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Consumption Uncertainty and Precautionary Saving

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Outline

- We present a new test for precautionary saving using subjective expectations on consumption risk
- We design a questionnaire that asks households about their expectations of future consumption distribution
- Estimate through a Euler equation a coefficient of relative prudence of about 2

Precautionary saving

- Precautionary saving depends on the third derivative of the utility function – convexity of marginal utility (Kimball, 1990)
- Strength of precautionary saving motive has been estimated through
  - associations of measures of wealth/precautionary saving with measures of income risk (Carroll and Samwick, 1997; Kennickel and Lusardi, 2005)
  - the Euler equation (Dynan, 1993)
  - structural models (Cagetti, 2003)

Euler equation

- The Euler equation for consumption is

$$u'(c_{i,t}) = \left(\frac{1+r}{1+\delta}\right) E_t\left(u'(c_{i,t+1})\right)$$

- If marginal utility is convex, expected consumption growth is correlated with expected consumption risk

Euler equation (cont.)

- A second-order Taylor series expansion of $u'(c_{i,t+1})$ around $c_{i,t}$ yields:

$$E_t\left(\frac{c_{i,t+1}-c_{i,t}}{c_{i,t}}\right)$$
$$= EIS\left(\frac{r-\delta}{1+r}\right)+\frac{p(c)}{2}E_t\left[\left(\frac{c_{i,t+1}-c_{i,t}}{c_{i,t}}\right)^2\right]+Residual$$

Euler equation (cont.)

- $p(c)$ is the coefficient of relative prudence

$$p(c) = \frac{u'''(c_{i,t})c_{i,t}}{u''(c_{i,t})}$$

- *EIS* is the intertemporal elasticity of substitution

$$EIS = -\frac{u''(c_{i,t})}{u'(c_{i,t})c_{i,t}}$$

Euler equation (cont.)

- With isoelastic preferences $p(c) = 1 +$ coefficient of relative risk aversion
- With quadratic utility $p(c) = 0$. That is, the null hypothesis that we are testing is the quadratic utility model
- In standard models income is the only source of risk
- More generally, consumption risk reflects also uncertainty about other random variables (risk of future liquidity constraints, shocks to asset prices, shocks to medical expenditures, family dissolution, etc.)

Euler equation tests

- The Euler equation can be used to estimate the sensitivity of consumption growth to consumption risk. The main problem is that typically *neither expected consumption growth nor expected consumption risk* are observable
- Hence, the error term *includes the forecast error*, which averages zero across time, but not necessarily cross-sectionally (e.g. due to aggregate shocks)
- This is a problem for the consistency of the estimates (Chamberlain, 1984)
- Need long panels (Attanasio and Low, 2004; Alan et al., 2012)

Related literature

- Dynan (*JPE*, 1993) uses consumption realizations and weak instruments (education, occupation). Estimate $p(c)$=0
- Bertola et al. (*REStud*, 2002) use the subjective variance of income as an instrument. Estimate $p(c)$=2
- Crump et al. (2015) use subjective expectations of consumption growth and inflation to estimate an Euler equation (that omits its conditional variance term). They find an EIS of about 0.8

Our contribution

- We rely on *elicited subjective expectations* of future consumption growth and of the distribution of the future consumption
- Advantages:
  - the error term of the estimated Euler equation is not contaminated by the forecast error
  - as a result, our estimates rely on the cross-sectional variability (consistent if *T* is short)
  - address the issue of endogeneity of the variable for observed consumption growth variability (Carroll, 2001)

Our contribution (cont.)

- We examine whether households that are likely liquidity constrained contaminate our results

- We perform IV estimation to check the robustness of our findings (e.g., to approximation and measurement error)

Data

- We use the CentER Internet panel in the Netherlands, sponsored by the DNB
- Interviews collected in June 2014, January 2015 and June 2015 via Internet
- To elicit the distribution of expected consumption we design a set of three questions and use the method in Guiso et al. (*JBES*, 2002)

Data (cont.)

Thinking ahead about your household spending during the next 12 months, what do you expect to be the value of such future spending in a typical month? Please provide the monthly future expenditures.

(a) Please give the *minimum* value: €…. (Y_min)

(b) Please give the *maximum* value: €…. (Y_max)

Data (cont.)

- What is the probability that the household spending value is *greater than* X = $(Y\_min+Y\_max)/2$

0	10	20	30	40	50	60	70	80	90	100

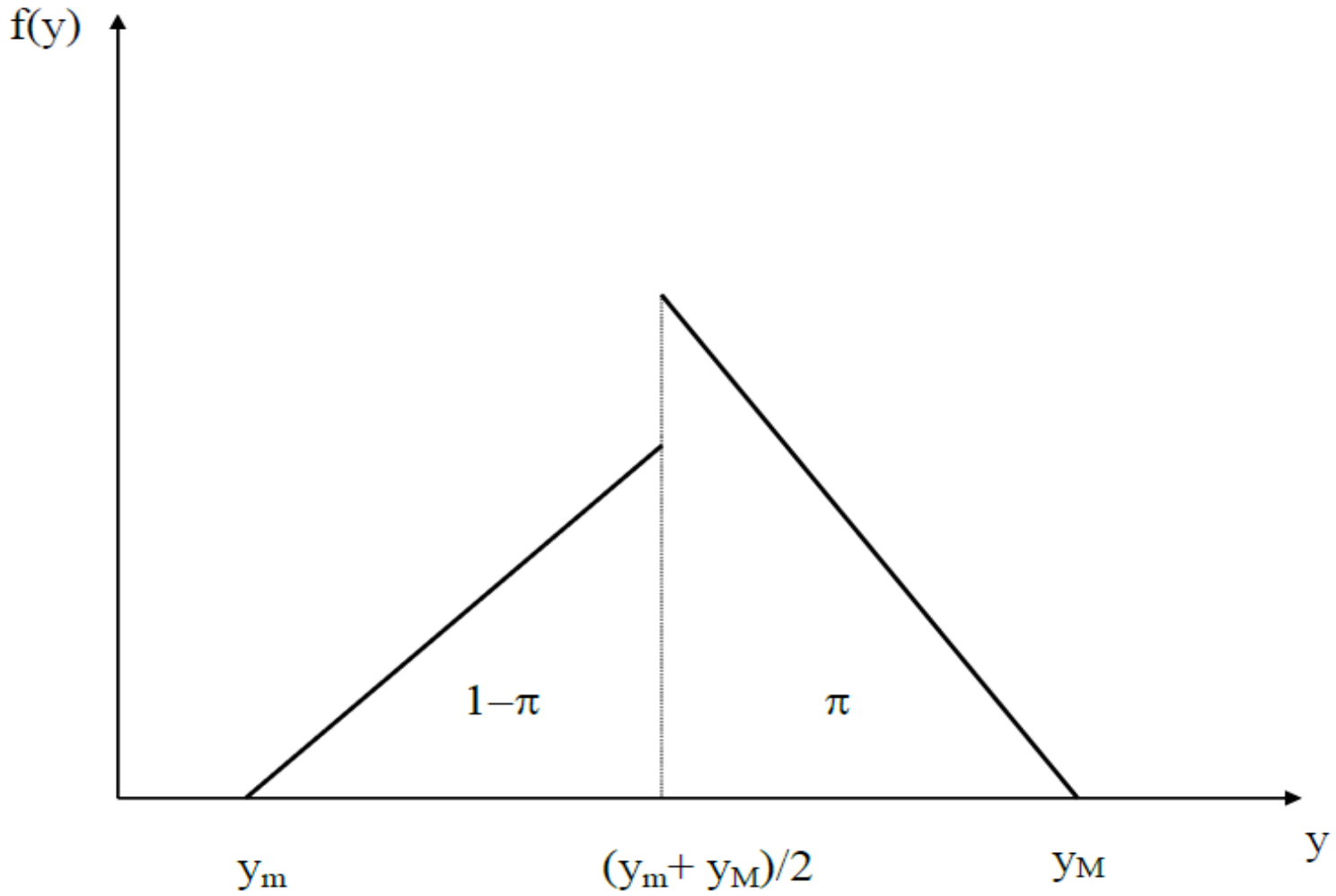
Absolutely no chance household spending to be greater than X

Absolutely certain household spending to be greater than X

Data (cont.)

- Given distributional assumptions (e.g. simple/ split triangular, uniform) we can compute all the moments of the distribution of future consumption

Split triangular distribution



Data (cont.)

- We use only 3 questions

- Pros: simple questions
- Cons: can use simple distributions and need to make a distributional assumption

- Similar questions about *income uncertainty*

- Respondents are also asked about their *expected consumption growth*

Descriptive statistics

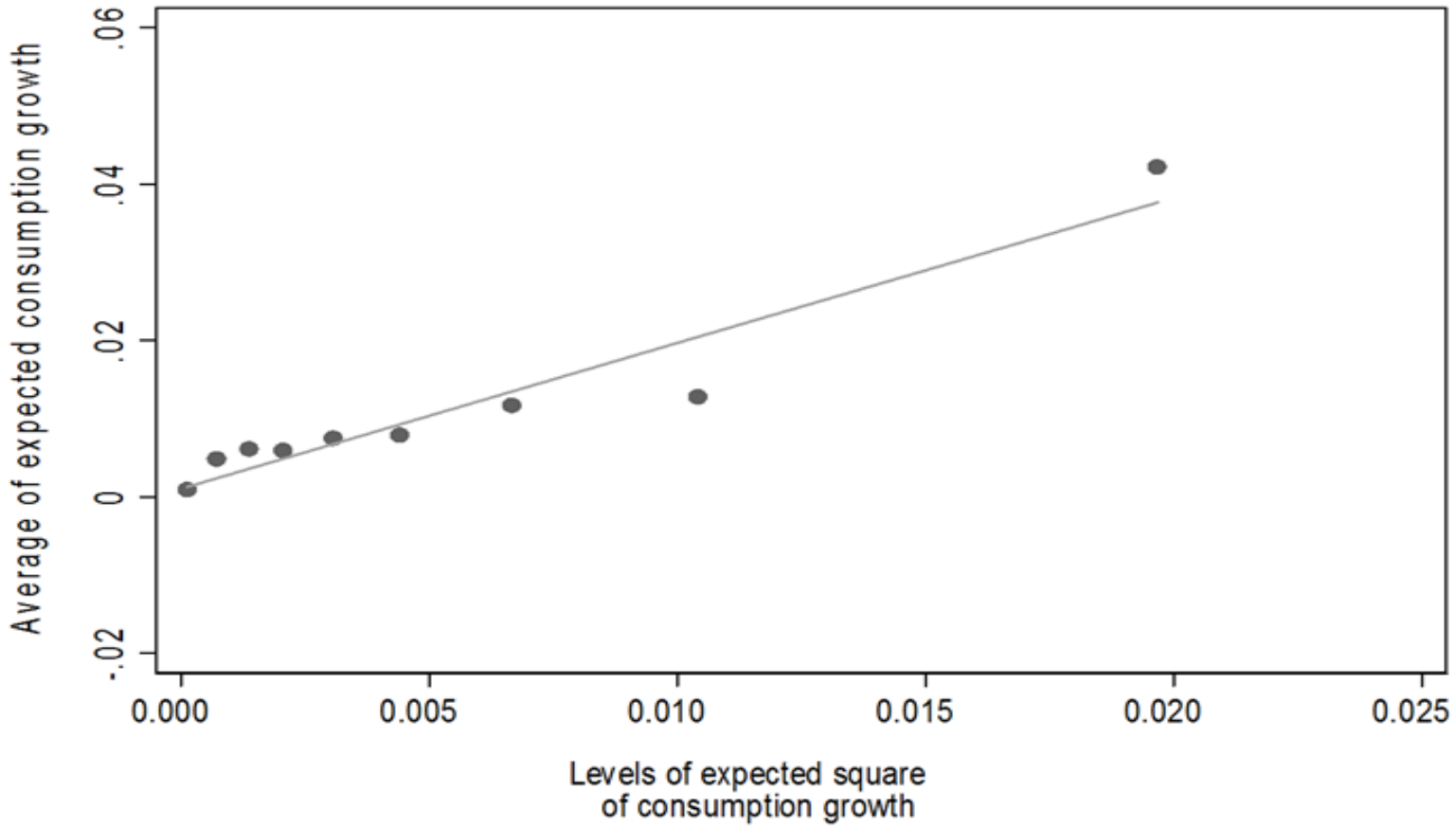
Variable	Mean	Median	Std. Deviation
Minimum expected consumption level	1,561.3	1,500.0	905.0
Maximum expected consumption level	1,970.7	1,900.0	1,117.5
Probability that the expected consumption level is above the average of the expected minimum and maximum values	0.477	0.500	0.233
Expected consumption growth	0.014	0.000	0.089
Standard deviation of expected consumption growth	0.050	0.042	0.041
Standard deviation of expected income growth	0.028	0.015	0.050
Age	55.8	58.0	15.5
Female householder	0.38	0.00	0.49
Household size	2.23	2.00	1.20
Has a partner	0.66	1.00	0.47
Number of observations	3,271		

Validation of expected variance of consumption growth

- It is correlated with various variables in the direction suggested by economic intuition:

  - Positively with *expected variance of income growth*
  - Negatively with *age* and *retirement status*
  - Positively with being *self-employed*
  - Negatively with belonging to a *union*

Graphical evidence



Empirical specification

- $E_{i,t}(g_{i,t+1}) = \alpha + \beta E_{i,t}(g_{i,t+1}{}^2) + \gamma X_{i,t} + v_{i,t+1}$
- Dependent variable: expected consumption growth
- Covariate of interest: variability of consumption, as measured by the expectation of the square of consumption growth $(\beta = p(c)/2)$
- Added covariates: age, gender of household head, household size, family kind, wave & region dummies

Empirical specification (cont.)

- Error term includes:
  - Taylor expansion approximation error
  - Measurement error (e.g. due to heaping)
  - Possible unobservables that affected expected consumption growth
  - ***But no*** forecast error

- The estimating equation represents an *equilibrium condition*

Baseline results

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	OLS			Robust Regression		
	Coeff.	Std. Error	P value	Coeff.	Std. Error	P value
Consumption Uncertainty	**0.640**	**0.122**	**0.000**	**0.963**	**0.008**	**0.000**
Age	0.000	0.000	0.322	0.000	0.000	0.953
Female Household Head	0.002	0.003	0.473	0.000	0.001	0.911
Household Size	0.001	0.002	0.595	0.000	0.000	0.453
Couple	-0.004	0.004	0.330	-0.001	0.001	0.599
Constant	0.014	0.009	0.099	0.006	0.003	0.014
Number of obs.	3,271			3,271		

Liquidity constraints

(**i**) HHs that applied for credit and their application was turned down (or did not apply because they were afraid so) (~ 3.6%)

(**ii**) HHs that were asked what they would do if they received a windfall sum equal to one month's income and said that they would spend at least 90% of it on *durables* and *non-durables* (other options presented: *save for future expenses*; *repay debts*) (~2.5%)

(**iii**) HHs with unemployed head and those in the bottom quintile of the disposable income distribution (~20.5%)

Results excluding liquidity-constrained households

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Has not been denied Credit			Marginal Propensity to Consume < 0.90			Household income above the 20th quantile and no Unemployment		
	Coeff.	Std. Error	p-value	Coeff.	Std. Error	p-value	Coeff.	Std. Error	p-value
Consumption Uncertainty	**0.954**	**0.013**	**0.000**	**0.962**	**0.009**	**0.000**	**0.957**	**0.012**	**0.000**
Age	0.000	0.000	0.608	0.000	0.000	0.857	0.000	0.000	0.615
Female Householder	0.001	0.001	0.347	0.000	0.001	0.912	-0.001	0.001	0.279
Household Size	0.000	0.001	0.647	0.000	0.000	0.335	0.000	0.000	0.345
Couple	0.000	0.001	0.742	0.000	0.001	0.692	0.001	0.001	0.288
Constant	0.007	0.003	0.016	0.007	0.003	0.011	0.006	0.003	0.034
Number of observations	2,642			3,188			2,600		

IV estimation

- Due to approximation and measurement error, we check the robustness of our results by using the variance of expected income growth as an instrument

- Expected income variability does not appear in the Euler equation. Expected consumption variability is a sufficient statistic for expected consumption growth

IV estimation (cont.)

- We use Lewbel's (*JBES*, 2012) generated instruments to circumvent a weak instrument problem
  - Use heteroskedasticity in the residuals of the first stage equation in order to create more instruments
  - Instruments are equal to the product of the demeaned exogenous regressors with the residuals of the first stage regression
  - Create overidentifying restrictions

IV results

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Standard IV			IV with generated instruments		
	Coeff.	Std. Error	P value	Coeff.	Std. Error	P value
Consumption Uncertainty	**0.888**	**0.165**	**0.000**	**0.994**	**0.129**	**0.000**
Age	0.000	0.000	0.704	0.000	0.000	0.807
Female Household Head	0.000	0.004	0.963	0.000	0.004	0.991
Household Size	0.001	0.002	0.723	0.000	0.002	0.783
Couple	-0.002	0.005	0.642	-0.002	0.005	0.728
Constant	0.003	0.010	0.741	0.001	0.008	0.950
Number of obs.	2,980			2,980		
F-test	*3.290*			*26.147*		
F-test of generated instrumetns				*19.244*		
Breusch-Pagan test for heteroskedasticity - p-value				0.000		
Test of overidentifying restrictions - p-value				0.381		
Test of overidentifying restrictions of generated instruments - p-value				0.460		
Test of endogeneity of consumtpion uncertainty - p-value	**0.273**			**0.274**		

Conclusions

- We estimate the coefficient of relative prudence, and thus check for the existence of a precautionary saving motive
- Elicited subjective expectations from a representative household survey
- We use the Euler equation, with expectations of consumption growth and its variability instead of realizations
- We estimate a coefficient of relative prudence to be about 2, which implies a coefficient of relative risk aversion of about 1

Conclusions (cont.)

- Hence there is robust evidence for the existence of a precautionary saving motive

- Results suggest that one can usefully estimate an Euler equation using short panels or even a single cross-section, through the use of *subjective expectations*

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Thank you for your attention !

For comments/ questions please send me an email: dimitris.georgarakos@bundesbank.de

Question about expected consumption growth

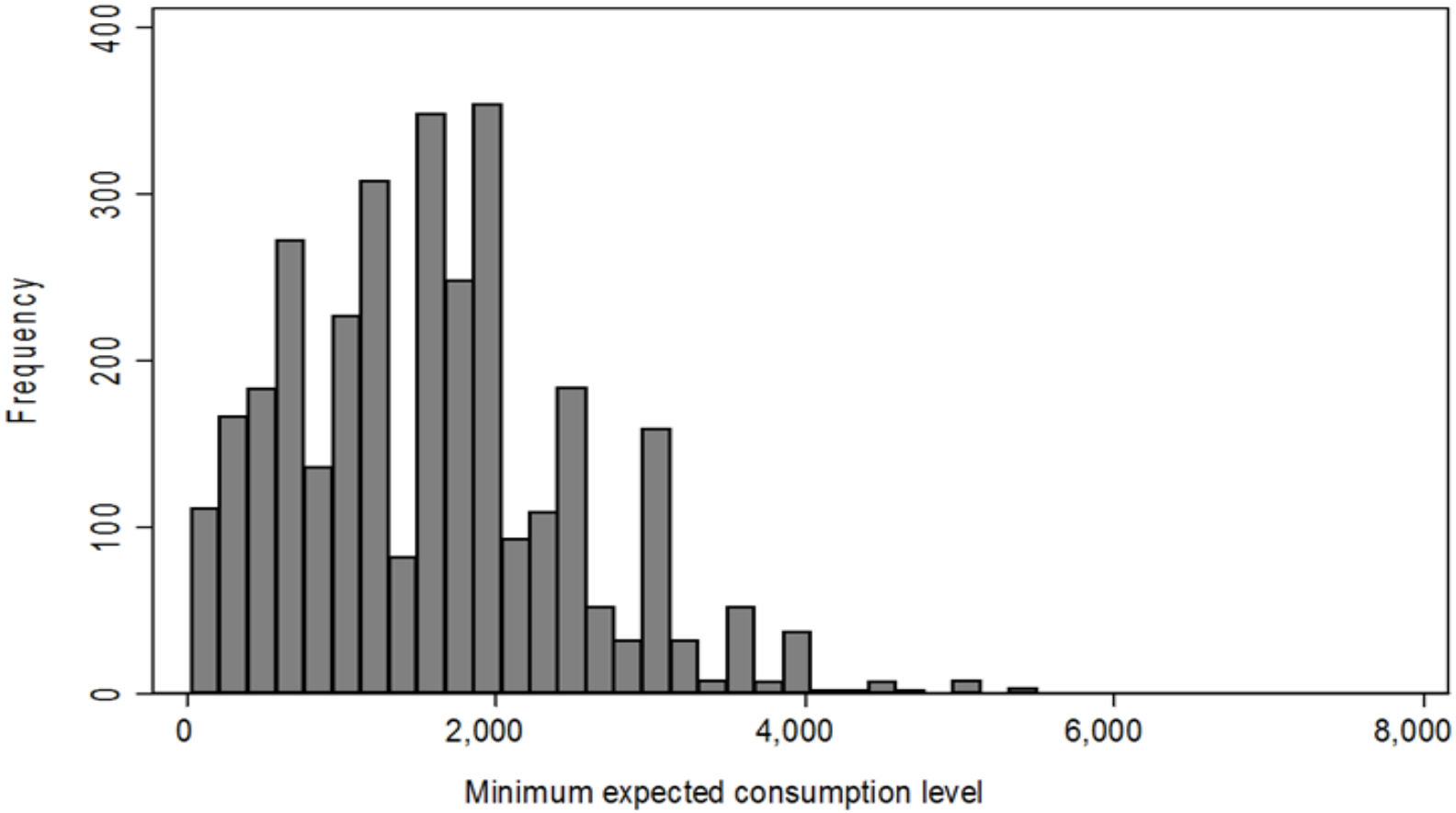
‘Thinking ahead to 12 months from now, how do you expect your household spending on all goods and services at that time to compare to your spending today?’

The possible answers were:

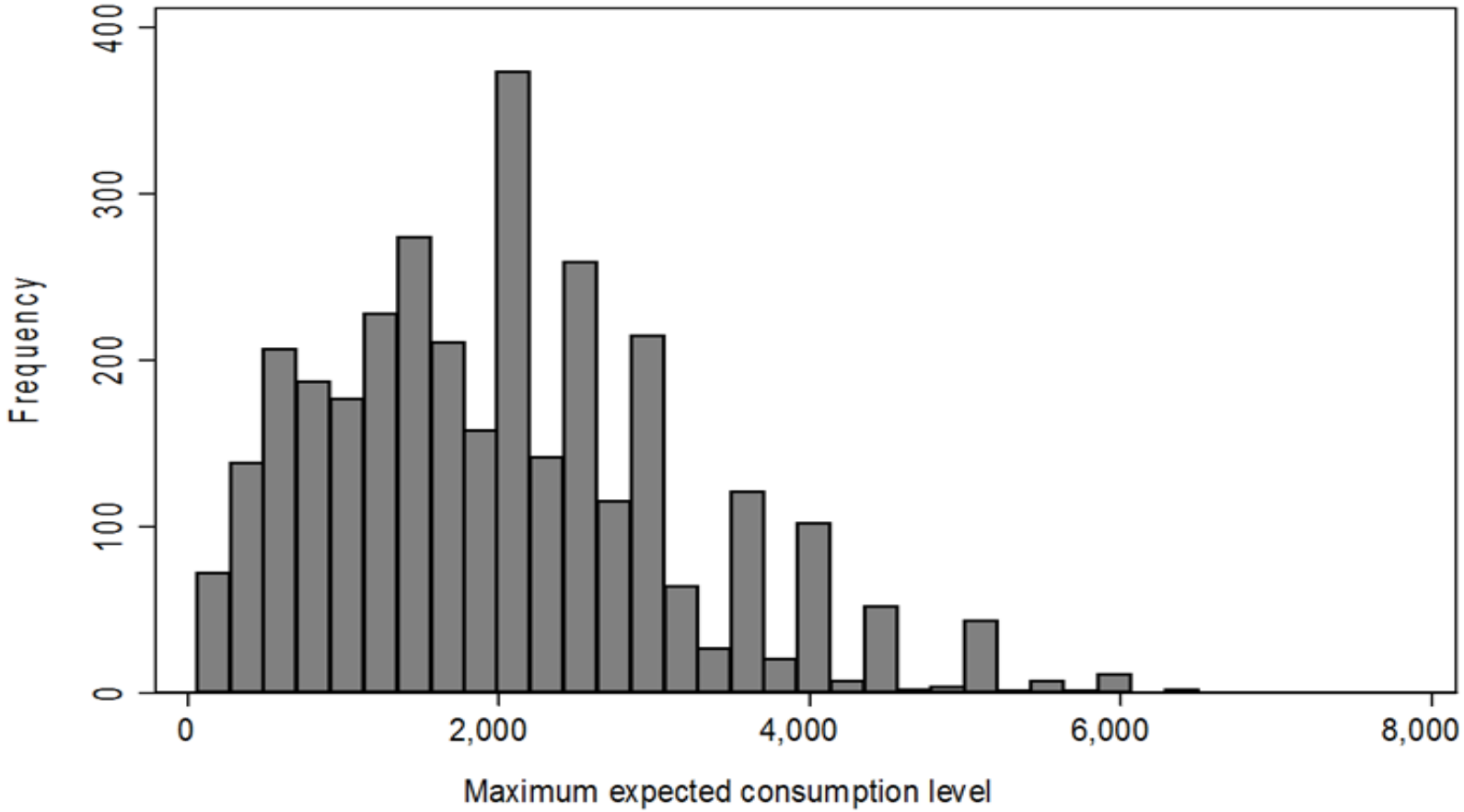
a) Higher than now
b) About the same
c) Lower than now
d) Do not know

‘How much (percentage-wise) do you expect that your household spending on all goods and services is [higher/lower] 12 months from now?’

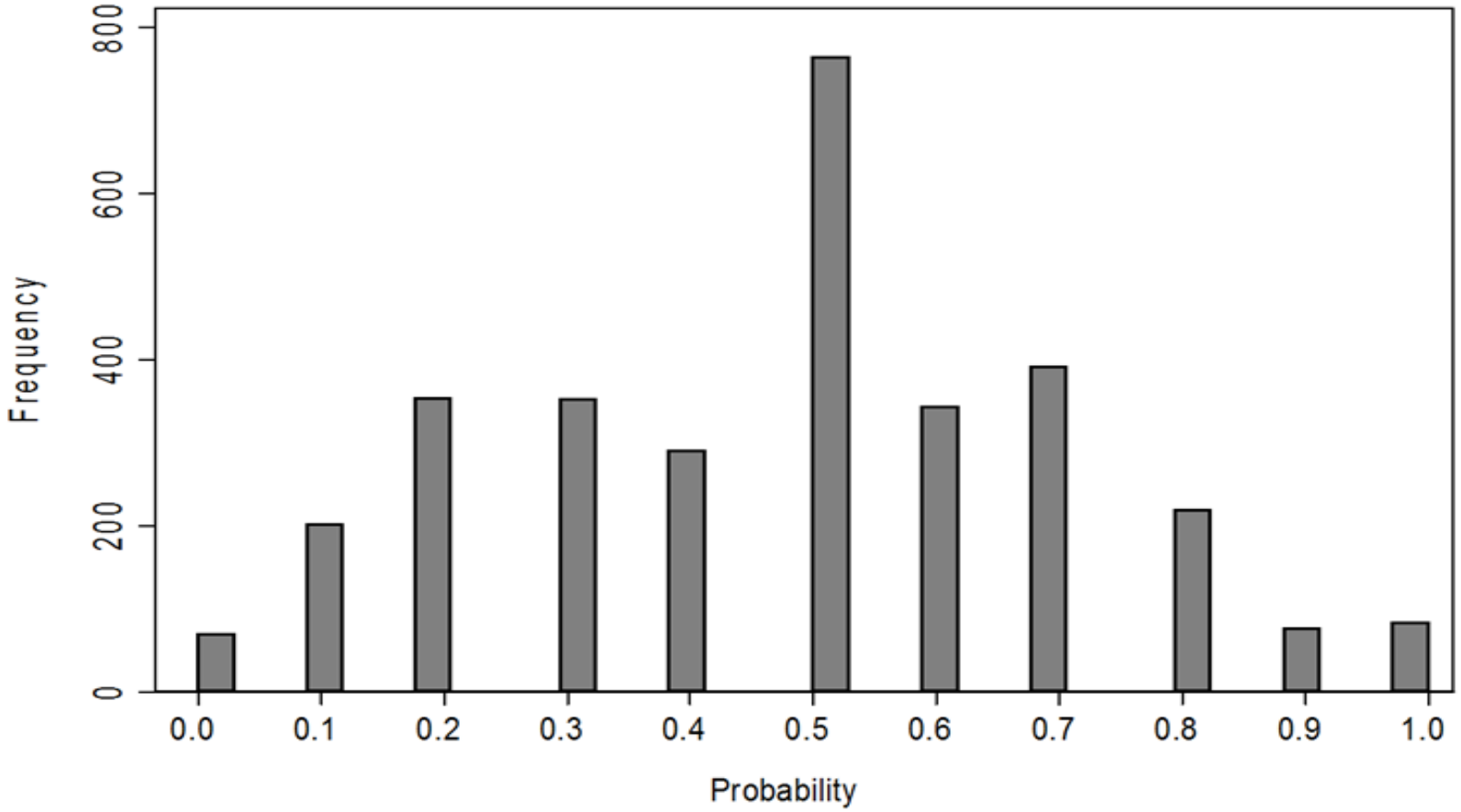
Histogram of the minimum expected consumption level



Histogram of the maximum expected consumption level



Histogram of the probability that expected consumption is above the average expected minimum and maximum values



Histogram of the standard deviation of expected consumption growth