Poverty and Instability

Joshua D. Merfeld [1] Jonathan Morduch [2]

[1]KDI School of Public Policy and Management and IZA

[2]Robert F. Wagner Graduate School of Public Service, New York University

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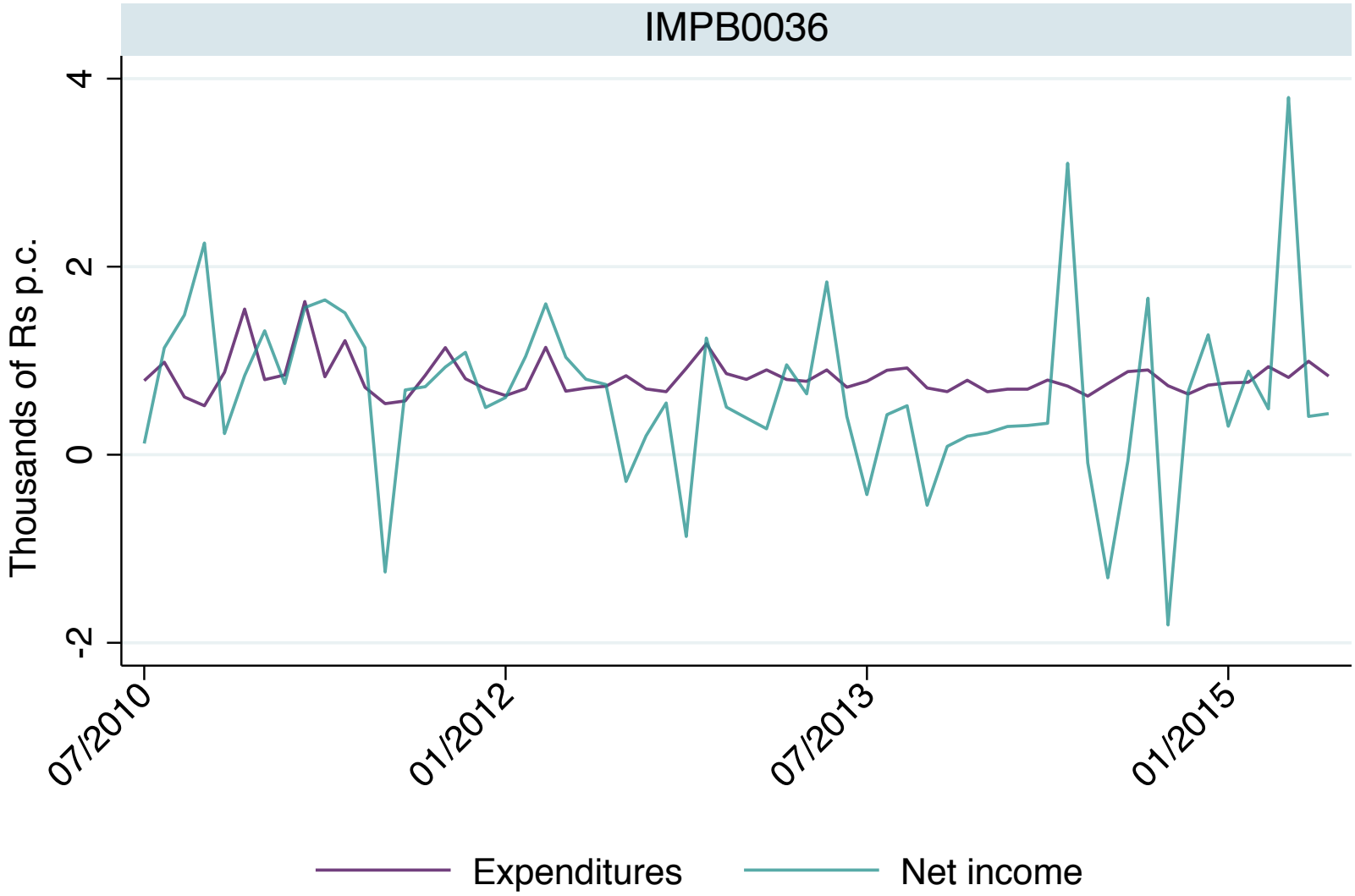
Introduction

- Poverty is often accompanied by instability, both across years and within years.

- Challenges of poverty are rooted in
  - Insufficient resources overall
  - Instability
  - Illiquidity

- Annual poverty rates capture insufficient resources for the year, but miss many episodes of poverty

One household in India



Aggregation

- Ups and downs within the year are hidden by aggregation of annual data on income and spending
  - Welfare analyses implicitly assume perfect within-year consumption-smoothing and non-binding liquidity constraints
  - Those assumptions are usually violated, especially in low-income populations
    - RCTs show large impacts of seasonality and interventions to increase liquidity (e.g., Bryan et al. 2014, Fink et al. 2020)

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Within-year instability

- Seasonal poverty is a well-established challenge (Longhurst et al. 1986, Devereux et al 2012, Khandker 2012).
  - RCTs show large impacts of addressing seasonality (Fink et al., 2020)

- Episodic poverty not just in developing countries
  - United States (2009-11):
    - 44% of poverty spells last < 4 months
    - 67% of poverty spells last < 8 months

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Data challenges

- Seldom have data on same households at different times during the year
  - Most World Bank Living Standards Measurement Surveys collect data annually or for different waves of households within year.
  - US Survey of Income and Program Participation collected poverty data every 4 months, but since 2014 collects data only annually with (noisy) monthly recall.
  - Financial diary data highlights economic instability but focuses on cash flows, not consumption
  - Big Data from financial companies gives within-year views but only sees some transactions and not strong on poor populations.

What we do

- We have household data, collected monthly for five straight years
- In each month, we can construct the monthly poverty measure and a measure aggregated over time
- We discuss the assumptions behind different aggregations (–¿ consumption smoothing important)

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What we find

- Annual aggregates miss a substantial amount of poverty
- Comparisons of poverty rates suggest households smooth consumption imperfectly
- The poorest households show the biggest differences in monthly vs. annual poverty measures

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Starting assumption

- The right way to understand poverty is as the ability to consume required resources across months, seasons, years...
  - Ultimately, we care about *consumption*, not income (or even expenditures).

- Let's focus on monthly vs. yearly poverty measures
  - Cannot go much shorter than a month
  - In developing countries, a year as the longest accounting unit seems reasonable (e.g. agriculture follows yearly cycle)
  - Assume total yearly income is equal to total yearly consumption
  - We can easily relax this assumption to look at periods of time t

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Some definitions

- We have consumption c and income i.
- Define some poverty measure – such as headcount – as $P(\cdot)$:
  - $P(c_{month})$ is the monthly poverty measure defined using total monthly consumption.
  - $P(i_{month})$ is the monthly poverty measure defined using net monthly income.
- We can also define a poverty measure using yearly consumption/income:
  - $P(c_{annual})$ $(= P(\Sigma c_{month}))$ is the annual poverty measure defined using total annual consumption.
  - $P(i_{annual})$ $(= P(\Sigma i_{month}))$ is the annual poverty measure defined using net annual income.

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Key questions

- Does the use of $P(c_{annual})$ vs $\Sigma P(c_{monthly})$ matter?
- Does the use of $P(i_{annual})$ vs $\Sigma P(i_{monthly})$ matter?
- Does the use of $P(c_{annual})$ vs $P(i_{annual})$ matter?
- In other words, what are the assumptions underlying the time period and choice of consumption vs. income?

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With perfect consumption smoothing

- Suppose households perfectly smooth consumption, so that c_{month} is identical every month.
- Since consumption is identical in every month, $P(c_{month})$ is also identical in every month.
- While i_{month} need not equal c_{month}, we assume $i_{annual} = c_{annual}$ for the year.
  - The data confirm this is reasonable.
- It follows that $P(i_{annual}) = P(c_{annual}) = \Sigma P(c_{monthly})$.

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With perfect consumption smoothing

- Note that this assumes nothing about i_{month}, and therefore nothing about $P(i_{month})$ or $\Sigma(i_{month})$.
- If income is volatile, then $\Sigma P(i_{month}) \neq \Sigma P(c_{month}) = P(i_{annual})$
- In other words, with perfect consumption smoothing across months, there is a theoretical justification for measuring poverty using annual income.

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With zero consumption smoothing

- Suppose households fail to smooth consumption at all, so that $c_{month} = i_{month}$ in each month.
- It follows that $P(c_{month}) = P(i_{month})$ in each month.
- It also follows that:

$$\Sigma P(c_{month}) = \Sigma P(i_{month}) \neq P(c_{annual}) = P(i_{annual})$$

- Now, there is an argument for using *monthly* income for our poverty measure, but not annual income nor annual consumption.

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Imperfect smoothing

- A more realistic scenario: households imperfectly smooth consumption.
- For smaller accounting units, $P(i_{month})$ can understate or overstate poverty relative to $P(c_{month})$. This is a potentially big problem.
- If there is some smoothing, then

$$Var(i_{month}) > Var(c_{month}) \text{ and } Var(P(i_{month})) > Var(P(c_{month})),$$

where $Var(\cdot)$ is household-specific variance.

The big question

- The big question:

  With imperfect smoothing, how does the bias in $\Sigma P(i_{month})$ compare to the bias in $P(i_{year})$ or $P(c_{year})$?

- We can explore this with our data, taking $\Sigma P(c_{month})$ as the benchmark.
  - I think of this has a better measure of "time spent" in poverty.

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To summarize

- With perfect smoothing:

$$\Sigma P(c_{month}) = P(i_{annual}) = P(c_{annual}) \neq \Sigma P(i_{month})$$

- With zero smoothing:

$$\Sigma P(c_{month}) = \Sigma P(i_{month}) \neq P(i_{annual}) = P(c_{annual})$$

- With imperfect smoothing:

$$\Sigma P(c_{month}) \neq \Sigma P(i_{month}) \neq P(i_{annual}) = P(c_{annual})$$

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The data

- With appropriate data, we can evaluate this bias.
  - This is also (implicitly) a test for consumption smoothing.
- ICRISAT's VDSA data from rural India
  - Five years of monthly income/expenditures data
  - 60 months of household-level panel data, for about 1,300 households.
  - NOT nationally representative
- We can construct measures of monthly income and expenditures
  - Note that we only have *expenditures*, not consumption.
  - We construct monthly net income using modules on production activities and finances.
  - We keep households we observe for at least 48 months.

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Construction of the measures

- In each month, we have data on expenditures. We also construct net income.
  - Expenditures data is broken down into different categories, principally "food" and "non-food" expenditures.
  - Income comes from wage/salaried employment, agriculture, livestock, non-farm self-employment, and finances.
- We can also use each month *and the previous 11 months* to construct a measure of "annual" income.

- We can do the same thing for different lengths, like three and six months.

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Some sanity checks

- First, let's look at some specific numbers to see how realistic our assumptions are, specifically the assumption that $i_{annual} = c_{annual}$.
- Means (2010 rupees; approx. 45 Rs per USD at market exchange rate)
  - Net income: 1,305 rupees p.c. ($\tilde{2}9$ USD)
  - Expenditures: 1,184 rupees p.c. ($\tilde{2}6$ USD)
- Medians
  - Net income: 847 rupees p.c. ($\tilde{1}9$ USD)
  - Expenditures: 816 rupees p.c. ($\tilde{1}8$ USD)
- We think the assumption is reasonable. More evidence on next few slides.

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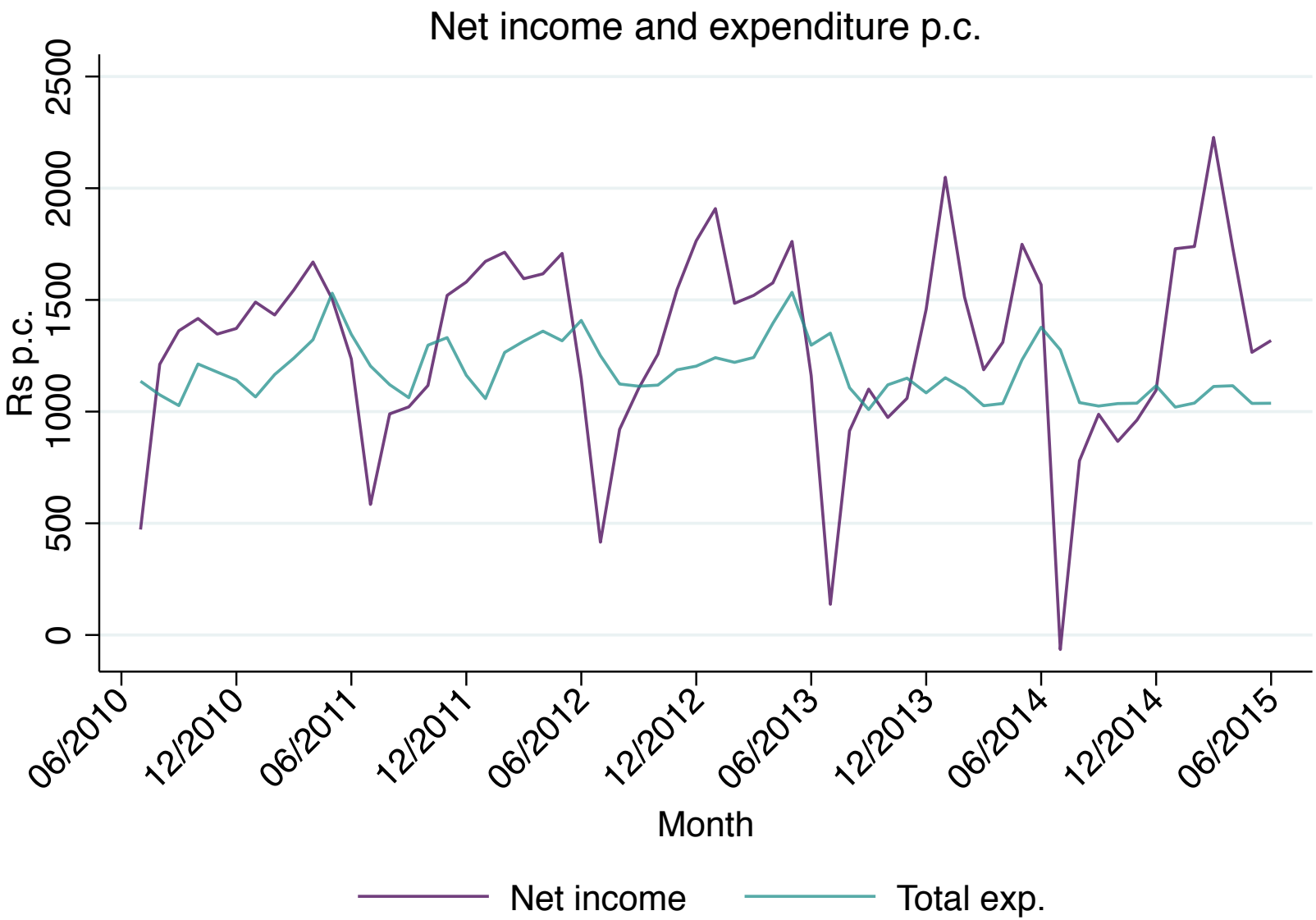
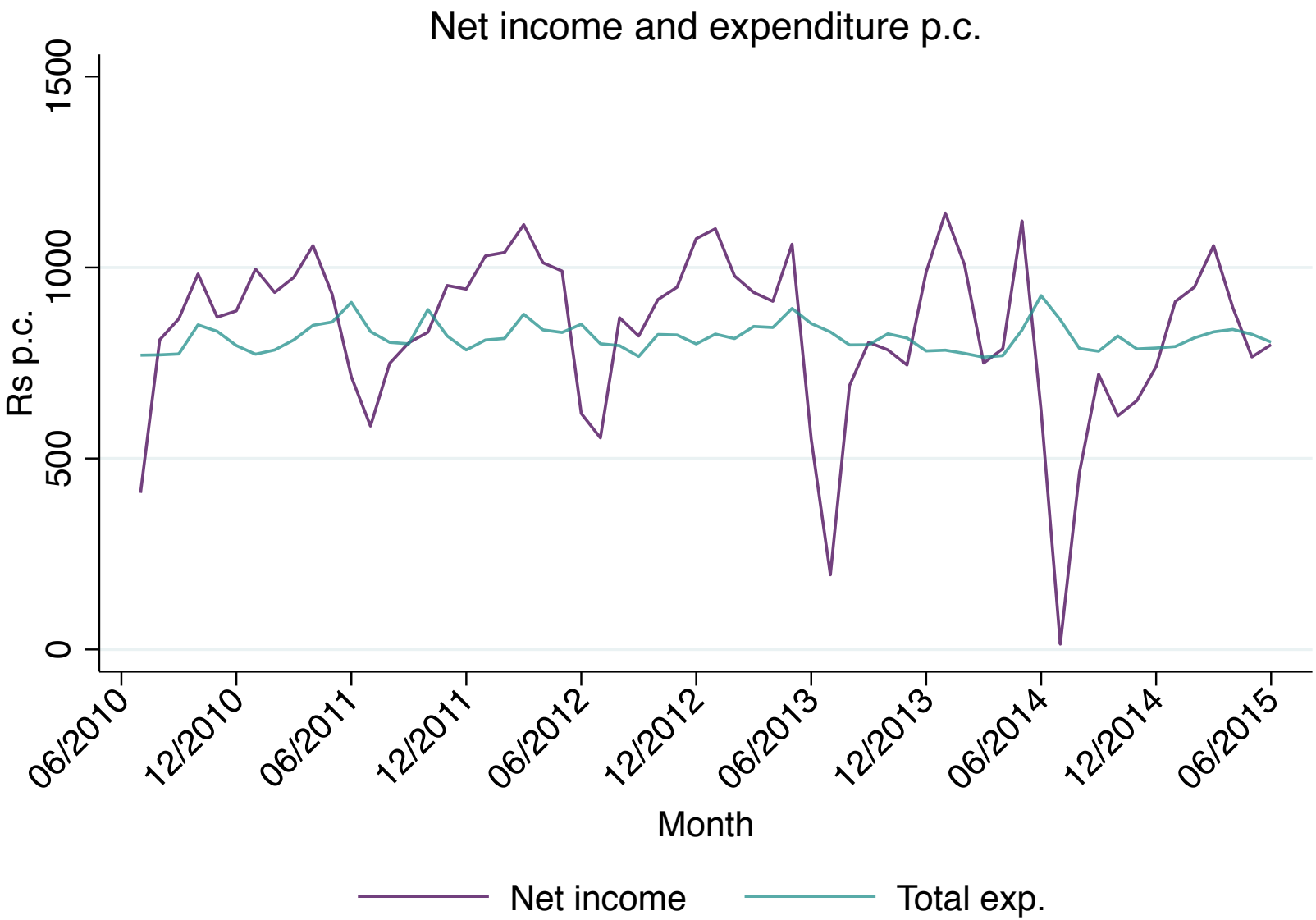
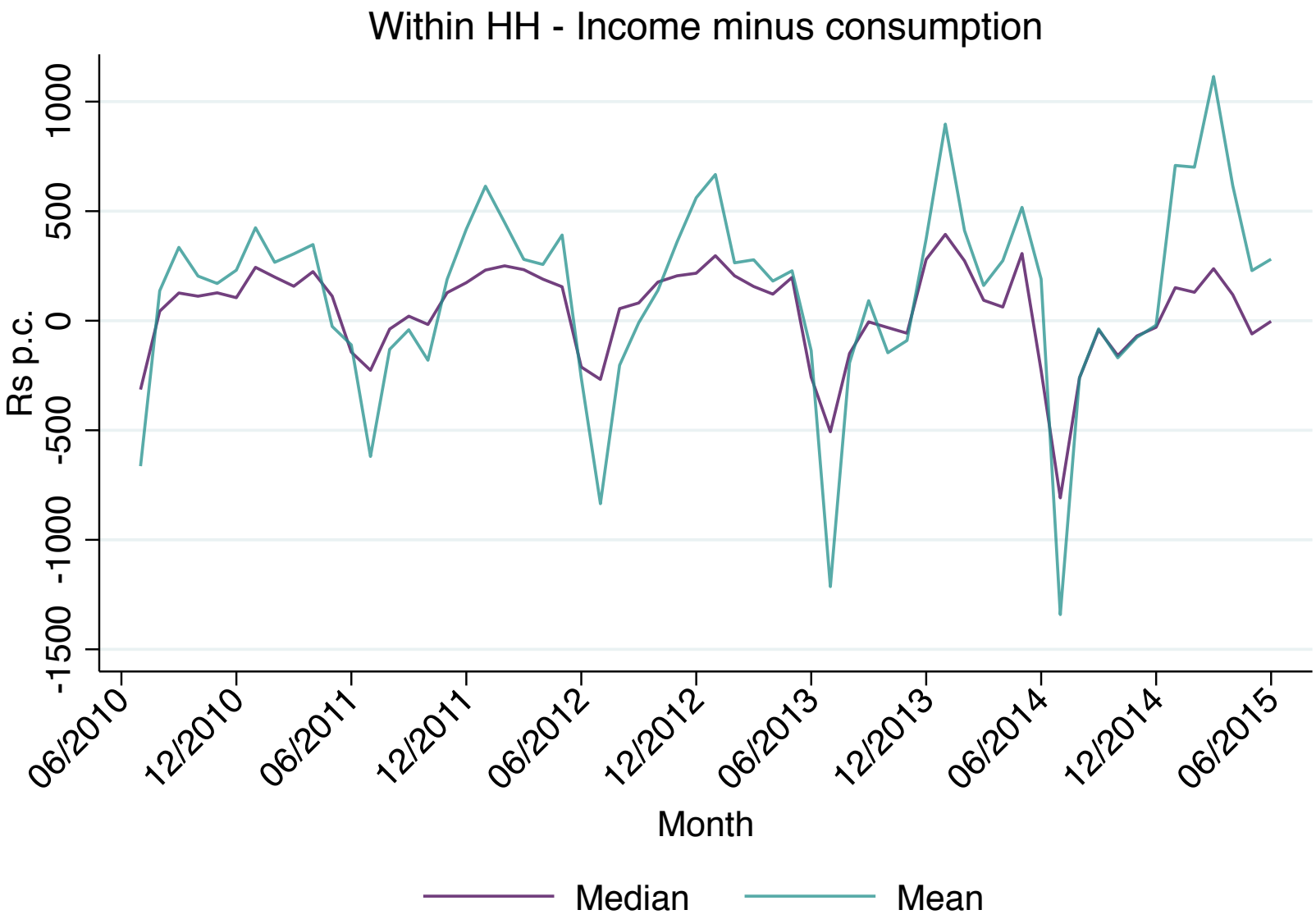
Mean incomes/expenditures



Median incomes/expenditures



Net income minus expenditures, within households



Variance of expenditures and net income

- Previous slides support assumption that $i_{annual} = c_{annual}$.
- However, they also make clear that $Var(i_{month}) > Var(c_{month})$.
  - Proxy consumption using expenditures (for food, we think this is correct).
  - Using the monthly mean and median, there is a lot more variation in income across months than in expenditures.
- This also holds within households. Next slide presents 12 randomly chosen households.

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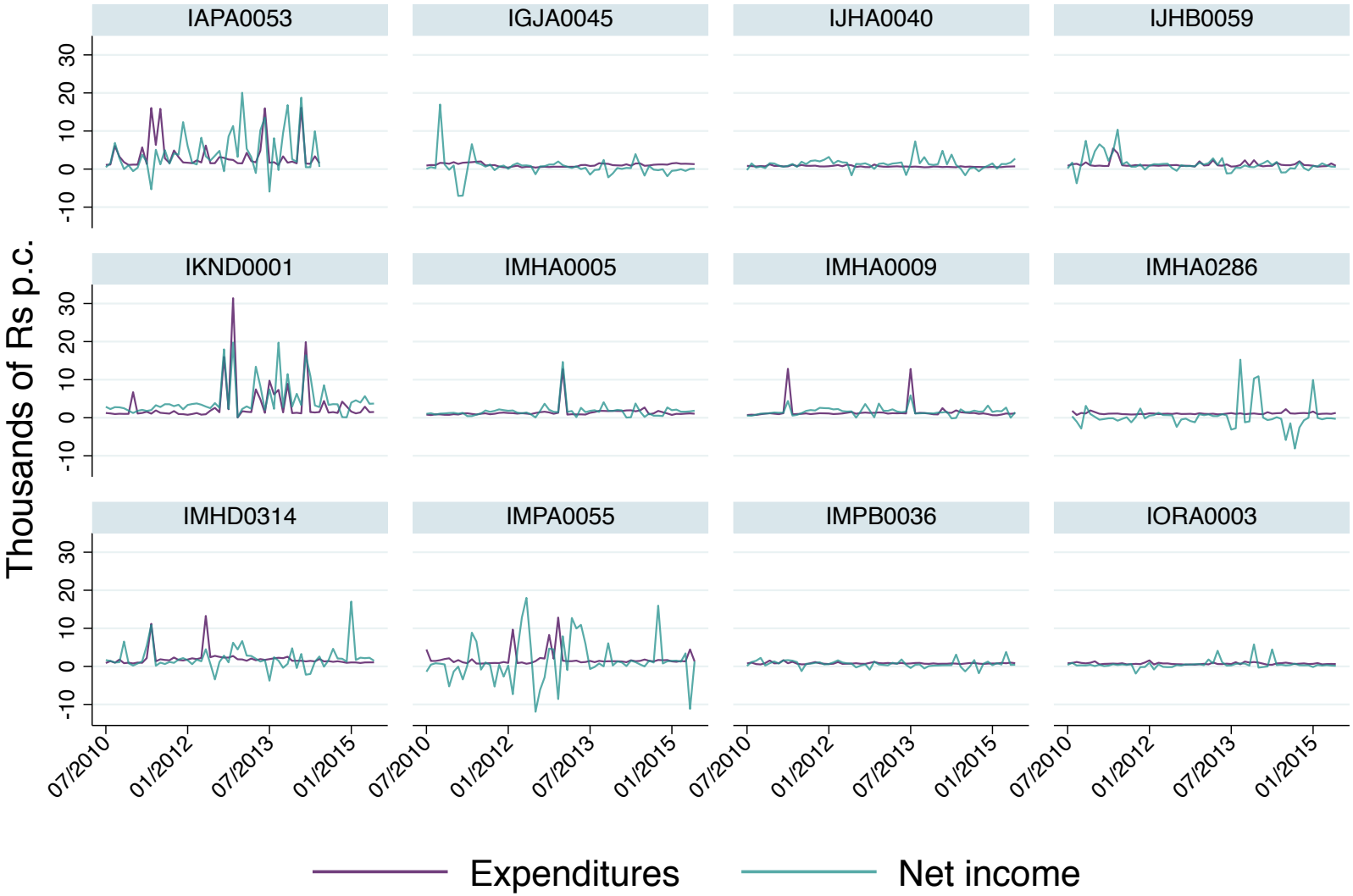
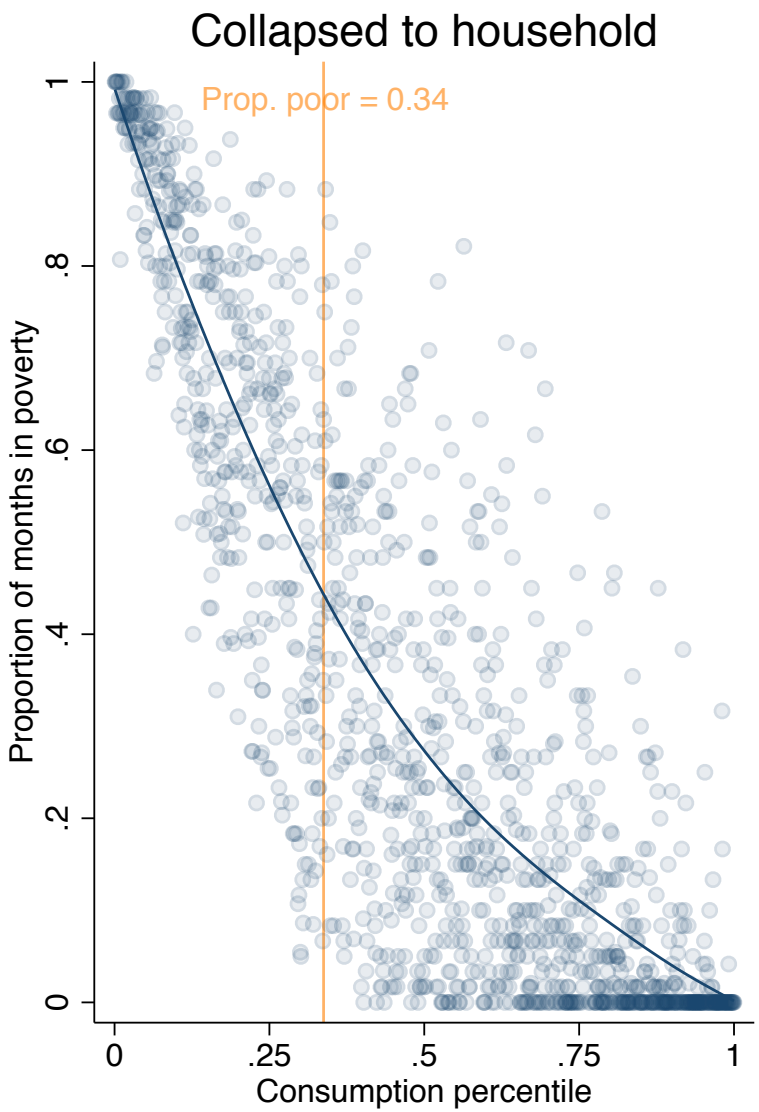
12 randomly chosen households

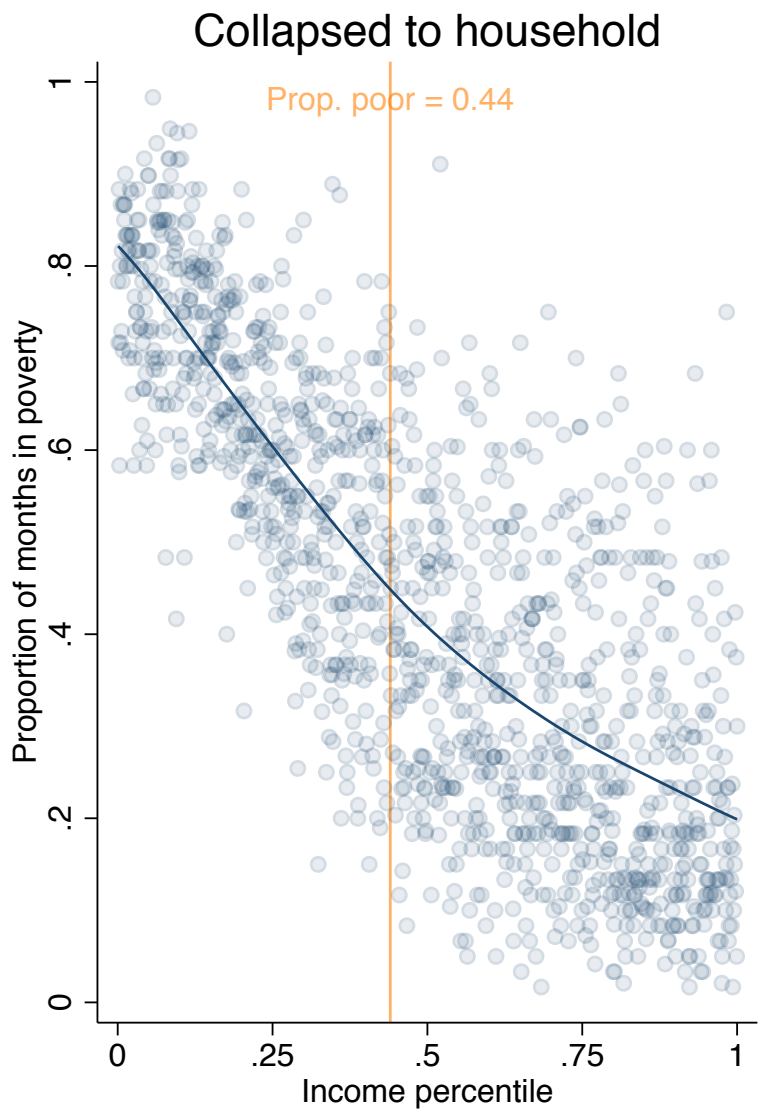


Variance of poverty measures

- There is strong seasonality in income measures.
  - The large drop each year in June is planting season (high production costs).
- Seasonality is much less pronounced in the expenditures series, both at the median and within households.
- How much do we miss when looking at average household expenditures/incomes?

Months in poverty and welfare percentiles





Variance of poverty measures

- A substantial amount of poverty remains, even for "non-poor" households.
- What about average poverty rates (headcount) using income vs. expenditures?
  - The difference in variance implies there could be very large differences in monthly poverty measures relative.
- We can look at monthly vs. annual *and* expenditures vs. income.

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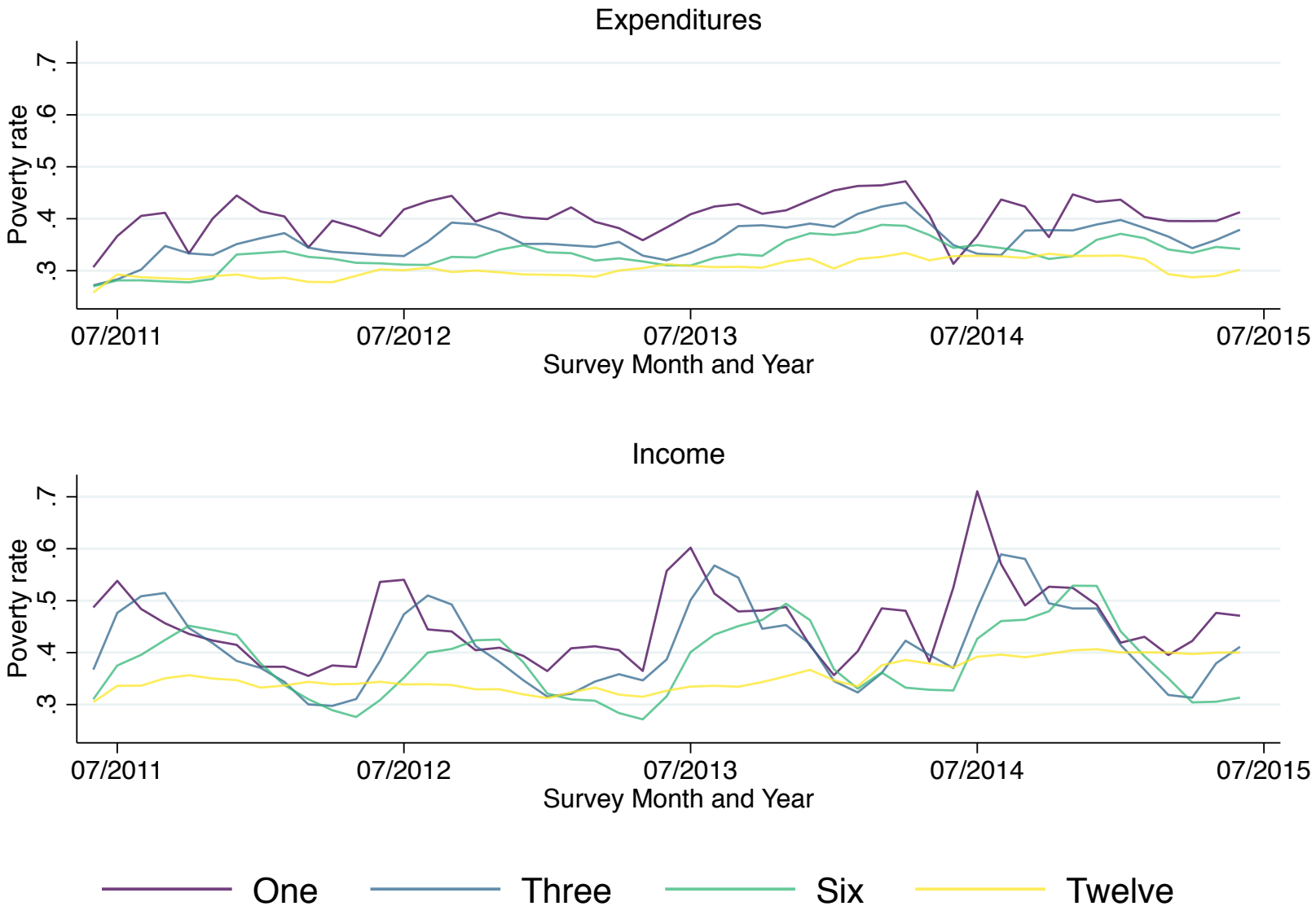
Poverty headcount, expenditures vs. net income



Key takeaways

- The monthly income poverty measure is generally higher than the monthly expenditure poverty measure.
- There is a marked seasonality in monthly poverty using income, which is not as apparent using expenditures.
- Within each measure (income vs. expenditure), shorter lengths lead to higher poverty rates.
  - This is more stark with distributionally sensitive poverty measures (next slide).

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Distributionally sensitive consumption measures

- Watts index: $(\ln(poverty\_line) - \ln(expenditures))$
  0 if expenditures>poverty line
- Poverty gap: $((poverty\_line - expenditures)/poverty\_line)$
  0 if expenditures>poverty line
- Poverty gap: $((poverty\_line - expenditures)/poverty\_line)^2$
  0 if expenditures>poverty line
- All three exhibit sensitivity to distribution of income below the poverty line (headcount does not).
- Compute only for expenditures due to issues with negative incomes.

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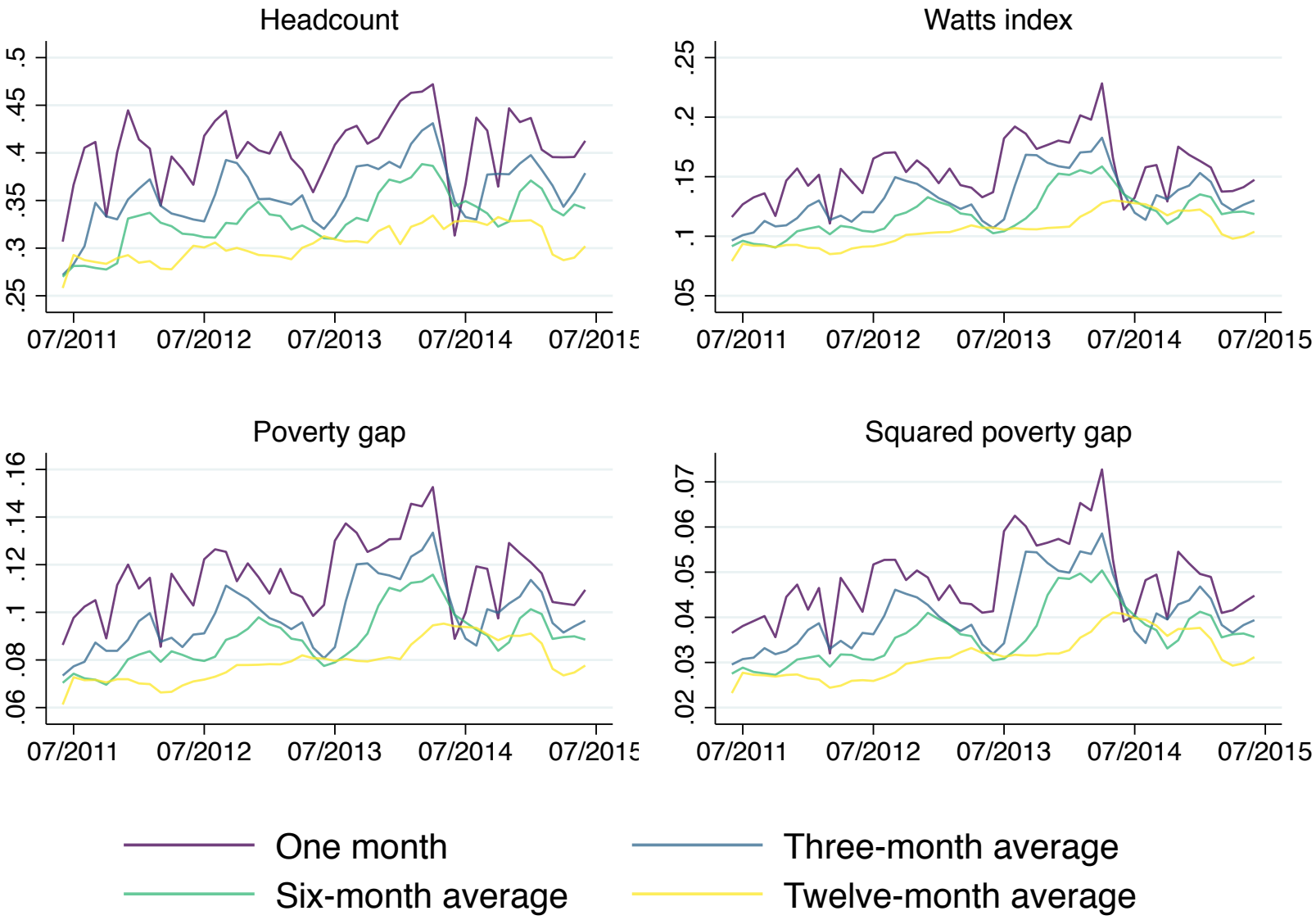
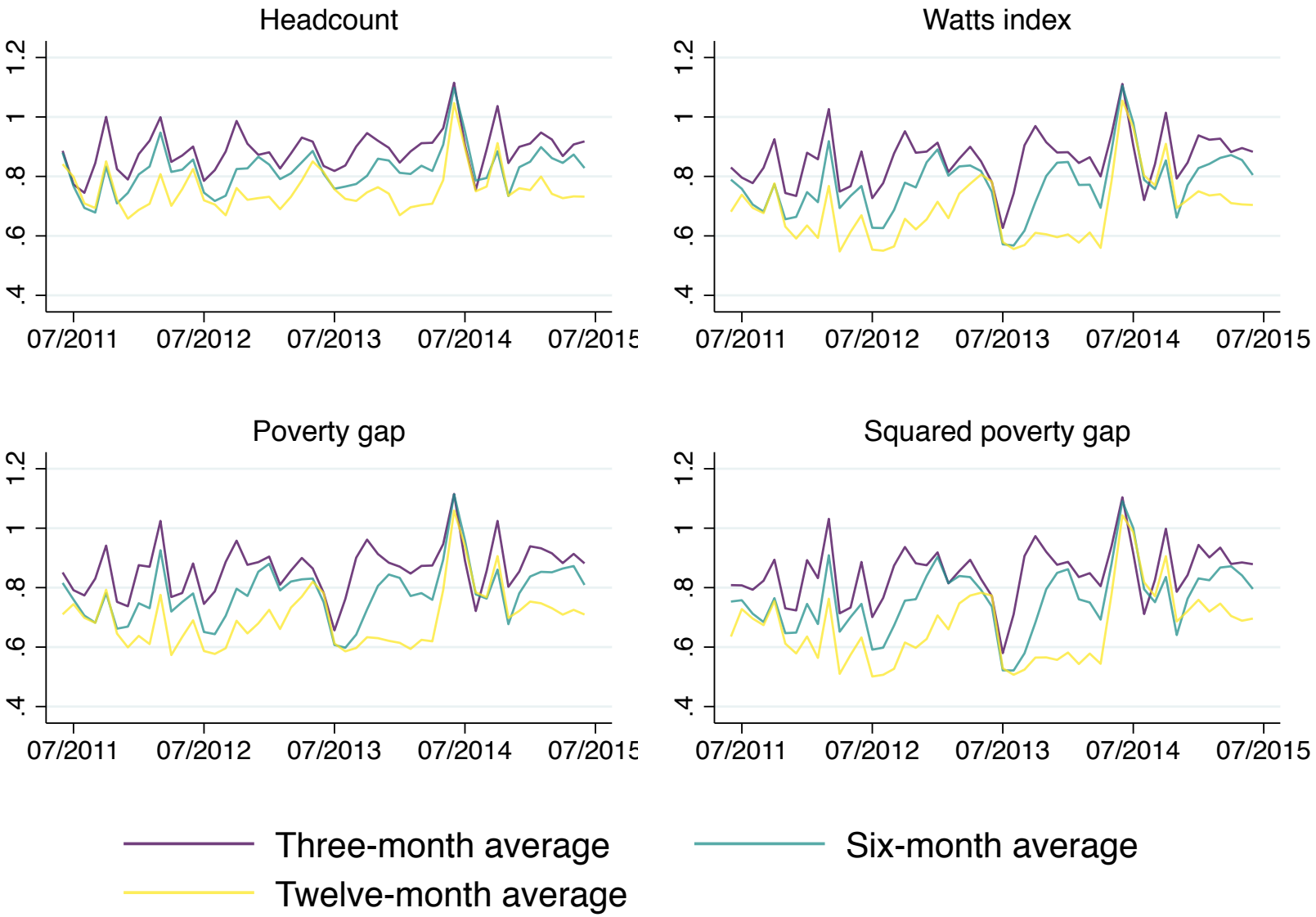
Poverty measures and consumption length



Poverty measures and consumption length, relative to one-month measure



Which households show the biggest differences?

- Previous slide indicated that distributionally sensitive poverty measures exhibit larger differences based on length of consumption
  - Implies that poorer households more likely to have more volatile monthly consumption series, with bigger troughs.

- We can explicitly compare differences: Define $pov\_diff_1 = P(c_{month}) - P(i_{month})$
  - Can also compare $P(c_{month})$ to $P(i_{quarter})$ and $P(i_{annual})$
  - Headcount only (due to issues with negative income values)

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Which households show the biggest differences?

- Can also compare different lengths of the distributionally-sensitive measures: Define $pov\_diff_2 = P(c_{month}) - P(c_{annual})$
  - Can also compare $P(c_{month})$ to $P(c_{quarter})$ and $P(c_{annual})$
  - Expenditures only (due to issues with negative income values)

- Some more details:
  - Cluster standard errors at household level, include month-by-village FE
  - Interested in household demographics (e.g. household size, education of head, etc.) $\rightarrow$ no household FE
  - Can also include one of the two poverty measures to look at "deviations"

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Comparing P(monthly expenditures) to P(income)

	(1) month	(2) quarter	(3) 6month	(4) annual
Prime-age males in HH (count)	0.066***	0.066***	0.066***	0.070***
	(0.008)	(0.009)	(0.009)	(0.010)
Prime-age females in HH	0.011	0.013	0.013	0.010
	(0.010)	(0.010)	(0.011)	(0.012)
Elderly males in HH	0.006	0.009	0.017	0.032
	(0.020)	(0.020)	(0.021)	(0.024)
Elderly females in HH	0.039**	0.042**	0.047**	0.041*
	(0.019)	(0.019)	(0.020)	(0.023)
Children in HH	0.058***	0.055***	0.051***	0.048***
	(0.006)	(0.006)	(0.007)	(0.007)
Head age (log)	−0.058	−0.059	−0.069*	−0.089*
	(0.037)	(0.038)	(0.040)	(0.046)
Head male (yes=1)	−0.110***	−0.110***	−0.110***	−0.133***
	(0.033)	(0.033)	(0.035)	(0.037)
Head educ: higher secondary or more	−0.164***	−0.153***	−0.151***	−0.148***
	(0.030)	(0.031)	(0.033)	(0.037)
Head educ: high secondary	−0.135***	−0.131***	−0.139***	−0.144***
	(0.028)	(0.029)	(0.030)	(0.033)
Head educ: Primary	−0.094***	−0.090***	−0.097***	−0.096***
	(0.023)	(0.024)	(0.025)	(0.028)
Head educ: Some primary	−0.039	−0.035	−0.034	−0.030
	(0.025)	(0.026)	(0.027)	(0.030)
Observations	75,699	73,101	69,204	61,410

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

Comparing P(monthly expenditures) to P(income)

	(1) month	(2) quarter	(3) 6month	(4) annual
Prime-age males in HH (count)	0.027***	0.027***	0.028***	0.029***
	(0.006)	(0.006)	(0.006)	(0.006)
Prime-age females in HH	0.019***	0.019***	0.019**	0.019**
	(0.007)	(0.007)	(0.007)	(0.007)
Elderly males in HH	0.034**	0.035**	0.036**	0.035**
	(0.015)	(0.015)	(0.015)	(0.016)
Elderly females in HH	0.050***	0.050***	0.050***	0.049***
	(0.014)	(0.014)	(0.014)	(0.015)
Children in HH	0.082***	0.082***	0.082***	0.082***
	(0.005)	(0.005)	(0.005)	(0.005)
Head age (log)	−0.060**	−0.061**	−0.062**	−0.064**
	(0.027)	(0.027)	(0.027)	(0.029)
Head male (yes=1)	−0.066***	−0.065***	−0.064**	−0.066***
	(0.025)	(0.025)	(0.025)	(0.025)
Head educ: higher secondary or more	−0.220***	−0.219***	−0.218***	−0.218***
	(0.021)	(0.021)	(0.022)	(0.022)
Head educ: high secondary	−0.126***	−0.126***	−0.129***	−0.132***
	(0.020)	(0.020)	(0.020)	(0.020)
Head educ: Primary	−0.099***	−0.100***	−0.102***	−0.105***
	(0.016)	(0.016)	(0.016)	(0.017)
Head educ: Some primary	−0.063***	−0.064***	−0.067***	−0.072***
	(0.018)	(0.018)	(0.018)	(0.019)
Income poverty measure	−0.995***	−0.997***	−0.995***	−0.998***
	(0.007)	(0.007)	(0.008)	(0.010)
Observations	75,699	73,101	69,204	61,410

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

Comparing $P(c_{month})$ to $P(c_{annual})$

	(1) Watts	(2) Pov gap	(3) Pov gap sq.	(4) Headcount
Prime-age males in HH (count)	0.008***	0.006***	0.003***	0.020***
	(0.002)	(0.001)	(0.001)	(0.004)
Prime-age females in HH	0.008***	0.006***	0.003***	0.016***
	(0.002)	(0.001)	(0.001)	(0.005)
Elderly males in HH	0.012***	0.009***	0.004***	0.028***
	(0.004)	(0.003)	(0.001)	(0.009)
Elderly females in HH	0.011***	0.008***	0.004**	0.033***
	(0.004)	(0.003)	(0.001)	(0.009)
Children in HH	0.011***	0.009***	0.004***	0.043***
	(0.001)	(0.001)	(0.000)	(0.003)
Head age (log)	−0.013*	−0.011**	−0.003	−0.056***
	(0.007)	(0.005)	(0.002)	(0.017)
Head male (yes=1)	−0.020***	−0.014***	−0.007***	−0.035**
	(0.007)	(0.005)	(0.002)	(0.016)
Head educ: higher secondary or more	−0.031***	−0.026***	−0.010***	−0.126***
	(0.005)	(0.003)	(0.002)	(0.014)
Head educ: high secondary	−0.016***	−0.013***	−0.005***	−0.080***
	(0.005)	(0.004)	(0.002)	(0.013)
Head educ: Primary	−0.015***	−0.014***	−0.005***	−0.063***
	(0.004)	(0.003)	(0.001)	(0.011)
Head educ: Some primary	−0.005	−0.006*	−0.001	−0.037***
	(0.005)	(0.003)	(0.002)	(0.012)
12-month poverty measure	−0.114***	−0.191***	−0.086***	−0.500***
	(0.015)	(0.014)	(0.017)	(0.011)

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

Comparing $P(c_{month})$ to $P(c_{quarter})$

	(1) Watts	(2) Pov gap	(3) Pov gap sq.	(4) Headcount
Prime-age males in HH (count)	0.003***	0.002***	0.001***	0.012***
	(0.001)	(0.000)	(0.000)	(0.002)
Prime-age females in HH	0.003***	0.003***	0.001***	0.007***
	(0.001)	(0.001)	(0.000)	(0.003)
Elderly males in HH	0.005***	0.004***	0.002***	0.014**
	(0.001)	(0.001)	(0.000)	(0.006)
Elderly females in HH	0.005***	0.004***	0.001***	0.020***
	(0.001)	(0.001)	(0.001)	(0.006)
Children in HH	0.005***	0.004***	0.002***	0.028***
	(0.001)	(0.000)	(0.000)	(0.002)
Head age (log)	−0.005**	−0.004**	−0.001	−0.024**
	(0.002)	(0.002)	(0.001)	(0.010)
Head male (yes=1)	−0.007***	−0.005***	−0.003***	−0.018*
	(0.002)	(0.002)	(0.001)	(0.009)
Head educ: higher secondary or more	−0.013***	−0.012***	−0.004***	−0.077***
	(0.002)	(0.002)	(0.001)	(0.009)
Head educ: high secondary	−0.007***	−0.006***	−0.002***	−0.046***
	(0.002)	(0.001)	(0.001)	(0.008)
Head educ: Primary	−0.005***	−0.005***	−0.002***	−0.032***
	(0.001)	(0.001)	(0.000)	(0.006)
Head educ: Some primary	−0.002	−0.003*	−0.001	−0.018***
	(0.002)	(0.001)	(0.001)	(0.007)
3-month poverty measure	−0.050***	−0.092***	−0.032***	−0.327***
	(0.004)	(0.005)	(0.004)	(0.006)

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

Conclusions

- The assumptions underlying the choice of income/consumption vs. length of time are often left unsaid
- The variance of consumption and income are of first-order importance when choosing the appropriate poverty measure
- In our sample, households smooth consumption imperfectly, implying that monthly income poverty measures overestimate poverty but annual poverty measures (income and consumption) underestimate true poverty

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Conclusions

- The differences based on t are larger for distributionally-sensitive poverty measures (Watts index, poverty gap, squared poverty gap)
- Poverty in the most vulnerable households is underestimated the most with longer-term measures
- This is true even when we control for the longer-term poverty measure (as well as annual income and expenditures, not shown), implying a higher variance, even with identical levels

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Questions and comments?

Josh Merfeld
merfeld@kdis.ac.kr

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