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US Farm-Household Consumption Expenditures and the Value of Crop Insurance

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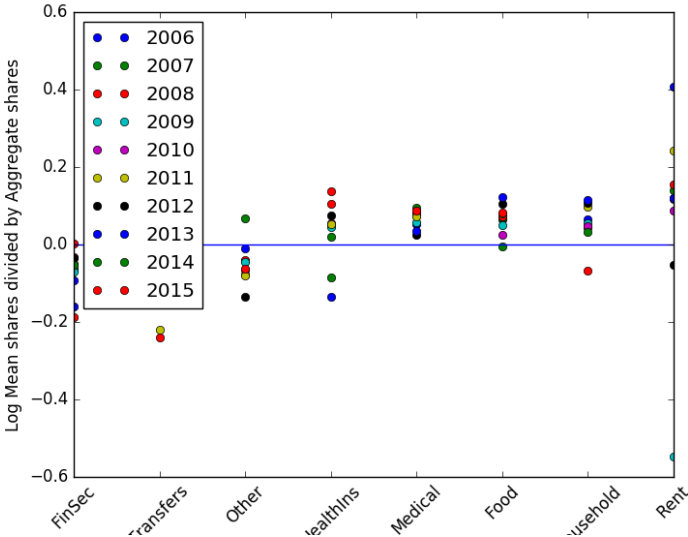
SCC-76 2017 Annual Meeting

Motivation and Introduction.

- The 2014 Farm Bill made crop insurance central to “farm safety net.”
- No one has measured the effect of crop insurance on the **well-being** of farmers in the US. [Brief literature review](#).
- Our contributions:
 - Apply Ligon's “neediness” measure (IoMUE) to farm-households in the US using ARMS expenditure data.
 - Using IoMUE as a “neediness” measure, determine the effect of farm business income on household welfare.
 - Using IoMUE as a “neediness” measure, determine the effect of insurance payments on household welfare.

Making an ARMS pseudo-panel.

- The Agricultural Resource Management Survey (ARMS) has been collecting data on farm-household expenditures since 2006. We use data from 2006-2015.
- The survey asks a different subset of farmers each year.
- To use this repeated cross-section as a panel, we create a set of representative farmers each year.
- We combine counties such that each county-group has minimum three farmer responses each year.



What is λ ?

In the next few slides will describe how we estimate our index of marginal utilities of expenditures (IoMUE) parameter, $\log \lambda$.¹ What is it?

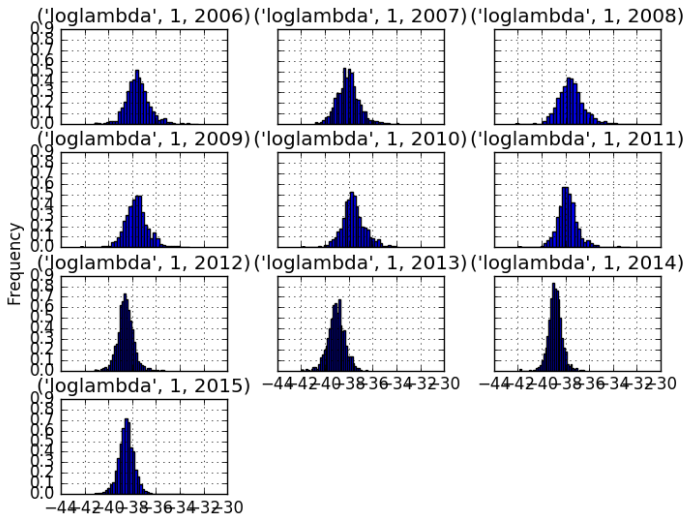
- **Precise definition:** The rate at which a particular cardinalization of household utility would increase if the household's expenditures received a small increase in a given period.
- **The Lagrange Multiplier on the Budget Constraint.** This is intuitive to economists, but no one else. It can also be thought of as the “neediness” of the household.

¹These slides follow the argument from a working paper by Ligon (2016): “Estimating household neediness from disaggregate expenditures”

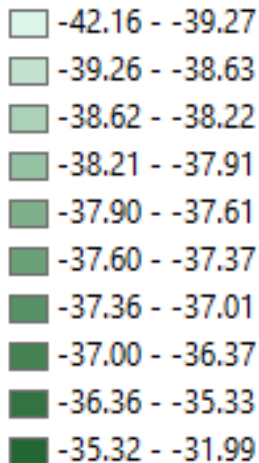
Estimating $\log \lambda$.

Estimation of $\log \lambda$ will take several steps.

- 1 Beginning with our standard household optimization problem, we analytically derive an estimable equation in which $\log \lambda$ enters linearly. In this expression we control for relative prices with year-good fixed effects.
- 2 Regress \log household expenditures on household characteristics with good-year fixed effects.
- 3 Use singular value decomposition of the residual to recover the \log lambdas.

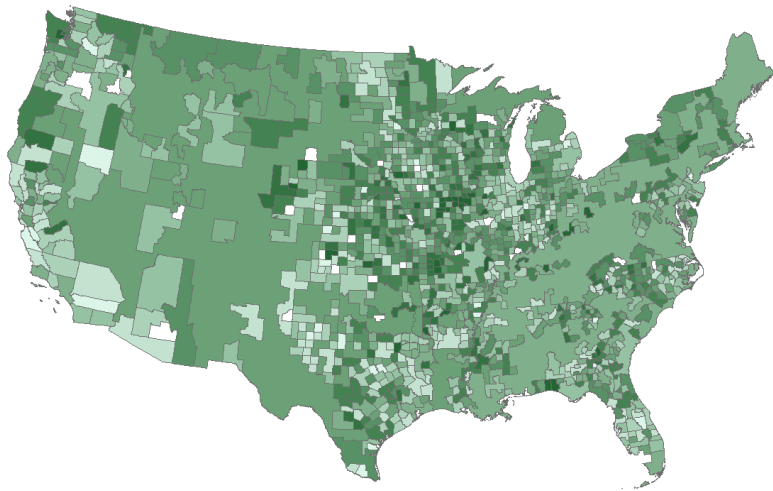
Distributions of $\log \lambda$ by Year

Log λ Map scale

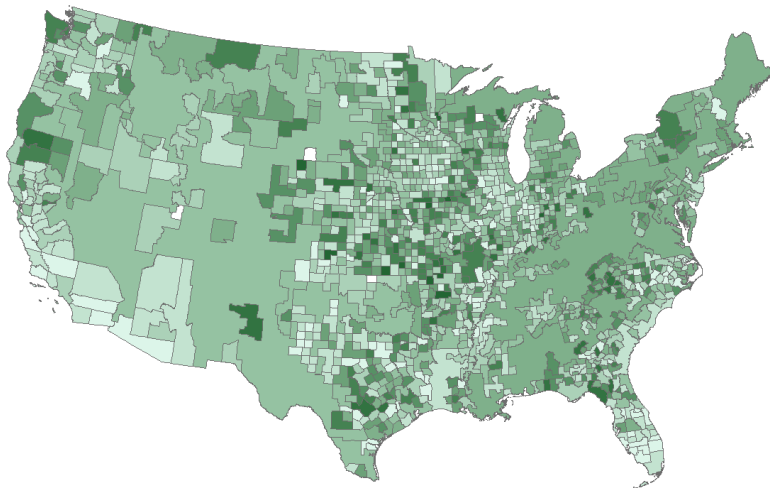


More negative \implies less needy.

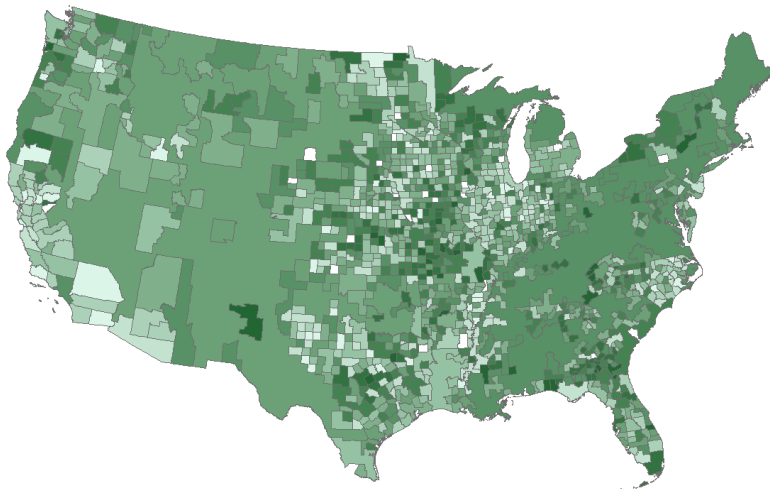
Log λ Map 2006



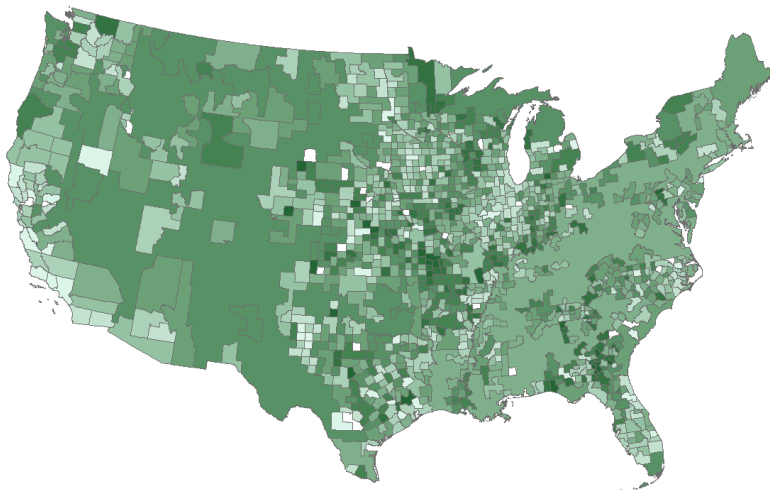
Log λ Map 2007



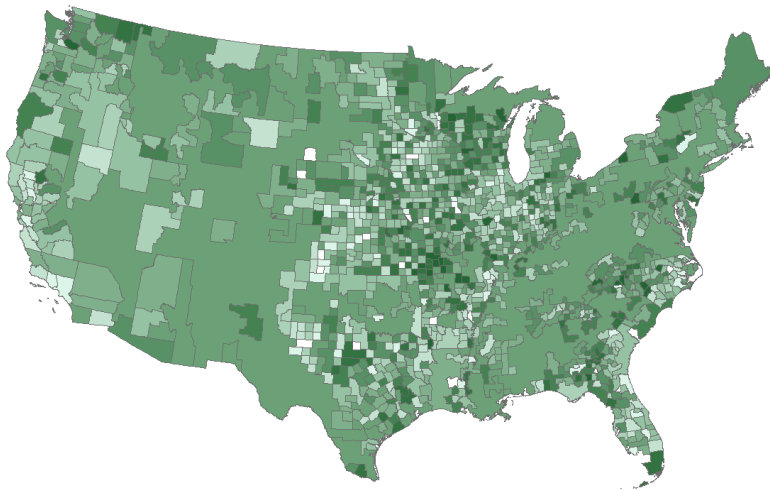
Log λ Map 2008



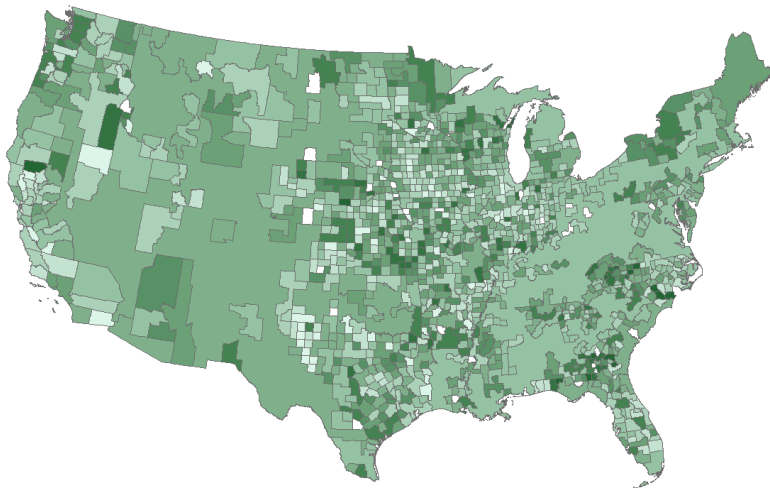
Log λ Map 2009



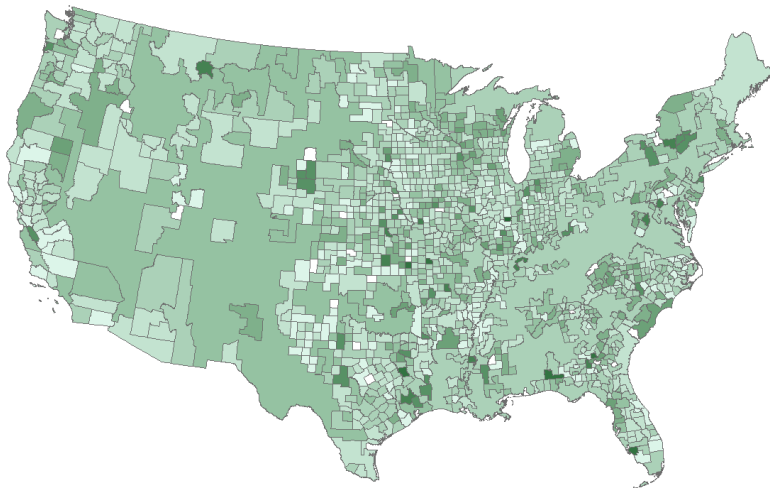
Log λ Map 2010



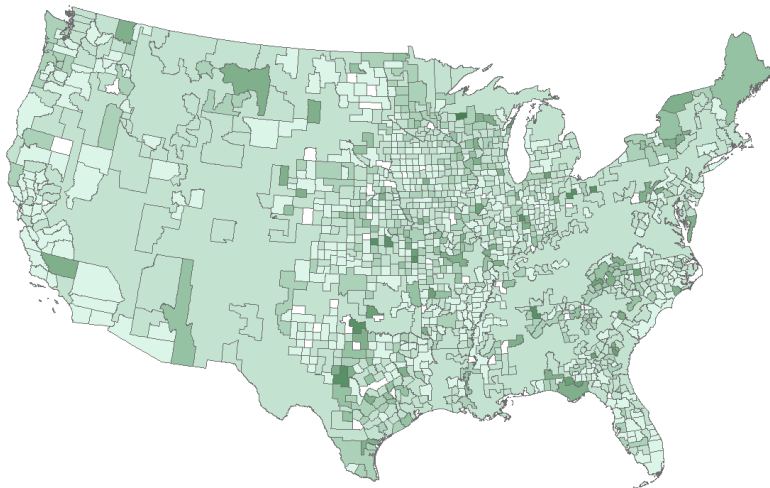
Log λ Map 2011



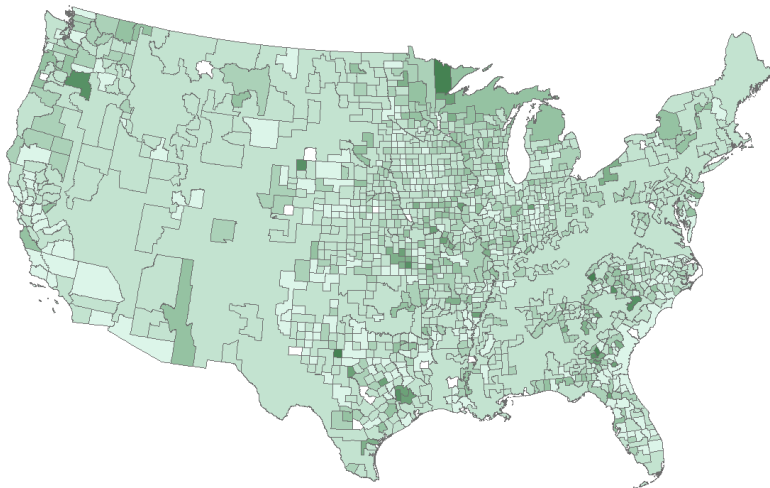
Log λ Map 2012



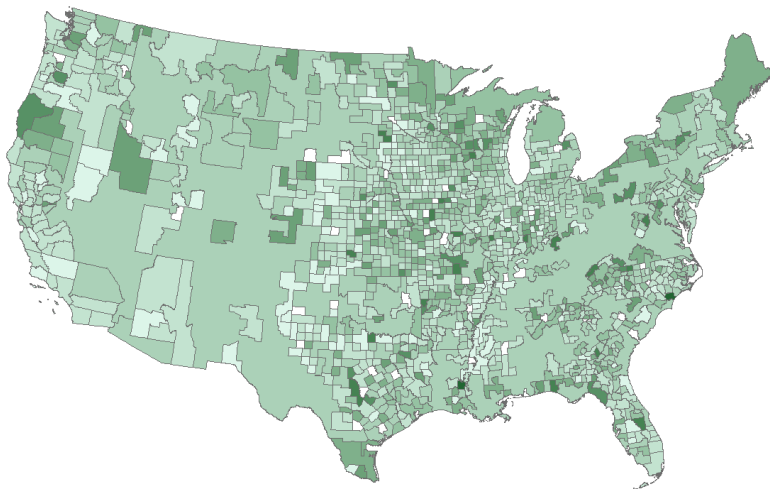
Log λ Map 2013



Log λ Map 2014



Log λ Map 2015



Income from Federal Crop Insurance



Average Farm Income

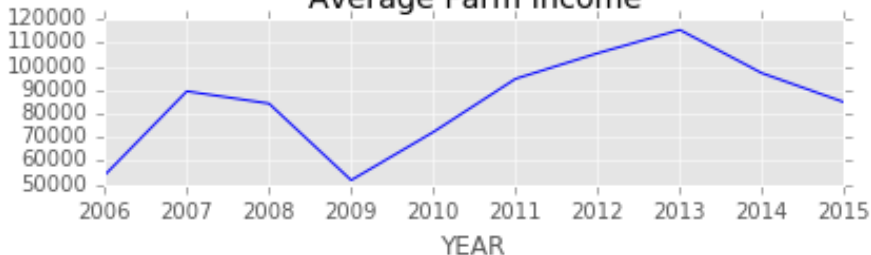


Table: Regressions on Farm Business Income

	<i>Dependent variable:</i>		
	loglambda		
	(1)	(2)	(3)
log Income	-0.294*** (0.010)	-0.226*** (0.013)	-0.241*** (0.009)
Constant	-35.025*** (0.111)		
Group FE	No	Yes	No
Year FE	No	No	Yes
Observations	10,171	10,171	10,171
R ²	0.074	0.243	0.354
Adjusted R ²	0.074	0.137	0.354

Note: *p<0.1; **p<0.05; ***p<0.01

Table: Regressions on Federal Crop Insurance Income

	<i>Dependent variable:</i>		
	loglambda		
	(1)	(2)	(3)
log Insurance Income	-0.131*** (0.007)	-0.122*** (0.008)	-0.064*** (0.006)
Constant	-36.919*** (0.068)		
Group FE	No	Yes	No
Year FE	No	No	Yes
Observations	8,506	8,506	8,506
R ²	0.038	0.266	0.302
Adjusted R ²	0.038	0.142	0.301

Note: *p<0.1; **p<0.05; ***p<0.01

Table: Regressions on Farm Income

	<i>Dependent variable:</i>		
	log Farm Income		
	(1)	(2)	(3)
log Insurance Income	0.131*** (0.007)	0.085*** (0.007)	0.113*** (0.007)
Constant	9.516*** (0.065)		
Group FE	No	Yes	No
Year FE	No	No	Yes
Observations	7,570	7,570	7,570
R ²	0.046	0.468	0.078
Adjusted R ²	0.046	0.368	0.077
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01		

- Our preliminary results imply that our welfare measure is reasonable.
- Future work for this paper:
 - Add a measure of federal crop insurance availability to regressions. If insurance is working as it should, we should see that farmers with insured crops have a lower correlation between expenditures and income than do uninsured farmers.
 - Improve estimates of $\log \lambda$ by adding household characteristics.
 - Run model on disaggregated data.

Thank You!

Estimating $\log \lambda$.

Assume prices are unknown, but all households face the same price. Then for household j , good i , and time t :

$$y_{it}^j = a_{it} + b_i^T (z_t^j - \bar{z}_t) + c_i w_t^j + e_{it}^j, \quad (1)$$

where

$$y_{it}^j = \log x_{it}^j$$

$$a_{it} = \log \alpha_i + \left[\log p_{it} - \sum_{k=1}^n \theta_{ij} \log p_{kt} \right] - \beta_i \overline{\log \lambda_t} + \beta_i \bar{e}_{it} + \bar{\xi}_{it}$$

$$b_i = \beta_i \delta_i$$

$$e_{it}^j = \beta_i (e_{it}^j - \bar{e}) + (\xi_{it}^j - \bar{\xi}_{it})$$

$$c_i w_t^j = -\beta_i (\log \lambda_t^j - \overline{\log \lambda_t}).$$

Existing research on crop insurance in the US generally focuses on one of three things:

- 1 the distribution of costs and payments under the program (Babcock 2012, Goodwin et al 2012);
- 2 farmer demand for crop insurance Goodwin 1993, Sherrick et al 2004, Du et al 2013) (but this work generally focuses on the characteristics of farms that purchase insurance);
- 3 or the effects of crop insurance on production decisions (Horowitz Lichtenberg 1993, Lafrance et al 2012, Goodwin et al 2004, Goodwin et al 2012, Ligon 2012, Walters et al 2012).

Ligon 2016 estimates a similar log λ for households in Uganda.

[Back](#)