Lifecycle Earnings Risk and Insurance:
New Evidence from Australia

Darapheak Tin *Chung Tran*

Research School of Economics,
Australian National University

TTPI Seminar

June 2022

Our study

1. Better understand the nature of income shock process in Australia

   $\rightarrow$ Decompose sources of earnings changes: Wage or hour

   $\rightarrow$ Explore individual earnings risk by age and income history

2. Study the insurance role of family and government

   $\rightarrow$ Family: Market earnings and private transfers

   $\rightarrow$ Government: Progressive taxes and targeted public transfers

Data and methodology

Data: HILDA 2001-2020 ($152,903$ observations).

Sampling criteria: (i) Primary earner, (ii) Employment history.

Methodology: Non-parametric approach following Guvenen et al. (2021) and De Nardi et al. (2021).

Definition: Risks

Residual income shocks := changes or growth of residual income (net of age and time effects) over time.

- **Second-order income risk**: Variance of a residual income shock distribution
- **Third-order income risk**: Skewness (S) measures the lack of symmetry in data distribution of shocks. A normal distribution has S=0
  - S between -0.5 and 0.5: fairly symmetrical;
  - S between -1 and -0.5 or between 0.5 and 1: moderately skewed.
  - S less than -1 or greater than 1: highly skewed.
- **Forth-order income risk**: Kurtosis (K) measures the tails of a shock distribution. It is actually the measure of outliers present in data.
  - $K = 3$ (Mesokurtic): Standard normal distribution
  - $K > 3$ (Leptokurtic): Distribution is longer, tails are fatter
  - $K < 3$ (Platykurtic): Distribution is shorter, tails are thinner

Definition: Risks

Residual income shocks := changes or growth of residual income (net of age and time effects) over time.

- **Second-order income risk**: Variance of a residual income shock distribution
- **Third-order income risk**: Skewness (S) measures the lack of symmetry in data distribution of shocks. A normal distribution has S=0
  - S between -0.5 and 0.5: fairly symmetrical;
  - S between -1 and -0.5 or between 0.5 and 1: moderately skewed.
  - S less than -1 or greater than 1: highly skewed.
- **Forth-order income risk**: Kurtosis (K) measures the tails of a shock distribution. It is actually the measure of outliers present in data.
  - $K = 3$ (Mesokurtic): Standard normal distribution
  - $K > 3$ (Leptokurtic): Distribution is longer, tails are fatter
  - $K < 3$ (Platykurtic): Distribution is shorter, tails are thinner

Definition: Risks

Residual income shocks := changes or growth of residual income (net of age and time effects) over time.

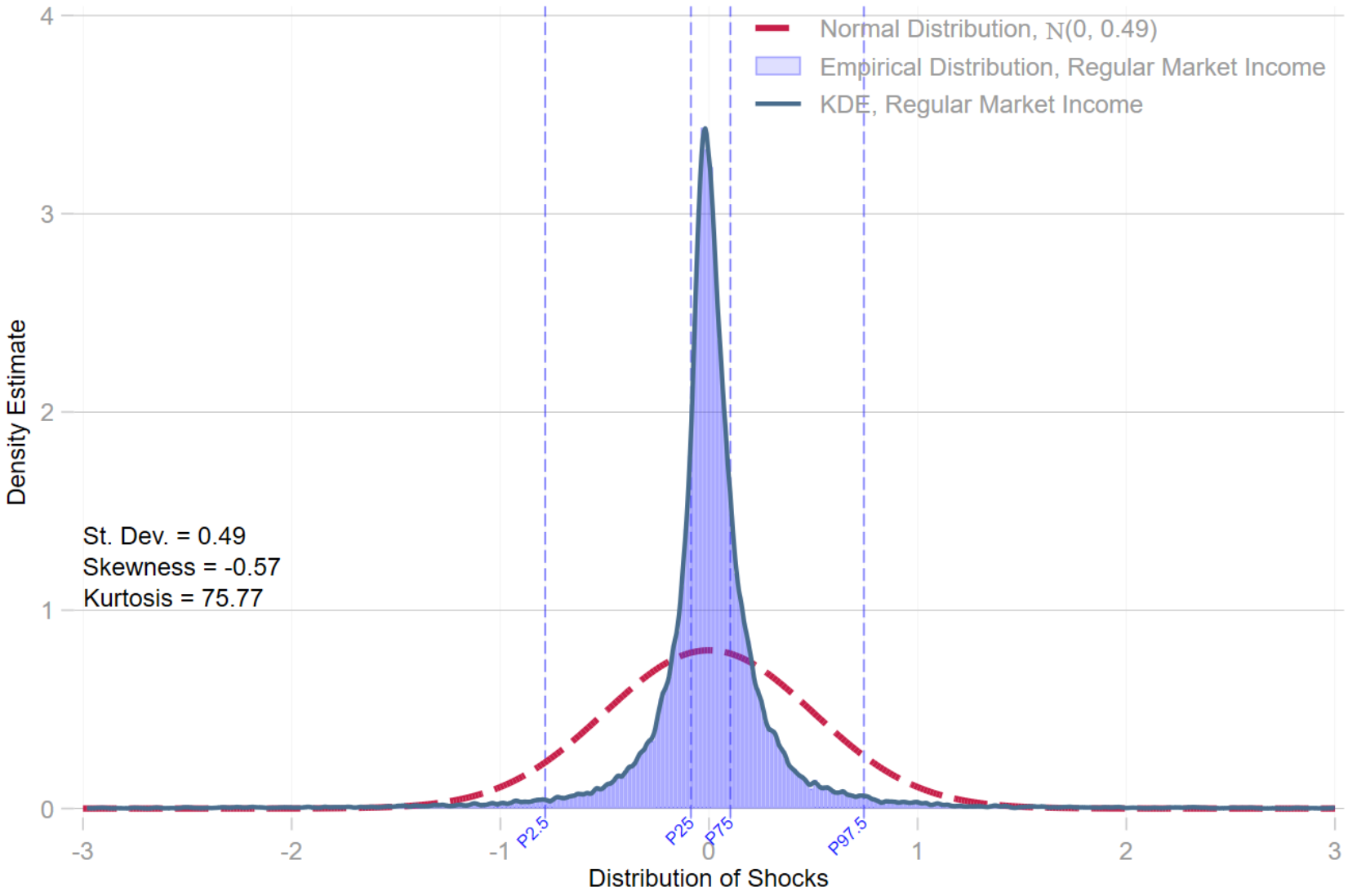
- **Second-order income risk**: Variance of a residual income shock distribution
- **Third-order income risk**: Skewness (S) measures the lack of symmetry in data distribution of shocks. A normal distribution has S=0
  - S between -0.5 and 0.5: fairly symmetrical;
  - S between -1 and -0.5 or between 0.5 and 1: moderately skewed.
  - S less than -1 or greater than 1: highly skewed.
- **Forth-order income risk**: Kurtosis (K) measures the tails of a shock distribution. It is actually the measure of outliers present in data.
  - $K = 3$ (Mesokurtic): Standard normal distribution
  - $K > 3$ (Leptokurtic): Distribution is longer, tails are fatter
  - $K < 3$ (Platykurtic): Distribution is shorter, tails are thinner

Definition: Risks

Residual income shocks := changes or growth of residual income (net of age and time effects) over time.

- **Second-order income risk**: Variance of a residual income shock distribution
- **Third-order income risk**: Skewness (S) measures the lack of symmetry in data distribution of shocks. A normal distribution has S=0
  - S between -0.5 and 0.5: fairly symmetrical;
  - S between -1 and -0.5 or between 0.5 and 1: moderately skewed.
  - S less than -1 or greater than 1: highly skewed.
- **Forth-order income risk**: Kurtosis (K) measures the tails of a shock distribution. It is actually the measure of outliers present in data.
  - $K = 3$ (Mesokurtic): Standard normal distribution
  - $K > 3$ (Leptokurtic): Distribution is longer, tails are fatter
  - $K < 3$ (Platykurtic): Distribution is shorter, tails are thinner

Empirical distribution of annual residual earnings shocks



See 3-year average earnings residual shock distribution.

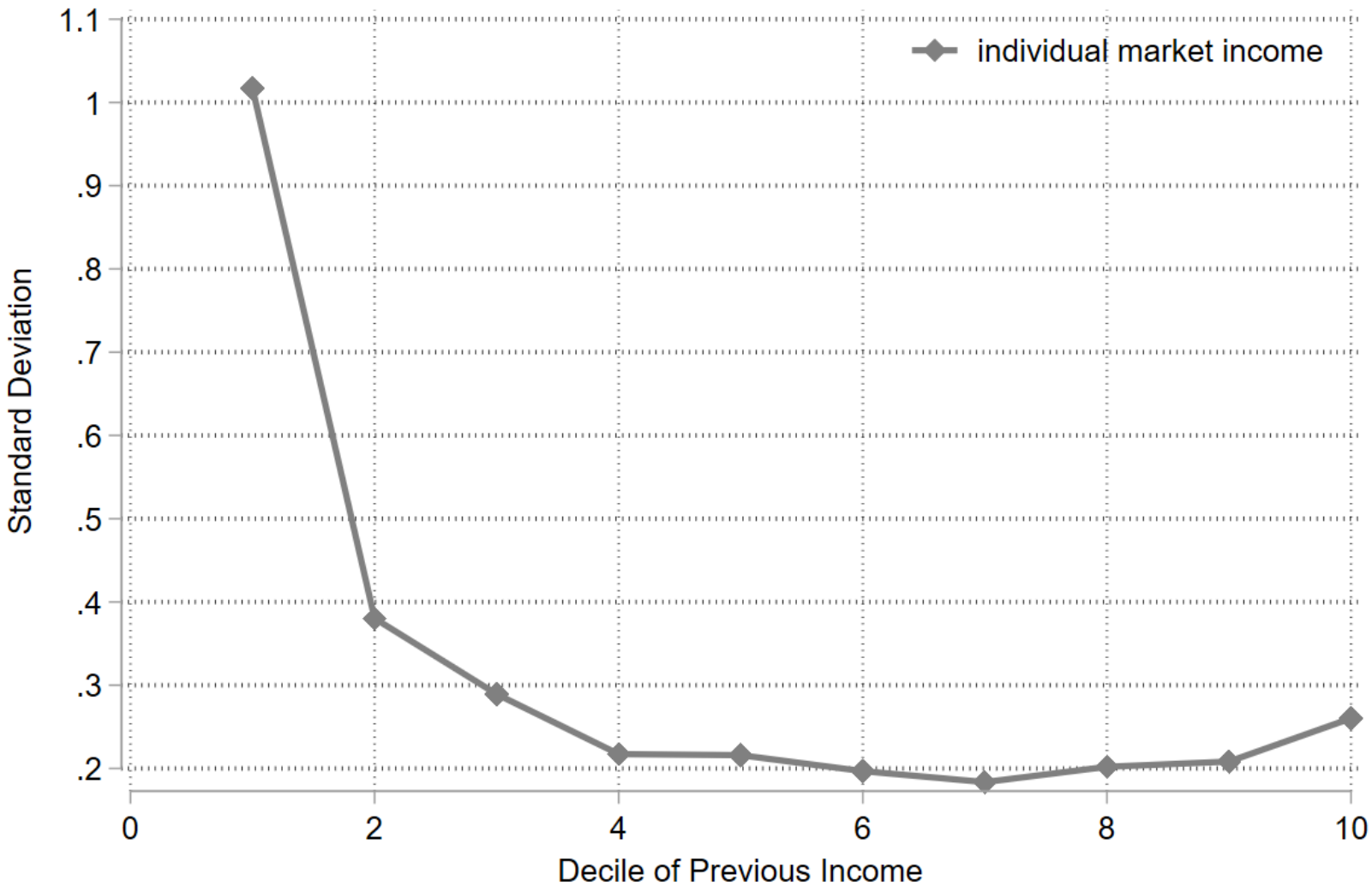
Definition: Insurance against income risks

Insurance := *the extent to which an income component reduces risks.*

- Market income risks $\xrightarrow[\text{(via members' annual earnings)}]{\text{family market income insurance}}$ Family market income risks
- Family market income risks $\xrightarrow[\text{(via private transfers)}]{\text{family transfer insurance}}$ Family pre-gov't income risks
- Family pre-gov't income risks $\xrightarrow[\text{(via income taxes)}]{\text{gov't tax insurance}}$ Family post-tax income risks
- Family post-tax income risks $\xrightarrow[\text{(via public transfers)}]{\text{gov't transfer insurance}}$ Family post-gov't income risks

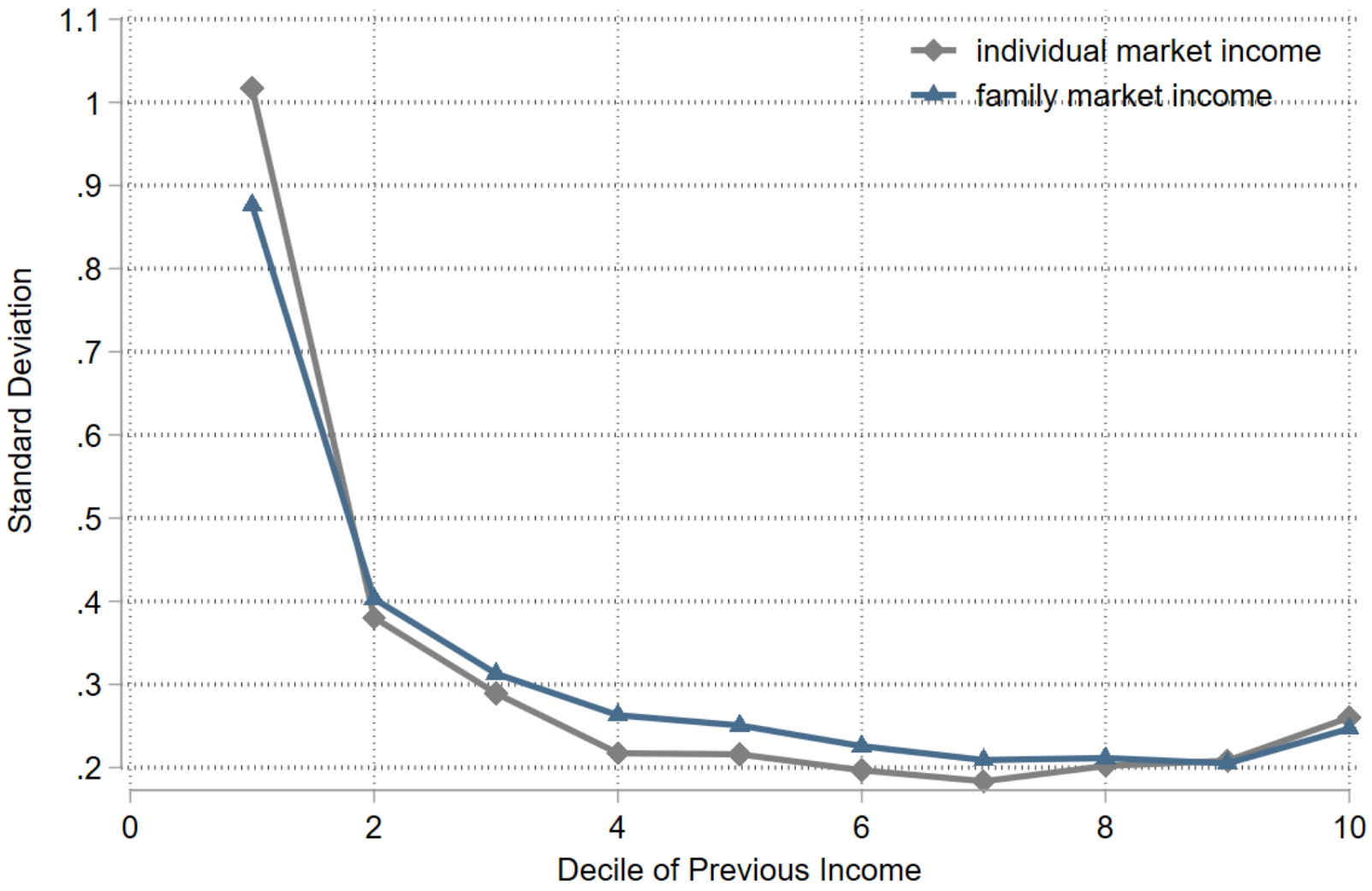
Example: Insurance against 2nd-order earnings risk

Primary earner's market income



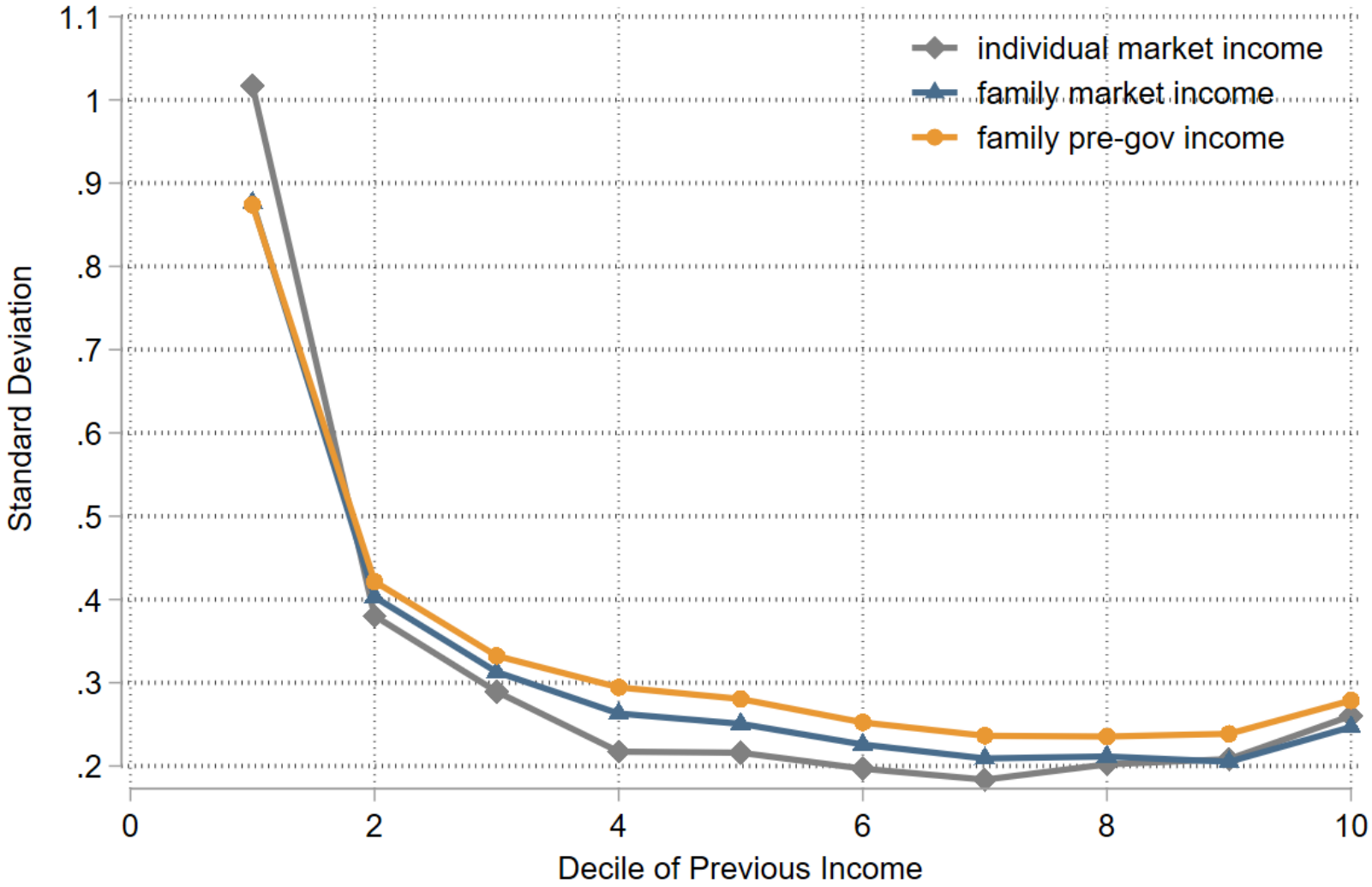
Example: Insurance against 2nd-order earnings risk

Primary earner's market income + Secondary earners' market income



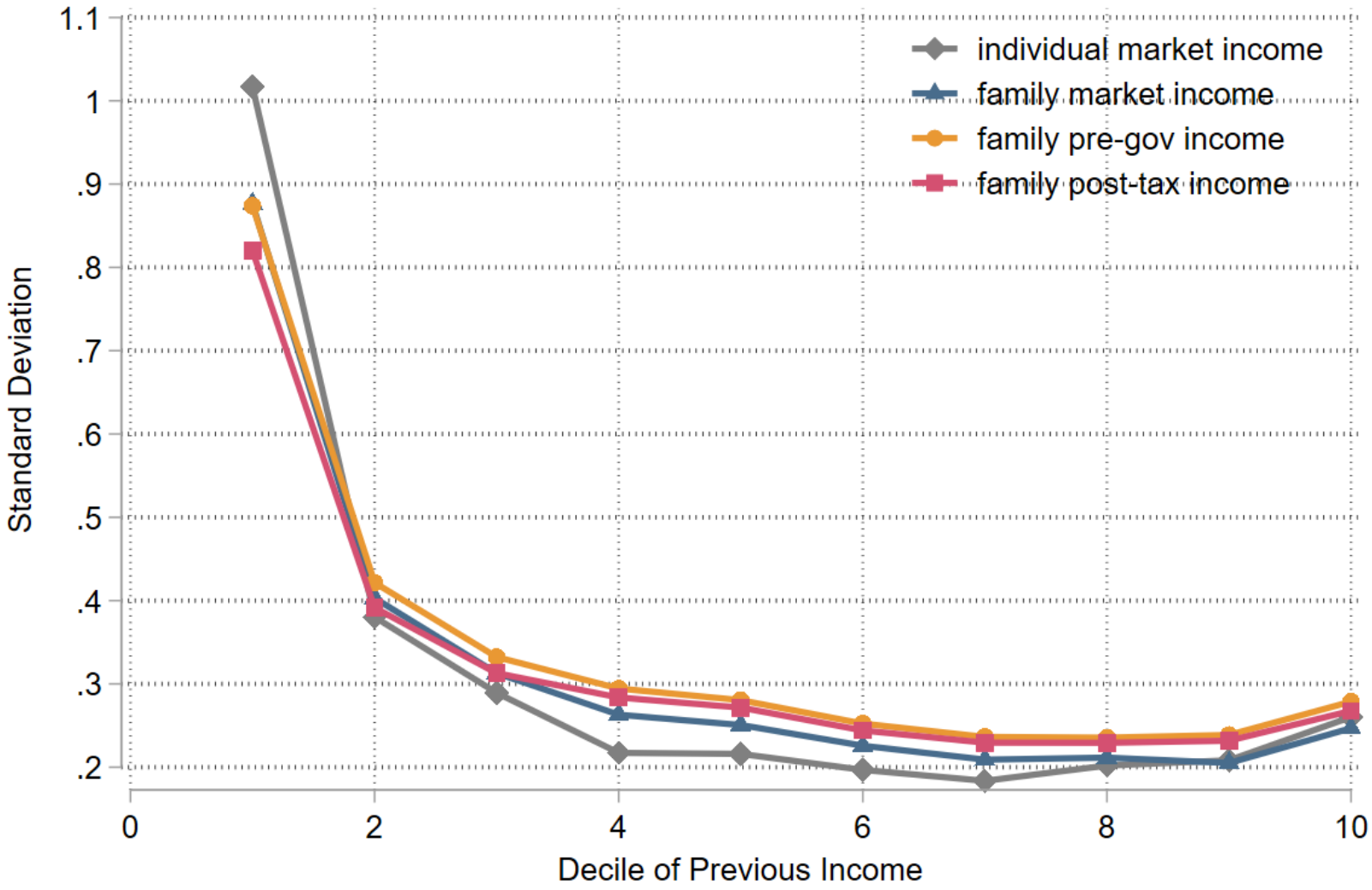
Example: Insurance against 2nd-order earnings risk

Primary earner's market income + Secondary earners' market income + Private transfers



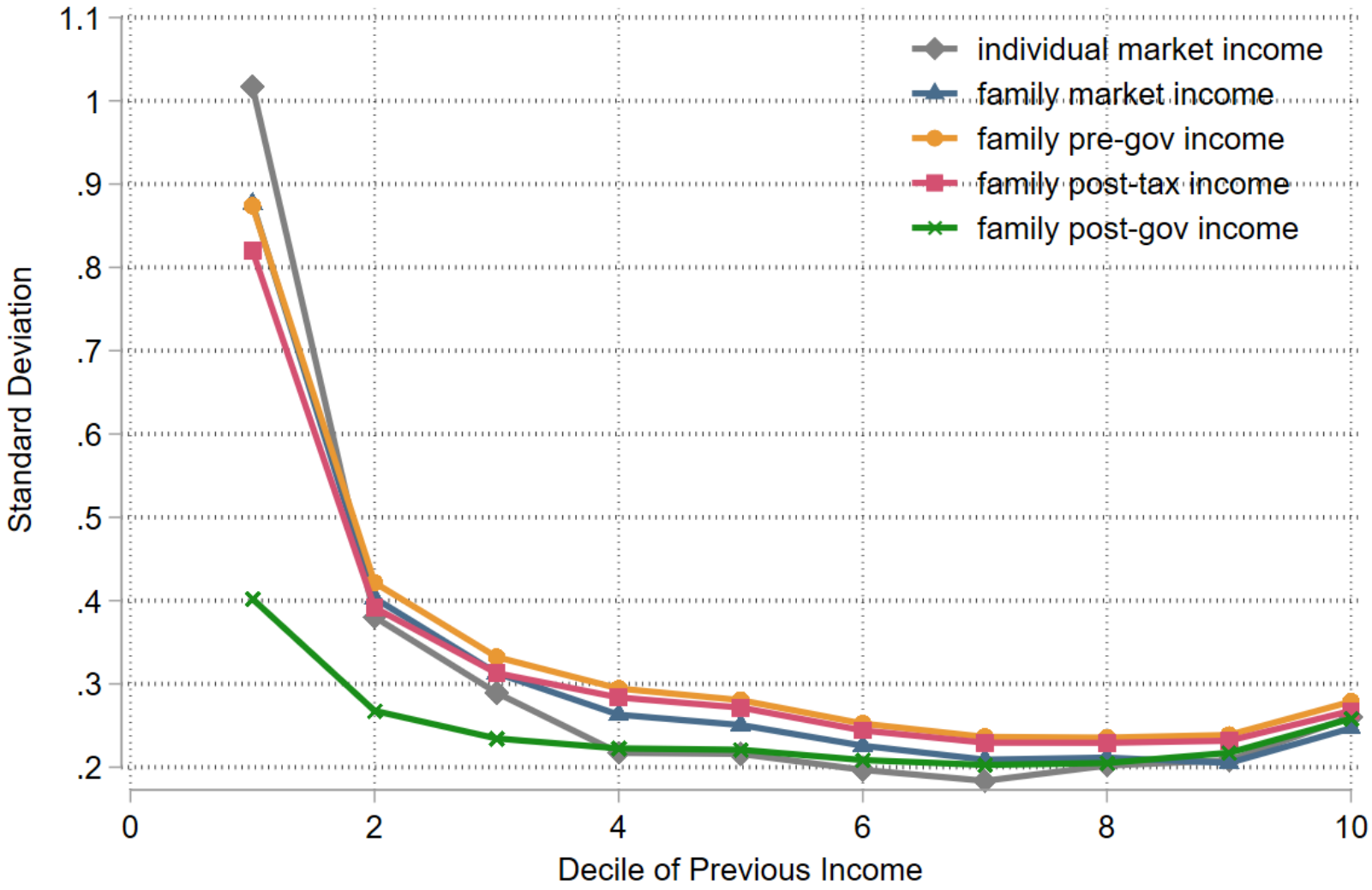
Example: Insurance against 2nd-order earnings risk

Primary earner's market income + Secondary earners' market income + Private transfers − (Combined taxes - Concessions)



Example: Insurance against 2nd-order earnings risk

Primary earner's market income + Secondary earners' market income + Private transfers − (Combined taxes - Concessions) + Public transfers



Related literature

Non-gaussian properties of earnings dynamics:

- Guvenen et al. (2021): US;
- Halvorsen et al. (2020): Norway;
- De Nardi et al. (2021): US and the Netherlands.

Studies in Australia:

- Gaussian shocks:
  - Chatterjee et al. (2016); Freestone (2018): Wage inequality and unobserved shocks;
  - Kaplan et al. (2018): Consumption and income inequality;
- Level and first moment of income:
  - Herault and Azpitarte (2015): Redistributive impact of tax and transfer;
  - Tran and Zakariyya (2021): Trends in tax progressivity and redistribution.

Main results

Main results for Australia are:

1. Non-linear and non-Gaussian income dynamics;
2. Shock distributions are highly left skewed and leptokurtic;
3. Substantial government and family insurance against risks;
4. These features of income dynamics are persistent.

Cross-country comparison

	Australia	The Netherlands	US
Driver of earnings risk			
Dispersion	Wages	Wages & Hours*	Wages & Hours
Left Skewness	Hours	Hours	Hours
Excess Kurtosis	Hours	Hours	Hours
Main insurance			
Dispersion	Gov't	Gov't	Family & Gov't
Left Skewness	Family	Family & Gov't	Family
Excess Kurtosis	Family	Family & Gov't	Family

*Note: In the Netherlands, hour changes contribute more to earnings dispersion at the lower income deciles

New findings and key lessons

What's new?

1. Income risks are more persistent for certain groups;
2. Risk equalizing effect of government insurance;
3. Within-country evidence of crowding-out effect of government insurance;

Key lessons and recommendations:

1. Institutional structure may explain the cross-country differences;
2. Risk gap and welfare effect of redistribution;
3. Persistent risks suggest the importance of government insurance, but *what explains the persistence of risks*?
4. Government insurance may crowd out family insurance;
5. More realistic shock properties in models can offer new insights.

New findings and key lessons

What's new?

1. Income risks are more persistent for certain groups;
2. Risk equalizing effect of government insurance;
3. Within-country evidence of crowding-out effect of government insurance;

Key lessons and recommendations:

1. Institutional structure may explain the cross-country differences;
2. Risk gap and welfare effect of redistribution;
3. Persistent risks suggest the importance of government insurance, but *what explains the persistence of risks*?
4. Government insurance may crowd out family insurance;
5. More realistic shock properties in models can offer new insights.

Summary statistics of primary earners in 2001

Primary Earner		N	Mean	Median	SD	Min	Max
Age	Individual	3,872	40.82	40	9.73	25	64
	Family	3,872	-	-	-	-	-
Weekly hours	Individual	3,872	40.09	40	13.09	0	120
	Family	3,872	53.01	47	32.39	0	201
Weekly wage	Individual	3,872	1,292.20	1,144.11	833.72	0.00	14,189.97
	Family	3,872	1,854.35	1,629.21	1,195.40	0.00	14,189.97
Labour Income	Individual	3,872	66,296.91	59,623.97	47,176.12	0.00	915,285.31
	Family	3,872	96,419.84	84,933.90	65,805.50	0.00	915,285.31
Market income	Individual	3,872	68,764.74	61,171.57	48,541.73	-53,391.64	916,353.19
	Family	3,872	103,635.25	91,527.77	73,219.05	-28,221.30	1.51e+06
Private transfer	Individual	3,872	414.57	0.00	2,450.85	0.00	36,611.41
	Family	3,872	605.10	0.00	3,016.12	0.00	44,543.89
Total income tax	Individual	3,872	16,818.29	12,684.33	18,900.91	-3,252.31	391,345.50
	Family	3,872	23,958.07	17,950.27	26,017.05	-8,808.10	637,691.50
Public transfer	Individual	3,872	2,366.43	0.00	5,257.32	0.00	47,440.77
	Family	3,872	5,276.89	0.00	8,855.15	0.00	69,825.59

Table 1: Summary statistics of primary earners in 2001. Note that, the values of income, tax liabilities and transfers are expressed in 2018 AUD.

Summary statistics of primary earners in 2020

Primary Earner		N	Mean	Median	SD	Min	Max
Age	Individual	5,064	41.62	40	11.42	25	64
	Family	5,064	-	-	-	-	-
Weekly hours	Individual	5,064	38.39	40	12.17	0	137
	Family	5,064	53.17	48	30.83	0	227
Weekly wage	Individual	5,064	1,602.68	1,407.68	994.18	0.00	13,106.03
	Family	5,064	2,366.64	2,135.80	1,479.03	0.00	15,752.48
Labour Income	Individual	5,064	85,855.68	75,723.73	56,891.76	0.00	970,817.13
	Family	5,064	129,099.10	114,556.42	85,839.93	0.00	1.13e+06
Market income	Individual	5,064	88,836.96	77,665.37	60,488.81	-42,502.38	970,817.13
	Family	5,064	139,555.66	121,949.19	102,986.36	-42,016.96	2.74e+06
Private transfer	Individual	5,064	446.73	0.00	3,197.68	0.00	132,911.66
	Family	5,064	809.84	0.00	5,273.85	0.00	168,922.17
Total income tax	Individual	5,064	20,926.39	15,641.81	23,154.97	-2,259.09	413,873.91
	Family	5,064	31,058.35	23,178.26	37,202.65	-7,960.70	1.16e+06
Public transfer	Individual	5,064	2,133.53	0.00	5,764.68	0.00	72,231.70
	Family	5,064	5,205.20	0.00	10,679.92	0.00	97,191.41

Table 2: Summary statistics of primary earners in 2020. Note that, the values of income, tax liabilities and transfers are expressed in 2018 AUD.

Derive moments of shocks: Non-parametric approach

Purge age and time effects:

$$\log income_{i,t} = age_{i,t} + age_{i,t}^2 + year_t + \mu_{i,t} \tag{1}$$

Calculate the nth-order differences of $\hat{\mu}_{i,t}$:

$$\Delta^n_{\hat{\mu}_{i,t}} = \hat{\mu}_{i,t} - \hat{\mu}_{i,t-n} \tag{2}$$

Group the residual shocks $\Delta^n_{\hat{\mu}_{i,t}}$ by (i) *age* and (ii) *past income decile*.

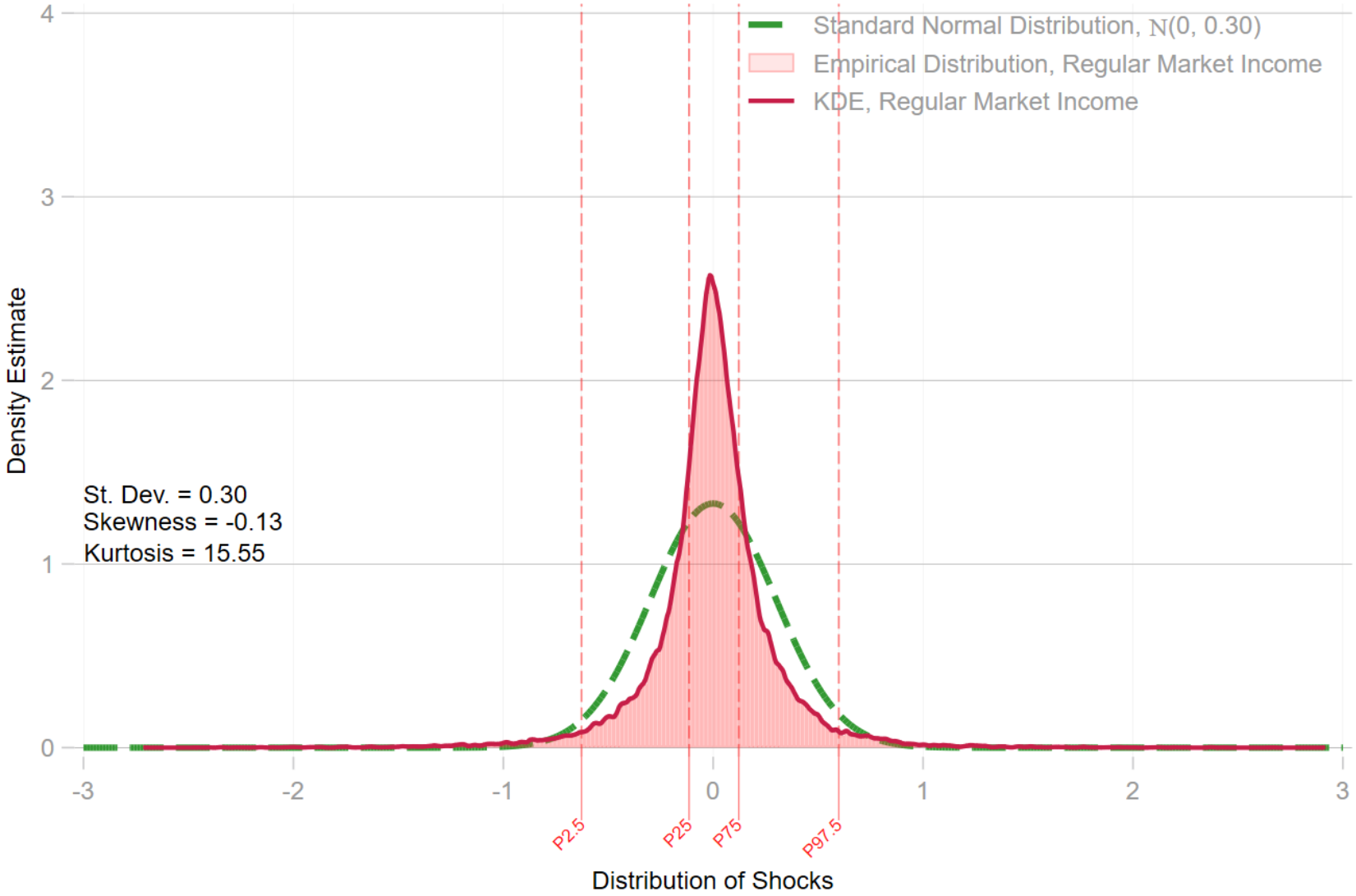
Calculate moments of the shock distributions for each group:

$$\tilde{\mu}^k_{\Delta y} = \frac{E\left[(\Delta y - \mu_{\Delta y})^k\right]}{\sigma^k} \tag{3}$$

where $\tilde{\mu}^k_{\Delta y}$:= the kth standardized moment of y shocks (*k^{th}-order risks*).

See derivation of shock moments via parametric approach in the appendix.

Empirical distribution of 3-year average residual earnings shocks



Back to Introduction

Summary of analytical framework

Summary of analytical framework:

1. Calculate moments of distributions of residual income changes (*risks*);
2. Decompose the moment estimates to study sources of risks (See appendix);
3. Examine the degree of insurance by family and government.

Decomposition: Dispersion of shocks

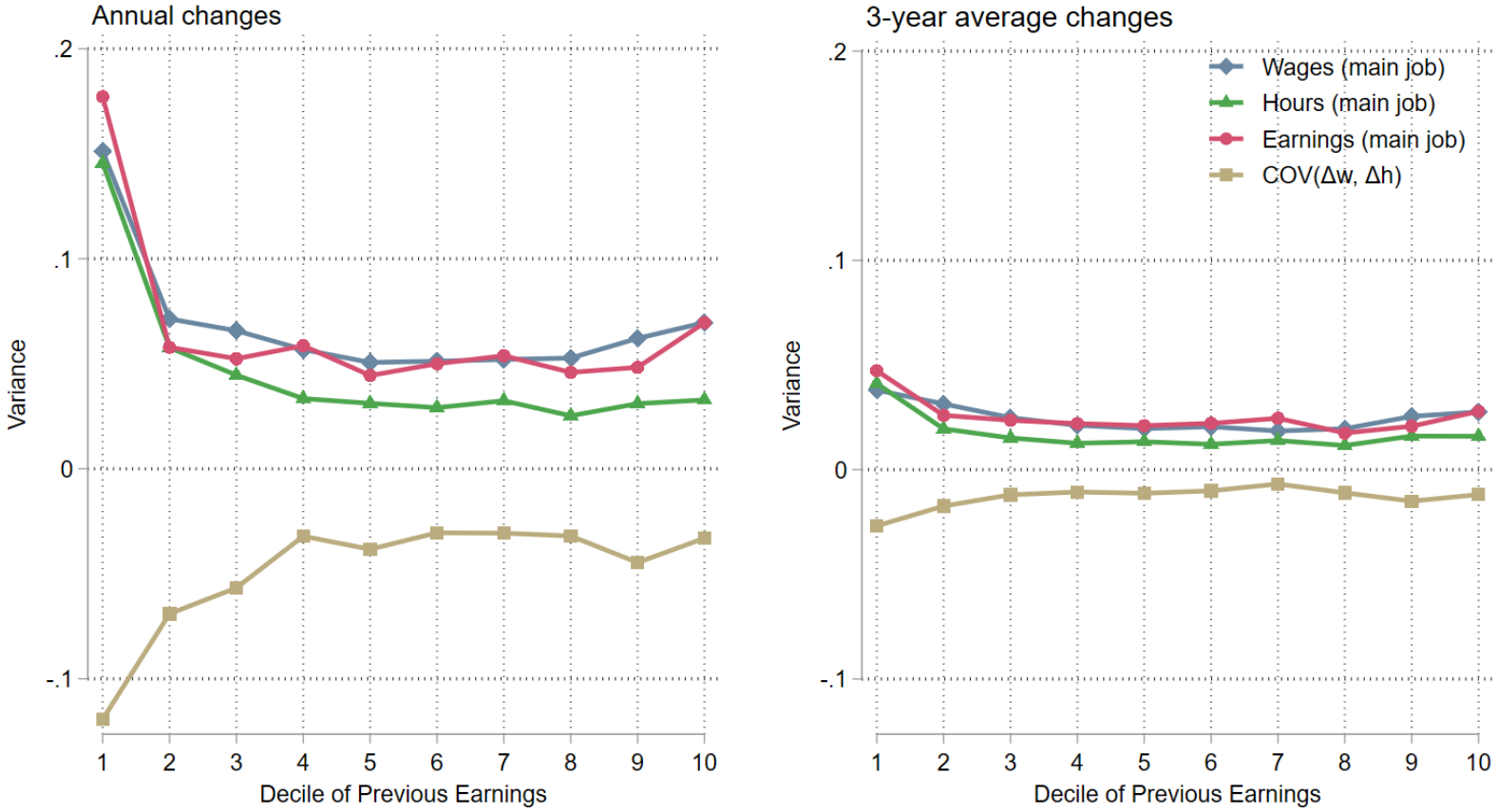


Figure: Variances of annual and 3-year average changes in usual weekly earnings, wages, and hours of primary earners

See derivation of decomposition formulae in the appendix.

Decomposition: Skewness and Kurtosis of shocks

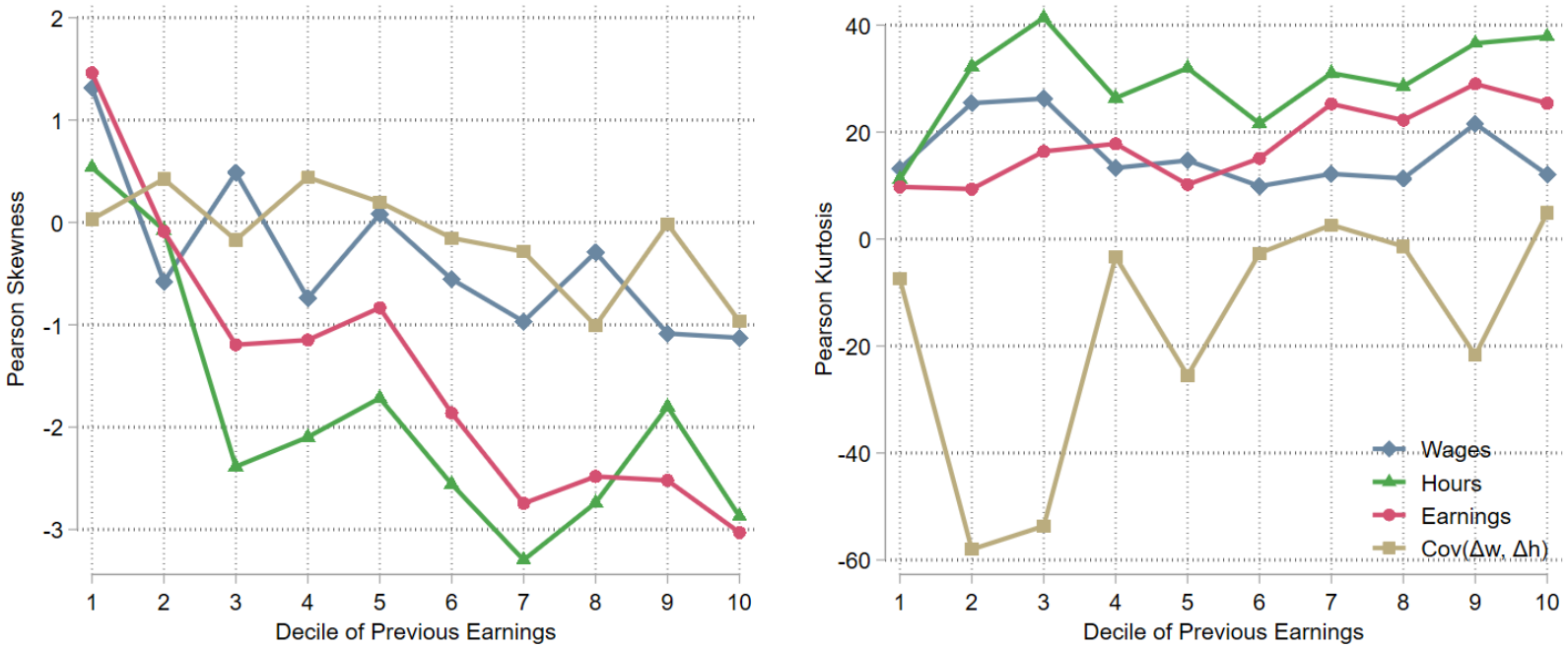


Figure: Pearson Skewness and Pearson Kurtosis of annual average changes in usual weekly earnings, wages, and hours of main job of primary earners (at least 18 years of employment)

See derivation of decomposition formulae in the appendix.

Wage and Hour changes vs. Earnings changes

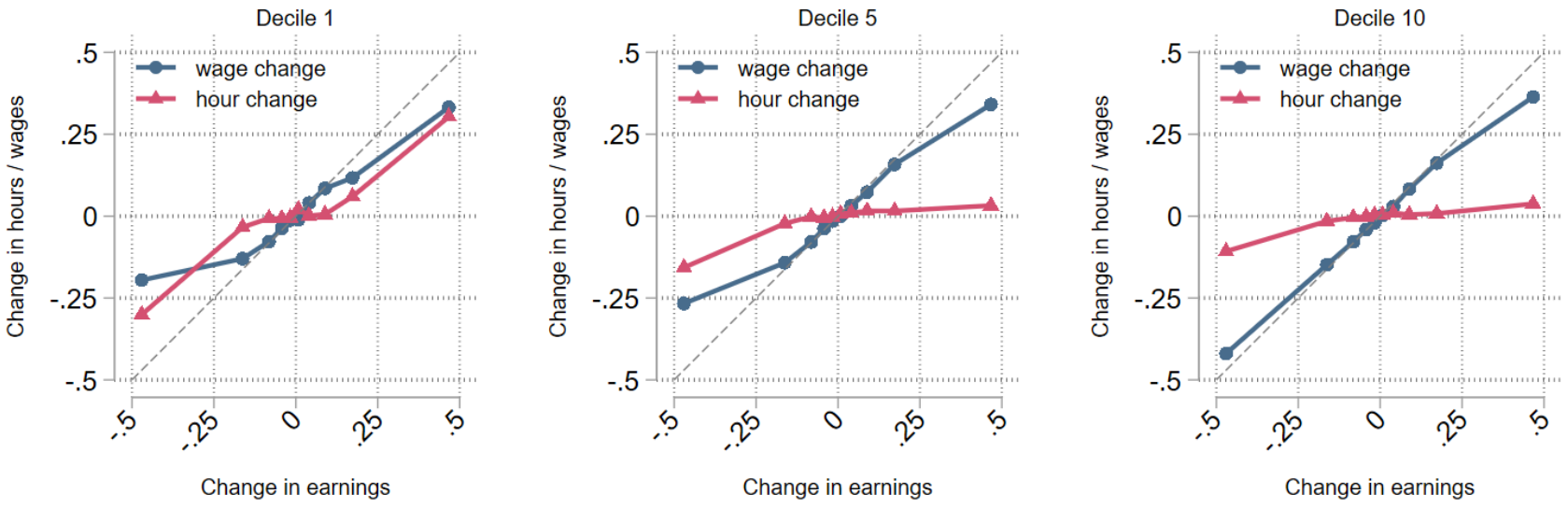


Figure: Annual changes in residual weekly wages and hours versus decile of annual changes in residual usual weekly earnings for primary earners in the 1st, 5th, and 9th deciles of past usual weekly earnings

See corresponding 3-year average change statistics in the appendix.

Family insurance against 2nd-order risk

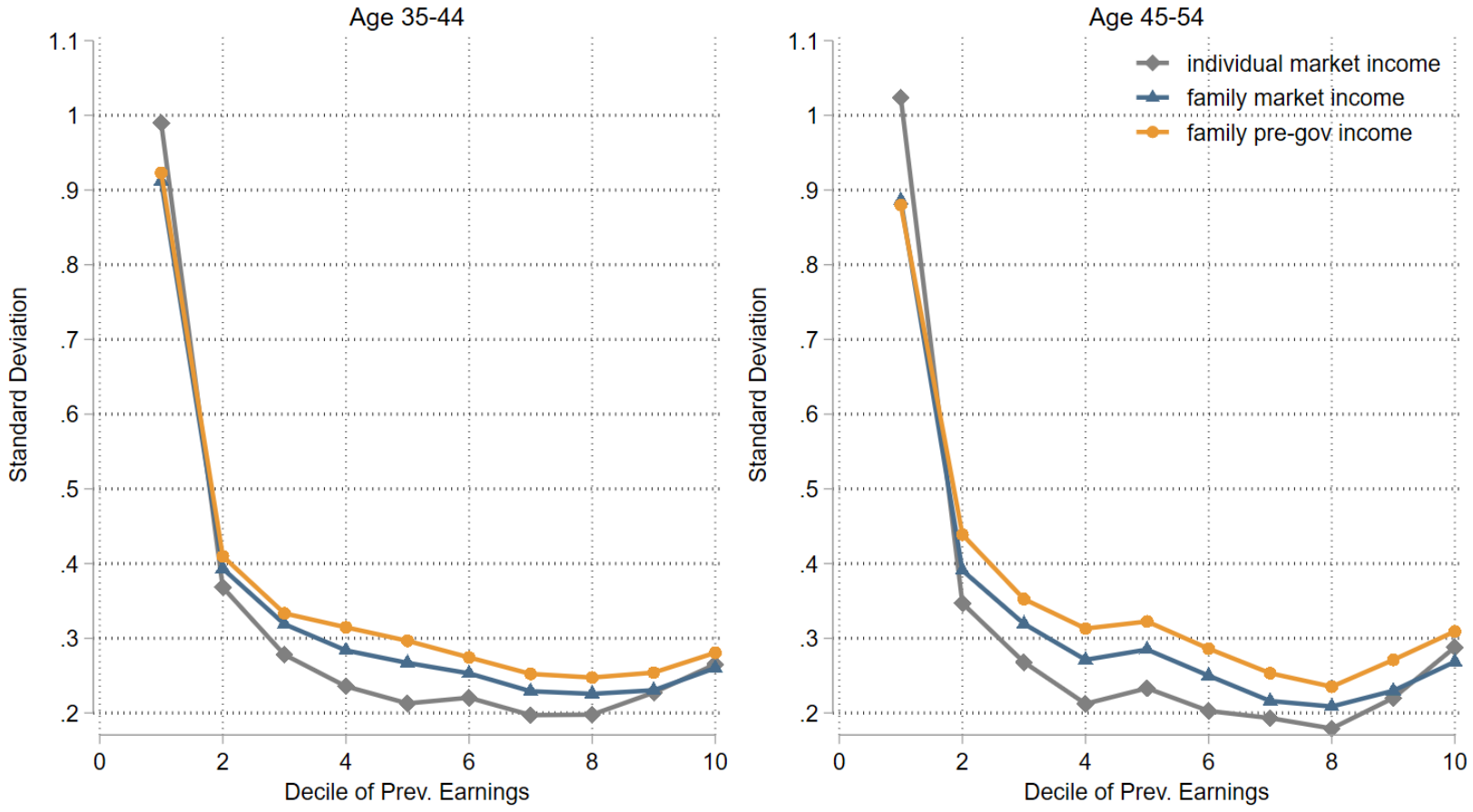


Figure: Standard deviation of the distribution of annual changes of family income (P1-P99) at different levels.

See a more detailed figure in the appendix.

Government insurance against 2nd-order risk

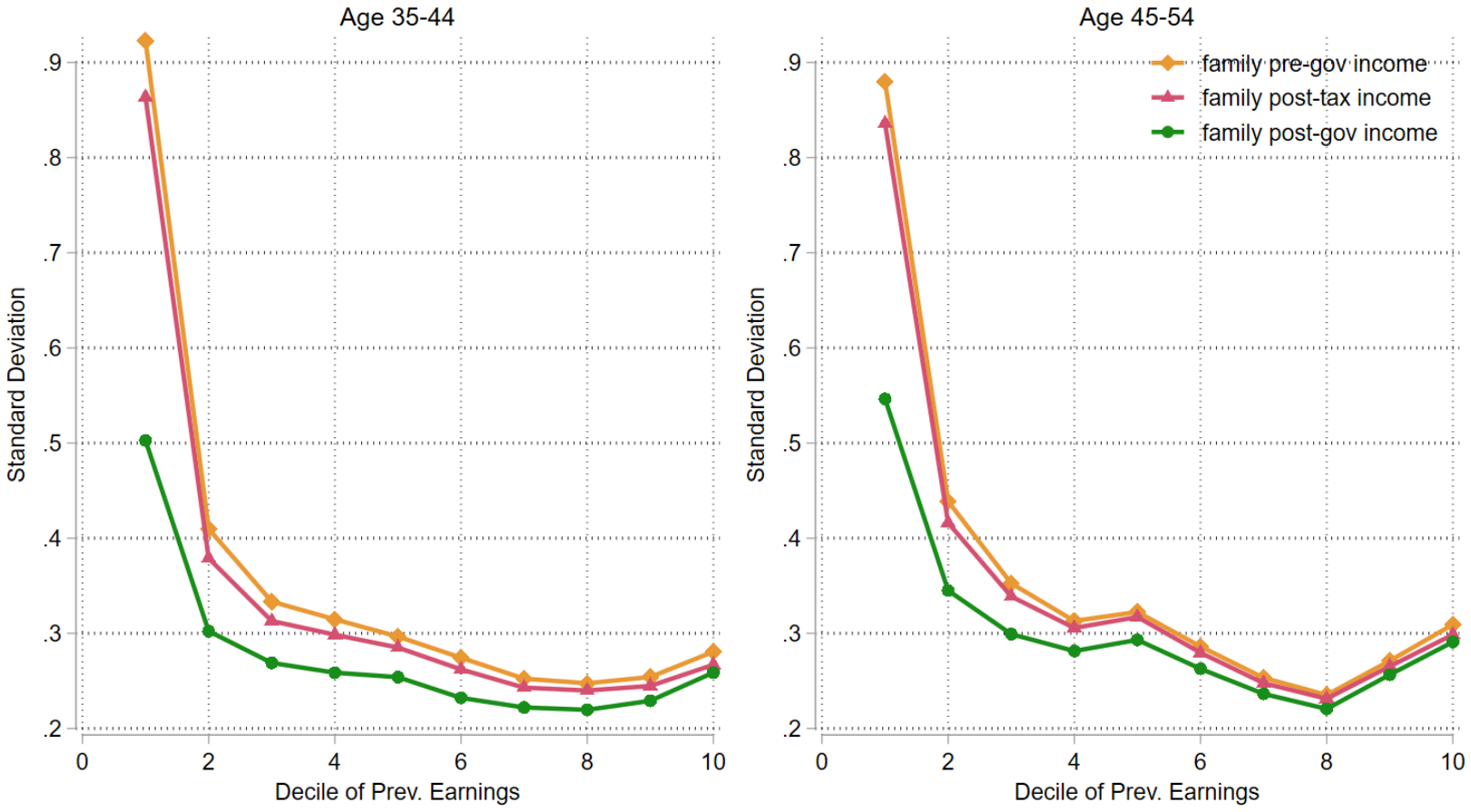


Figure: Standard deviation of the distribution of annual changes of post-tax and disposable (or post-government) family income (P1-P99) at different levels.

See a more detailed figure in the appendix.

Family insurance against 3rd- and 4th-order risks

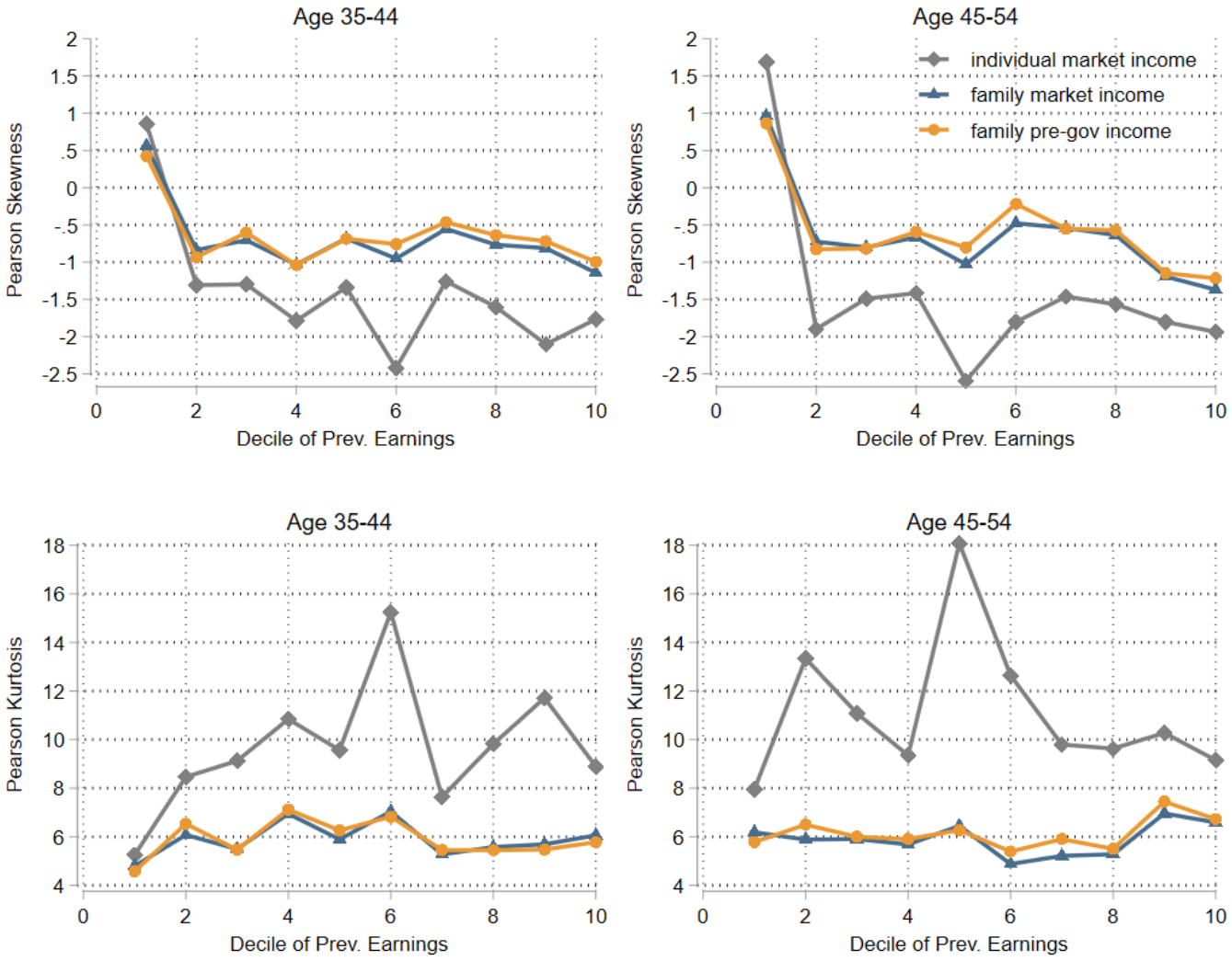


Figure: Standardized Skewness (top) and Kurtosis (bottom) of the distribution of annual changes of family income (P1-P99) at different levels.

Government insurance against 3rd- and 4th-order risks

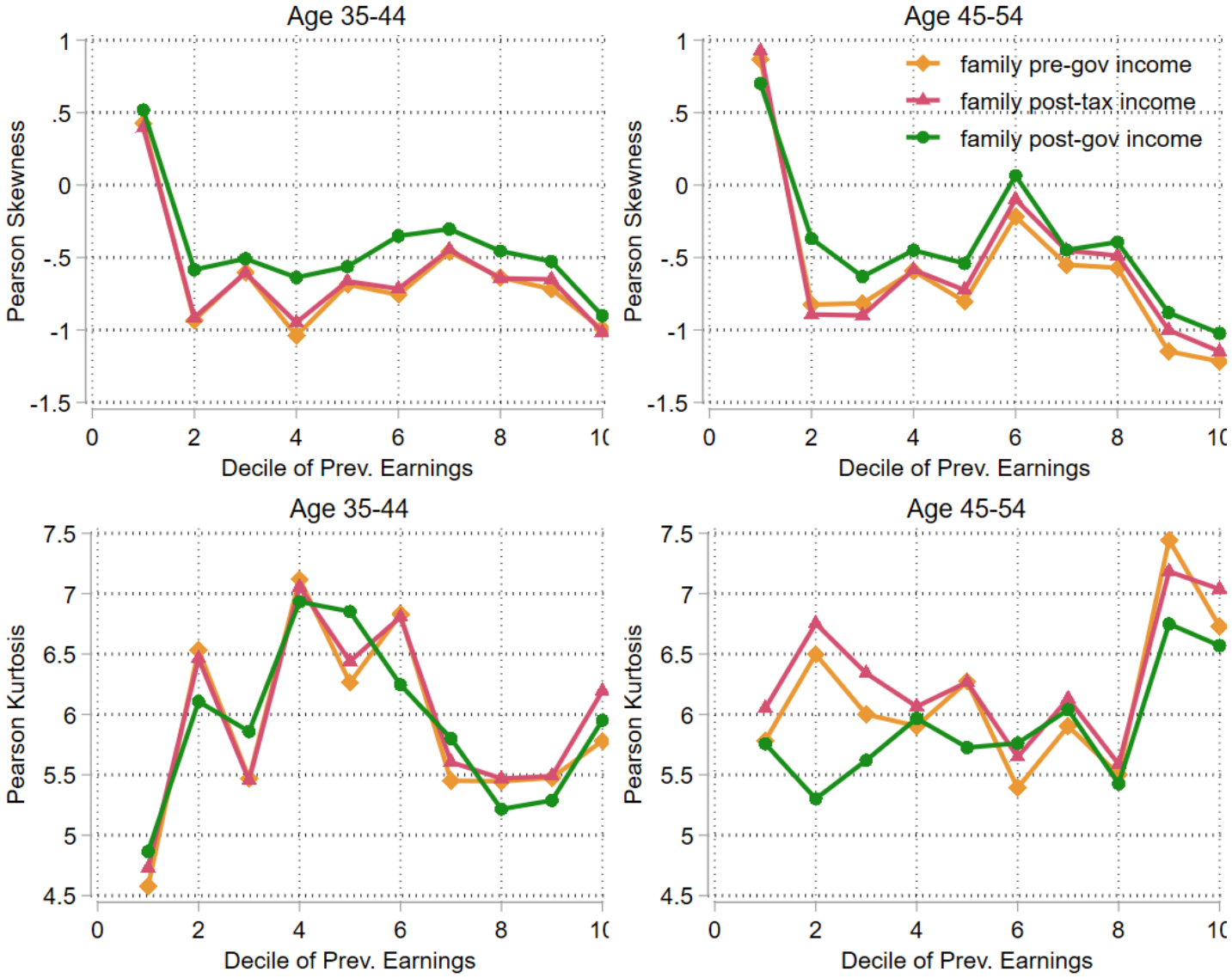


Figure: Standardized Skewness (top) and Kurtosis (bottom) of the distribution of annual changes of post-tax and disposable (or post-government) family income (P1-P99) at different levels.

Insurance against *transitory* shocks: Male vs. Female

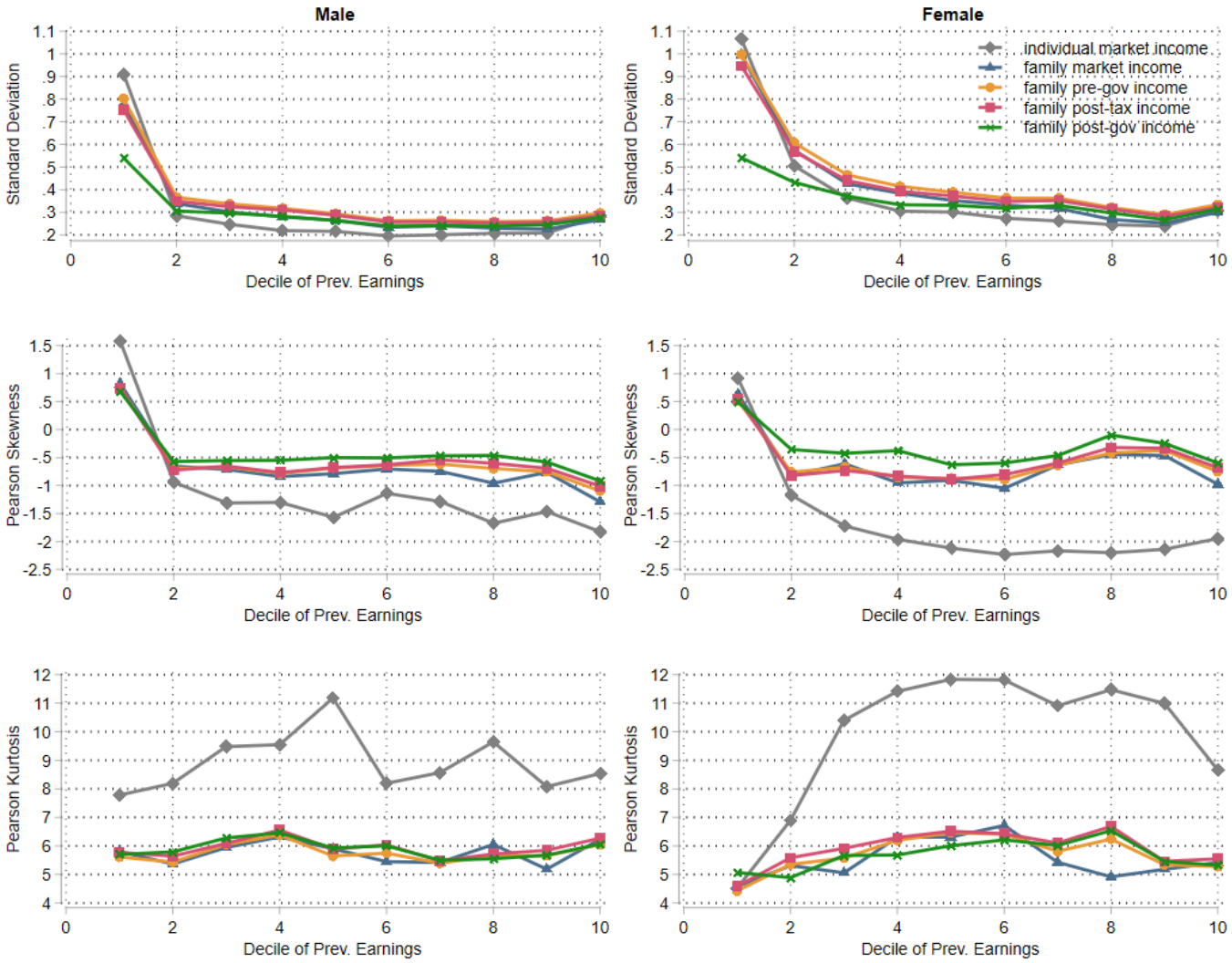


Figure: Moment properties of the distributions of annual income shocks of male (left panel) and female (right panel) primary earners (P1-P99 Pearson statistics).

Insurance against *persistent* shocks: Male vs. Female

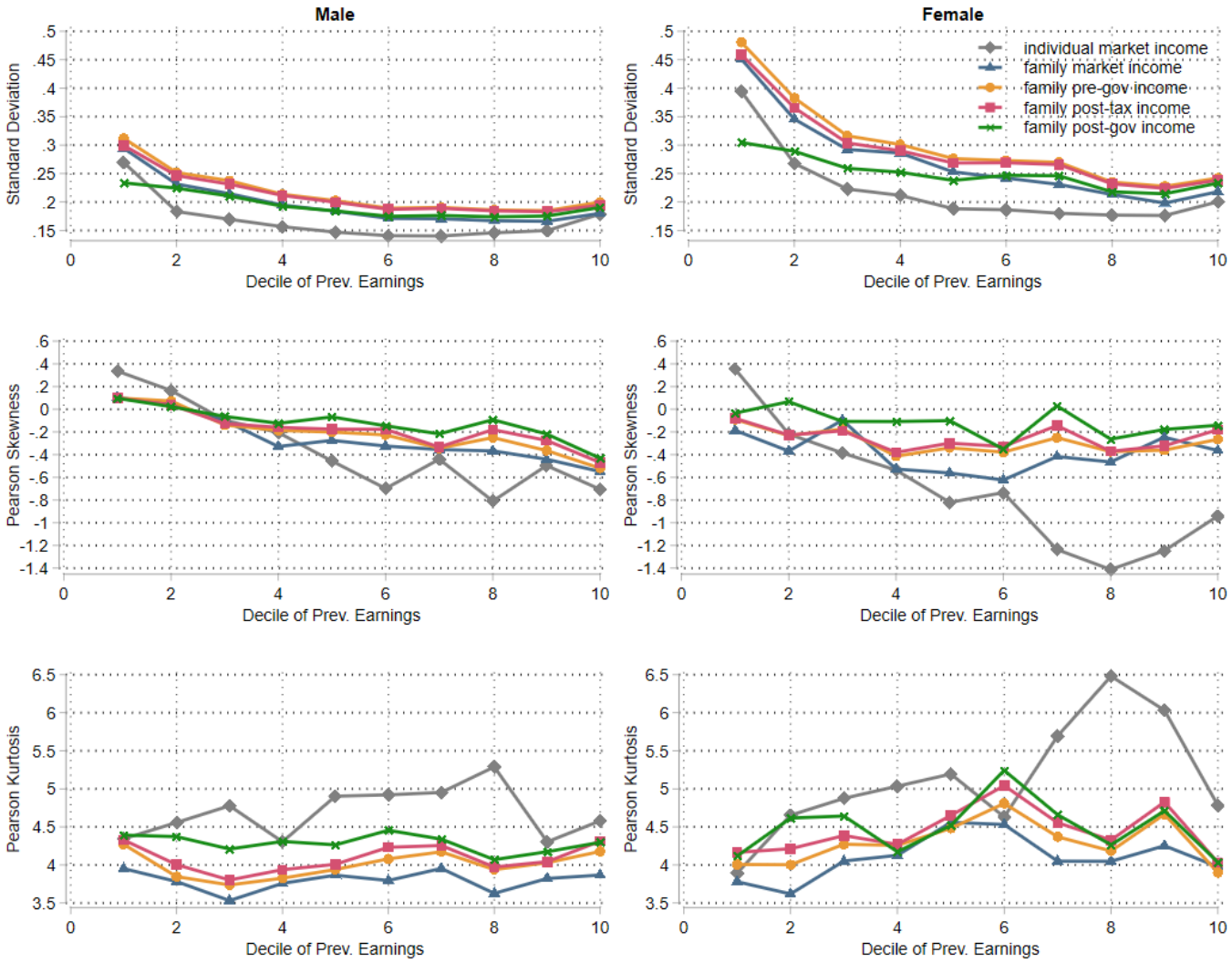


Figure: Moment properties of the distributions of 3-year average income shocks of male (left panel) and female (right panel) primary earners (P1-P99 Pearson statistics)

Spousal response vs Public transfer

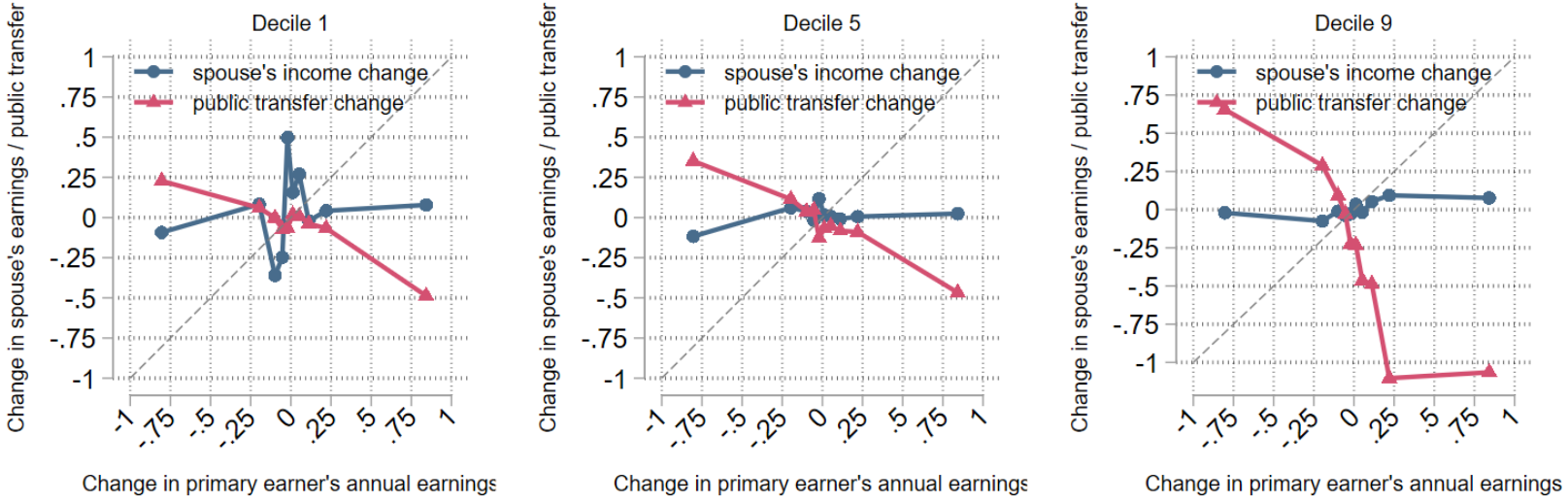


Figure: Annual changes in spousal earnings and public transfers versus decile of annual changes in past market earnings of primary earners in the 1st, 5th, and 9th deciles of past regular market income.

See a more detailed figure in the appendix.

Insurance against *transitory* shocks: Partnered vs. Lone parents

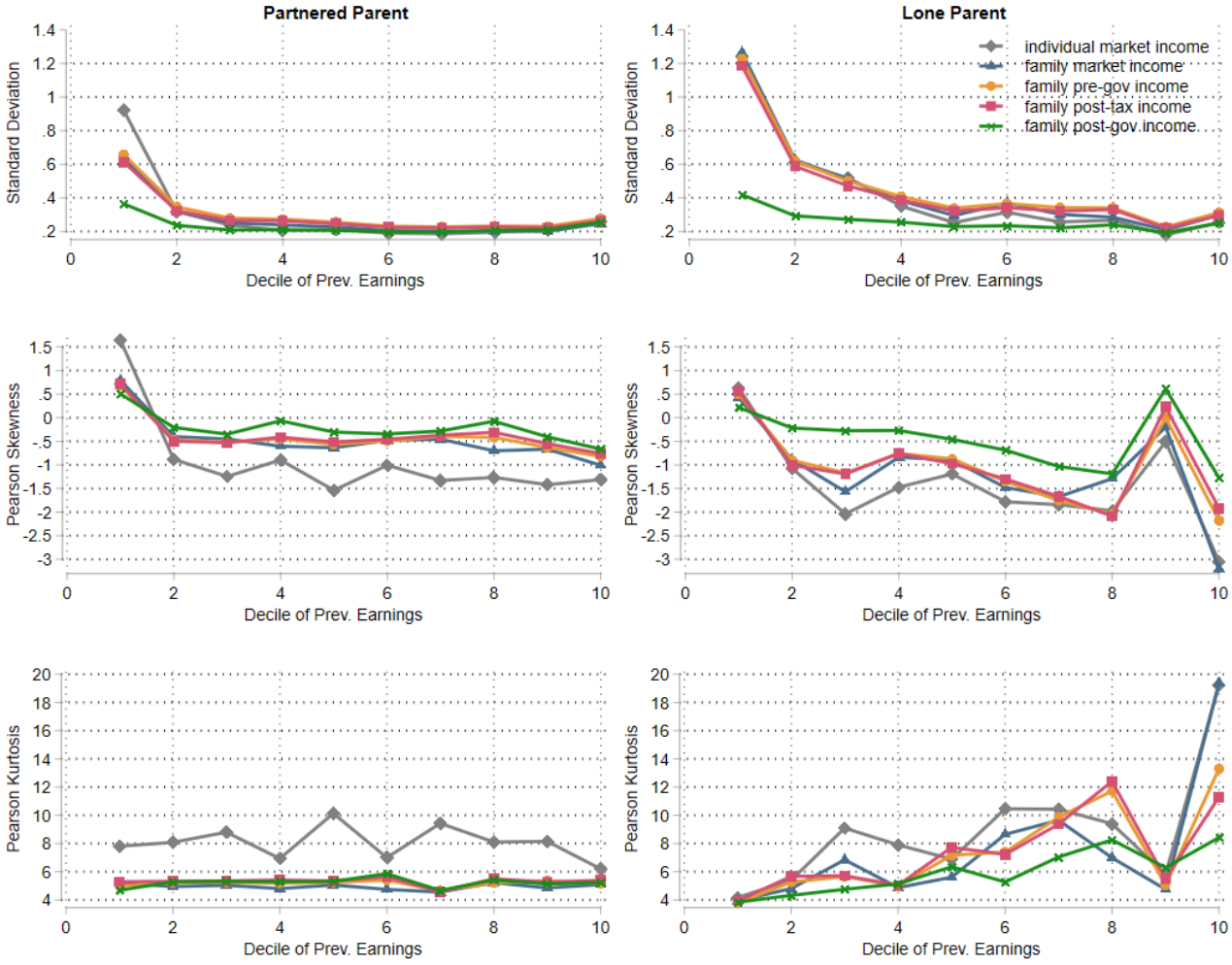


Figure: Moment properties of the distributions of annual income shocks of partnered (left panel) and lone (right panel) parents (P1-P99 pearson statistics)

Concluding remarks

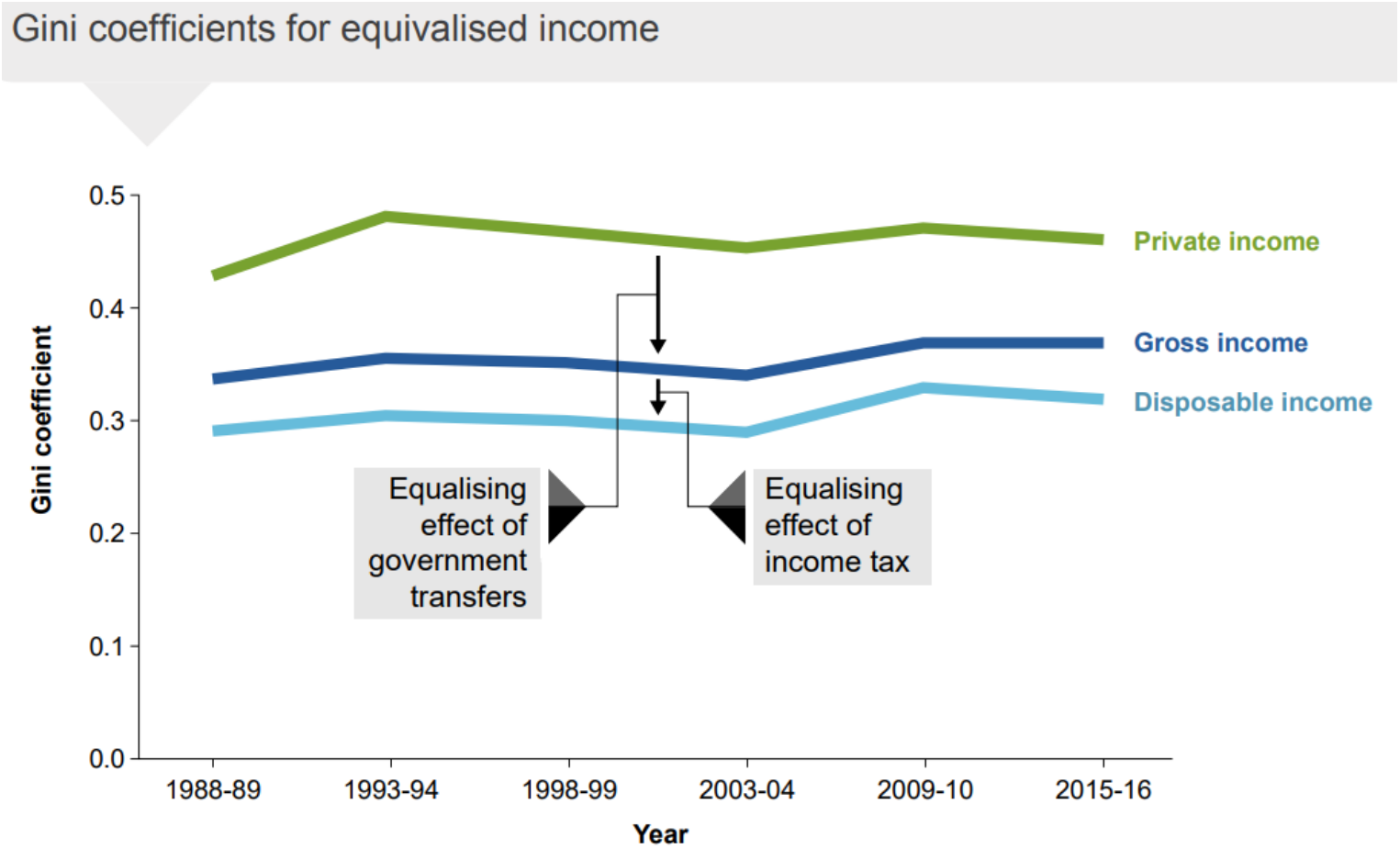
Our findings on the dynamics of income suggest:

1. Similar earnings dynamics in Australia as in other OECD countries;
2. Some differences with regards to the sources of risks and insurance;
3. Understanding earnings risks and insurance against risks is crucial for designing optimal tax and transfer policies.

Future work:

1. Topics: retirees and age pension; consumption risk;
2. Data: Administrative data
3. Modelling: Mapping microdata to macroeconomic model

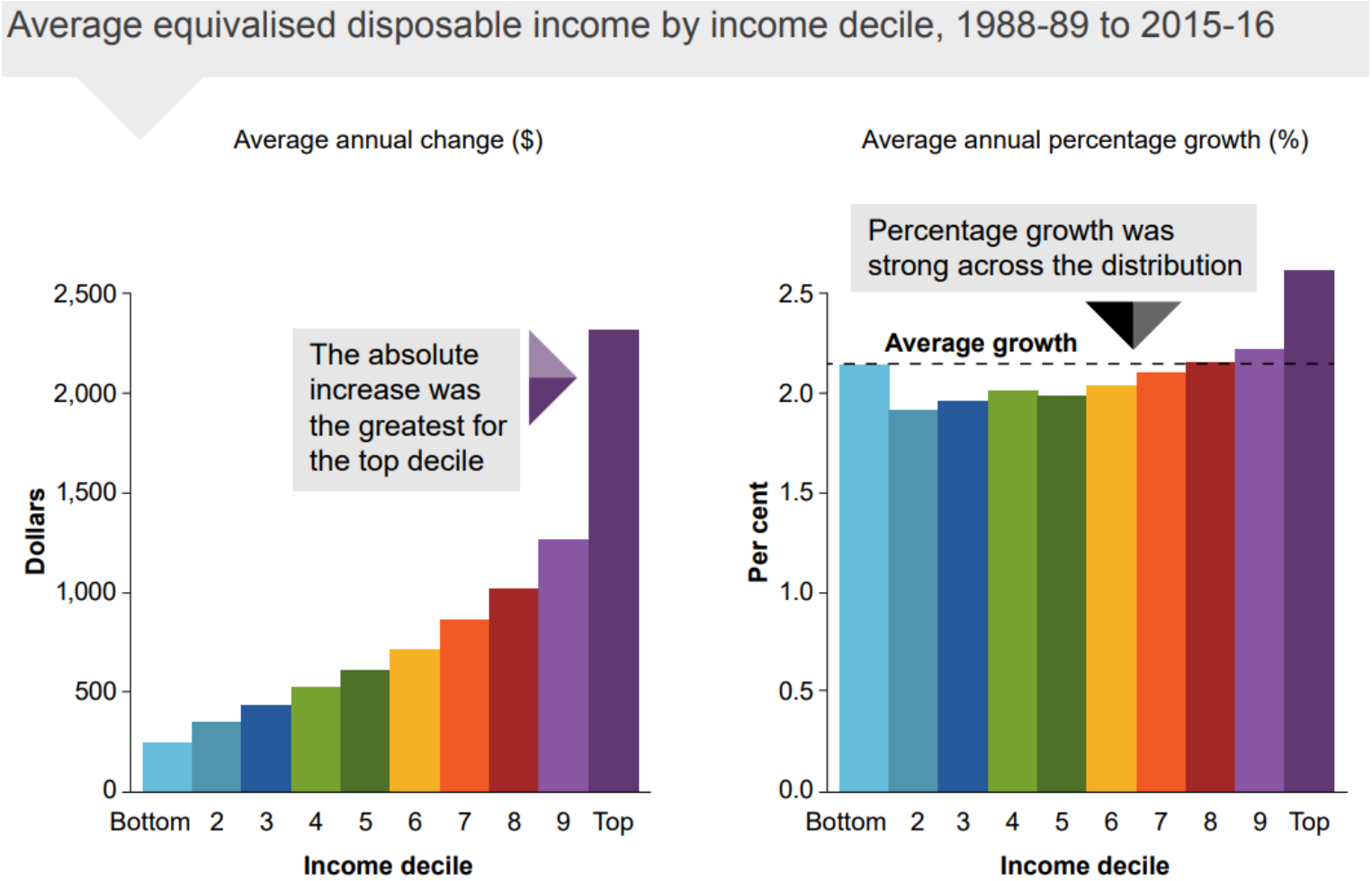
Appendix: Inequality and the role of government in Australia



Data: ABS (Microdata: Household Expenditure, Income and Housing, 2015-16, Cat. no. 6540.0, released 25/10/17) and ABS HES Basic confidentialised unit record files for years 1988-89 through 2009-10 as available at 25/10/17. **Source**: *Rising Inequality? A stocktake of the evidence (Productivity Commission, 2018).*

See appendix for comparison between average annual income growth figures computed using (i) static distributions by PC, and (ii) our method.

Appendix: Average disposable income growth (*PC*)



Data: ABS (Microdata: Household Expenditure, Income and Housing, 2015-16, Cat. no. 6540.0, released 25/10/17) and ABS HES Basic confidentialised unit record file for 1988-89 as available at 25/10/17.

Source: *Rising inequality? A stocktake of the evidence (Productivity Commission, 2018).*

Appendix: Average annual growth of residual income by decile using equation 1

Income Decile	N	Individual Labour Income	Individual Market Income	Household Pre-gov't Income	Household Disposable Income
1	10,965	58.64%	56.27%	29.11%	16.23%
2	10,964	5.86%	5.97%	4.17%	0.22%
3	10,950	-0.88%	-0.24%	2.54%	-0.01%
4	10,940	-3.20%	-3.20%	-0.56%	-1.42%
5	10,982	-4.45%	-4.03%	-1.73%	1.00%
6	10,930	-4.86%	-4.82%	-2.49%	-1.85%
7	10,950	-4.51%	-4.79%	-2.31%	-1.90%
8	10,947	-4.17%	-4.84%	-3.95%	-1.89%
9	10,953	-5.39%	-6.17%	-3.60%	-2.82%
10	10,948	-7.80%	-10.00%	-7.16%	-5.83%

Table 3: Average Annual Residual Income Growth (2001-2020) of Employees. The growth statistics shown are for employees (not self-employed) age 25-64. The residual changes are obtained from controlling for time and age effects (see equation 1). The figures account for cross-decile mobility over time.

Appendix: Derive moments of shocks via parametric approach (1)

Consider a parsimonious model for the residual income in equation 1:

$$\hat{\mu}_{i,t} = z_{i,t} + \epsilon_{i,t} \tag{4}$$

$$z_{i,t} = z_{i,t-1} + \eta_{i,t} \tag{5}$$

where $\eta_{i,t}$ and $\epsilon_{i,t}$ are drawn from some distributions $F_\eta \sim (0, \sigma_\eta^2)$ and $F_\epsilon \sim (0, \sigma_\epsilon^2)$, respectively.

The n-year growth of $\hat{\mu}_{i,t}$ is thus:

$$\Delta^n_{\hat{\mu}_{i,t}} = \hat{\mu}_{i,t} - \hat{\mu}_{i,t-n} \tag{6}$$

$$= \sum_{j=t-n+1}^{t} \eta_{i,j} + \epsilon_{i,t} - \epsilon_{i,t-n} \tag{7}$$

Appendix: Derive moments of shocks via parametric approach (2)

Given the parametric model 7, the higher-order moments of the distribution of $\Delta^n_{\hat{\mu}_{i,t}}$ are:

$$\sigma^2_{\Delta^n_{\hat{\mu}_{i,t}}} = n\sigma^2_\eta + 2\sigma^2_\epsilon \tag{8}$$

$$S^n_{\Delta\hat{\mu}_{i,t}} = \frac{n \times \sigma^3_\eta}{(n\sigma^2_\eta + 2\sigma^2_\epsilon)^{\frac{3}{2}}} S_\eta \tag{9}$$

$$K^n_{\Delta\hat{\mu}_{i,t}} = \frac{n \times \sigma^4_\eta}{(n\sigma^2_\eta + 2\sigma^2_\epsilon)^2} K_\eta + \frac{2 \times \sigma^4_\epsilon}{(n\sigma^2_\eta + 2\sigma^2_\epsilon)^2} K_\epsilon \tag{10}$$

Assuming $N_\eta \sim (0, \sigma^2_\eta)$ and $N_\epsilon \sim (0, \sigma^2_\epsilon)$, we can estimate σ_η and σ_ϵ (as in *Chatterjee et al. (2016)*) and work out the three moment statistics.

Back to Methodology

Appendix: Additional consideration

We use quantile-based measures of skewness and kurtosis for comparability with the previous studies.

$$S_{kelley} = \frac{(P_{90} - P_{50}) - (P_{50} - P_{10})}{P_{90} - P_{10}} \tag{11}$$

$$K_{crow-siddiqui} = \frac{P_{97.5} - P_{2.5}}{P_{75} - P_{25}} \tag{12}$$

We consider robust moment statistics: *P1-P99*, *P5-P95*, and *P10-P90*.

Alternatively, using Arc-Percent Change method yields similar results.

Appendix: Decompose earnings shocks (1)

We have:

$$y_{i,t} = w_{i,t} \times h_{i,t} \tag{13}$$

$$\implies \frac{\%\Delta y_{i,t}}{dt} = \frac{\%\Delta w_{i,t}}{dt} + \frac{\%\Delta h_{i,t}}{dt} \tag{14}$$

which can be simplified as

$$\Delta y = \Delta w + \Delta h \tag{15}$$

Let $\tilde{\mu}_z^k := \mathbb{E}\left(\frac{z - \mu_z}{\sigma_z}\right)^k$ and $\sigma_z := \sqrt{var(z)}$ for a random variable z.

Appendix: Decompose earnings shocks (2)

Second moment:

$$\sigma^2_{\Delta y} = \sigma^2_{\Delta w} + \sigma^2_{\Delta h} - 2cov(\Delta w, \Delta h) \tag{16}$$

Third moment:

$$\begin{aligned}\tilde{\mu}^3_{\Delta y} = &\frac{1}{\sigma^3_{\Delta y}}\left[\sigma^3_{\Delta w}\tilde{\mu}^3_{\Delta w} + \sigma^3_{\Delta h}\tilde{\mu}^3_{\Delta h}\right] \\ &+ \frac{3}{\sigma^3_{\Delta y}}\left[\mathbb{E}(\Delta h - \mu_{\Delta h})^2(\Delta w - \mu_{\Delta w}) + \mathbb{E}(\Delta w - \mu_{\Delta w})^2(\Delta h - \mu_{\Delta h})\right]\end{aligned} \tag{17}$$

Fourth moment:

$$\begin{aligned}\tilde{\mu}^4_{\Delta y} = &\frac{1}{\sigma^4_{\Delta y}}\left[\sigma^4_{\Delta w}\tilde{\mu}^4_{\Delta w} + \sigma^4_{\Delta h}\tilde{\mu}^4_{\Delta h}\right] \\ &+ \frac{4}{\sigma^4_{\Delta y}}\mathbb{E}\left[(\Delta h - \mu_{\Delta h})^3(\Delta w - \mu_{\Delta w}) + (\Delta w - \mu_{\Delta w})^3(\Delta h - \mu_{\Delta h})\right] \\ &+ \frac{6}{\sigma^4_{\Delta y}}\mathbb{E}\left[(\Delta w - \mu_{\Delta w})^2(\Delta h - \mu_{\Delta h})^2\right]\end{aligned} \tag{18}$$

Back to Main Section

Appendix: Volatility of shocks by income and age

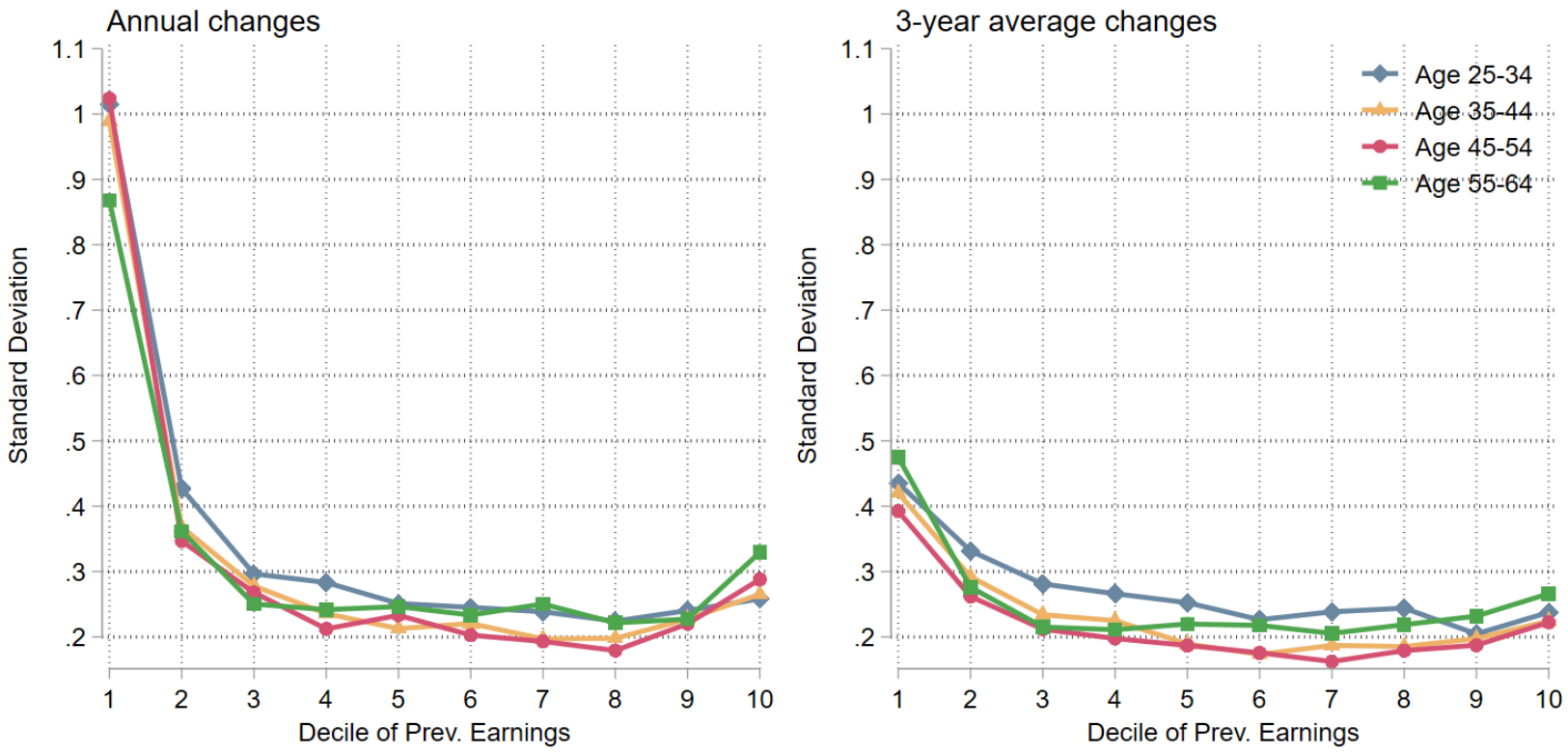


Figure: Standard deviation of the distribution of changes in regular market earnings for primary earner (P1-P99)

Appendix: Decomposition (skewness and kurtosis)

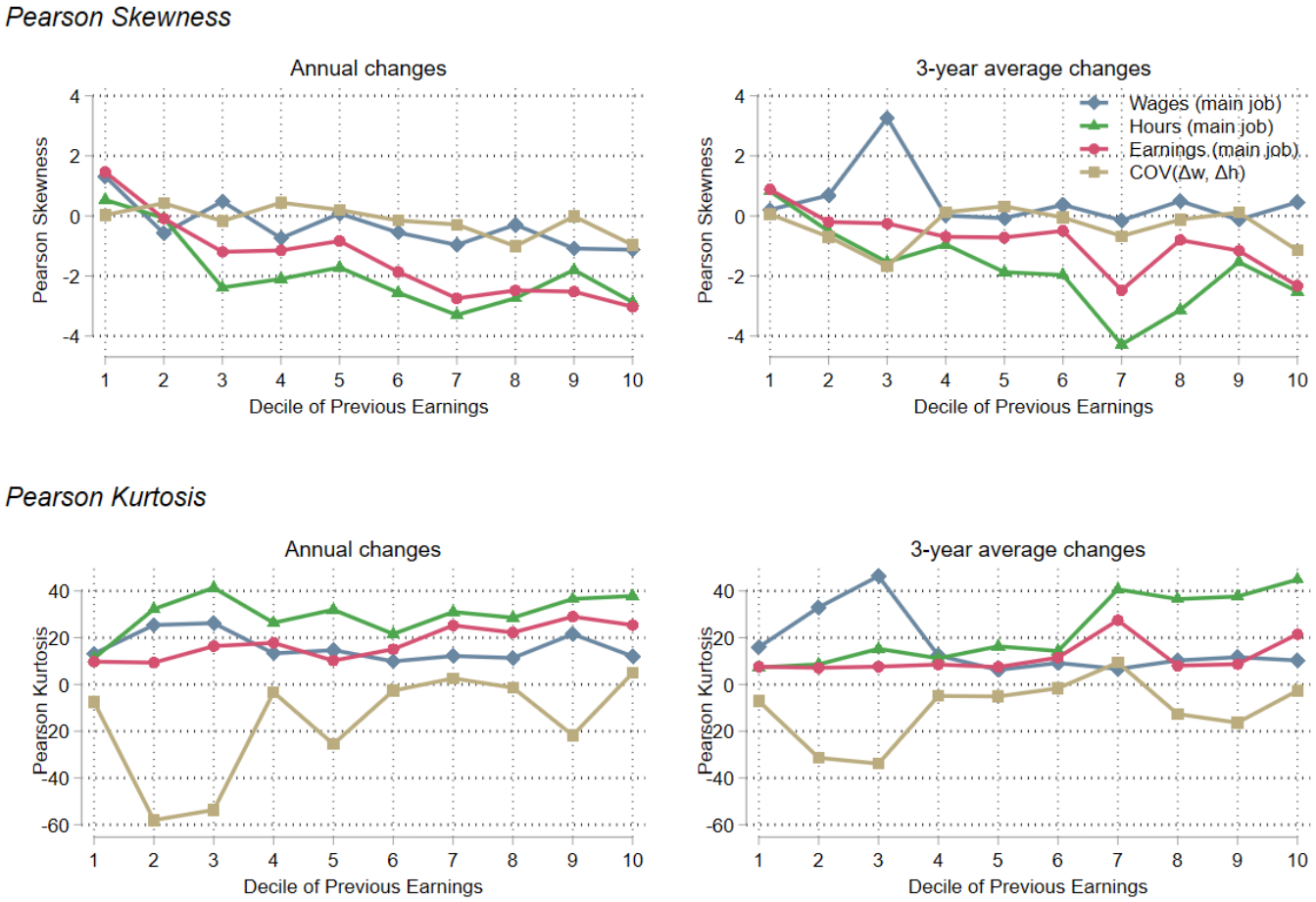


Figure: Pearson Skewness and Pearson Kurtosis of annual average and 3-year average changes in usual weekly earnings, wages, and hours of main job of primary earners (at least 18 years of employment)

Appendix: Wage and Hour changes vs. Earnings changes

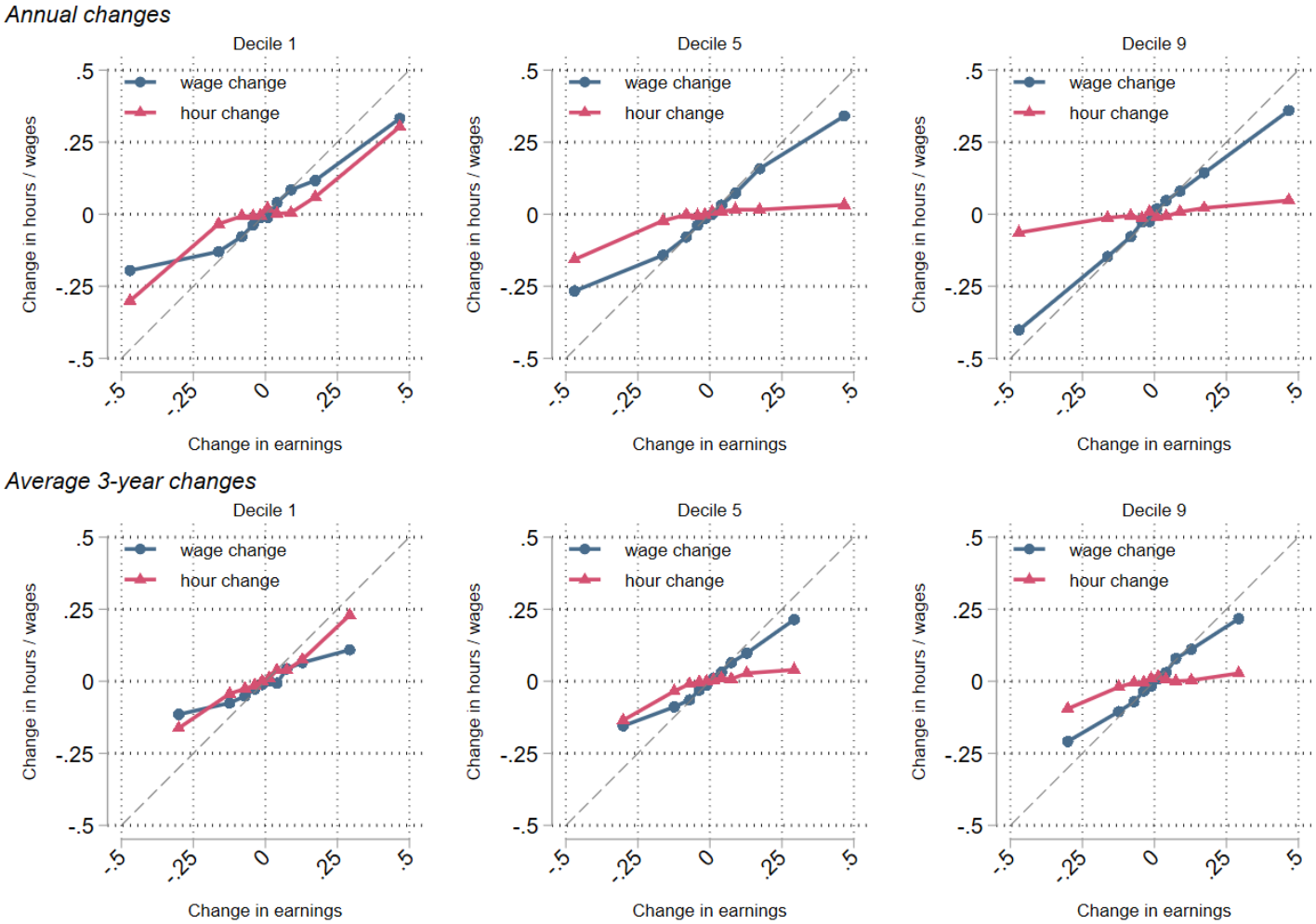


Figure: Changes in residual weekly wages and hours versus decile of changes in residual usual weekly earnings for primary earners in the 1st, 5th, and 9th deciles of past usual weekly earnings

Appendix: Family insurance against 2nd-order risk

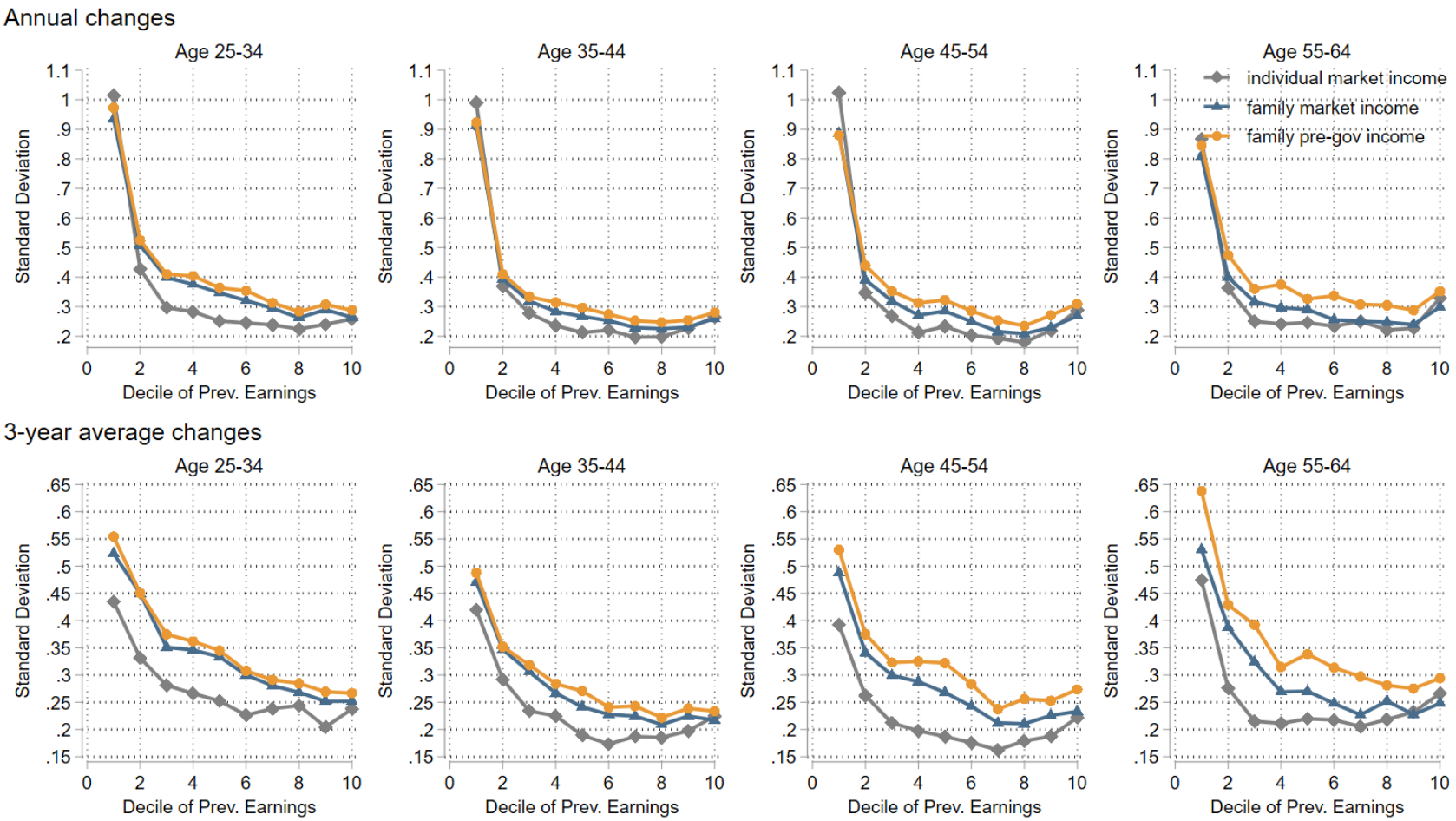


Figure: Standard deviation of the distribution of annual and 3-year average changes of family income (P1-P99) at different levels. The figure captures the relative contribution of family market income and private transfer to the second-order risk of pre-government family income.

Back to Main Section

Appendix: Family insurance against 3rd- and 4th-order risks (1)

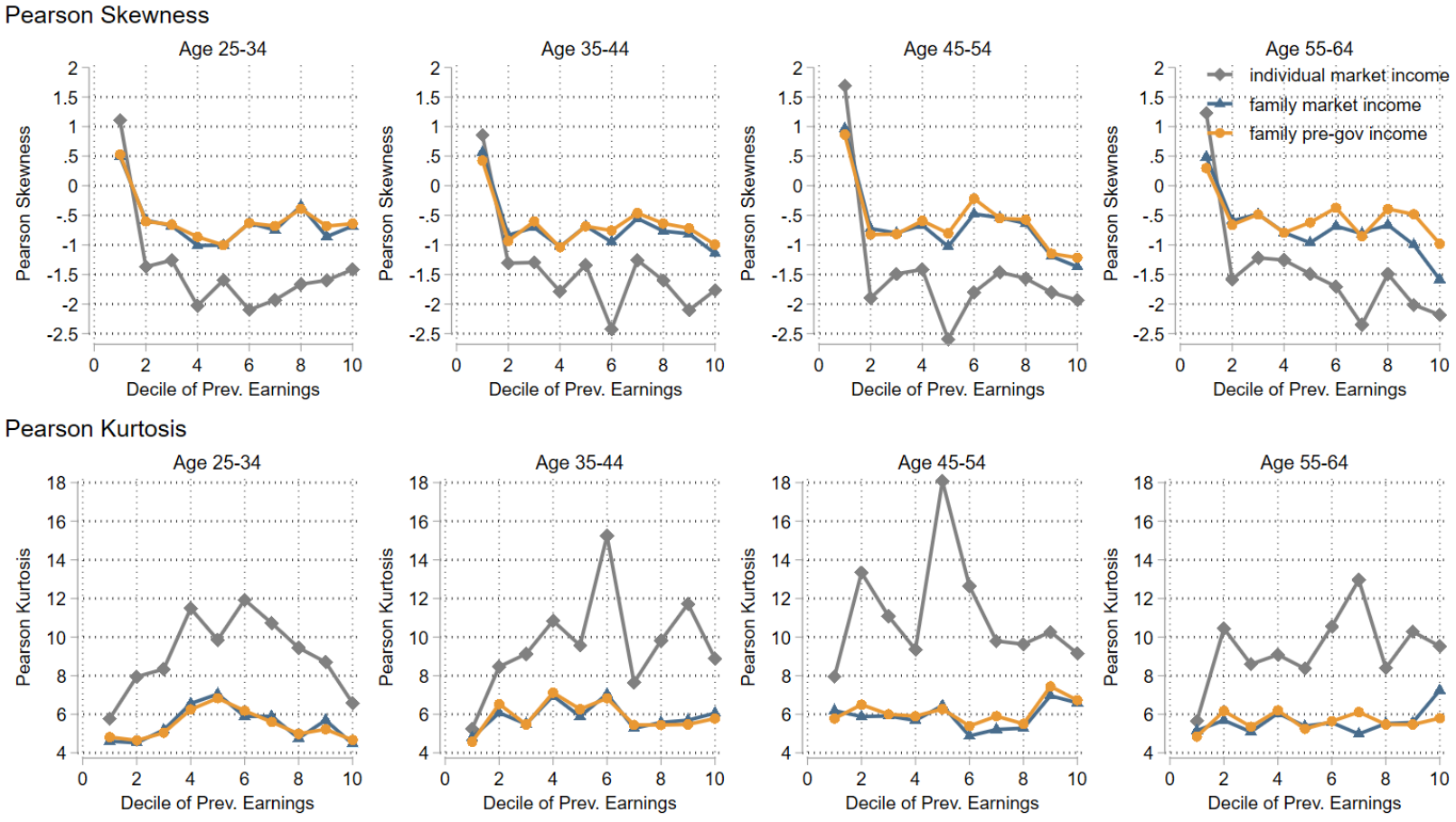


Figure: Skewness (top) and Kurtosis (bottom) of the distribution of annual changes of family income (P1-P99) at different levels. The figure captures the relative contribution of family market income and private transfer to the third- and fourth-order risks of pre-government family income.

Appendix: Family insurance against 3rd- and 4th-order risks (2)

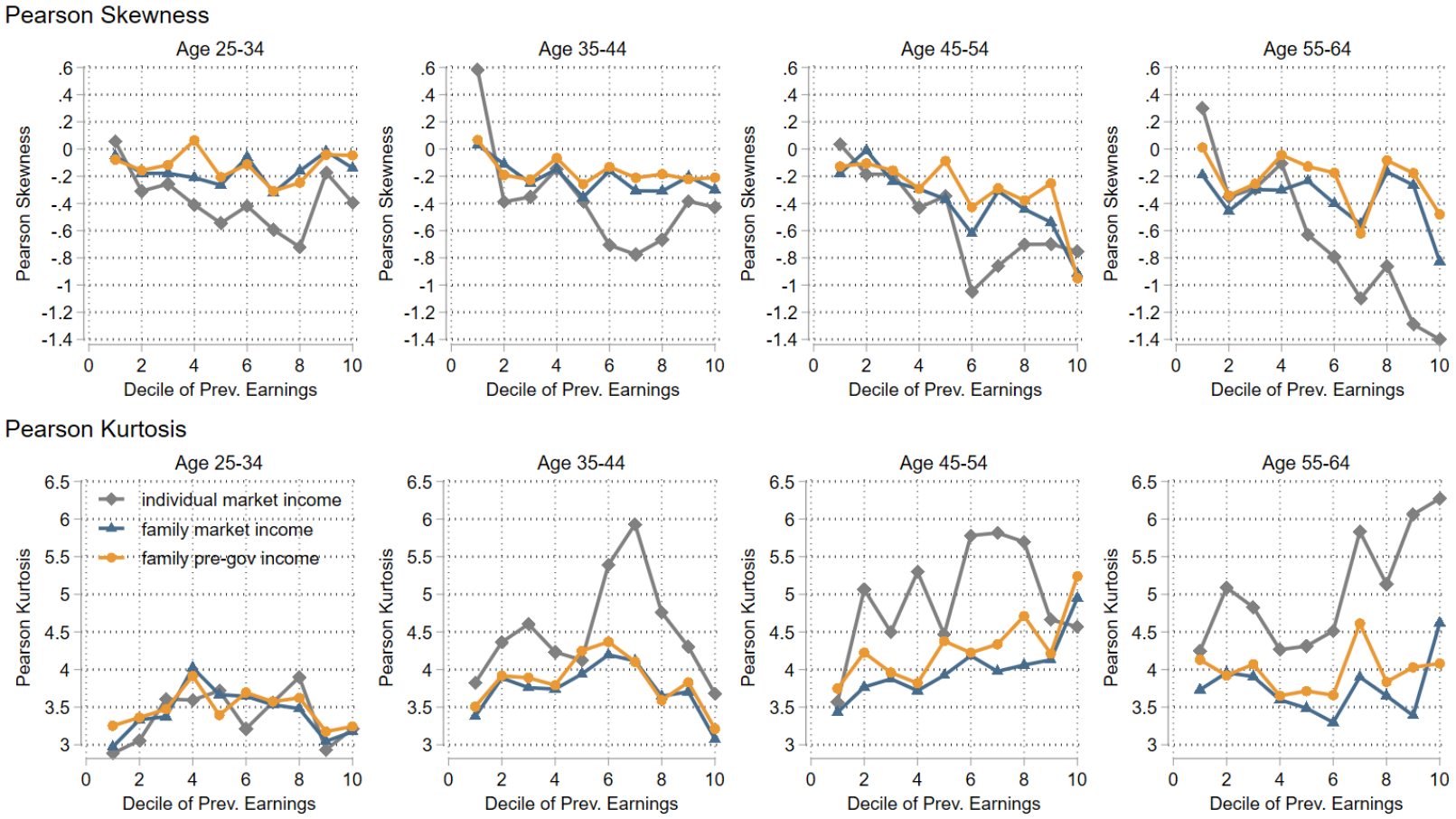


Figure: Skewness (top) and Kurtosis (bottom) of the distribution of 3-year average changes of family income (P1-P99) at different levels. The figure captures the relative contribution of family market income and private transfer to the third- and fourth-order risks of pre-government family income.

Appendix: Gov't insurance against 2nd-order risks

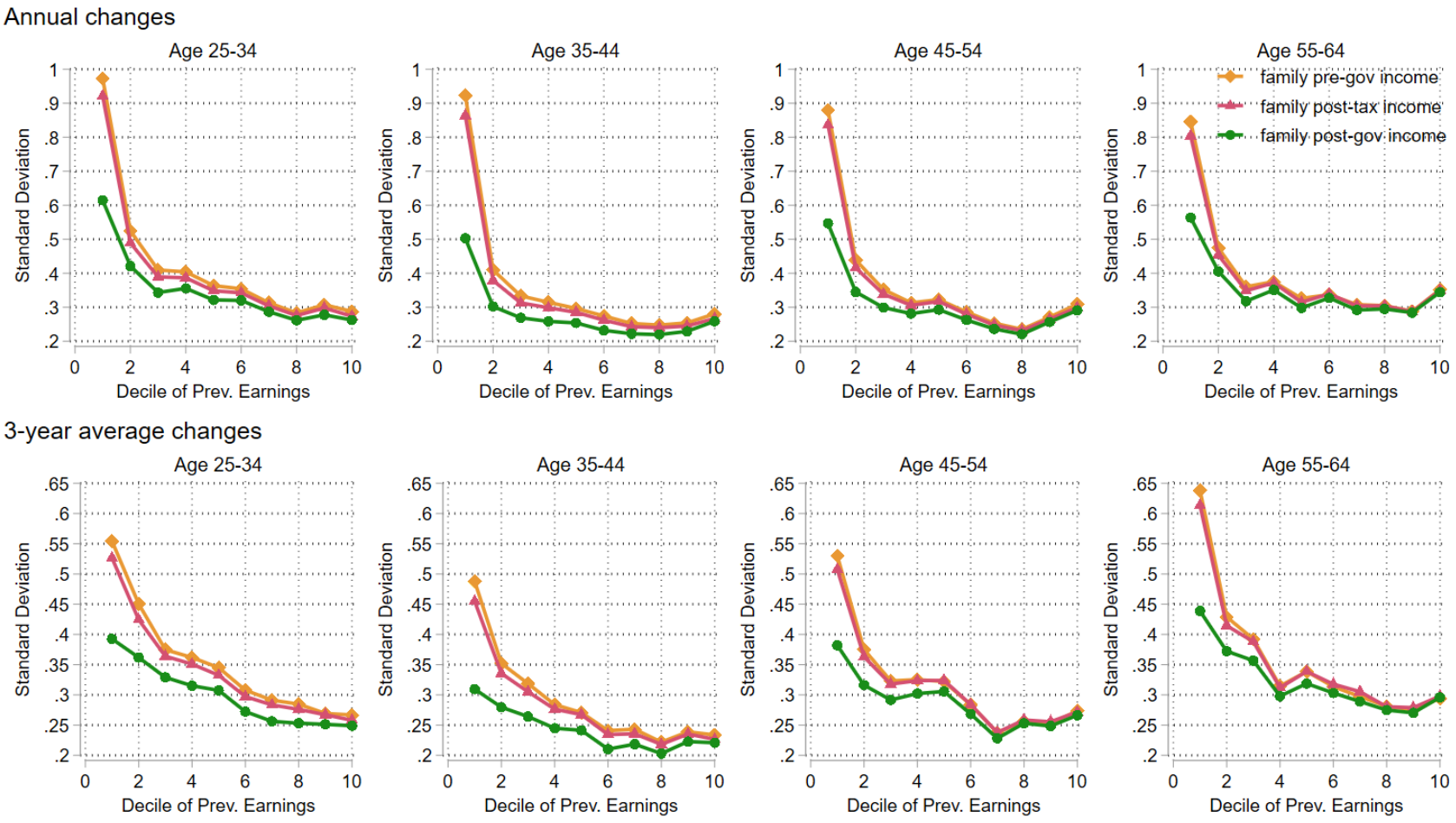


Figure: Standard deviation of the distribution of annual and 3-year average changes of post-tax and disposable (or post-government) family income (P1-P99) at different levels. The figure captures the relative contribution of tax and transfer to the second-order risk of disposable family income.

Back to Main Section

Appendix: Gov't insurance against 3rd- and 4th-order risks

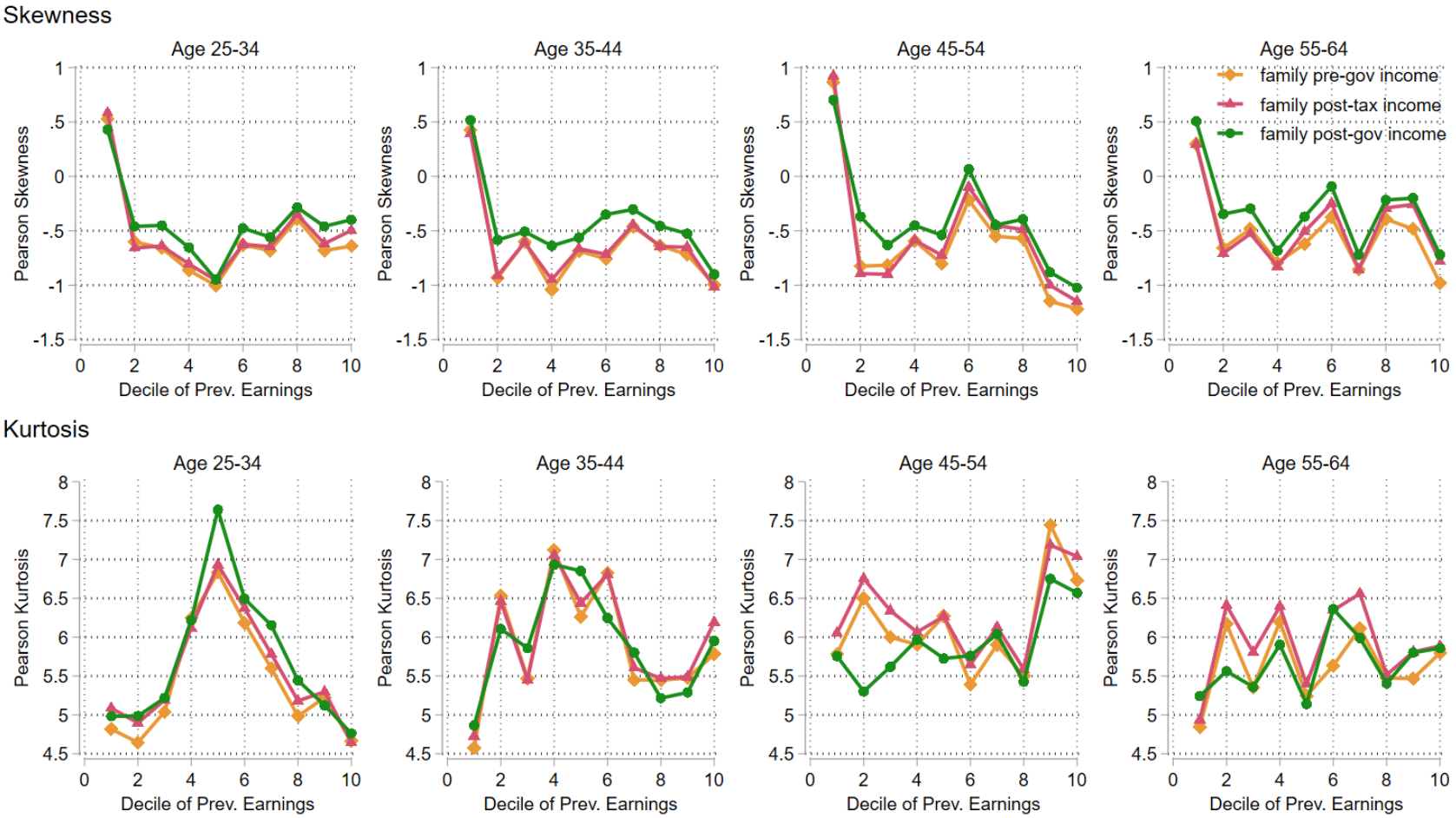


Figure: Skewness (top) and Kurtosis (bottom) of the distribution of annual changes of post-tax and disposable (or post-government) family income (P1-P99) at different levels. The figure captures the relative contribution of tax and transfer to the third- and fourth-order risks of disposable family income.

Back to Main Section

Appendix: Male vs. Female secondary earners

Secondary Earner		Age	Higher Education	Hours (Weekly)	Wage (Weekly)	Market Income (Annual)	Govt Transfer (Annual)
1	Male	36	47%	29.9	$619.43	$19,554.41	$10,633.30
	Female	34.4	47%	25.3	$566.46	$21,166.45	$11,822.05
2	Male	38.3	57%	35	$823.47	$40,572.98	$5,065.07
	Female	36.3	54%	26.6	$664.96	$29,604.74	$6,705.75
3	Male	40.7	65%	38	$959.69	$49,668.30	$3,046.49
	Female	38.6	58%	29.6	$775.35	$38,089.68	$3,708.15
4	Male	42.3	73%	40	$1,201.26	$65,238.51	$1,729.30
	Female	40	67%	31.9	$958.34	$50,298.72	$1,670.62
5	Male	46.1	82%	41.5	$1,670.71	$104,266.79	$885.92
	Female	42.9	76%	33.9	$1,281.75	$74,134.83	$1,114.50

Table 4: Average 20-year statistics for male and female secondary earners by family market income quintile. All income and transfer values are stated in 2018 Australian dollar.

Appendix: Insurance against *transitory* shocks and parenthood

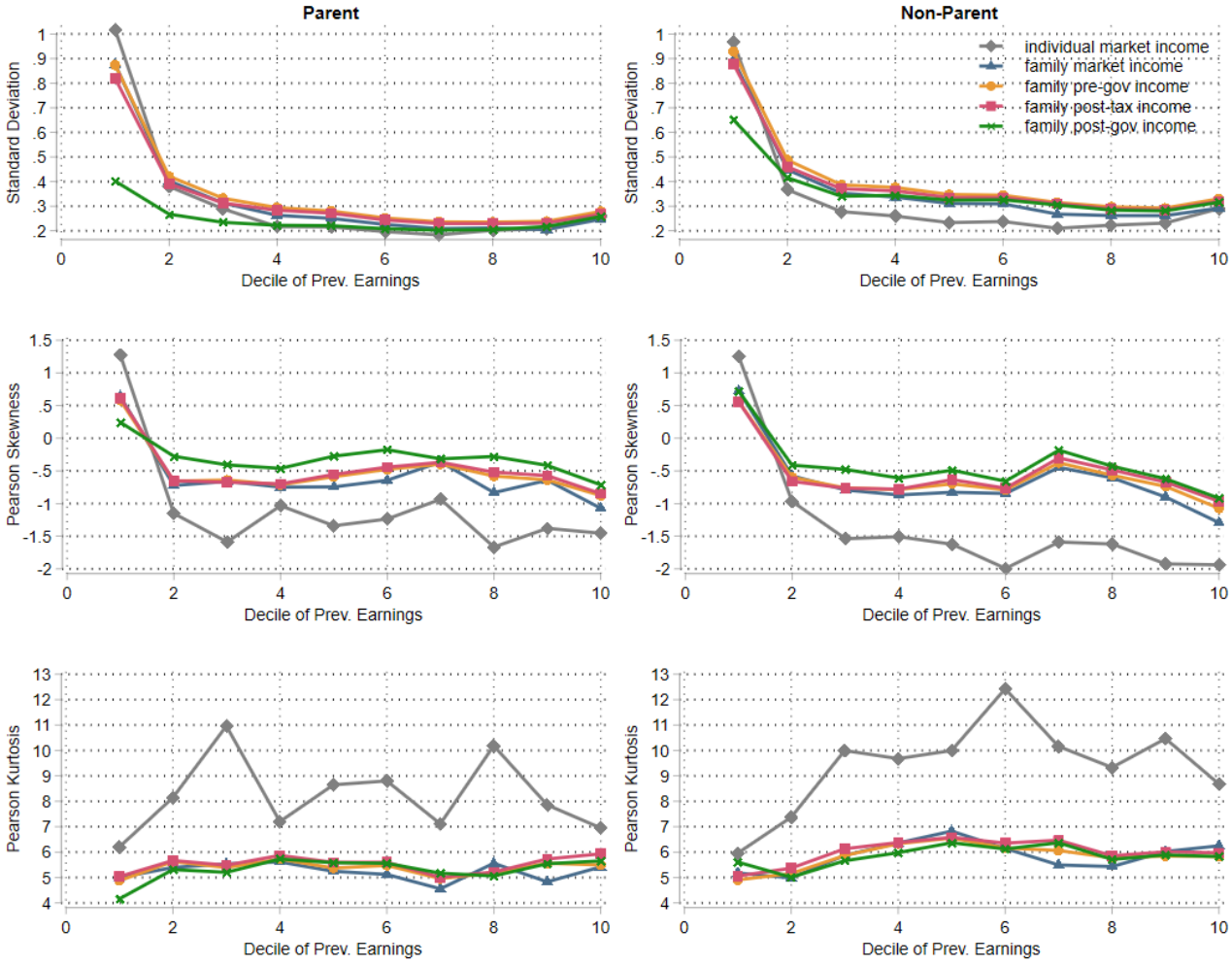


Figure: Moment properties of the distributions of annual income shocks of parent (left panel) and non-parent (right panel) primary earners (P1-P99 pearson statistics)

Appendix: Insurance against *persistent* shocks and parenthood

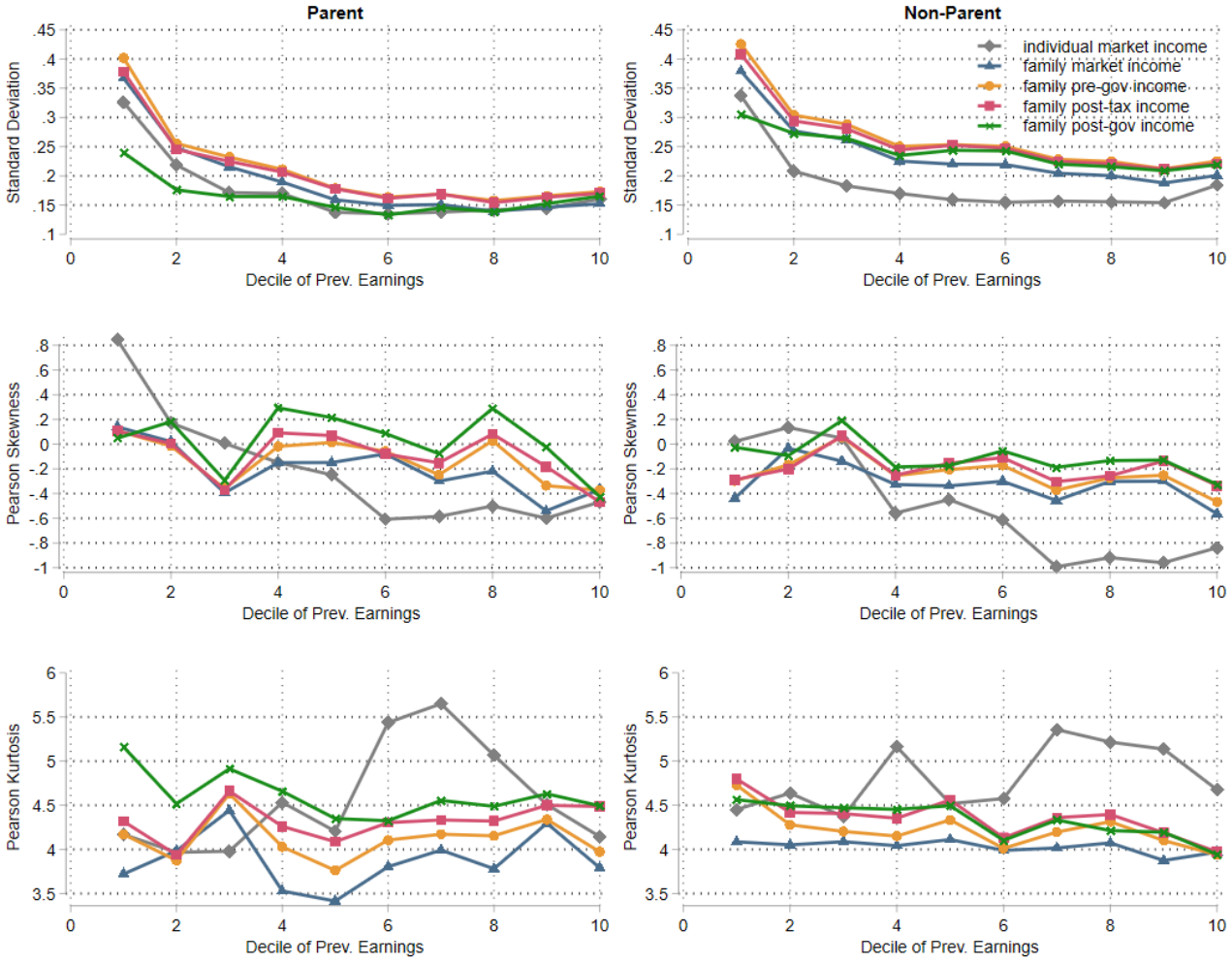


Figure: Moment properties of the distributions of 3-year average income shocks of parent (left panel) and non-parent (right panel) primary earners (P1-P99 pearson statistics)

Appendix: Age-profiles of work hours and LFP rate

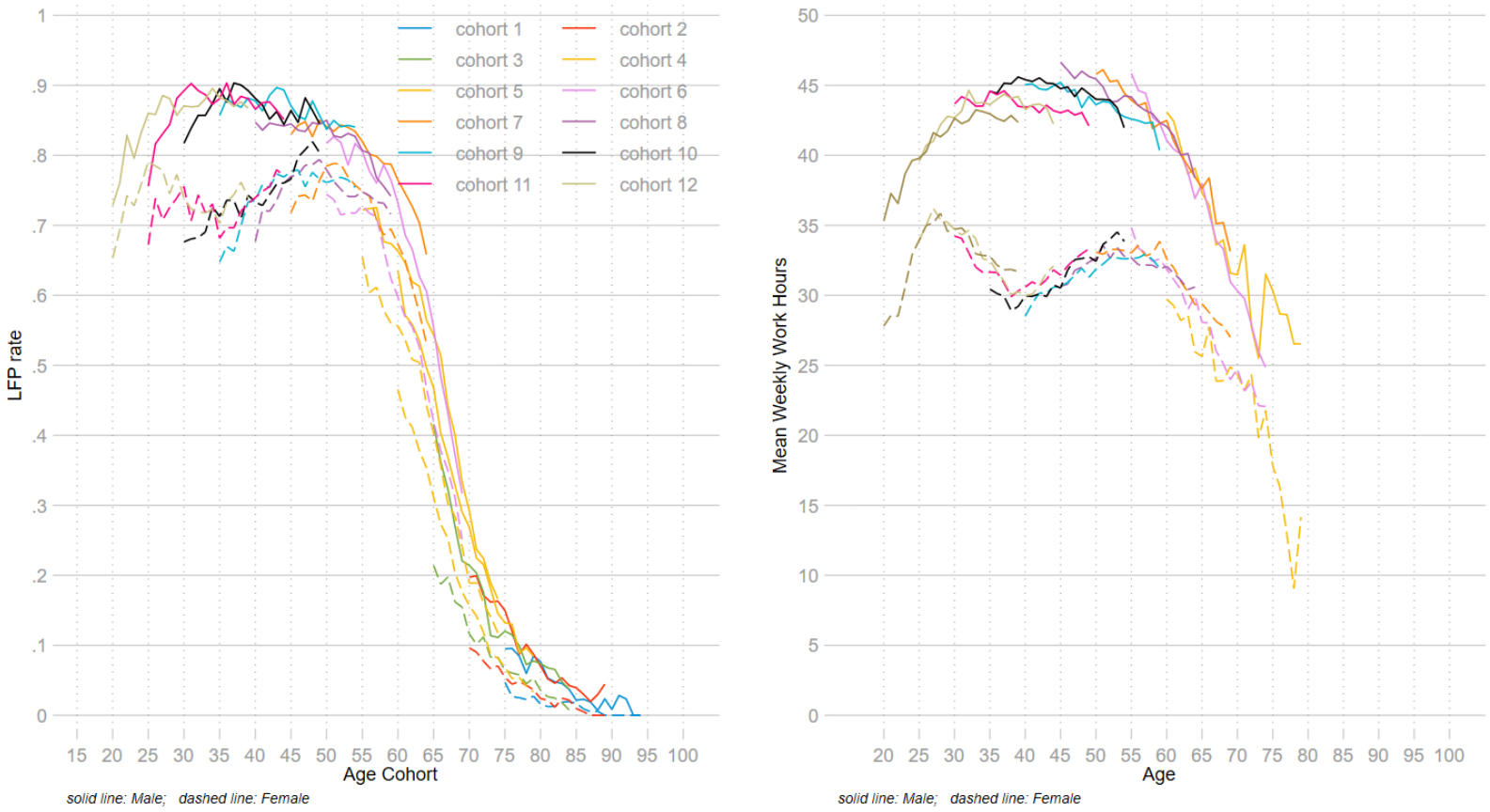


Figure: M-shaped age-profiles of work hours (left panel) and LFP rate (right panel). Solid line for men, dashed line for women.

Appendix: Spousal response vs Public transfer

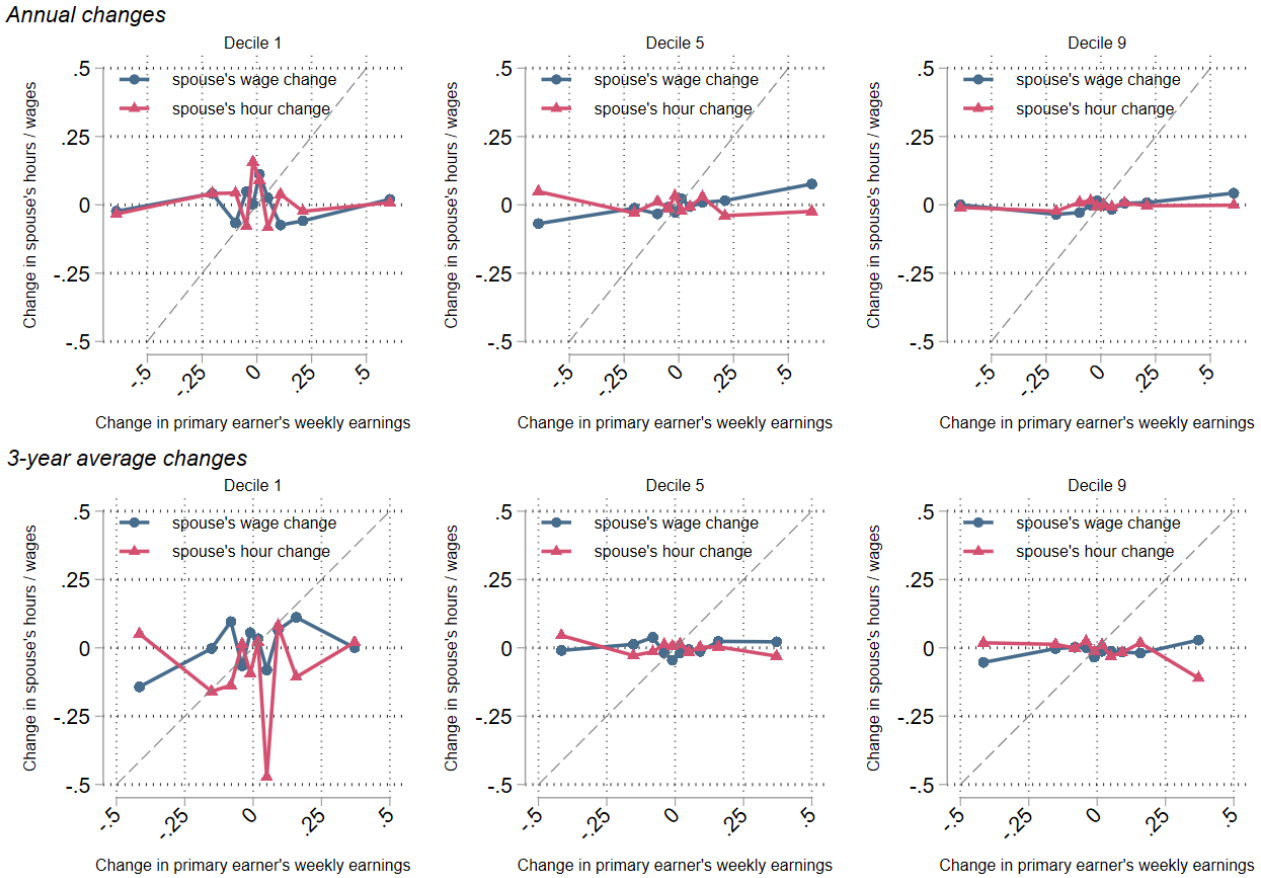


Figure: Changes in usual weekly wages and hours of spouse versus decile of changes in usual weekly earnings (main job) of primary earners in the 1st, 5th, and 9th deciles of past weekly earnings. The top and bottom panels report annual and 3-year average changes, respectively.

Back to Main Section

Appendix: Spousal response vs Public transfer

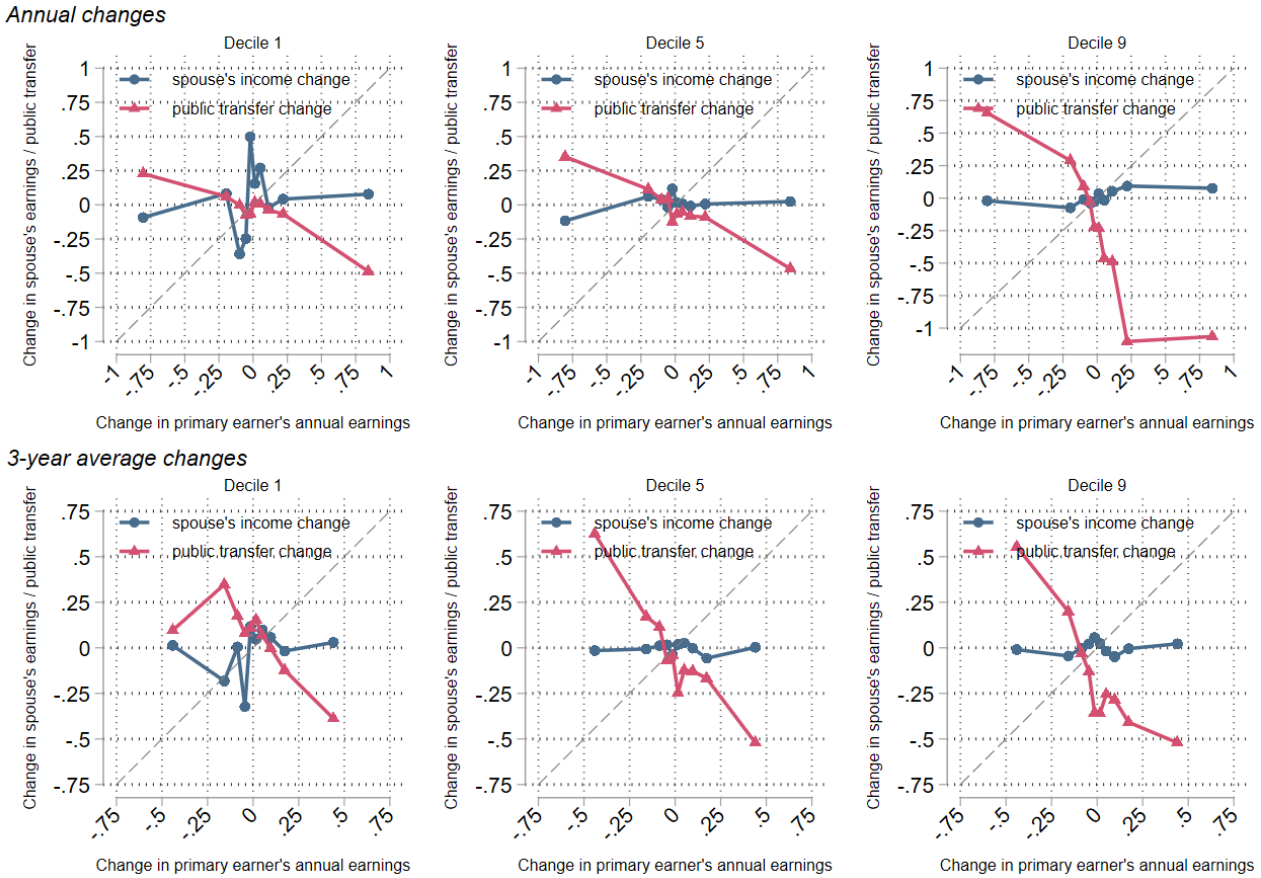


Figure: Changes in spousal earnings and public transfers versus decile of changes in past market earnings of primary earners in the 1st, 5th, and 9th deciles of past regular market income. The top and bottom panels report annual and 3-year average changes, respectively.

Back to Main Section

Appendix: Additional statistics

	Age 25-34		Age 35-44		Age 45-54		Age 55-64		
Past decile	Part-time	Full-time	Part-time	Full-time	Part-time	Full-time	Part-time	Full-time	Total
1	188	231	418	247	389	276	320	143	2,212
	53.56%	6.90%	48.21%	3.64%	44.20%	3.81%	45.58%	4.40%	9.44%
	8.50%	10.44%	18.90%	11.17%	17.59%	12.48%	14.47%	6.46%	100.00%
2	51	419	177	593	137	604	96	268	2,345
	14.53%	12.51%	20.42%	8.73%	15.57%	8.34%	13.68%	8.24%	10.01%
	2.17%	17.87%	7.55%	25.29%	5.84%	25.76%	4.09%	11.43%	100.00%
3	35	450	54	630	78	684	77	340	2,348
	9.97%	13.43%	6.23%	9.28%	8.86%	9.44%	10.97%	10.45%	10.02%
	1.49%	19.17%	2.30%	26.83%	3.32%	29.13%	3.28%	14.48%	100.00%
4	27	407	58	681	80	708	55	332	2,348
	7.69%	12.15%	6.69%	10.03%	9.09%	9.77%	7.83%	10.21%	10.02%
	1.15%	17.33%	2.47%	29.00%	3.41%	30.15%	2.34%	14.14%	100.00%
5	15	445	41	753	66	708	46	298	2,372
	4.27%	13.28%	4.73%	11.09%	7.50%	9.77%	6.55%	9.16%	10.12%
	0.63%	18.76%	1.73%	31.75%	2.78%	29.85%	1.94%	12.56%	100.00%
6	14	324	36	847	38	783	42	268	2,352
	3.99%	9.67%	4.15%	12.47%	4.32%	10.81%	5.98%	8.24%	10.03%
	0.60%	13.78%	1.53%	36.01%	1.62%	33.29%	1.79%	11.39%	100.00%
7	13	311	35	771	39	842	19	343	2,373
	3.70%	9.28%	4.04%	11.35%	4.43%	11.62%	2.71%	10.54%	10.12%
	0.55%	13.11%	1.47%	32.49%	1.64%	35.48%	0.80%	14.45%	100.00%
8	5	292	26	724	22	886	15	389	2,359
	1.42%	8.72%	3.00%	10.66%	2.50%	12.23%	2.14%	11.96%	10.06%
	0.21%	12.38%	1.10%	30.69%	0.93%	37.56%	0.64%	16.49%	100.00%
9	3	252	11	749	28	897	18	408	2,366
	0.85%	7.52%	1.27%	11.03%	3.18%	12.38%	2.56%	12.54%	10.09%
	0.13%	10.65%	0.46%	31.66%	1.18%	37.91%	0.76%	17.24%	100.00%
10	0	219	11	795	3	857	14	464	2,363
	0.00%	6.54%	1.27%	11.71%	0.34%	11.83%	1.99%	14.26%	10.08%
	0.00%	9.27%	0.47%	33.64%	0.13%	36.27%	0.59%	19.64%	100.00%
Total	351	3,350	867	6,790	880	7,245	702	3,253	23,438
	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
	1.50%	14.29%	3.70%	28.97%	3.75%	30.91%	3.00%	13.88%	100.00%

Table 5: Proportion of primary earners in part-time employment by decile of usual weekly wages from main job. The subsample contains primary earners who report positive usual weekly labour earnings for at least 18 years of

Appendix: Additional statistics

	Age 25-34		Age 35-44		Age 45-54		Age 55-64		
Past decile	Casual	Permanent	Casual	Permanent	Casual	Permanent	Casual	Permanent	Total
1	113	306	130	535	135	532	116	347	2,214
	31.92%	9.15%	30.23%	7.40%	33.33%	6.89%	37.54%	9.52%	9.45%
	5.10%	13.82%	5.87%	24.16%	6.10%	24.03%	5.24%	15.67%	100.00%
2	51	419	58	713	64	677	51	313	2,346
	14.41%	12.52%	13.49%	9.86%	15.80%	8.77%	16.50%	8.58%	10.01%
	2.17%	17.86%	2.47%	30.39%	2.73%	28.86%	2.17%	13.34%	100.00%
3	52	433	51	633	47	715	36	381	2,348
	14.69%	12.94%	11.86%	8.76%	11.60%	9.26%	11.65%	10.45%	10.02%
	2.21%	18.44%	2.17%	26.96%	2.00%	30.45%	1.53%	16.23%	100.00%
4	26	408	35	705	38	750	20	367	2,349
	7.34%	12.19%	8.14%	9.75%	9.38%	9.71%	6.47%	10.07%	10.02%
	1.11%	17.37%	1.49%	30.01%	1.62%	31.93%	0.85%	15.62%	100.00%
5	23	437	23	770	24	750	14	330	2,371
	6.50%	13.06%	5.35%	10.65%	5.93%	9.71%	4.53%	9.05%	10.12%
	0.97%	18.43%	0.97%	32.48%	1.01%	31.63%	0.59%	13.92%	100.00%
6	15	323	26	857	16	805	14	296	2,352
	4.24%	9.65%	6.05%	11.86%	3.95%	10.42%	4.53%	8.12%	10.03%
	0.64%	13.73%	1.11%	36.44%	0.68%	34.23%	0.60%	12.59%	100.00%
7	15	309	16	790	16	865	17	345	2,373
	4.24%	9.23%	3.72%	10.93%	3.95%	11.20%	5.50%	9.46%	10.12%
	0.63%	13.02%	0.67%	33.29%	0.67%	36.45%	0.72%	14.54%	100.00%
8	15	282	21	729	15	893	7	397	2,359
	4.24%	8.43%	4.88%	10.09%	3.70%	11.56%	2.27%	10.89%	10.06%
	0.64%	11.95%	0.89%	30.90%	0.64%	37.86%	0.30%	16.83%	100.00%
9	26	228	19	741	20	905	9	417	2,365
	7.34%	6.81%	4.42%	10.25%	4.94%	11.72%	2.91%	11.44%	10.09%
	1.10%	9.64%	0.80%	31.33%	0.85%	38.27%	0.38%	17.63%	100.00%
10	18	201	51	755	30	830	25	453	2,363
	5.08%	6.01%	11.86%	10.45%	7.41%	10.75%	8.09%	12.42%	10.08%
	0.76%	8.51%	2.16%	31.95%	1.27%	35.12%	1.06%	19.17%	100.00%
Total	354	3,346	430	7,228	405	7,722	309	3,646	23,440
	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
	1.51%	14.27%	1.83%	30.84%	1.73%	32.94%	1.32%	15.55%	100.00%

Table 6: Proportion of primary earners in casual employment by decile of usual weekly wages from main job. The subsample contains primary earners who report positive usual weekly labour earnings for at least 18 years of observation.

Appendix: Additional statistics

		Married		Single		
Income Quintile	Parenthood	Male	Female	Male	Female	Total
Q1	Non-parent	143	455	238	177	1,013
		4.34%	12.14%	21.38%	19.39%	11.17%
		14.12%	44.92%	23.49%	17.47%	100.00%
	Parent	167	809	12	117	1,105
		5.07%	21.58%	1.08%	12.81%	12.18%
		15.11%	73.21%	1.09%	10.59%	100.00%
Q2	Non-parent	200	407	319	217	1,143
		6.07%	10.86%	28.66%	23.77%	12.60%
		17.50%	35.61%	27.91%	18.99%	100.00%
	Parent	234	597	1	32	864
		7.10%	15.93%	0.09%	3.50%	9.53%
		27.08%	69.10%	0.12%	3.70%	100.00%
Q3	Non-parent	327	379	261	179	1,146
		9.92%	10.11%	23.45%	19.61%	12.64%
		28.53%	33.07%	22.77%	15.62%	100.00%
	Parent	399	386	2	19	806
		12.11%	10.30%	0.18%	2.08%	8.89%
		49.50%	47.89%	0.25%	2.36%	100.00%
Q4	Non-parent	361	255	165	120	901
		10.95%	6.80%	14.82%	13.14%	9.93%
		40.07%	28.30%	18.31%	13.32%	100.00%
	Parent	548	219	2	1	770
		16.63%	5.84%	0.18%	0.11%	8.49%
		71.17%	28.44%	0.26%	0.13%	100.00%
Q5	Non-parent	349	129	111	51	640
		10.59%	3.44%	9.97%	5.59%	7.06%
		54.53%	20.16%	17.34%	7.97%	100.00%
	Parent	568	112	2	0	682
		17.23%	2.99%	0.18%	0.00%	7.52%
		83.28%	16.42%	0.29%	0.00%	100.00%
	Total	3,296	3,748	1,113	913	9,070
	%	100.00%	100.00%	100.00%	100.00%	100.00%
	%	36.34%	41.32%	12.27%	10.07%	100.00%

Table 7: Cross-tabulation of frequencies between parenthood, marital status, and gender. Since HILDA tracks individuals and their households over time, we present a snapshot of the first cohort entering the survey in 2001. The table suggests a negative assortative matching (or matching of unlike) between higher income males and lower

Appendix: Additional statistics

	Married		Single		
Highest education attained	Male	Female	Male	Female	Total
High school or lower	1,226	2,227	639	494	4,586
	37.20%	59.45%	57.41%	54.11%	50.57%
	26.73%	48.56%	13.93%	10.77%	100.00%
Above high school,	1,741	1,221	424	350	3,736
at most bachelor's degree	52.82%	32.59%	38.10%	38.34%	41.20%
	46.60%	32.68%	11.35%	9.37%	100.00%
Above bachelor's degree,	329	298	50	69	746
at most post-graduate degree	9.98%	7.96%	4.49%	7.56%	8.23%
	44.10%	39.95%	6.70%	9.25%	100.00%
Total	3,296	3,746	1,113	913	9,068
%	100.00%	100.00%	100.00%	100.00%	100.00%
%	36.35%	41.31%	12.27%	10.07%	100.00%

Table 8: Cross-tabulation of frequency between education, marital status, and gender. Since HILDA tracks individuals and their households over time, we present a snapshot of the first cohort entering the survey in 2001. The table suggests a negative assortative matching (or matching of unlike) between higher education males and lower education females. The observed pattern becomes less pronounced in later years of the survey, partly due to attrition and the inclusion of new and younger households

Bibliography I

Chatterjee, A., Singh, A., and Stone, T. (2016). Understanding wage inequality in australia. *Economic Record*, 92:348–60.

De Nardi, M., Fella, G., Knoef, M., Paz-Pardo, G., and Ooijen, R. V. (2021). Family and government insurance: Wage, earnings, and income risks in the netherlands and the us. *Journal of Public Economics*, 193:104327.

Freestone, O. (2018). The drivers of life-cycle wage inequality in australia. *Economic Record*, 97 (307):424–444.

Guvenen, F., Karahan, F., Ozkan, S., and Song, J. (2021). What do data on millions of us workers reveal about life-cycle earning risk? *Econometrica*, 89(5)(20913):2303–2339.

Halvorsen, E., Holter, H., Ozkan, S., and Storesletten, K. (2020). Dissecting idiosyncratic earnings risk. *Working Paper*, (15395).

Herault, N. and Azpitarte, F. (2015). Recent trends in income redistribution in australia: Can changes in the tax-benefit system account for the decline in redistribution? *Economic Record*, 91(292):38–53.

Bibliography II

Kaplan, G., Cava, G. L., and Stone, T. (2018). Household economic inequality in australia. *Economic Record*, 94:117–134.

Tran, C. and Zakariyya, N. (2021). Tax progressivity in australia: Facts, measurements and estimates. *Economic Record*, 97 (316):45–77.