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Aggregate Shocks and Consumption Inequality

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A large empirical literature on how household income inequality is related to household consumption inequality: e.g., Deaton and Paxson (1994), Attanasio and Davis (1996), Blundell and Preston (1998), Blundell et al, (2008), Guvenen and Smith (2012)

This relationship depends on

- the underlying persistence of income shocks
- the degree of consumption insurance w.r.t these shocks

Introduction

Inequality and the variances of shocks are within-group measures

- Aggregate shocks only affect aggregate (or average) income and consumption
- Conditional on group-level changes, aggregate shocks do not affect household consumption

Individual income is much more variable than aggregate income:

- Pischke (1995): the std of quarterly household level income changes is about 40 times larger than that for aggregate per household income
- Implies that the welfare cost of business cycles is low (Lucas 1987)

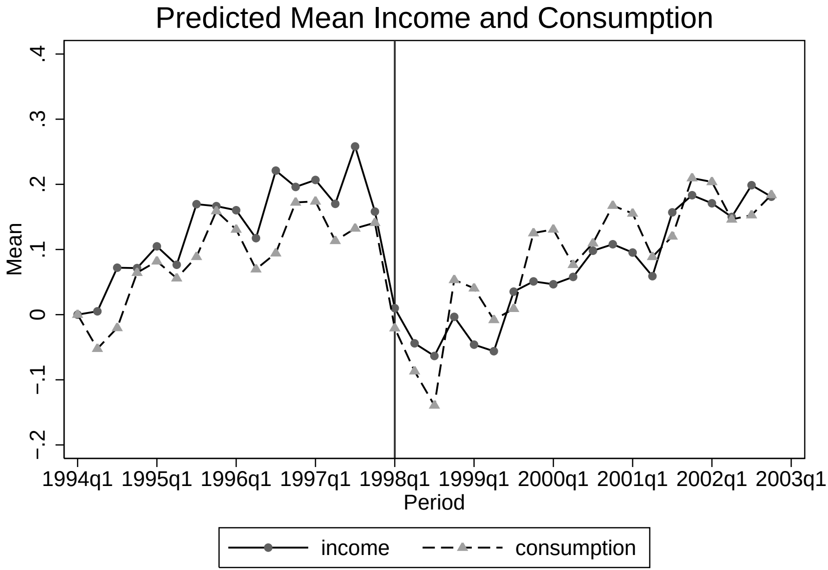


Figure: Mean of Log Household Income and Nondurable Consumption

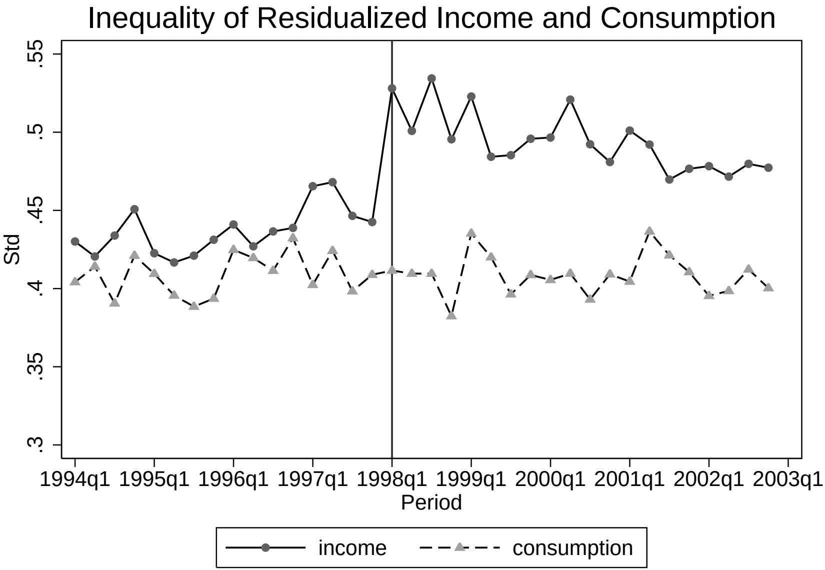


Figure: Std of Log Household Income and Nondurable Consumption

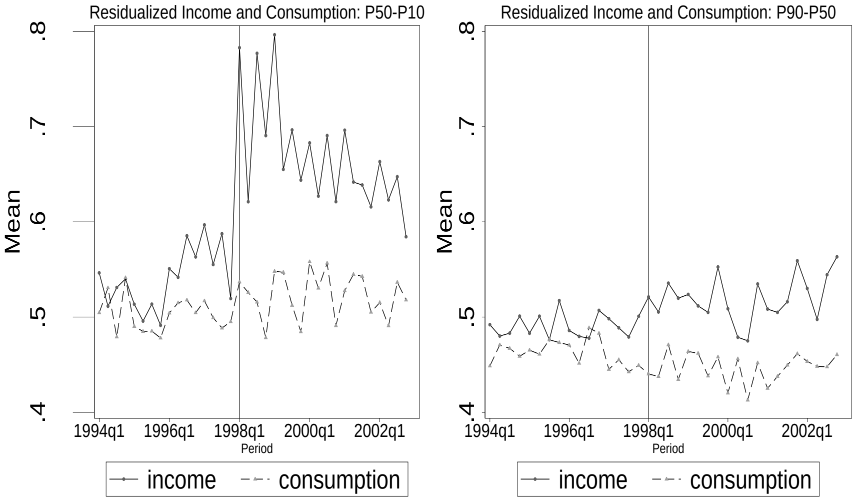


Figure: P50-P10 and P90-P50 Ratio of Log Household Income and Nondurable Consumption

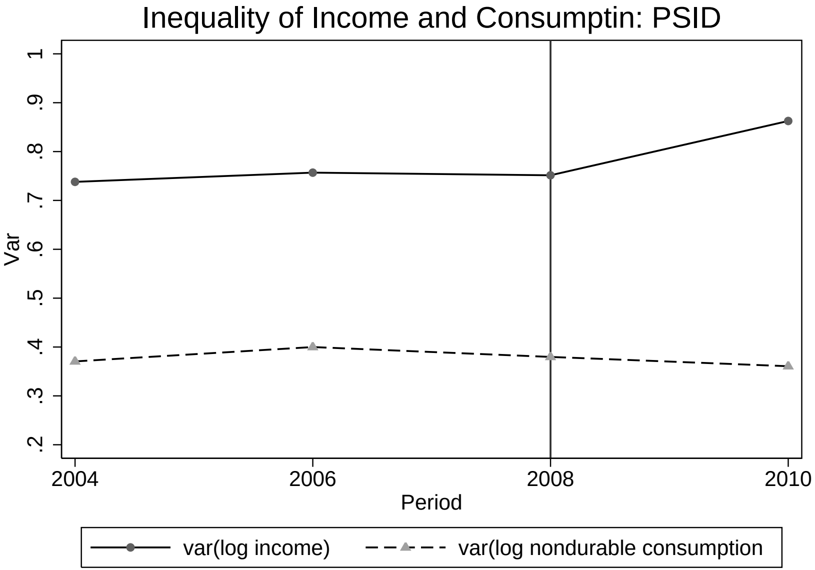


Figure: Variance of Log Income and Nondurable Consumption: PSID (Attanasio and Pistaferri 2014)

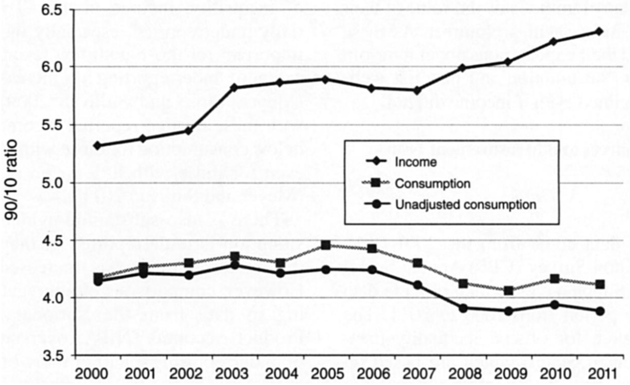


FIGURE 1. INCOME AND CONSUMPTION INEQUALITY, 2000–2011

Notes: Income is after-tax money income plus food stamps and housing and school lunch subsidies. Consumption is adjusted for underreporting by calculating a predicted value of consumption from a regression of unadjusted consumption on core consumption and demographic characteristics using data from 1980 and 1981. See text for more details.

Figure: Consumption and Income Inequality: US (Meyer and Sullivan 2013)

Our paper: Research questions

We examine the evolution of consumption and income inequality through the lens of a model with incomplete markets and risk-averse households

There are a number of key questions addressed:

1) How do large aggregate shocks affect households' income and consumption inequality?

2) Are the effects from aggregate shocks on household income permanent or transitory?

3) Is the households' ability to insuring against shocks affected by aggregate shock? If so, through which channel?

Our paper: What We Do

We begin by documenting that large aggregate shock also affect the distribution and the dynamics of income and consumption

Key empirical challenges:

1. Follow households over time (both income and consumption)
2. Aggregate shocks typically occur at a higher frequency than survey (time averaging)
3. Large aggregate shock

To address these challenges, we:

- Use quarterly panel data containing consumption and total income records from Korea
- Data span the period of Asian financial crisis

Our paper: What We Do

We construct and estimate an income process with aggregate shocks

- Aggregate shocks may have both permanent and transitory effects on household income
- Distinguish heterogeneity from unanticipated deviations
- Combine it with consumption data to estimate "reduced-form" consumption insurance

We use the estimated income process to calibrate a buffer-stock model

- Aggregate shocks are state variables (not i.i.d)
- Evaluate the channels through which aggregate shocks affect household consumption (income, uncertainty, return to assets)
- Compute the welfare implications of aggregate shocks vs. idiosyncratic shocks

Introduction: Relation to existing research

1) How aggregate shock affects the dynamics of earnings:

- Standard income processes: assume additive separability (e.g. Meghir and Pistaferri 2004; Blundell et al., 2015)
- Idiosyncratic risk over the business cycle (e.g. Storesletten, et.al., 2004, Shore and Carey 2013)
- Large aggregate shocks have persistent and heterogeneous impacts across households (e.g., the scaring effect of recession, Hoynes et.al 2012).

2) How households are insured against income shocks

- Focus on (family) labor supply, assets, and taxes (e.g., Blundell et al. 2008, 2016; Heathcote et al., 2014)

3) Household consumption under income uncertainty

- Aggregate shocks are not state variables (e.g., Carroll 1997, Gourinchas and Parker 2002).

Plan of the talk

1. Data
2. Descriptive evidence
3. The income process with aggregate shocks
4. Model based interpretation of estimates

Data sources

Household Income and Expenditure Survey in urban areas of Korea from 1994 to 2003:

A panel of both income and consumption:

- each household are covered over 12 to 60 months
- collected in dairy (monthly frequency)
- durable and non-durable consumption
- other information such as occupation and household structure

Estimation sample

Sample selection:

- household head aged between 25-60
- households whose head and spouse do not change over the sample period
- drop the head whose main income (2/3) is from self-employment

Main analysis focuses on real household disposable income (post-tax) and real non-durable consumption

- income from financial assets excluded
- education and health care expenditures excluded (robust to including them)
- durables
- Additional analysis: pre-tax household income (role of taxes and transfers) and pre-tax earnings of the head (family labor supply)

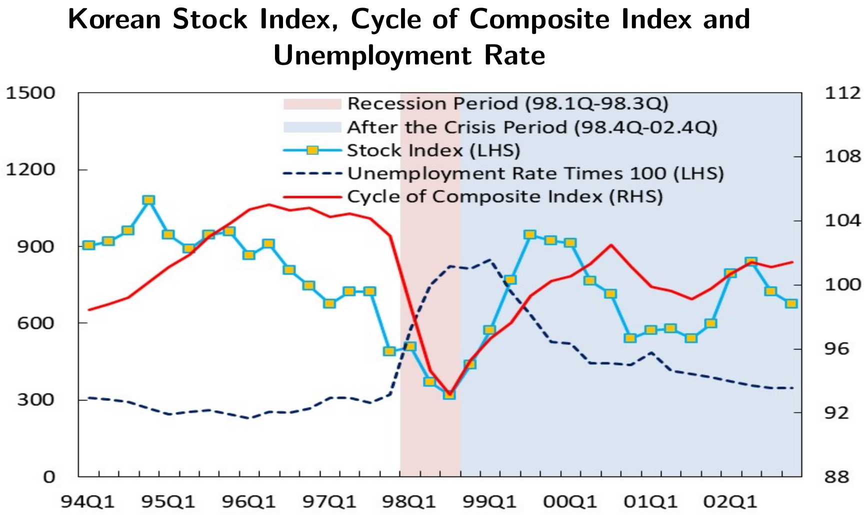


Figure: Macro Time Series

Income Dynamics

The log household income for a household i in quarter t is:

$$\log Y_{it} = X'_{it}\beta + \tau_t^y + y_{it} \quad (1)$$

$$y_{it} = P_{it} + v_{it} \quad (2)$$

$$P_{it} = P_{it-1} + \zeta_{it}, \quad E(\zeta_{it}|t) = 0 \quad (3)$$

$$v_{it} = \sum_{k=0}^{q} \theta_k \xi_{it-k}, \quad E(\xi_{it}|t) = 0 \quad (4)$$

- X'_{it} is a set of characteristics observable and known by household at time t, and τ_t^y is a set of time fixed effects
- y_{it} is the residual income which is the function of permanent (P_{it}) and transitory (v_{it}) component
- ζ_{it} and ξ_{it} are the idiosyncratic permanent and transitory income shocks, respectively

Income Dynamics

The Asian financial crisis pass onto the household via the permanent and transitory component

$$var(\zeta_{it}|t) = \gamma + \kappa_R D_{tR} + \kappa_A D_{tA} \quad (5)$$
$$var(\xi_{it}|t) = \alpha + \lambda_R D_{tR} + \lambda_A D_{tA} \quad (6)$$

$$\begin{bmatrix} D_{tR} = 1 \;\; if \;\; t \in T_R \;\; and \;\; 0 \;\; otherwies \\ D_{tA} = 1 \;\; if \;\; t \in T_A \;\; and \;\; 0 \;\; otherwies \end{bmatrix}$$

- γ and α are heterogeneous fixed effects
- κ and λ are period-specific additional effect
- D_{tR} is a dummy variable which has a value one if t is included in the time period of recession ($t \in [1998.1Q, 1998.3Q]$)
- D_{tA} has a value one if t is in the period of after the crisis ($t \in [1998.4Q, 2002.4Q]$)

Consumption Dynamics

The log household consumptions for a household i in quarter t is:

$$\log C_{it} = X_{it}'\theta_c + \tau_t^c + e_{it} \tag{7}$$

$$\Delta c_{it} = e_{it} - e_{it-1} = \phi_t \zeta_{it} + \pi_t \xi_{it} + \varepsilon_{it} \tag{8}$$

$$\phi_t = \frac{exp(a_0 + a_R D_{tR} + a_A D_{tA})}{1 + exp(a_0 + a_R D_{tR} + a_A D_{tA})} \tag{9}$$

$$\pi_t = \frac{exp(b_0 + b_R D_{tR} + b_A D_{tA})}{1 + exp(b_0 + b_R D_{tR} + b_A D_{tA})} \tag{10}$$

$$var(\varepsilon_{it}) = \sigma^2_{\varepsilon,B} + (\sigma^2_{\varepsilon,A} - \sigma^2_{\varepsilon,B}) \times 1_{(t \in T_R \text{ or } t \in T_A)} \tag{11}$$

- $\Delta c_{it} = e_{it} - e_{it-1}$ is the unexplained consumption growth
- ϕ_t and π_t measure the transmission of permanent and transitory income shocks to consumption growth
  - Full insurance of income shocks: $\phi_t = 0$ and $\pi_t = 0$
  - Self-insurance through precautionary savings: $\pi_t < \phi_t$

Estimation Method: Minimum Distance Estimation

In order to estimate the variance of income shocks and insurability, we use a minimum distance estimator

- Build on and extend the framework developed by Blundell, Pistaferri, and Preston (2008)
- Minimize the sum of squared deviations between elements in the empirical variance-covariance of Δy and Δc and corresponding predicted elements

A total of 992 moment conditions are used

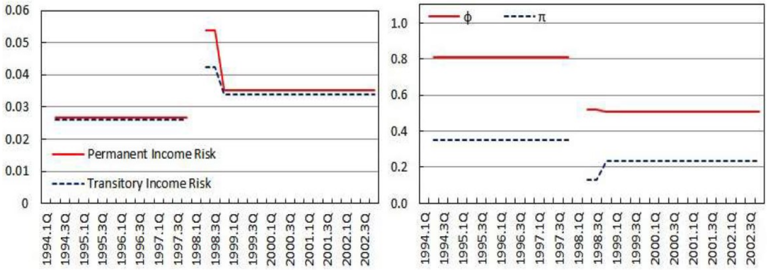
- As moments, we use variance-covariance of income and consumption growth ($s \geq 0$):
  - $cov(\Delta y_{it}, \Delta y_{it+s})$: s includes all available leads
  - $cov(\Delta c_{it}, \Delta c_{it+s})$: s includes all available leads
  - $cov(\Delta c_{it}, \Delta y_{it+s})$: s includes upto second leads

Estimates

	Minimum Distance		
	(2)		(4)
γ	0.0267	$a_0/10$	0.1441
	(0.0011)		(0.0194)
κ_R	0.0270	$a_R/10$	- 0.1360
	(0.0051)		(0.0276)
κ_A	0.0084	$a_A/10$	-0.1416
	(0.0014)		0.0205
α	0.0261	$b_0/10$	- 0.0609
	(0.0010)		(0.0071)
λ_R	0.0164	$b_R/10$	- 0.1274
	(0.0024)		(0.0218)
λ_A	0.0077	$b_A/10$	- 0.0584
	(0.0010)		(0.0096)
θ_1	- 0.1480	$\sigma^2_{\varepsilon,B}$	0.0655
	(0.0207)		(0.0010)
		$\sigma^2_{\varepsilon,A} - \sigma^2_{\varepsilon,B}$	-0.0055
			(0.0013)

Figure: Estimates of the Variance of Income Shocks and Insurability

Estimates



(a) Variance of ζ_{it} and ξ_{it} (b) ϕ_t and π_t

Figure: Estimates of the Variance of Income Shocks and Insurability

Variance of consumption changes is:

$$var(\Delta c_{it}) = \phi_t^2 var(\zeta_{it}) + \pi_t^2 var(\xi_{it}) + var(\varepsilon_{it,B}) + (var(\varepsilon_{it,A}) - var(\varepsilon_{it,B}))I_{tA}$$

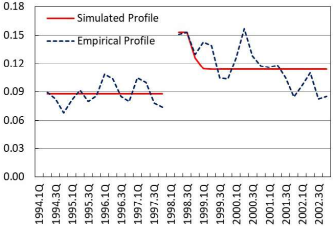
Minimum Distance Estimation Results

During the recession period (1998Q1-1998Q3),

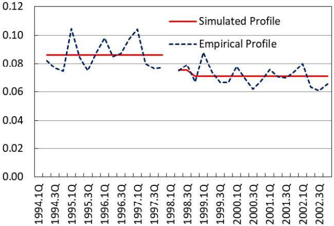
- The estimated variance of income shock temporarily picked-up, and average permanent income shock (σ_ζ^2) increased more than transitory shock (σ_ξ^2)
- ϕ_t (-36%) and π_t (-63%) decreased greatly

When comparing the period of before (1994Q1-1997Q4) and after (1998Q4-2002Q4) the crisis,

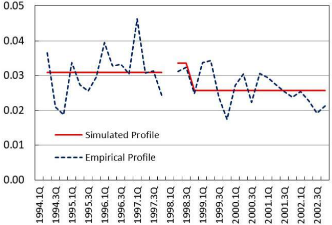
- σ_ζ^2 and σ_ξ^2 increased 31.5% and 29.5%, respectively
- The insurability of both permanent (ϕ_t) and transitory shocks (π_t) has increased much (decrease in the values of ϕ_t and π_t)
- The variance of the innovation to consumption growth also decreased ($\sigma_{\varepsilon,B}^2 = 0.066 \Rightarrow \sigma_{\varepsilon,A}^2 = 0.060$)



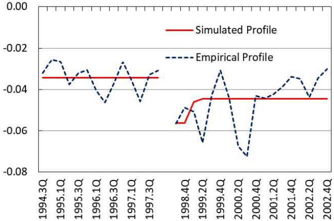
(a) $var(\Delta y_{it})$



(b) $var(\Delta c_{it})$



(c) $cov(\Delta y_{it}, \Delta c_{it})$



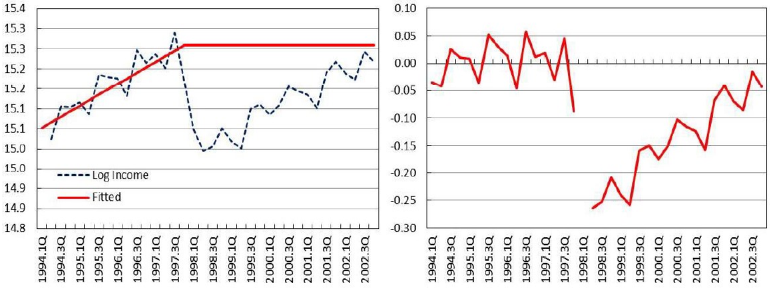
(d) $cov(\Delta y_{it}, \Delta y_{it+1})$

Goodness of Fit

Alternative Specification

We construct and estimate an alternative model of income and consumption dynamics with aggregate shocks (g_t)

- The crisis may have played an important role in changing σ_ζ^2, σ_ξ^2, ϕ and π
- Specify g_t as unexpected aggregated income shocks which are the part of household income that cannot be explained in a deterministic way Model Fit.



(a) Log Household Income and Trend (b) Estimated Aggregate Shock ($\hat{g}_t$)

Model based interpretation of estimates

The buffer stock saving models (Gourinchas and Parker 2002, Carroll 1997) focuses on idiosyncratic shocks

We augment the buffer stock model subject to the income process containing both aggregate shocks as well as idiosyncratic shocks to

- Evaluate the channels through which aggregate shocks affect household consumption (income, uncertainty, return to assets)
- Compute the welfare implications of aggregate shocks vs. idiosyncratic shocks

The key challenge is to specify a plausible (and feasible) process for the aggregate shock M_t (or the distribution of future aggregate shocks)

Model based interpretation of estimates

The macro state is Markovian

$$prob(M_t = z_i | M_{t-1} = z_j) = p_{ij} \tag{12}$$

where $i, j = 1, 2$; $p_{i1} + p_{i2} = 1$.

The return to savings is correlated with the macro state.

$$prob(R_t = r_i | M_t = z_j) = q_{ij} \tag{13}$$

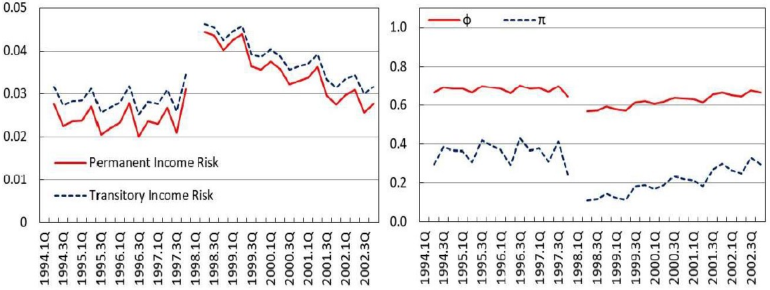
where $i, j = 1, 2$; $q_{1j} + q_{2j} = 1$; $r_1 > r_2$, and $1 > q_{11} > q_{21} > 0$, i.e., the return to saving is more likely low when the macro state is bad.

Model based interpretation of estimates

1. In the pre-crisis period, calibrate the model by normalizing M_t=0, thereby shutting down the impact of macro shock on mean income, return to savings and income risks.
2. Then assume there is a shock to M_t, where M_t=2 (the mean change in unemployment rate during the crisis), and put in the transition matrix of M_t with two states: M_t=2 (crisis), M_t=0 (normal) to simulate the model.
3. The calibrated transition matrix represents uncertainty on the aggregate economy.

Appendix-Alternative Model: Estimates

- Negative aggregate shocks increased the the variance of permanent and transitory income shocks
- Continuous negative shocks increased the degree of insurance

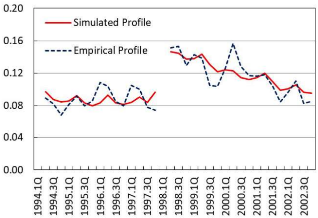


(a) Variance of ζ_{it} and ξ_{it} (b) ϕ_t and π_t

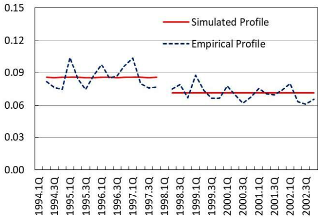
Figure: Estimates of the Variance of Income Shocks and Insurability

Alternative Specification

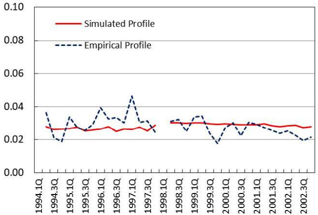
Appendix-Alternative Model: Goodness of Fit



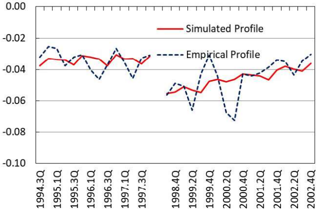
(a) $var(\Delta y_{it})$



(b) $var(\Delta c_{it})$



(c) $cov(\Delta y_{it}, \Delta c_{it})$



(d) $cov(\Delta y_{it}, \Delta y_{it+1})$

Goodness of Fit

Alternative Specification