100 might be interpreted by some respondents as the probability of taking the action, but in any event they are a monotonic mapping of expected utility
-



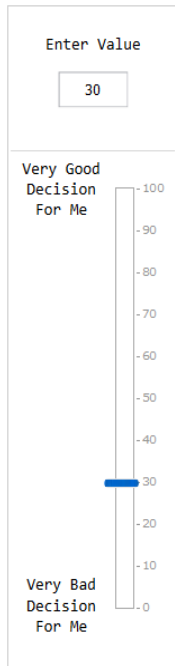
Imagine that you are still a long way from retirement and you have been at the same job for several years. You like the company and your coworkers, but you have been disappointed by what you consider low income growth in recent years. Your boss is sympathetic, but blames the bad economy. Your boss says that things probably won't get any worse, but does not know if or when things will get better at the company.

You have learned that another company will pay you the following income (see below) with the same benefits, for the same type of work. How do you rate the decision to take the new job if the new job will pay...

Please enter your answer in the box or by clicking on the scale below.

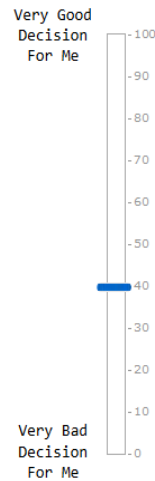
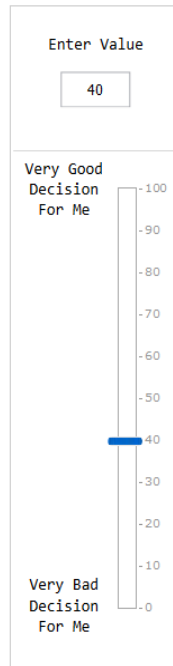
Q9a

...the same income?



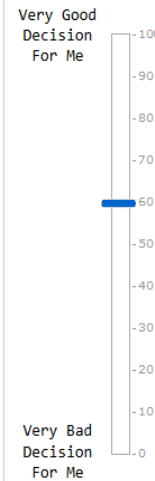
Q9b

...5 percent more income?



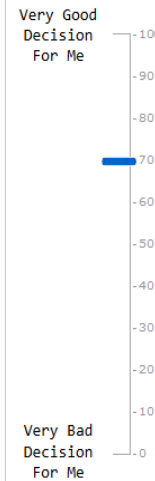
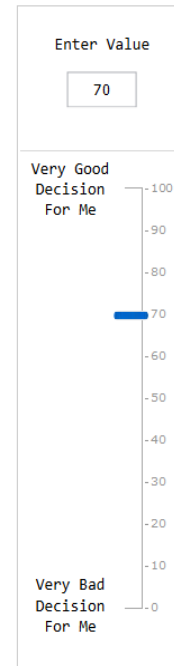
Q9c

...15 percent more income?



Q9d

...25 percent more income?



BACK NEXT





Preliminary findings

- Median (tipping point) analysis
 - At what payoff are respondents just indifferent about taking the action in question?
 - Relationship to core SCE subjective expectations
 - Are differences in respondents' "tipping points" consistent with differences in subjective expectations?
-



“Tipping Point” Payoffs

(Respondents at 25th percentile are MORE reluctant to take action)

	Competing Employer Wage Offer Such That Respondent Just Indifferent About Changing Jobs	Incremental Cost of Owning Relative to Renting Such That Respondent Just Indifferent About Buying Home	Incremental Cost of New Car Payment Relative to Repairs Such That Respondent Just Indifferent About Buying Car
25 th Percentile	18.4%	6.7%	10.0%
Median	11.0%	17.3%	25.0%
Mean	11.9%	19.4%	40.6%
75 th Percentile	0.0%	30.0%	50.0%



“Tipping Point” Regression Results

Subjective Expectations Variable	Job Change	Home Buying	Car Buying
Expect Own Situation (Much or Somewhat) Worse in 12 Months	-2.74	1.49	-1.08
Probability of Moving Within Next 12 Months	0.00	0.02	0.04
Probability Unemployment Rate Higher in 12 Months	0.04	0.02	-0.30***
Probability Interest Rates Higher in 12 Months	-0.09**	0.05	0.18*
Probability Stock Market Higher in 12 Months	-0.03	-0.01	0.11
Probability of Losing Own Job Within Next 12 Months	-0.12**	-0.02	0.11
Probability of Leaving Own Job Within Next 12 Months	0.02	0.08*	-0.13
Probability of Finding Job Within 3 Months, Given Job Loss	0.00	0.02	0.03
Probability Late on Own Debt Payments Within Next 3 Months	0.02	-0.08	-0.10
Probability Credit is (Much/Somewhat) Easier to Obtain in 12 Months	-1.77	4.36	3.48
Expected Inflation Rate, Next 12 Months	-0.37	-0.25	0.46
Expected Own Earnings Growth Rate, Next 12 Months	0.04	0.31	0.39
Expected House Price Growth Rate, Next 12 Months	0.31*	0.43*	-0.78

Notes: Sample is currently employed respondents, n=593, significance: *=10% level, **=5% level, *=1% level. Demographic controls include sex, education, age, marital status, job tenure gt 5 years, income, number of kids in household under 18.**



Effects of Changes in Subjective Expectations

- Use (highly-collinear) estimated coefficients to “predict” tipping point means for entire SCE, 2013 through 2016
 - See little change in predictions, consistent with only small changes in underlying expectations (remember SCE histograms earlier)
 - Outcomes themselves are also only changing modestly since late 2013, so not much information either way
 - How would willingness to change jobs, buy home, or buy car change if expectations suddenly moved?
 - Caution: subjective expectations are correlated
 - For example, $\text{pr}(\text{unemployment rate will increase})$ is strongly correlated (but less than 1:1) with $\text{pr}(\text{losing own job})$
 - Can do counterfactuals with and without correlations
-



Job Change: Sensitivity to E(Unemployment)

- In September 2016, mean predicted “*Competing Employer Wage Offer Such That Respondent Just Indifferent About Changing Jobs*” is 10.6%
 - If we make everyone 100% certain unemployment will increase, raises mean reservation wage to 13.3%
 - If we make everyone 100% certain unemployment will NOT increase, lowers mean reservation wage to 8.8%
 - Adding correlation between own $pr(\text{job loss})$ and overall unemployment cuts predicted changes in half; increased risk of own job loss substantially lowers reservation wage
-



Car Buying: Sensitivity to E(Unemployment)

- In September 2016, mean predicted *“Incremental Cost of New Car Payment Relative to Repairs Such That Respondent Just Indifferent About Buying Car”* is 37.4%
 - If we make everyone 100% certain unemployment will increase, lowers mean buy new/repair cost gap to 20.7%
 - If we make everyone 100% certain unemployment will NOT increase, raises mean buy new/repair cost gap to 48.1%
 - Adding correlation between own $pr(\text{job loss})$ and overall unemployment has offsetting but fairly small impact
-



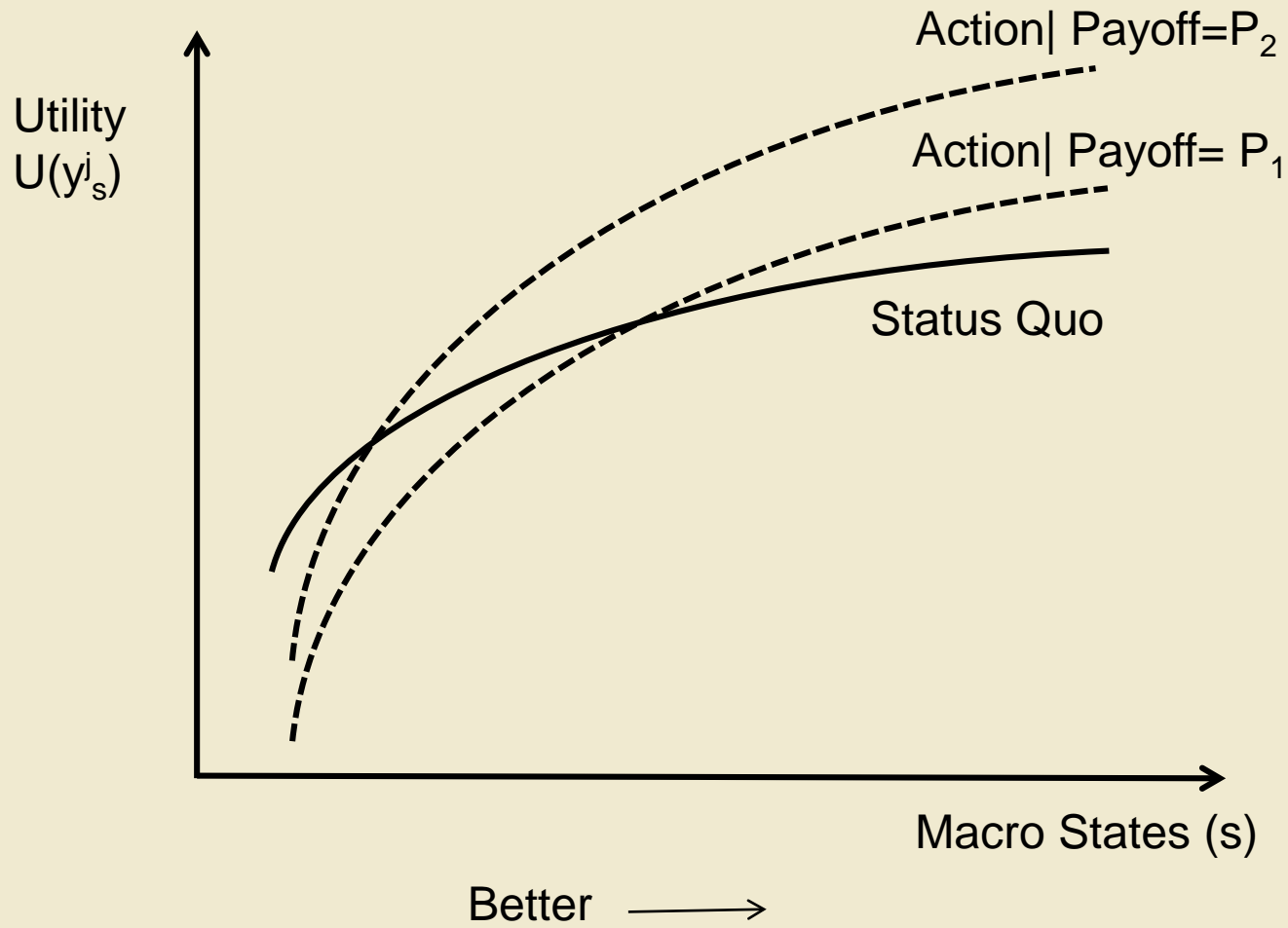
Home Buying: Sensitivity to E(House Prices)

- In September 2016, mean predicted *“Incremental Cost of Owning Relative to Renting Such That Respondent Just Indifferent About Buying Home”* is 19.7%
 - Increase expected house price index growth by 10% for everyone raises homeowner to renter cost gap to 23.9%
 - Lower expected house price index growth by 10% for everyone lowers homeowner to renter cost gap to 15.5%
 - Effects larger if expected house price growth positively correlated with other expectations (employment, wages) that also make homeownership more attractive
-



Next Steps

- Experiment was originally designed as an input for estimating a dynamic programming problem
 - Specify utility function with some fixed disutility associated with action going bad (i.e., job a bad match)
 - Specify functional relationship between cost of action going bad and macroeconomic states (i.e., cost of becoming unemployed in a good economy bad economy)
 - Given respondent's subjective expectations, is the respondent's score for a higher payoff consistent with model-generated change in expected utility?
-





Thanks!

john.sabelhaus@frb.gov



Extra Slides



Now we will ask you to think about some decisions that a person such as yourself might have to make at some point in your life. Although you are probably not making most of these types of decisions right now, please try to imagine yourself in the situation.

You will be asked to score each of these decisions on a scale from 0 to 100. A score of 0 means you think the decision is a very bad decision, something you would never do, and a score of 100 means you think it is very good decision, something you would do without question.

Values between 0 and 100 cover the possible range of very bad decision to very good decision. For example, a "25" would mean you think it is a mostly bad decision, but you can see why someone such as yourself may do that in some situations. A score of "75" would mean you mostly think it is a good decision, but you have some concerns. Values in the middle around "50" would mean you think it is neither obviously a good decision nor obviously a bad decision.

BACK NEXT





Voluntary job change question

Imagine that you are still a long way from retirement and you have been at the same job for several years. You like the company and your coworkers, but you have been disappointed by what you consider low income growth in recent years. Your boss is sympathetic, but blames the bad economy. Your boss says that things probably won't get any worse, but does not know if or when things will get better at the company.

You have learned that another company will pay you the **same income**, with the same benefits, for the same type of work. How do you rate the decision to take the new job?

- Slider scale with range 0 to 100 and number box appears, respondent enters a number or moves slider
-



Voluntary job change (incremental payoffs)

- Respondent sees each new payoff incrementally, eventually has four separate sliders on screen, can change earlier scores as well:

You have learned that another company will pay you **5 percent more income**, with the same benefits, for the same type of work. How do you rate the decision to take the new job?

You have learned that another company will pay you **15 percent more income**, with the same benefits, for the same type of work. How do you rate the decision to take the new job?

You have learned that another company will pay you **25 percent more income**, with the same benefits, for the same type of work. How do you rate the decision to take the new job?



Home purchase question

Imagine you have been renting a house in a city you like and where you intend to stay. You have learned that the identical house next door is for sale. You qualify for the mortgage, and you have the required down payment.

After figuring in all of the additional costs and tax effects, your monthly payment if you buy the house would be **25 percent more** than renting. How do you rate the decision to buy the house?

- Slider scale with range 0 to 100 and number box appears, respondent enters a number or moves slider
-



Home purchase (incremental payoffs)

- Respondent sees each new payoff incrementally, eventually has four separate sliders on screen, can change earlier scores as well:

After figuring in all of the additional costs and tax effects, your monthly payment if you buy the house would be **10 percent more** than renting. How do you rate the decision to buy the house?

After figuring in all of the additional costs and tax effects, your monthly payment if you buy the house would be **the same as** renting. How do you rate the decision to buy the house?

After figuring in all of the additional costs and tax effects, your monthly payment if you buy the house would be **10 percent less** than renting. How do you rate the decision to buy the house?



Car buying question

Imagine that you bought a car several years ago, and it now has many miles on the odometer, so the regular repairs are starting to get expensive.

You estimate that the monthly car payment for an equivalent newer car would be **100 percent more than** what you are currently paying in regular repair costs (**that is, double the cost**). How do you rate the decision to buy the newer car?

- Slider scale with range 0 to 100 and number box appears, respondent enters a number or moves slider
-



Car buying (incremental payoffs)

- Respondent sees each new payoff incrementally, eventually has four separate sliders on screen, can change earlier scores as well:

You estimate that the monthly car payment for an equivalent newer car would be **50 percent more than** what you are currently paying in regular repair costs. How do you rate the decision to buy the newer car?

You estimate that the monthly car payment for an equivalent newer car would be **25 percent more than** what you are currently paying in regular repair costs. How do you rate the decision to buy the newer car?

You estimate that the monthly car payment for an equivalent newer car would be **10 percent more than** what you are currently paying in regular repair costs. How do you rate the decision to buy the newer car?



Out of Bounds Follow-Ups

- The four provided payoff options sometimes did not span the “tipping point” where score=50
 - Voluntary job change (Δ wage = 0%, 5%, 10%, 25%)
 - 75% within the range
 - 14% scored all options >50, 11% no option >50
 - Renter to owner (Δ cost = +25%, +10%, 0%, -10%)
 - 68% within the range
 - 28% scored all options >50, 4% no option >50
 - Car buying (Δ cost = +100%, +50%, +25%, +10%)
 - 69% within the range
 - 11% scored all options >50, 20% no option >50
 - In out-of-bounds situations, follow-up question on the payoff such that they would just be indifferent
-



SCE Core: Probability of Outcome Questions

Q2 (worseoffnext12)

*And looking ahead, do you think you (and any family living with you) will be financially better or worse off **12 months from now** than you are these days?*

Q3 (pr_move)

*What do you think is the percent chance that **over the next 12 months** you will move to a different primary residence (that is, the place where you usually live)?*

Q4 (pr_urhigher)

*What do you think is the percent chance that **12 months from now** the unemployment rate in the U.S. will be higher than it is now?*

Q5 (pr_irhigher)

*What do you think is the percent chance that **12 months from now** the average interest rate on saving accounts will be higher than it is now?*

Q6 (pr_smhigher)

*What do you think is the percent chance that **12 months from now**, on average, stock prices in the U.S. stock market will be higher than they are now?*

SCE Core: Probability of Outcome Questions (cont)

Q17 (pr_lose_job)

[if Q9 includes codes 1,2,4 or 5 and if Q11 is NOT self-employed and Q10>0] What do you think is the percent chance that you will lose your ["main" if Q10>1, "current" if Q10=1] job during the next 12 months?

Q18 (pr_leave_job)

[if Q9 includes codes 1,2,4 or 5 AND if Q11 is NOT self-employed and Q10>0] What do you think is the percent chance that you will leave your ["main" if Q11>1, "current" if Q11=1] job voluntarily during the next 12 months?

Q26 (pr_find_job)

[if Q19 does NOT equal "self-employed" and Q9 includes codes 1,2,4 or 5 and Q10>0] Suppose you were to lose your ["main" if Q10>1] job this month. What do you think is the percent chance that within the following 3 months, you will find a job that you will accept, considering the pay and type of work This condition was added to the survey in August 2013

Q33 (pr_debt_late)

*What do you think is the percent chance that, **over the next 3 months**, you will **NOT** be able to make one of your debt payments (that is, the minimum required payments on credit and retail cards, auto loans, student loans, mortgages, or any other debt you may have)?*



SCE Core: Inflation Questions

Q7a

The next few questions are about inflation. **Over the next 12 months**, do you think that there will be inflation or deflation? (Note: deflation is the opposite of inflation)

Inflation

Deflation (the opposite of inflation)

Q7b

What do you expect the rate of [inflation (if Q7a=inflation)/deflation (if Q7a=deflation)] to be **over the next 12 months**? Please give your best guess.

Over the next 12 months, I expect the rate of [inflation/deflation] to be ____ %



SCE Core: Inflation Density Question

Q7c (q7cmean=exp_inflation)

Now we would like you to think about the different things that may happen to inflation **over the next 12 months**. We realize that this question may take a little more effort.

In your view, what would you say is the percent chance that, **over the next 12 months...**

- the rate of inflation will be 12% or higher _____ percent chance
- the rate of inflation will be between 8% and 12% _____ percent chance
- the rate of inflation will be between 4% and 8% _____ percent chance
- the rate of inflation will be between 2% and 4% _____ percent chance
- the rate of inflation will be between 0% and 2% _____ percent chance
- the rate of deflation (opposite of inflation) will be between 0% and 2% _____ percent chance
- the rate of deflation (opposite of inflation) will be between 2% and 4% _____ percent chance
- the rate of deflation (opposite of inflation) will be between 4% and 8% _____ percent chance
- the rate of deflation (opposite of inflation) will be between 8% and 12% _____ percent chance
- the rate of deflation (opposite of inflation) will be 12% or higher _____ percent chance

Total

100



SCE Core: Earnings Growth Questions

Q27a

[Q9 includes codes 1,2,4 or 5 AND Q10>0] Please think ahead to **12 months from now**. Suppose that you are working in the exact same ["main" if Q11>1] job at the same place you currently work, and working the exact same number of hours. What do you expect to have happened to your earnings on this job, before taxes and deductions?

Twelve months from now, I expect my earnings to have...

- increase by 0% or more
- decrease by 0% or more

Q27b

[if Q27a=increase or decrease] By about what percent do you expect your earnings to have [increased/decreased as in Q27a]? Please give your best guess.



SCE Core: Earnings Growth Density Question

Q27c (q27cmean=exp_earnings_gr)

[if Q9 includes codes 1,2,4 or 5 and Q10>0] Suppose again that, **12 months from now**, you are working in the exact same [“main” if Q11>1] job at the same place you currently work, and working the exact same number of hours. In your view, what would you say is the percent chance that 12 months from now...

Your earnings on this job, before taxes and deductions, will have...

increased by 12% or more	_____	percent chance
increased by 8% to 12%	_____	percent chance
increased by 4% to 8%	_____	percent chance
increased by 2% to 4%	_____	percent chance
increased by 0% to 2%	_____	percent chance
decreased by 0% to 2%	_____	percent chance
decreased by 2% to 4%	_____	percent chance
decreased by 4% to 8%	_____	percent chance
decreased by 8% to 12%	_____	percent chance
decreased by 12% or more	_____	percent chance
Total	100	



SCE Core: House Price Growth Questions

Q34a

Next we would like you to think about home prices nationwide.

Over the next 12 months, what do you expect will happen to the average home price nationwide?

Over the next 12 months, I expect the average home price to...

- increase by 0% or more
- decrease by 0% or more

Q34b

[if increase or decrease in Q34a] By about what percent do you expect the average home price to [increase/decrease as in Q34a]? Please give your best guess.



SCE Core: House Price Growth Density Question

Q34c (q34cmean=exp_hpi_gr)

[if repeat respondent] And in your view, what would you say is the percent chance that, **over the next 12 months**, the average home price nationwide will...

increased by 12% or more	_____	percent chance
increased by 8% to 12%	_____	percent chance
increased by 4% to 8%	_____	percent chance
increased by 2% to 4%	_____	percent chance
increased by 0% to 2%	_____	percent chance
decreased by 0% to 2%	_____	percent chance
decreased by 2% to 4%	_____	percent chance
decreased by 4% to 8%	_____	percent chance
decreased by 8% to 12%	_____	percent chance
decreased by 12% or more	_____	percent chance

Total


100



Q7

Now we have a question to get at how you think about risk. How do you see yourself: are you generally a person who is fully prepared to take financial risks or do you try to avoid taking financial risks? Please click a box on the scale where the value 0 means: 'not at all willing to take financial risks' and the value 10 means: 'very willing to take risks.'

Please enter your answer in the box on the left or by clicking on the scale below.

Enter Value	Not at all Willing to Take Risks	Very Willing to Take Risks
<input type="text" value="5"/>		

BACK NEXT

