Lifecycle Earnings Risk and Insurance: New Evidence from Australia*

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Abstract

This paper studies the nature of earnings dynamics in Australia, using the Household, Income and Labour Dynamics in Australia (HILDA) Survey 2001-2020. Our results indicate that the distribution of earnings shocks displays negative skewness and excess kurtosis, deviating from the conventional linearity and normality assumptions. Wage changes are strongly associated with earnings changes and account more for the dispersion of earnings shocks; meanwhile, the contribution of hour changes is largely absent in upward movement and relatively small in downward movement of earnings changes. Furthermore, family and government insurance play distinct roles in reducing exposure to earnings risk. Government insurance embedded in the targeted transfer system is important in mitigating the dispersion of shocks, whereas family insurance via income pooling and adjustment of secondary earners' labour market activities is dominant in reducing the magnitude and likelihood of extreme and rare shocks. The magnitude and persistence of earnings risk as well as the insurance role of family and government vary significantly across gender, marital and parental status. Accounting for these non-Gaussian and non-linearity features is important for evaluating the insurance role of government transfer programs.

JELL: E24, H24, H31, J31.

Keywords: Income dynamics; Earnings risk; Higher-order moments; Non-Gaussian shocks; Family insurance; Government insurance; Inequality.

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1 Introduction

Understanding the nature of earnings risk is crucial for better understanding of income dynamics, trends in income equality as well as the insurance role of a redistributive tax and transfer system. There is a growing literature that takes advantage of administrative and household datasets, and new statistical techniques to explore the rich dynamics of income process. Recent developments, including Arellano, Blundell and Bonhomme (2017), De Nardi et al. (2021), Guvenen et al. (2021) and Halvorsen et al. (2022), have identified non-Gaussian and non-linearity features of residual income fluctuations. These studies demonstrate that the persistence of innovations is not uniform but exhibits systematic asymmetries, and that the distribution of innovations to income displays strong negative (left) skewness and excess (leptokurtic) kurtosis than normally distributed shocks. De Nardi et al. (2021) and Halvorsen et al. (2022) also examine on the role of family and government in insuring against earnings risk. A key result from these studies is that family and government are important sources of insurance. De Nardi et al. (2021) in particular finds that family insurance in the US is larger than that in the Netherlands.

In a similar vein, our paper is the first to comprehensively examine the distribution of earnings risk and the degree of insurance provided by family and government in Australia. We use micro data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey release 20 (2001-2020). Similar to De Nardi et al. (2021) and Guvenen et al. (2021), we adopt nonparametric methods. Our results reveal that the features of income dynamics documented previously for other countries are observed in Australia; however, there are differences in the sources of earnings risks and the insurance roles of family and government.

We begin by calculating second- and higher-order moments of residual labour earnings shocks for primary earners (heads of households) in the 25-64 age range and are employees in non-own businesses. We uncover a rich shock process that exhibits strong non-linear and non-Gaussian features across age and income history (grouped by decile of past income).[1] Specifically, the variance of earnings shocks (*second-order risk*) is most pronounced at the lower income deciles, especially for older cohorts. Those in the upper deciles experience a relatively high dispersion, albeit several times lower than that of the former group. Moreover, excluding the poorest, the shock distribution is negatively skewed (*third-order risk*) and leptokurtic (*fourth-order risk*). There are significant differences in the degrees of variance, skewness and kurtosis by age cohort and income history. In our extension, we follow Guvenen et al. (2021) and estimate a parametric model of earnings dynamics that is capable of reproducing the overall pattern of these key empirical facts.

Focusing on the dynamics of labour earnings allows us to disentangle the moments of earnings changes into those of wage and work hour changes. Our findings broadly indicate that wage changes mainly account for the dispersion of earnings changes. Meanwhile, changes in hours induce the negative skewness and the excess kurtosis. Restricting the sample to workers with consistent employment history (to partially remove short-term hour irregularities) or by demographic attributes does not alter this conclusion. In addition, we observe the following asymmetry. Barring those in the bottom decile, the role of hours is negligible on the positive changes in earnings and contributes by a relatively lesser degree to the negative changes. In contrast, earnings changes in both directions are correlated

[1] The terms *shocks* and *changes* are used interchangeably to refer to residual shocks net of age and time effects. Income history of an individual is defined as the income decile to which he/she belonged in the previous period, and may be referred to as the past/previous income decile.

strongly with wage movement.

We next examine the extent to which earnings risk is mitigated by implicit and explicit forms of insurance arrangement. For this purpose, instead of labour earnings, we use the regular market earnings which is a broader income definition comprising earnings from all market sources. To quantify insurance, we compare distributional properties of income changes at various levels. Technically, the differences between moment statistics of the distributions of individual regular market income changes and family pre-government income changes capture insurance components pertaining to family market earnings and private transfers. Analogously, the differences between those of family pre- and post-government income changes imply the role of government insurance provided via the tax and transfer system.[2]

In our analysis, insurance has two primary roles: (i) as a mitigator of the variation of shocks (or *the second-order risk*), and (ii) as a mitigator of the magnitude and probability of shocks at the extreme which correspond to skewness and kurtosis of income shock distributions (*the third- and fourth-order risks*), respectively. We find two dominant channels of (external) insurance: *within family responses,* i.e. family market income insurance, and *net public transfers,* i.e. government transfer insurance. In terms of insurance against the second-order risk, family insurance is small and limited to primary earners in the bottom decile of past income, whereas government transfer insurance is larger and more robust across a wide range of specifications. Against the third- and fourth-order risks, on the other hand, family market income insurance plays a more dominant role. Overall, family market income and government transfer are vital sources of insurance against earnings risks, but they are not capable of providing full insurance to completely eliminate the non-Gaussian and non-linear elements from the household disposable income dynamics.

As an extension, we further investigate how earnings risks for different age and income groups are affected by demographic factors. We mainly focus on three attributes: *gender*, *marital* and *parental status* that are prominently embedded in the Australian welfare system. The results suggest that the shock distributions still display negative skewness and excess kurtosis even after taking into account these idiosyncrasies. However, there are pronounced disproportionate effects of government insurance by household type, partly a result of the demographic differences in income dynamics and the targeted nature of the Australian welfare system. For instance, lower-income female heads of households and non-parents both confront persistently high income risks, but due to the targetedness of transfer programs, the former group benefits significantly more from government insurance. As a consequence, the gap in disposable income risks between female and male primary earners shrinks substantially, whereas that between parents and non-parents remains wide. Conversely, family insurance appears to be more important for those not targeted by the means-tested public transfer schemes, including non-parents and upper income partnered parents. Together with our finding of weak spousal and strong public responses to individual earnings shocks, this implies the provision of government insurance potentially crowds out family insurance, which is consistent with a conjecture by De Nardi et al. (2021) based on their comparison of the US and the Netherlands.

Thus, our findings underline the importance of the risk minimizing effect of tax and transfer policies for households prone to persistent and extreme shocks but lack the capability to self-insure via family insurance (e.g., lone parents). We highlight such household groups benefit greatly from

[2] Throughout the discussion, post-government income may also be referred to as after-tax-and-transfer income, post-fiscal, or disposable income.

the disposable income smoothing effect of Australian targeted transfer policies. However, there are household groups who rely mainly on family insurance. It appears that accounting for the non-Gaussian and non-linearity features of earnings shocks is important for better understanding the income inequality dynamics and the benefits of social insurance programs in Australia.

Related literature. Our paper contributes to a growing literature that studies non-Gaussian and non-linear features of earnings dynamics (e.g., De Nardi et al. 2021; Guvenen et al. 2021 and Halvorsen et al. (2022)). We provide a new case study using Australian microdata. Unlike prior studies revolving around male workers, ours focuses on primary earners to account for the sizeable proportion (39%) of female headed households in our sample.[3] The results point at a strong resemblance between Australia and other OECD countries previously examined in the literature - in particular the US (De Nardi et al. 2021; Guvenen et al. 2021), the Netherlands (De Nardi et al. 2021) and Norway (Halvorsen et al. (2022)). Notwithstanding, there are some differences. For instance, as opposed to the US and the Netherlands where wage and hour changes contribute in almost equal proportion to the second-order earnings risk, the principal driver in Australia appears to be wage changes. Another notable difference is that the roles of family and government insurance in Australia generally do not overlap. Government insurance smooths out small and moderate shocks while family insurance tends to respond to more extreme events.

This paper is also related to a body of work on the role of government insurance in heterogeneous agent models with family structure (e.g., Kaygusuz 2015; Nishiyama 2019; De Nardi, Fella and Paz-Pardo 2020). Kaygusuz (2015) and Nishiyama (2019) assume normally distributed earnings shocks and find that the US's spousal and survival benefits transfer welfare from two-earner to single-earner households. De Nardi, Fella and Paz-Pardo (2020) show the extent to which a government helps households depends on their family composition and the risk distribution that they face. Similarly, our results suggest that those facing more persistent risks such as female headed households (half of whom belong to dual-earner households) benefit greatly from government insurance against earnings risk even though they receive relatively smaller public transfer on average than their male counterparts do. Relaxing the Gaussian and linear assumptions to account for more realistic risk structure may therefore have considerable influence on quantitative results.

Furthermore, our work contributes directly to the understanding of income dynamics and inequality in Australia. The early literature (e.g., Chatterjee, Singh and Stone 2016; Freestone 2018; Kaplan, Cava and Stone 2018) show that an increase in labour earnings inequality is mainly due to residual factors reflecting idiosyncratic wage risks drawn from normal distributions. These studies commonly assume that income shocks follow a Gaussian process and estimate a linear model of risk. Overall, our findings agree with the previous work that residual wage shocks drive the residual earnings fluctuations. In addition, we further illustrate that the shock process is more complex and deviates from the normality and symmetry assumptions, and that hours also have a role to play in shaping the extreme ends of the earnings shock distribution. Finally, our paper is connected to a body of empirical studies on the redistributive effects of the Australian tax and transfer policies (e.g., Herault and Azpitarte 2015; Tran and Zakariyya 2021). These studies mainly focus on the first-order moment of income level. Differently, this paper emphasizes the second- and higher-order moments of income changes. In doing so, we uncover the drivers of risks, and the functions and limitations of family and government

[3] We show separate results for male primary earners in section 4 and section F in the technical appendix. We find no significant qualitative difference. That is, our conclusion based on a male primary earner sample would be similar to the combined sample used in the main study.

insurance, which are fundamental for understanding the dynamics of income as well as the insurance role of the Australian tax and transfer system.

The paper hereinafter proceeds as follows. Section 2 provides a description of the dataset, descriptive statistics and methodology. Section 3 discusses the main results. Section 4 presents extensions. Section 5 concludes. The online technical Appendix report additional information and results.

2 Data and methodology

2.1 Data and variable construction

We use data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey Restricted Release 20 (2001 − 2020). Began in 2001 and has since been conducted on an annual basis, HILDA is a nationally representative panel data of Australian households on a wide range of subjects pertaining to family and labour market dynamics. The survey collects information on respondents and their family members, including demographics, earnings and their sources, taxes and transfers, household and family identifiers, and a rich set of covariates that enables a more comprehensive study. Compared to the General Release dataset, the Restricted Release also contains details on variables such as income and wealth (not confidentialised via top coding), employment characteristics and birth dates. This allows for more accurate estimations of total individual and household incomes, and taxes and transfers.[4]

We include wave 20, which corresponds to the 2019-20 financial year (from 01 July 2019 to 30 June 2020), as a larger sample size enhances the quality of our moment statistics. This means income, tax, and benefit variables are affected to an extent by the COVID-19 pandemic. Nonetheless, our sensitivity tests demonstrate that the findings are robust to the inclusion of wave 20. This could be due to two reasons. First, we control for time effect. Second, the 2019-20 data includes at most 3 months of the pandemic effect.

Our core unit of analysis when documenting earnings risk is an adult individual who legally pays taxes in Australia. Restricting the sample to only employees (of non-own businesses), we retain 152, 903 observations. The choice to exclude employers and employees of family-own businesses (paid or unpaid) is made for two reasons. First, the group constitutes a small proportion of the sample (26,771 observations). The methodology employed (e.g., to get 3-year average residual differences) and the sample selection criteria (e.g., consistent employment history) further reduce the sample size. This matters when one wishes to obtain reliable moment statistics conditioning on subgroups (age, income history and demographics). Second, our objective is to produce comparable results with the previous work on other OECD countries. For similar reasons, youth (15-24) and elderly employees (65+) are not considered in this study. We turn to family as the main unit of analysis when analysing the insurance role of family and government. The primary sample here involves single and partnered (married or in de facto relationship) primary earners distinguished by their unique family unit identifiers. For our purpose, the terms "family" and "household" are interchangeable. A family unit usually includes spouses, independent children and other members sharing a common family identifier.[5]

[4]Compared to the household survey data, the merit of using administrative data is the significantly larger and thus more representative sample of the Australian population. However, at the time of writing, we are not aware of any Australian administrative datasets that contain information on work hours and demographic structure which are essential for our decomposition exercise of the earnings dynamics.

[5]Note that, a household unit defined in the HILDA data may include multiple family units. As an example, the

At the weekly level, the HILDA survey reports usual weekly earnings and usual work hours of the financial year immediately preceding the interview. In the first part of the study on earnings risk and its decomposition, measures of weekly wage rates are derived from these two figures. A caveat is that these variables do not capture interim unemployment spells and other short-term hour irregularities. The estimates of weekly earnings and its constituents are thus subject to measurement errors that could result in an underestimation of the role of hours in driving the dynamics of earnings.[6] As a partial remedy in subsection 3.1, we restrict the sample to employees with consistent workforce participation history - defined as those having worked one day or more per week for at least 18 years of observation and received at least a minimum hourly wage of A$20 (in 2018 dollar). We relax this requirement, by setting the cutoff work duration to 10 years, for certain subgroups (e.g., non-parents) to allow sufficient sample size. Regardless, because of the large differences found in our study between the roles of wages and hours in explaining transitory and persistent earnings changes, we believe the true patterns are unlikely to deviate in any significant manner from our estimates.

For our analysis on family and government insurance effects in subsection 3.2, on the other hand, we include all employees regardless of their work history. The reason is major welfare programs in Australia such as the Family Tax Benefit (FTB part A and part B) and JobSeeker Payment are not conditional on labour market participation. Thus, comprehending the full impact of government insurance demands that we do not drop those who temporarily exited the workforce. Moreover, the measurement error problem is of less concern to our annual estimates. Simply multiplying the usual weekly earnings by work weeks to obtain the annual figures would indeed introduce significant measurement errors and lead to clustering of hours as a consequence of omitting information on short-term changes during the year. HILDA eases this constraint by collecting annual income, tax and transfer data on a completed financial year preceding the date of interview, which permits more accuracy in imputing tax, transfer, and disposable income at the annual level. Of particular relevance to the study of insurance is that estimates of annual family income encompass all individual members' regular market income flows from market sources such as wage and salary, business income, investment income and regular private pension. While labour income is useful for our decomposition exercise, it fails to provide a complete picture of insurance against risk. Hence, the broader market income definition is used. Jointly with private transfer, this makes up family pre-government income.

We examine annual income variables separately from weekly variables since annual data captures more within-year variation. Besides, because tax and benefit are estimated and reported annually in the survey, it is through the annual variables that government insurance effects are estimated.[7] More precisely, the schema is as follows:

Weekly income variables:

$$\begin{cases} \text{Hourly wage} \xrightarrow[\text{(via work hours)}]{\text{self-insurance}} \text{Total weekly earnings} \\ \text{Total weekly earnings} \xrightarrow[\text{(via members' earnings)}]{\text{family market income insurance}} \text{Total weekly family earnings} \end{cases}$$

survey records independent lone persons in a shared household as separate family units living within the same household unit.

[6] De Nardi et al. (2021) reports an overestimation of the role of wages in driving the earnings dynamics by comparing their estimates based on household surveys to those using administrative datasets, but the margins of errors are small and the qualitative patterns are maintained.

[7] We work with annual data and thus lack information on benefits or components of benefits that accrue at a higher frequency (e.g., fortnightly).

Annual income variables:

$$\begin{cases} \text{Regular market income} \xrightarrow[\text{(via members' annual earnings)}]{\text{family market income insurance}} \text{Family regular market income} \\ \text{Family regular market income} \xrightarrow[\text{(via private and irregular transfers)}]{\text{family transfer insurance}} \text{Family pre-gov't income} \\ \text{Family pre-gov't income} \xrightarrow[\text{(via combined income taxes)}]{\text{government tax insurance}} \text{Family post-tax private income} \\ \text{Family post-tax private income} \xrightarrow[\text{(via public transfers)}]{\text{government transfer insurance}} \text{Family post-gov't income} \end{cases}$$

Individual and family units play different but equally important roles throughout the analysis. Individual unit is pivotal for computing tax statistics due to the separate tax filing system in Australia. Family unit is the primary basis for computing transfer statistics because an eligibility criterion for major transfer programs is means testing combined family income as opposed to individual income. Particularly, variables at the family level must be calculated and handled explicitly apart from those at the individual level. This is done by modifying the HILDA tax-benefit model to first decouple the benefit system from the tax system and calculate individual taxable and adjusted taxable income. Afterwards, individual values are merged back together by family identifier to construct various family income definitions (e.g., gross adjusted taxable family income) which are then used to calculate social benefits and their related supplements. Public transfers are assumed (as done in the HILDA survey) to be shared evenly among members of the same family, except for maternity support which is assigned only to mothers. In this manner, the approach allows us to bypass the need for parametric functions in deriving relevant tax-benefit variables and calculating moments of pre- and post-government income variables.

Table 1 presents descriptive statistics of some of the main variables at individual and family levels 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 1: **Summary statistics of primary earners in financial year 2020**. The values of income, tax liabilities and transfers are expressed in 2018 AUD.

2.2 Methodology

We employ a nonparametric approach from Guvenen et al. (2021) to characterize earnings dynamics, and similar metrics as in De Nardi et al. (2021) to measure family and government insurance. Accordingly, the terms "*insurance*" is defined as the extent to which the second- and higher-order risks (*standard deviation*, *skewness* and *kurtosis* of an income shock distribution) are mitigated by a particular income component. The current practice involves comparisons of moment properties between distributions of shocks at different income layers in a successive fashion, ranging from individual market earnings to household disposable income, to capture each component's contribution (i.e., insurance) to the eventual risk outcome.

Income growth rate. As in Guvenen et al. (2021), the income process abstracts from macroeconomic events, time trends and deterministic life cycle factors. More precisely, we first purge age and time effects from income variables by taking a least squares regression of log income on quadratic age terms and dummy year variables

$$\log y_{i,t} = \beta_1 age_{i,t} + \beta_2 age_{i,t}^2 + \beta_3 year_t + \mu_{i,t}, \tag{1}$$

where $y_{i,t}$ is income of individual i at time t. Next, we compute the residual income ($\widehat{\mu}_{i,t}$) from equation 1 for each individual i in year t and calculate the changes between two years.[8] The resulting n-period residual income changes are given by $\Delta^n_{\widehat{\mu}_{i,t}} = \widehat{\mu}_{i,t} - \widehat{\mu}_{i,t-n}$. Technically, $\Delta^n_{\widehat{\mu}_{i,t}}$ represents a change in income of person i at time t occurring in n periods after controlling for the age and time effects. For example, when $n = 1$, $\Delta^1_{\widehat{\mu}_{i,t}}$ is the annual growth rate of residual income. We refer to these changes in 'residual' income as *income shock*s.

Figure 1 reports an empirical distribution of the annual residual income shocks. The second, third, and fourth moments of the distribution are named *second-*, *third-*, and *fourth-order earnings risk*, respectively. In this analysis, we examine both annual ($n = 1$) and 3-year ($n = 3$) average residual changes. Without knowledge of the nature of measurement errors in the survey data, the former contains both transitory shocks and measurement errors. Thus, by partially removing the transitory component, the latter's statistics achieve two objectives. First, they capture the more persistent element of shocks. Second, they help reduce the influence of measurement errors.

Group-specific income shocks. Individual income shocks are subsequently grouped by (*i*) *age cohort* and (*ii*) *income history*. There are four age cohorts, namely $\{25-34,\ 35-44,\ 45-54,\ 55-64\}$. Income history, measured by either past usual weekly earnings or past regular annual market income, is grouped by decile.[9] Then, for every subgroup conditioned on (i) and (ii), we study their respective empirical distributions.

[8] The use of log income implicitly drops observations with zero labour income. To address this problem, we recalculate all our moment estimates using the Arc-Percent Change method which is the mid-point average of changes of individual-to-group income ratios. The group income is the average income by subgroup of interest (e.g., age cohort and income history). In other words, $\Delta^n_{\hat{\mu}^{arc}_{i,t}} = \dfrac{\hat{\mu}^{arc}_{i,t} - \hat{\mu}^{arc}_{i,t-n}}{(\hat{\mu}^{arc}_{i,t} + \hat{\mu}^{arc}_{i,t-n})/2}$ where $\hat{\mu}^{arc}_{i,t} = \dfrac{y_{i,t}}{\bar{y}_t}$. We do not find any significant differences and conclude that our results are robust to the inclusion of zero income.

[9] When $n = 1$, the past or previous period income refers to last year income. When $n = 3$, the appropriate previous period income is the average income of the past 3 years. Since we do not have a longer time series covering the entire life cycle of individual observations, the setup allows us to understand what the dynamics of individual earnings and household income look like at different points of life. In other words, it tells us the average experience with regards to earnings risk and insurance of someone who belongs to the intersection of a particular age and income group. Because the reliability of estimates for each subgroup depends on the size of observations, we limit our study to just four age cohorts and income decile.

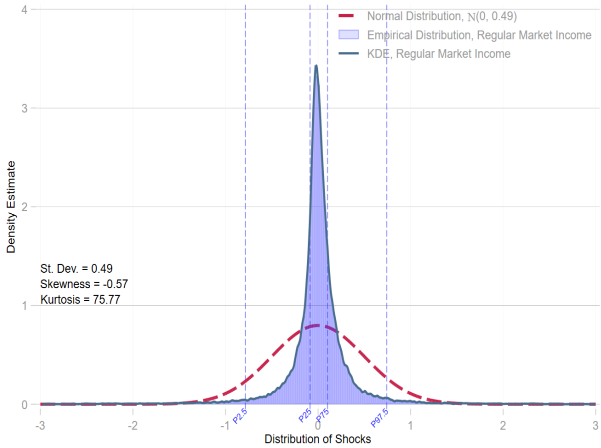

Figure 1: **Empirical distribution of annual growth ($\Delta^{n=1}_{\widehat{\mu}_{i,t}}$) of residual individual regular market income for primary earners aged** $25-64$. *Notes:* A corresponding distribution of 3-year average income growth ($\Delta^{n=1}_{\widehat{\mu}_{i,t}}$) is reported in the online technical Appendix.

Higher-order moments. We characterize the distribution of income shocks using second- and higher-order moments: (a) *Variance*, (b) *Standardized (Pearson) Skewness*, and (c) *Standardized (Pearson) Kurtosis.*

To better understand the dynamics of income process and draw a distinction between parametric and nonparametric methods in deriving the second- and higher-order moments of shocks, consider first a parsimonious permanent and transitory component model for the equation 1

$$\widehat{\mu}_{i,t} = z_{i,t} + \epsilon_{i,t}$$

where $z_{i,t}$ is the permanent component which follows a random walk such that $z_{i,t} = z_{i,t-1} + \eta_{i,t}$, and $\epsilon_{i,t}$ is the transitory component. The permanent ($\eta_{i,t}$) and transitory ($\epsilon_{i,t}$) innovations are drawn from some distributions $F_\eta \sim \left(0, \sigma^2_\eta\right)$ and $F_\epsilon \sim \left(0, \sigma^2_\epsilon\right)$, respectively. Note we do not restrict the innovation terms to be drawn from normal distributions. Accordingly, we can compute $n-$year log income growth

$$\Delta^n_{\widehat{\mu}_{i,t}} = \widehat{\mu}_{i,t} - \widehat{\mu}_{i,t-n} = \sum_{j=t-n+1}^{t} \eta_{i,j} + \epsilon_{i,t} - \epsilon_{i,t-n}. \tag{2}$$

This implies that the income shock process (or earnings risk) is driven by the permanent ($\eta_{i,t}$) and transitory ($\epsilon_{i,t}$) innovations. Accordingly, let σ_x, S_x and K_x denote the standard deviation, skewness and kurtosis of distribution F_x, $x \in \{\eta, \epsilon\}$, respectively. Given the parametric model defined in Equation 2, we can compute the second to fourth moments of the $n-$year log income growth $\Delta^n_{\widehat{\mu}_{i,t}}$ analytically

$$\begin{aligned}
\sigma^2_{\Delta^n_{\widehat{\mu}_{i,t}}} &= n\sigma^2_\eta + 2\sigma^2_\epsilon \\
S_{\Delta^n_{\widehat{\mu}_{i,t}}} &= \frac{n \times \sigma^3_\eta}{\left(n \times \sigma^2_\eta + 2 \times \sigma^2_\epsilon\right)^{\frac{3}{2}}} S_\eta \\
K_{\Delta^n_{\widehat{\mu}_{i,t}}} &= \frac{n \times \sigma^4_\eta}{\left(n \times \sigma^2_\eta + 2 \times \sigma^2_\epsilon\right)^2} K_\eta + \frac{2 \times \sigma^4_\epsilon}{\left(n \times \sigma^2_\eta + 2 \times \sigma^2_\epsilon\right)^2} K_\epsilon
\end{aligned}$$

The previous literature assume that the permanent and transitory innovation terms are drawn from normal distributions $N_\eta \sim (0, \sigma_\eta^2)$ and $N_\epsilon \sim (0, \sigma_\epsilon^2)$, respectively. This implies that $\Delta^n_{\widehat{\mu}_{i,t}}$ follows a normal distribution $N_{\Delta^n_{\widehat{\mu}_{i,t}}} \sim (0, n\sigma_\eta^2 + 2\sigma_\epsilon^2)$. For example, Chatterjee, Singh and Stone (2016) employs this approach to estimate a random-walk permanent/transitory model for Australia. If we use similar assumptions and moment conditions, we can estimate σ_η and σ_ϵ and work out $\sigma_{\Delta^n_{\widehat{\mu}_{i,t}}}$, $S_{\Delta^n_{\widehat{\mu}_{i,t}}}$, and $K_{\Delta^n_{\widehat{\mu}_{i,t}}}$.

However, we take a different (nonparametric) approach as in Guvenen et al. (2021) and directly calculate the second- and higher-order moments of income shocks. That is, we calculate the group–specific shocks via

$$\tilde{\mu}_z^k = \mathbb{E}\left(\frac{z - \mu_z}{\sigma_z}\right)^k \tag{3}$$

where z denotes $\Delta^n_{\widehat{\mu}_{i,t}}$, μ_z denotes $\mathbb{E}(z)$ and $\tilde{\mu}_z^k$ denotes the k^{th} standardized moment of z. This approach allows us to test the Gaussian and linear shock assumptions in addition to identifying the sources behind the non-normalities and non-linearities.

For comparability with the literature, we also document quantile-based measures of skewness and kurtosis, namely,

$$Kelley's\ Skewness = \frac{(P_{90} - P_{50}) - (P_{50} - P_{10})}{P_{90} - P_{10}}$$

and

$$CrowSiddiqui\ Kurtosis = \frac{P_{97.5} - P_{2.5}}{P_{75} - P_{25}}.$$

3 Results

In this section, we present two sets of main findings. We discuss the dynamics of earnings, wages, and hours of primary earners by age group and past income decile in subsection 3.1. We turn to the role of family and government in subsection 3.2.[10]

3.1 Second and higher-order moments

3.1.1 Dispersion

Figure 2 reports second moment statistics of average earnings, wage, and hour changes by earnings history of employees who are primary earners with consistent work history.

There are common features between the left and right panels which respectively show the variances for annual and 3-year average changes. First, the variances of earnings, wage and hour changes are especially pronounced for the bottom-most decile, more than twice those of the remaining income groups. That a similar pattern can still be observed for the 3-year average changes, though to a much smaller extent, suggests that the poorest labour income earners face more persistent second-order risks. While primary earners in the top decile do experience a somewhat larger dispersion in their earnings and wage changes, the difference to those in the upper lower and middle income brackets is trivial. Second, wage changes play a markedly bigger role in explaining residual earnings fluctuations, except

[10]Supplementary analyses on (i) self-employed, and (ii) permanent and full-time employees are in Appendices C and D, respectively.

for the bottom decile whose changes in hour and wage exert virtually equal influence sizewise on the variance of annual earnings shocks. The fact that a large proportion of part-time (≈50%) and casual (≈30%) workers in the sample belongs to the bottom decile helps account for their higher variance of hour changes.[11] Third, the large negative covariance $COV(\Delta w, \Delta h)$, particularly for the lower past income deciles, suggests a strong negative income effect. In other words, low-income primary earners encountering adverse wage shocks make up for the loss by significantly increasing their work hours.[12]

figures/Earnings dynamics/fig2_variances_1year_and_3year_changes_pe_20-ep

Figure 2: **Variances of average changes in regular earnings, wages and hours of primary earners**.

There are also notable differences between the annual and 3-year statistics. The latter's variance undergoes a substantial decline, most strikingly for the bottom past income decile. One can say that the second-order persistent earnings risk falls precipitously for the lowest decile to a comparable level with their higher income counterparts. For the rest of the income group, the variance of hour changes diminishes by a lesser extent compared to that of wage changes, but wage changes still contribute more to the fluctuations of their 3-year average earnings shocks. In addition, the right panel displays a significant shrinkage of income effect as reflected by the lesser wage-hour covariance magnitude for persistent risk.

Knowing that the second-order earnings risk is more strongly associated with the wage process does not inform us about how wages and hours explain different directions and sizes of earning changes. Figure 3 thus complements the above findings by illustrating that: (i) wage changes constitute the main driving force behind earnings changes, especially in the upward movement, (ii) hour changes are more important for low income groups, and (iii) there exists asymmetry between positive and negative earnings changes with respect to their contributing factors.

The annual statistics of Figure 3 show that, apart from the bottom decile, wages contribute substantially more to the movement in earnings, whereas the contribution by hours is either small or absent. For the fifth and ninth deciles, hours contribute solely to negative earnings changes, though their role is still limited relative to that of wage changes. In contrast, for the poorest, hour changes contribute about as much as wage changes do to large earnings fluctuations.

A critical distinguishing factor between the annual (*top panel*) and the 3-year (*bottom panel*)

[11] We find that this non-linearity of the second-order risk persists across subsamples (see Appendix F). We also find that removing part time and casual employees significantly weakens the role of hours in driving the earnings dynamics of low income earners (see Appendix D).

[12] We report more second moment statistics of annual and 3-year average earnings, wage and hour changes in the technical appendix.

figures/Earnings dynamics/fig3new_decomp_earningschanges_1yearVS3year_pe_18minemp_2

Figure 3: **Average changes in residual regular wages and hours versus changes in residual regular earnings.** *Notes:* These are results for primary earners (main job) in the 1st, 5th, and 9th deciles of past regular weekly earnings. The top and bottom panels report annual and 3-year average changes, respectively.

average statistics in Figure 3, aside from the smaller extremes, is the stronger earnings-hour correlation of the latter. As depicted in the bottom-left graph for primary earners in the lowest past income decile, hour changes are dominant in driving extreme earnings changes on both ends. For example, at their highest positive (*negative*) earnings changes of 0.30 (-0.30) log points, the corresponding average hour and wage changes are around 0.25 (-0.18) and 0.125 (-0.12) log points, respectively. Likewise, for the median and top income earners (bottom-middle and bottom-right graphs), their 3-year average changes in hours explain a greater proportion of the fall in earnings, particularly at the extreme. On the positive side, however, the top and the bottom panels show almost no divergence with respect to the relative shares of hour and wage changes in accounting for earnings changes of the two income groups.

The above findings indicate that for middle and upper income primary earners, transitory and persistent earnings changes are largely determined by wage changes. The role of hours is negligible on the positive side, but it does explain a small to moderate fraction of large falls in their earnings. These results are consistent with the rising variance of log hourly wages and persistent component of wage shocks over time and over life cycle as documented in Chatterjee, Singh and Stone (2016); Kaplan, Cava and Stone (2018); Freestone (2018). However, they deviate from the previous findings for other OECD countries where hours take either a dominant or an equal role in driving the earnings dynamics (see De Nardi et al. (2021) for the US and the Netherlands and Halvorsen et al. (2022) for Norway). The institutional features of the laws and regulations surrounding wages and work hours in Australia, including the national minimum wage and the national employment standards (NES), might have generated rigidity along the intensive margin of labour supply, making it hard for both employers and employees to adjust non-casual hours up. More specific examples are the high extra remuneration for overtime work and the legal arrangement that permits annual leave to be accrued on overtime hours (abolished in 2009).[13] In consequence, it is unlikely that full-time workers can

[13] More information on overtime pay in Australia can be found on FairWork Ombudsman's website.

increase their earnings by working longer hours than they already do. The labour market structure that influences job and career mobility - voluntary or involuntary - might also have played a role in raising the influence of wages on earnings growth. Conversely, there are fewer barriers when hours fall due to, for instance, early retirement, health shock and unemployment spells that are either less or not constrained by the hour cap or the institutional friction.

Quite the contrary, the earnings dynamics of employees in the bottom decile behave differently. Hour changes contribute roughly as much as wage changes do to the changes in their earnings. As a large portion of this group works in casual and/or part-time employment, they are subject to fewer regulations and have a greater degree of freedom to adjust their hours. This group is also more likely to be underemployed or unemployed temporarily, which implies that the perceived changes in usual work hours may also involve some information on the extensive margin.[14]

Lastly, some caveats apply in interpreting the results. As wages are derived from usual weekly work hours and earnings, measurement errors arise because of the loss of information pertaining to short-term unemployment spells and other irregularities affecting work hours within each year of observation. The exclusion of workers with inconsistent employment history helps alleviate the problem, but the strict sample selection criteria come at some cost of information on the extensive margin. This finding therefore applies primarily to the intensive margin of labour supply. That said, assuming independent measurement errors, the errors would have to be large to explain away the observed pronounced differences in hour and wage contributions. Note too that, relaxing the sampling restriction brings about a greater relationship between negative hour and negative earnings changes, and in this sense, enlarges the role of hours in explaining the earnings shock dispersion. Nonetheless, it does not change the result with regards to the non-existent impact of hours on the upward earnings movement, nor does it alter the fact that wage changes play the biggest role in producing the second-order earnings risk. On this ground, we expect the inclusion of more extensive margin information (e.g., with high-frequency administrative data) to reduce the measurement errors and expand the role of hours in explaining the downward movement of earnings, though it is improbable that the overall pattern described above will change qualitatively.

3.1.2 Skewness and Kurtosis

Figure 4 reports higher-order moments of earnings shocks. As seen in the top panel, except for workers in the bottom decile, the distribution of usual weekly earnings shocks is highly left skewed with its magnitude being an increasing function of past weekly earnings. In more colloquial terms, negative or left skewness (i.e., third-order risk) means extreme negative earnings shocks are more severe compared to positive ones, and at the annual level, the severity of third-order earnings risk rises with earnings. The corresponding 3-year average changes are however more symmetric although primary earners in the upper four past income deciles still experience a relatively high negative skewness. This implies that upper income primary earners are affected by more persistent extreme adverse shocks to their labour earnings.

It is apparent that both the distributions of annual and 3-year average hour changes are considerably more left skewed than those of earnings changes while the opposite is the case of wage changes.[15]

[14]We only have access to report on their employment status at the annual frequency. Even with the stricter sample selection criterion on work history, it is highly improbable that we are able to fully exclude those unemployed over a short time span within a year.

[15]Results are consistent across the various household characteristics we examine. See our technical appendix for the

figures/Earnings dynamics/fig4new_pskewness_and_kurtosis_1year_and_3year_changes_pe

Figure 4: **Pearson Skewness and Pearson Kurtosis of average changes in regular earnings, wages and hours of primary earners.**

These estimates demonstrate that the third-order earnings risk is driven by hours. In addition, we see that co-skewness of the annual changes tends to hover around zero, while the co-skewness of the 3-year average changes is more on the negative side. Negative co-skewness reflects the interaction between wage and hour changes, how a fluctuation in one tends to be accompanied by a decrease in the other. Since the second-order risk associated with wages is relatively high, the volatility of wage changes is the primary determinant of co-skewness. In this regard, negative co-skewness means large wage fluctuations are often associated with declines in hours, which add to the adverse earnings shocks. This explains why the co-skewness in Figure 4 moves in tandem with the skewness of earnings changes, though this joint wage-hour influence is small compared to that of hours.

The findings conform to our earlier understanding. Earnings shocks have more room downward than upward. Being in a full-time employment, to say nothing of the various institutional restraints, naturally places a hard upper bound on hours. Prior quantitative investigations suggest the nature of job ladder as a strong candidate explaining the role of hours in driving the third-order earnings risk. In particular, Lise (2012) shows how workers at the top of the wage distribution faces job-loss risk while those at the bottom climb the ladder slowly with the arrival of job opportunities and the incremental wage gains. Similarly, Huckfeldt (2018) finds that job loss leads to occupation displacement for some workers who are forced to search in the lower skilled labour market. In Australia, workers experiencing job loss could be absorbed and entrenched in its large part-time and casual employment industries. These factors might help account for the observed third-order hour and earnings risks of the upper income earners. For further discussion, see appendix D.[16]

third-moment statistics of annual and 3-year average earnings, wage, and hour changes by selected subsamples.

[16] In Appendix D, we show that removing casual and part-time employees from the sample leads to hours (wages) having a much weaker (stronger) influence on the 3rd-order earnings risks but does not diminish the magnitude of transitory earnings risk. This evidence, though incomplete, points in the direction of Lise (2012). It seems that most of the observed transitory 3rd-order earnings risk belongs to permanent and full-time employees. This in turn is driven by wage changes which can be interpreted as job loss and relocation to lower skilled industries, but we cannot rule out other factors such as voluntary job switching. For Australia, in particular, the third-order risk is not persistent for full-time and permanent workers. The entrenchment story of Huckfeldt (2018) does not seem to hold in this case.

The bottom panel of Figure 4 depicts shock distributions with excess kurtosis (leptokurtic). A leptokurtic distribution is denser around the centre (high peakedness) and thicker at the tails than the standard Gaussian distribution. The large kurtosis (i.e., fourth-order risk) thus implies that earnings shocks are rare and most are small, but at the extreme, they occur more frequently than typically assumed. To put it differently, most breadwinners seldom encounter any large changes to their earnings, but the probability of experiencing drastic earnings changes is greater than otherwise prescribed by the standard Gaussian distribution. The figure shows that the fourth-order earnings risk is driven primarily by the large kurtosis of hour changes. As an example, except for those in the lowest decile, although both wage and hour kurtoses contribute to the excess kurtosis of annual earnings shocks, the contribution by hours is approximately twice as much.

The impact of hour changes on the fourth-order earnings risk is dampened to an extent by the negative co-kurtosis, a counter-balancing force. Co-kurtosis between two random variables captures the relationship between extreme change of one variable and deviation of the other. They can also be understood as the likelihood that two random variables undergo either positive and negative drastic changes together. The negative co-kurtosis thus suggests that an extreme decrease (*increase*) in wages tends to be offset by an increase (*decrease*) in work hours. This interaction reduces the otherwise high density at the centre and tailends of the annual earnings shock distribution, thereby mitigating the fourth-order earnings risk to a relatively moderate level. For more persistent changes (bottom-right panel), the effect size of hours shrinks for the lower six deciles, though its contribution to the fourth-order earnings risk remains strong for the upper four deciles.

In short, our findings indicate that the distribution of earnings shocks displays negative skewness and excess kurtosis, deviating from the conventional linearity and normality assumptions. In our extension, we estimate a parametric model of earnings dynamics and find that the estimated non-Gaussian model can reproduce the pattern of these key empirical facts.[17]

Results in this section also highlight the variation in the sources of earning shocks. Based on the second moment statistics, wage changes account more for the second-order earnings risk and are strongly associated with earnings changes on average; meanwhile, the contribution of hour changes is largely absent in upward movement and relatively small in downward movement of earnings changes. In contrast, our third and fourth moment estimates in Figure 4 tells a story of hour dominance. They show that hour changes constitute the principal source behind the higher-order earnings risks. These findings concerning the role of wages and hours in explaining earnings dynamics are qualitatively robust across the different household characteristics examined.

3.2 Insurance against earnings risk

In this section we study the extent to which earnings risk is mitigated by implicit and explicit forms of insurance arrangement. We use regular market earnings - a broader income definition comprising earnings from all market sources - instead of labour earnings. We begin with a brief comparison of the second-order regular market earnings risks faced by different age cohorts. We next report the role of family and government insurance in part 3.2.1 and 3.2.2, respectively.

For our purpose in this section, we relax the previous section's sampling restriction and include all employees regardless of their employment history. In addition, we consider robust moment statistics P1-P99, P5-P95, and P10-P90 to address potential outliers that may arise due to the broader sampling

[17] We provide a detailed description of the econometric model, estimation method and results in Appendix E.

criteria. Nonetheless, the non-robust and robust statistics only differ quantitatively while the qualitative patterns persist across settings. We chose to present the P1-P99 figures in the main paper for ease of interpretation, conciseness and aesthetic. For higher-order moments, the discussion revolves around the Pearson measures of skewness and kurtosis (i.e., the standardized third and fourth moments) of the income shock distributions and not the quantile-based robust skewness and kurtosis (i.e., Kelley's Skewness and Crow-Siddiqui Kurtosis).[18] This is to ensure an acceptable degree of robustness without sacrificing too many observations at the tails of the distributions that contain information crucial for the understanding of family and government insurance against higher-order risks.

3.2.1 Family insurance

Figure 5 displays standard deviation statistics of the shock distributions for annual (*left panel*) and 3-year (*right panel*) average regular market income, both of which have U-shaped income profiles for all four age cohorts with the greatest dispersion for primary earners whose past regular market income lies in the lowest decile. As in the case of usual weekly earnings statistics discussed above, top earners experience relatively strong fluctuations, but the magnitude is considerably smaller than those of the bottom decile. The high share of low income earners employed in part-time and casual jobs that entail more irregular hours, seasonality, and risk of layoff is one potential reason.

There are notable differences between the two panels. First, excluding the bottom decile, we see a small non-uniform decrease in the second-order persistent earnings risk associated with the 3-year statistics for all cohorts. Second, for workers in the bottom-most decile in particular, the fluctuations of their 3-year average market earnings shocks are substantially smaller compared to those of their annual shocks. The drop is even more drastic for the younger cohorts.

A closer inspection further shows that the distributions of earnings shocks of the two middle age cohorts ($35-44$ and $45-54$) are predominantly less dispersed compared to those of the youngest and the oldest. Career/job switching and pursuit of higher education are possible causes of the more volatile shocks for the young. Health shock and early retirement are more prevalent among members of the oldest cohort ($55-64$). However, for the middle cohorts who are in the prime age of carrying family responsibilities (e.g., raising children), these events are perhaps less likely. In turn, when compared to the oldest, the youngest experiences higher transitory and persistent fluctuations, especially if they happen to be below the median past income. Loosely speaking, this implies that the process driving the second-order earnings risk for the youngest group is more potent and persistent. A plausible explanation is that job/career mobility and other early life events can result in either adverse or favourable earnings growth and therefore more variation, whereas health status deterioration and early retirement in later life cycle only lead to decline (a unidirectional change) in market earnings and thus less variation. Similar results are observed across the different measurements of second-order risk.[19]

A logical follow-up question to the prior discussion is to what extent does family income insure primary earners against their market earnings risks. To answer this question, we first compare the standard deviation of individual market income with that of family market income to capture *family market income insurance.* Then, private transfers from non-resident family members are added to

[18]For comparability with the literature, Kelley's and Crow-Siddiqui figures are included in the appendix and the extension section of the main paper, though not elaborated. P5-P95 statistics are reported in the appendix. We do not present P10-P90 statistics due to space constraint.

[19]See Appendix F for more detail.

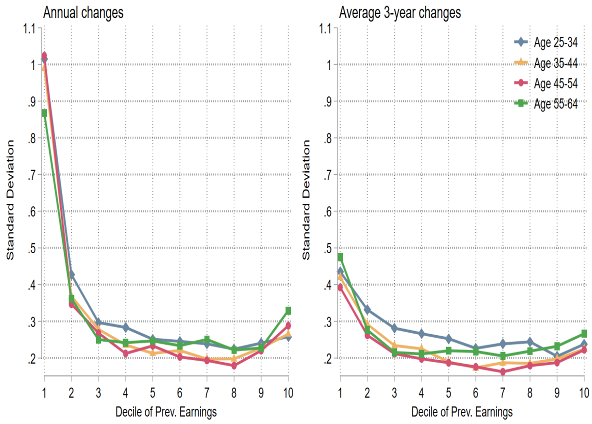

Figure 5: **Standard deviation of the distribution of regular market earnings shocks for primary earner (P1-P99)**.

family market income to derive total family pre-government income. We define the extent by which the standard deviation of this new variable falls below that of the family market income as *family private transfer insurance.*

Evidence from Figure 6 reveals that the insurance effect of family market income and private transfer against the second-order individual market income risk is little to none. This is unexpected. The top panel demonstrates that family insurance only applies to those situated in the bottom past income decile, and only family market income matters while the addition of private transfer marginally raises the dispersion level. Even this small family market income insurance for the poorest dissipates completely when we consider the more persistent 3-year average shocks. In fact, the bottom panel indicates that family earnings and private transfer actually elevate the second-order persistent risk.

The absence of family insurance implies dominance of the *income-pooling effect* of family as opposed to the *added-worker effect.*[20] That is, family members do not actively adjust their market activities (e.g., labour supply) in response to primary earner's earnings shocks. As a result, earnings from secondary earners tend to increase the variance of combined family market income.

Next, in order to learn about family insurance against higher-order risks, we perform the same pairwise comparison on skewnesses and kurtoses of the distributions of primary earner's own market income, family market income and family pre-government income.

Figure 7 conveys more revealing information. As it turns out, the above passiveness of family members only applies to small and moderate shocks. Family income is still paramount to insuring against the third- and fourth-order market earnings risks. Secondary earners appear to respond to extreme adverse earnings shocks of primary earners.[21] The top panel of Figure 7 shows large negative skewness (between -1.0 and -2.5) for primary earners in the upper nine deciles of the past market income distribution across all age groups. Evidence from Figure 4 points to hour changes as the

[20]The variance of family income changes is given by $VAR(\Delta f) = f_p^2 VAR(\Delta p) + \overbrace{f_s^2 VAR(\Delta s)}^{\text{income-pooling effect}} + \overbrace{2 f_p f_s COV(\Delta p, \Delta s)}^{\text{added-worker effect}}$, where f_p and $f_s = 1 - f_p$ are income shares of the primary and secondary earners, respectively; $f_p^2 VAR(\Delta p)$ is the contribution of primary earner's earnings shock variance; $f_s^2 VAR(\Delta s) > 0$ is the contribution of secondary earner's shock variance (*income-pooling effect*); $2 f_p f_s COV(\Delta p, \Delta s)$ is the contribution of the covariance (*added-worker effect*). See subsection B.2 of the appendix for further exposition.

[21]The observed insurance effect against higher-order earnings risks is generally consistent across all the subsamples analysed. Thus, we only report the annual statistics and leave the rest in the appendix.

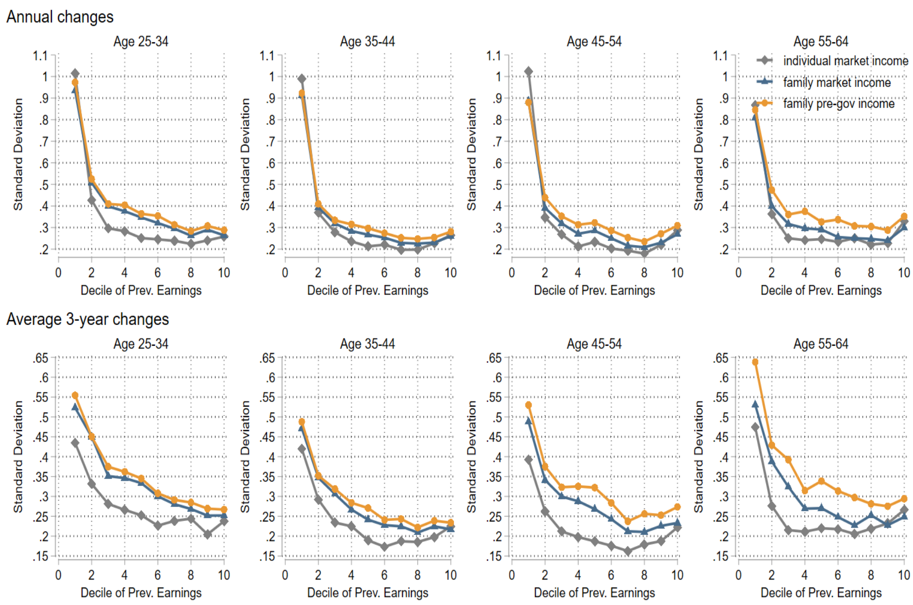

Figure 6: **Standard deviation of the distributions of annual and 3-year average shocks of individual market income, family market income and total pre-government family income by decile and age**. *Notes:* The figure shows the relative contribution of family market income and private transfer to the second-order risk of total family pre-government income.

main driver. Under this scenario, family market income provides substantial insurance, resulting in remarkably lower negative skewnesses (ranging between -0.5 and -1.5) compared with those of the individual income shocks. Better-off households (at or above the median past earnings) from the oldest age cohort ($55-64$) also benefit from moderate private transfer insurance, supplementing the market income adjustment by their members. In fact, the presence of private transfer allows the third-order pre-government income risk of the richer seniors to arrive at a similar level as those of the younger cohorts who rely exclusively on family market income insurance.

The sole outlier is the bottom decile primary earners whose skewness is strongly positive. As aforementioned in subsection 3.1.2, the bottom decile earners have more room upward than downward. More flexibility and opportunities for growth of hours and wages could help account for the observed dynamics.

Kurtosis of the earnings shock distribution also manifests non-Gaussian and non-linear properties. According to the lower panel of Figure 7, kurtosis is large and positive (leptokurtic) with a somewhat hump-shaped income-profile for all age cohorts. Its minimum is around 5 which is well above the standard normal kurtosis value of 3. Like skewness, kurtosis statistics in Figure 4 suggest hours to be the main explanatory factor. Moreover, since annual level earnings shocks may involve short-term unemployment spells, they likely augment the influence of hours. As for insurance against the fourth-order earnings risk, the mitigating effect of family market income is significant, enough to reduce the kurtosis levels for all households to comparable degrees (between 5 and 7). The only exception is for the bottom decile primary earners whose kurtosis is already small to begin with. Again, the ability to adjust one's hours for casual and part-time employees in response to shocks could partly explain the relatively smaller fourth-order risk of those in the lower past income deciles.

We also compute Kelley's skewness and Crow-Siddiqui kurtosis.[22] The Crow-Siddiqui kurtosis

[22] See subsection F.2. in the appendix for the corresponding P1-P99 and P5-P95 standardized and quantile-based statistics of the annual and 3-year average changes.

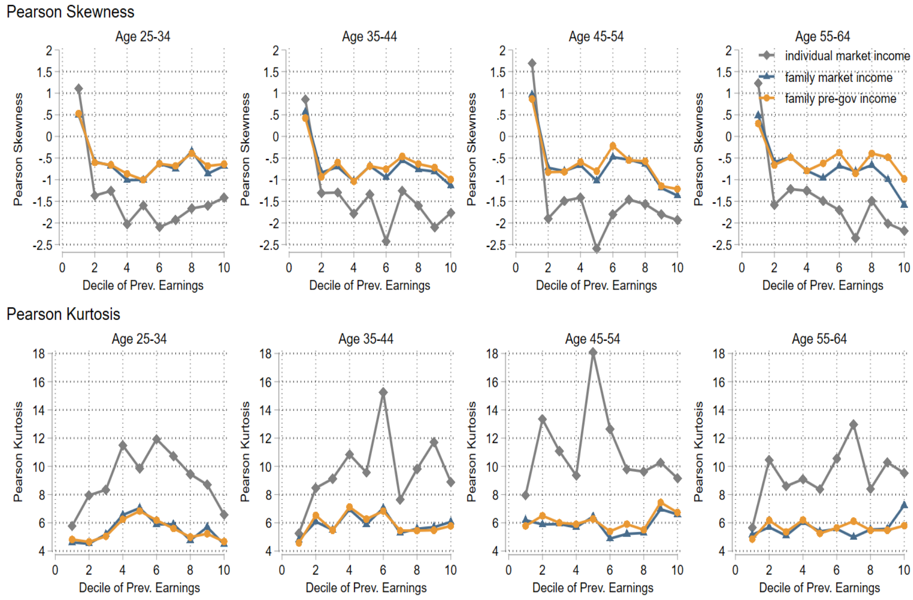

Figure 7: **Skewness and Kurtosis of the distributions of annual shocks of individual market income, family market income and total pre-government income by decile and age**. *Notes:* The figure captures the relative contribution of family market income and private transfer to the third- and fourth-order risks of total family pre-government income. Corresponding moment statistics for 3-year average changes show similar patterns and are provided the technical Appendix.

behaves more erratically compared with the Kelley's skewness statistics, though the hump-shaped income profile and the family insurance effect can still be observed. In contrast, Kelley's skewness exhibits more consistent patterns across the different measurements. It demonstrates that once enough extreme shocks at the tailends have been excluded, the shock distributions for those below the median lean rightward and the upper deciles shock distributions lean leftward. The distribution of shocks however become fairly symmetrical, which confirms that the third-order risk discussed is primarily the story of the lower and upper 10% whom the Kelley's skewness ignores. Additionally, it highlights the fact that extreme shocks in either direction (i.e., adverse or favourable) bring about family responses. Not only do family members increase their market activities to offset severe downward shocks, the Kelley's skewness statistics indicate that they also react to large positive shocks by cutting back their own market activities.

In a nutshell, it appears that extreme shocks induce responses from family. For a typical employee - who is also the primary earner of their household - in Australia, their family market income serves as a crucial source of insurance against the third- and fourth-order earnings risks even if it does not mitigate the second-order risk.

3.2.2 Government insurance

We now turn to the role of government insurance provided via progressive taxes and transfers - *government tax insurance* and *government transfer insurance* - against the second- and higher-order risks of family pre-government income. For our purpose, government tax insurance is defined as the extent to which combined family income taxes reduce the second- and higher-order risks of family pre-government income. Analogously, government transfer insurance is the extent to which public transfers can fulfill the same task. We capture the former by the gap between moment statistics of family pre-government income and post-tax (pre-transfer) income, and the latter by that between family post-tax (pre-transfer) income and family post-government (post-tax and post-transfer) income.

Figure 8 depicts the effect of government insurance in mitigating the dispersion of shocks (second-order risk). Based on annual change statistics in the top panel, though tax insurance is trivial, government transfer considerably decreases the second-order risk of family pre-government income for primary earners below the median past market income.[23] The insurance is at its largest for the poorest households and declines rapidly as one moves up the income hierarchy. A noteworthy observation is that relative to the annual statistics, government transfer insurance against persistent second-order risk remains significant (bottom panel of Figure 8). For the bottom decile, the magnitude of insurance may have declined but not in a relative sense. This is most likely a product of the targeted and means tested welfare programs such as the family-oriented social securities from which families receive pecuniary support (with large base and maximum payments) conditional on number of dependent children and combined family income level. Thus, government insurance is effective against both transitory and persistent second-order risks. However, it may also be a sign that households rely too heavily on public transfers, and that the presence of strong government insurance influences behaviour and consequently the persistence of income risk.[24]

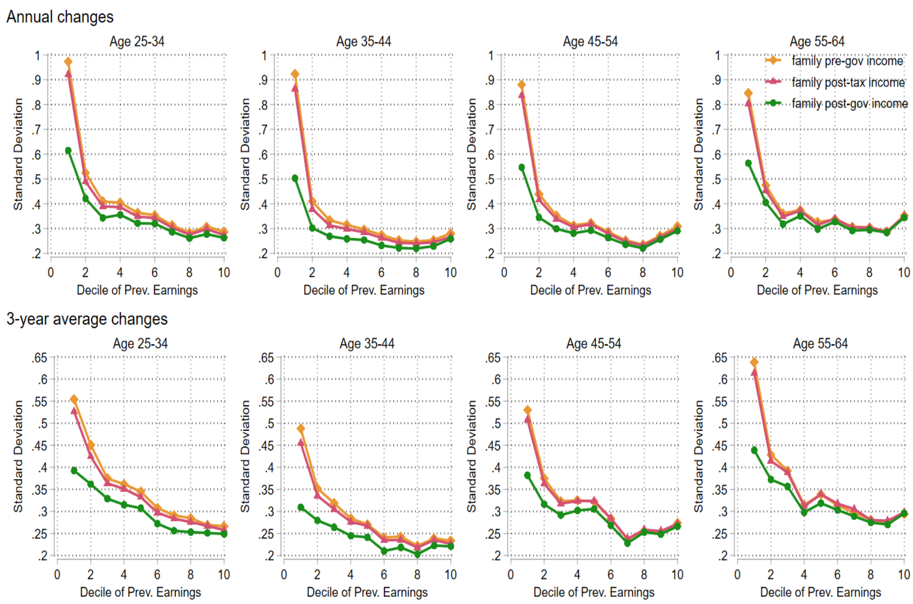

Figure 8: **Standard deviation of the distributions of annual and 3-year average shocks of pre-government family income, post-tax (pre-transfer) family income and post-government (post-transfer) family income by decile and age**. *Notes:* The figure shows the relative contribution of tax and public transfer to the second-order risk of family disposable income.

Figure 9 shows the relative contributions of tax and transfer to the third-order risks of annual (*top panel*) and 3-year (*bottom panel*) average family disposable income. Given the large family insurance against extreme shocks, it is to be expected that the government insurance is relatively small. Still, government transfer insurance against the third-order risk at the annual level is visible and non-trivial for most households, especially those of the younger two cohorts. For the 3-year average changes, the

[23]This occurs because by construction, public transfer and pre-transfer income move in opposite direction. That is, $COV(income, transfer) < 0$.

[24]See subsection F.3 of the appendix for the corresponding P1-P99 and P5-P95 second moment statistics of the annual and 3-year average changes.

insurance remains sizeable for the youngest but largely disappears for the older cohorts.

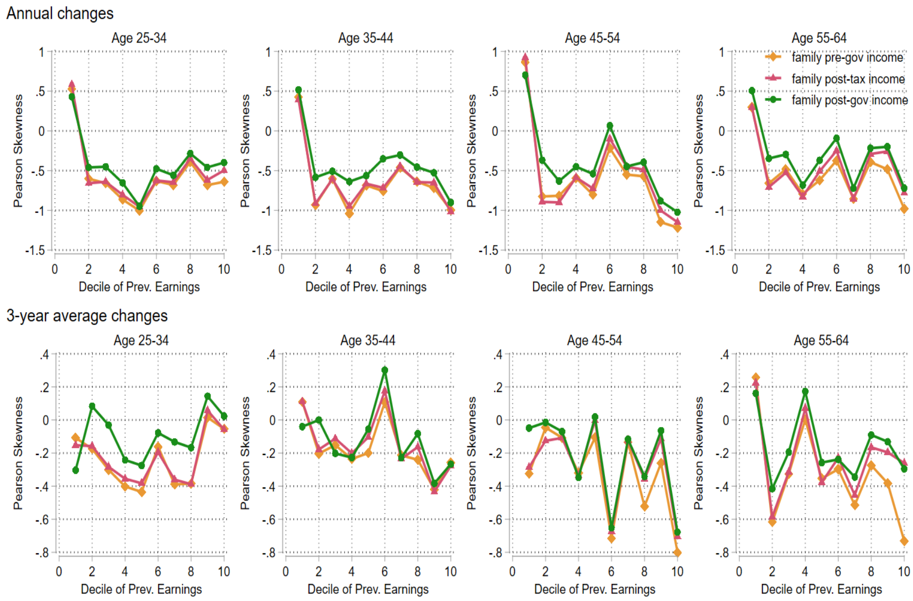

Figure 9: **Skewness of the distributions of annual and 3-year average shocks of pre-government family income, post-tax (pre-transfer) family income and post-government (post-transfer) family income by decile and age**. *Notes:* The figure shows the relative contribution of tax and public transfer to the third-order risk of family disposable income**.**

On the other hand, the annual statistics on the top panel of Figure 10 suggest that government tax and transfer insurance against the fourth-order family pre-fiscal income risk is generally absent. Likewise for the 3-year average changes on the bottom panel, government tax and transfer play no insurance role; on the contrary, they could lead to more excess kurtosis for some households.[25]

3.2.3 Spousal response versus government transfer

One of the key lessons from the previous section is that government transfer is an important source of insurance against income shock volatility while family market income insurance is most potent against extreme shocks. To explore this result further, we construct two additional figures (aggregated over age) to learn more about primary earner's earnings shocks and their correlations with changes in spouse's market earnings and public transfer.

Figure 11 plots spouse's average weekly wage and hour changes against changes in weekly earnings for primary earners grouped by their past income rank. In the top panel, we see that annual changes in work hours and wages of spouse in response to primary earner's earnings shocks are largely absent. As Figure 11 is based on usual weekly work hours and wage rates, one may argue that some fluctuations within a year such as temporary unemployment of primary earners and employment of their partners are omitted, which could explain the absence of spousal response. However, the fact that the 3-year average statistics (the bottom panel) still show no sign of any sizeable or consistent spousal response corroborates our earlier hypothesis that market activity adjustment on the part of spouse is indeed lacking.[26]

[25]See subsection F.3 of the appendix for corresponding P1-P99 and P5-P95 third and fourth moment statistics of the annual and 3-year average changes.

[26]In appendix D, we show that the observed (lack of) spousal responses holds even more strongly for the permanent and full time subsample.

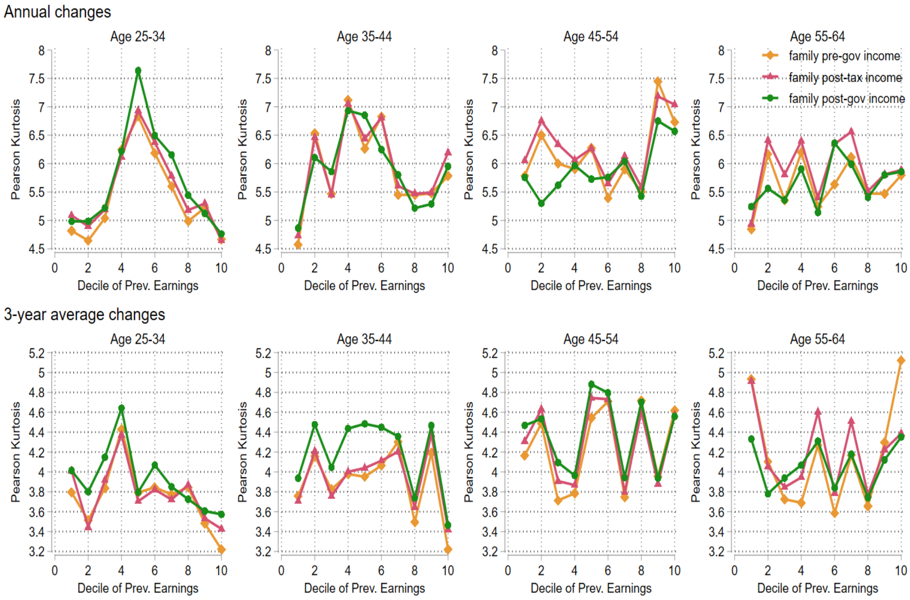

Figure 10: **Kurtosis of the distributions of annual and 3-year average shocks of pre-government family income, post-tax (pre-transfer) family income and post-government (post-transfer) family income by decile and age**. *Notes:* The figure shows the relative contribution of tax and public transfer to the fourth-order risk of family disposable income.

figures/Earnings dynamics/fig12_decompose_changes_1yearVS3year_spouse_20-eps-conver

Figure 11: **Changes in weekly wages and hours of spouse versus decile of changes in weekly earnings**. *Notes:* These are results for of primary earners (main job) in the 1st, 5th, and 9th deciles of past weekly earnings. The top and bottom panels report statistics of annual and 3-year average changes, respectively.

Figure 12 compares average changes in annual spousal earnings and public transfer against changes in primary earner's annual regular market earnings. Partly, annual variables allow us to address the aforementioned shortcoming and capture more information at the extensive margin of labour supply. Nevertheless, the figure depicts an almost identical result on spousal response to that of the weekly statistics. Evidently, average spousal responses to both negative and positive changes in primary earner's annual earnings are economically insignificant. While we do see some movement in spousal earnings, they are inconsistent and do not suggest a conscious counteraction made by the spouse to changes in their partner's income. Perhaps equally striking, though anticipated, is the strong negative correlation between changes in primary earner's residual income and public transfer. At the extreme of annual changes for the median income primary earners (top-middle graph in Figure 12), for example, a decrease (*increase*) in their previous annual earnings by -0.8 (0.8) log points corresponds to an increase (*decrease*) of approximately 0.35 (-0.5) log points in public transfer. Response from the transfer system is even greater for richer households in the 9th decile, plausibly owing to the means test on combined family income. The 3-year average change statistics on the bottom panel convey a matching story.

figures/Earnings dynamics/fig13_decompose_changes_1yearVS3year_spouseVSgovttransfer

Figure 12: **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**.

Figures 11 and 12 offer a new perspective and make possible comparison between different directions and degrees of changes. What has become transparent is that, on average, the greatest response to individual earnings changes comes from the public transfer side. The spousal earnings adjustment tends to be either insignificant or inconsistent. Interestingly, though the sign is weak, it appears that spousal and government responses move in opposite direction. Government insurance may have crowded out family insurance, and how much of the observed spousal behaviour stems from the existence of large public transfer insurance is a subject worth inquiring into.

In summary, section 3.2 demonstrates that the roles of family and government insurance in Australia generally do not overlap. Family market income does not insure against the second-order risk; however, against the higher-order risks, it is a major source of insurance. Conversely, government transfer serves as an effective tool insuring against the second-order risk, especially for young and low income households, but its impact on the third-order risk is comparatively small. Our findings are different from those of De Nardi et al. (2021) which show that government transfers are a major source of insurance in the Netherlands, substantially reducing the standard deviation, negative skewness, and kurtosis of residual income shocks; whereas, the role of family insurance is much larger on all fronts in the US.[27]

Note that, these findings are restricted to employees who constitute the largest share of our sample (84.3%). The sample size of the self-employed is inadequate to get comparable detailed results. A more specialized dataset is necessary. As a preliminary examination and a guide for future work, we estimate moment statistics of the self-employed by past income quintile and two broad age groups. Interestingly, we find their family market income and private transfer insurance against the second-order individual earnings risk to be non-trivial.

4 Extensions

Demographic variability raises questions about the extent to which household structure can affect the role of family and government insurance. In this section we extend our analysis to consider three key demographics including gender, marital status and parenthood. Unless otherwise stated, all discussion related to the second- and higher-order risks are based on standardized Pearson moments.

4.1 Gender

Households with female primary earners, a.k.a female headed households, account for approximately 39% (46.37% of whom live in partnered households) of our pooled sample of single and partnered employees. This warrants a more detailed comparison between male and female primary earners. .

Figure 13 compares moment properties of the shock distributions of male (*left panel*) and female (*right panel*) headed households aggregated over age. For both genders, government transfer provides substantial insurance against the dispersion of shocks for the bottom decile, and relatively small insurance against the negative skewness. Conversely, family market income greatly reduces the negative skewness and kurtosis of shocks, but its dispersion mitigating role is largely absent.

At the same time, there are differences. First, the second-order risk of the pre-transfer (post-tax) income of female headed households tends to be larger than those of their male counterparts - especially for the lower three deciles. This is primarily driven by the relatively higher individual earnings shock variance of female heads themselves. A likely secondary cause is the larger share of labour hours and earnings of male secondary earners (in female headed households) as displayed in Table 2.[28] Higher income share of male secondary earners then translates to higher positive influence of shocks to their income on the variance of family income shocks (i.e., income-pooling effect).[29] Having said that, we expect this effect to be small since the gaps between the standard deviations of

[27]More precisely, government insurance insures against the second-order earnings risk in the Netherlands, and their joint force with family insurance insures families against the higher-order risk. In the US, government insurance, together with family insurance, have comparable effects in mitigating the second-order risk; however, against the third- and fourth-order risks, family income is the dominant source of insurance.

[28]The substantial fraction of matching between higher income male and lower income female might account for the lower earnings of female secondary earners. Note that the lower female secondary earnings is not simply an ex-post marriage adjustment since we also observe educational attainment gap associated with couples which is also reflected by the smaller weekly wages of female secondary earners relative to those of male secondary earners as evident in Table 2.

[29]We provide an explicit formula and discussion in Appendix B.

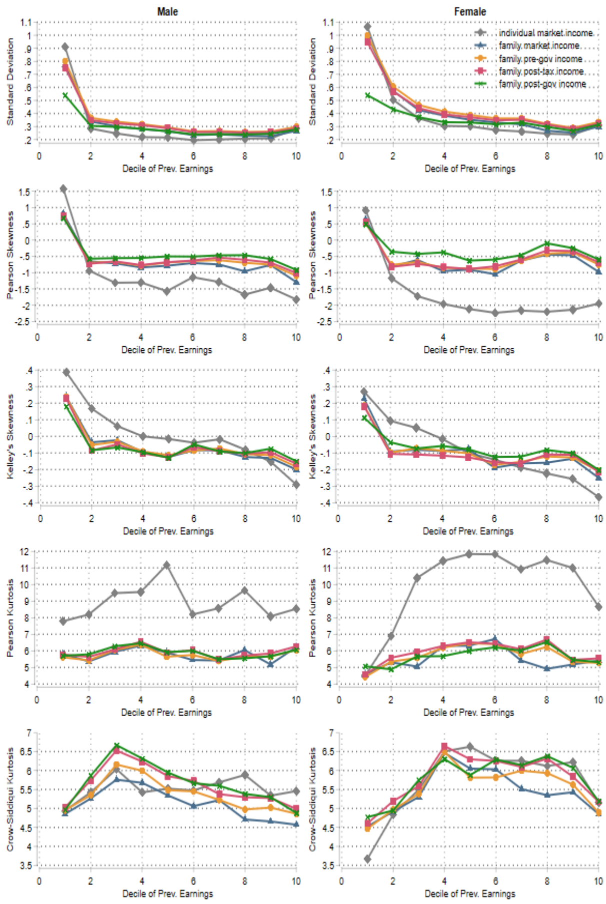

Figure 13: **Second- and higher-order moments of the distributions of annual income shocks of male (left panel) and female (right panel) primary earners and their households (P1-P99 Pearson statistics).**

individual and family market income shock distributions for both male and female heads are roughly equal in size. Partly due to these individual and household gross earnings dynamics, together with the means-tested and targeted welfare design, government transfer has a stronger insurance effect on the second-order earnings risk of female headed households below the median past market income, whereas only the poorest male headed households benefit from the transfer insurance. Second, concerning the skewness of individual earnings shocks, those of female primary earners are on the whole greater in magnitude. Coupled with the fact that male secondary earners bring home substantially more income than their female counterparts do, this might explain why family market income insurance against the third-order risk is greater for female primary earners. For similar reasons with the second-order risk case, while the government insurance against the third-order risk is small, there is sign of relatively larger government insurance for female headed households. Regarding the fourth-order risk, family market income appears to be the sole insurance and its effect is in overall larger for female heads.

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 2: **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.**

Male and female primary earners diverge further with respect to persistent income risks. Figure 14 reveals that, at both the individual and household levels, shocks on the female side continue to be more volatile than those on the male side, especially if they happen to be below the median past market earnings. Compared to the annual statistics in Figure 13, a marked difference occurs at the bottom-most decile where we see a significant decline in the second-order risk of male primary earners, whereas the improvement, though sizeable in the absolute sense, still leaves the lowest income women worse off than their male and higher income female counterparts. The persistent shock process of female primary earners and their households may be influenced by motherhood and the entailing social security benefits that distort incentive. Institutionally induced rigidities in the labour market can further prevent them from making labour supply adjustment. Precise answers to these endogeneity questions, however, require a more sophisticated economic model. What is clearly laid out here is that government transfer maintains its status as a major source of insurance against persistent second-order risk for female headed households even when its insurance effect becomes almost trivial for male heads. This has important implications for structural models of households and public policies because unlike transitory risks, more persistent adverse risks impact lifetime wealth and are harder to insure through self-insurance mechanisms such as labour supply and savings. A model shock process capable of capturing the demographic difference in pre-government earnings risks potentially places more weight on means-tested and targeted transfers, and thereby outputs different optimal policy recommendations

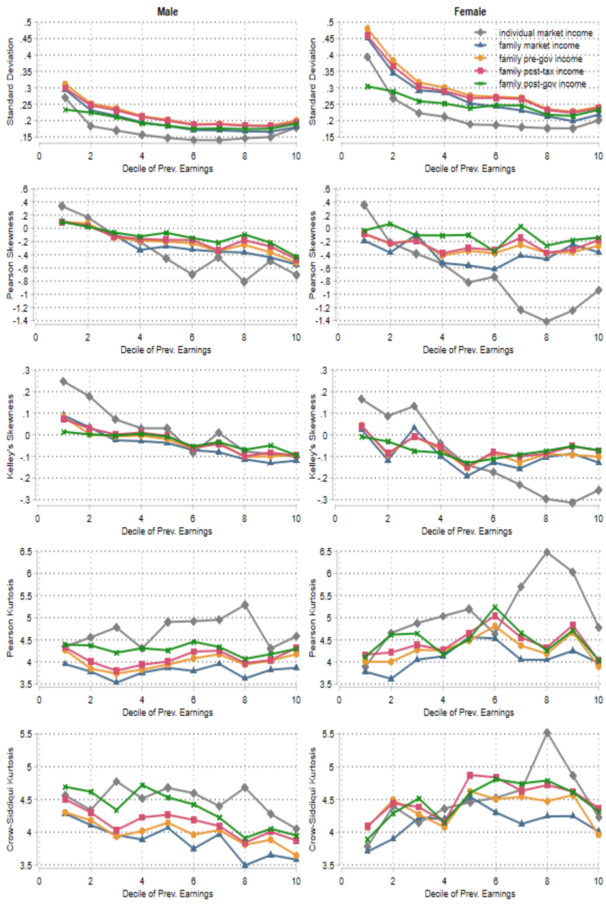

Figure 14: **Second- and higher-order moments of the distributions of 3-year average income shocks of male (left panel) and female (right panel) primary earners (P1-P99 Pearson statistics).**

than a traditional model that does not have this key feature highlighted.

Next, we compare standardized skewness and kurtosis between the two household types. The skewness and kurtosis in Figure 14 exhibit some distinct patterns from those of the annual statistics in Figure 13. On skewness, the distribution of female primary earner's income shocks remains more negatively skewed compared to that of male heads. Family market income insurance still exerts a strong third-order risk mitigating effect for women, particularly for those in the upper past income deciles. Conversely, female heads below the median benefit significantly more from government transfer insurance. For the male group, we see smaller family insurance in general, and little to no government insurance.

On kurtosis, male and female primary earners experience a sharp decrease in their fourth-order risks compared to the corresponding annual statistics. Family market income does reduce kurtosis in this case, but the effect is much less consequential. On the other hand, public and private transfers cause small increases in kurtosis for both groups. Inspecting their empirical density distributions (figures not included) suggests that the increase in kurtosis could also stem from higher peakedness of the household disposable income shock distributions as opposed to thicker tails. Transfers may cause changes in their household disposable income to be more clustered about the mean of the shock distribution and thus helps explain the result.

Figures 13 and 14 show some sharp differences in income dynamics and insurance between male and female headed households. More interestingly, government transfer equalizes the risk outcomes between these two household types. An important implication is that examining income level and first moment metrics alone might not allow one to fully grasp the role of family and government insurance across socioeconomic and demographic groups. The supplementary statistics on average government transfer in Table 2, as an example, report a larger average transfer to male headed households even though their female counterpart has been found to persistently benefit more from government insurance against risks. Hence, investigating the second- and higher-order risks are important, though they do not offer precise answers about the aggregate efficiency and welfare effects. Note that, the strength of government insurance effect for female headed households, particularly against the third-order risk, weakens when single households (53.63% of the female headed households) are excluded, but the overall pattern remains. Allowing for rich income dynamics and heterogeneities in family structure can therefore improve the assessment quality of social insurance effects in quantitative work. De Nardi, Fella and Paz-Pardo (2020) make a similar point using the UK case study.

4.2 Marriage and parenthood

In this subsection, we examine how family and government insurance effects differ among households varied by marital and parental status.[30] Arguably, the weight of parenthood (i.e., child-bearing and child-rearing responsibilities) tends to fall more heavily on mothers, especially if they are single. Marriage and parenthood might therefore explain the persistently greater fluctuations of shocks and the large government insurance for female headed households since family support programs are strongly tied to the presence of dependent children. This motivates the rest of our discussion.

[30] We count those legally married or in de facto relationship as married or partnered. Only parents of dependent children are counted as parents. By these definitions, parents account for 39.29% of the 152,903 observations. Partnered primary earners comprise 89.07% of parents and 53.99% of non-parents.

4.2.1 Parent and non-parent primary earners

The first row of Figure 15 shows the differences between insurance effects against the second-order annual income risks faced by parents (*left panel*) and non-parents (*right panel*). Family market income behaves as a moderate insurance mitigating the individual shock dispersion for parents in the bottom decile but the effect is barely discernible for non-parents. Government transfer insurance is visible for all parents below the median, whereas for non-parents, the insurance is limited to the poorest households. The transfer insurance is at its largest for parents in the bottom decile, more than double that for non-parents.

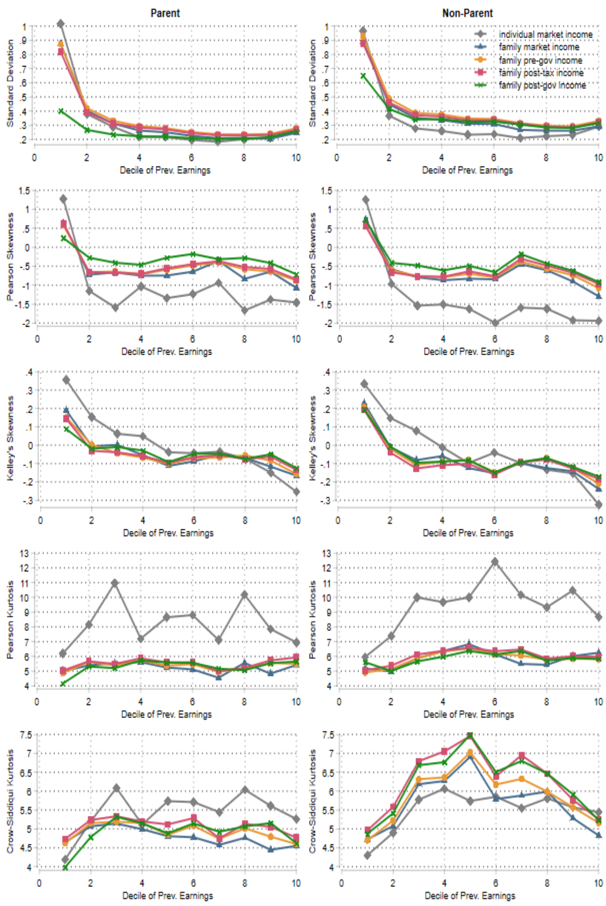

Figure 15: **Second- and higher-order moments of the distributions of annual income shocks of parent (left panel) and non-parent (right panel) primary earners (P1-P99 Pearson statistics).**

Figure 16 reports the corresponding 3-year average statistics. It demonstrates the persistence of government insurance against the second-order risk for parent households below the median past income even as family insurance has completely vanished. Interestingly, not only does the government transfer insurance effect for this group remains substantial, it extends to those in the upper brackets. For non-parents, on the other hand, government transfer continues to serve as a vital source of insurance but only for the lowest decile.

Turning back to Pearson skewness in the second row of Figure 15, we see that family insurance is present for both parents and non-parents, though it is generally larger for latter. To both, the role of government transfer insurance in dampening the transitory third-order risk is small in relation to that of family insurance. However, the transfer insurance appears to be more widespread and represents a larger fraction of the total insurance for parent households.[31] This observation matches the skewness statistics of 3-year average changes in Figure 16 which show that for the most part, government insurance for parent households is relatively larger across income status. Additionally, the figure indicates that family market income is still the only primary source of insurance against the third-order risk for non-parents above the median income, whereas for parents within the same past income bracket, their family market income, private transfer, and government transfer make up roughly equal shares of the total insurance.

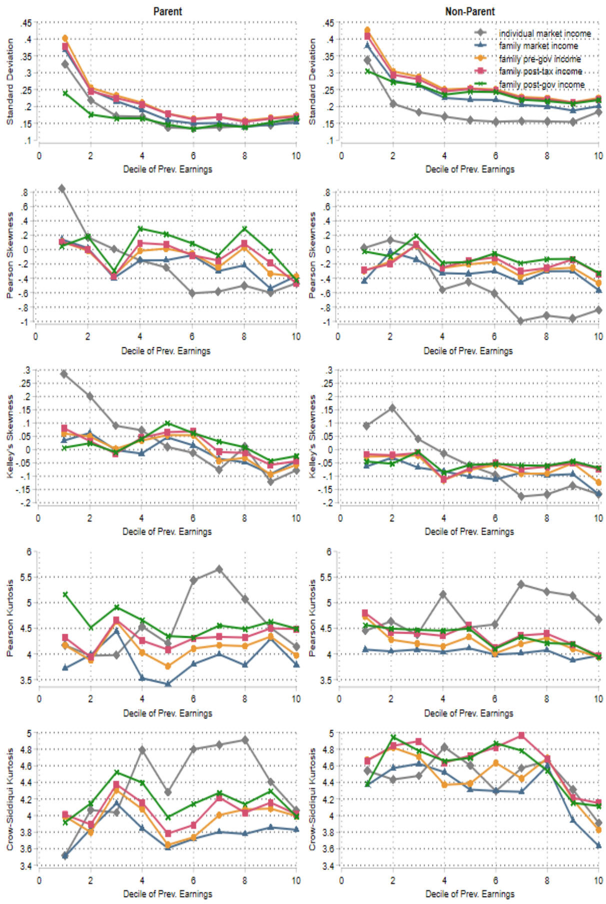

Figure 16: **Second- and higher-order moments of the distributions of 3-year average income shocks of parent (left panel) and non-parent (right panel) primary earners (P1-P99 Pearson statistics).**

The Pearson kurtosis measures in the fourth row of Figures 15 and 16 illustrate that family market income significantly reduces the fourth-order earnings risk for parent and non-parent primary earners alike while government transfer plays virtually no role for the annual statistics and even generates more excess kurtosis for the 3-year average statistics. The question is whether the higher (*lower*) clustering of shocks around the mean or the increased (*decreased*) density at the tails drives the increase (*decrease*) in the kurtosis level. Further inspection as shown Appendix F implies that the former scenario is plausible. In other words, government transfer has two counteracting effects on kurtosis: (i) it reduces the tail mass of the shock distribution which lessens kurtosis, and (ii) it creates a larger cluster around the mean, causing the peak of the shock distribution of household disposable income shocks to increase relative to that of the pre-transfer income (transfers counter income shocks)

[31] The non-robust moment statistics (containing all data points at the tails of shock distributions) in subsection F.3 of Appemdix F show decisively larger government insurance for parents relative to their non-parent counterpart.

which augments kurtosis. The latter process (ii) can more than offset the smaller decline in the tail density (i), and ultimately cause the greater peakedness decide the direction of changes in the fourth moment.

We can draw a few critical points from the above discussion. First, the existence of means-tested benefits (independent of labour market participation) targeting parents might help explain the dissimilarities in earnings risk and insurance between parents and non-parents. Second, the results are ex-post statistical measures and do not allow us to infer behavioural responses of households to the incentive (or disincentive) to work and save induced by the transfer system. It is possible that the family insurance effect would change substantially were the government insurance absent. Third, in spite of the limitation stated, the inter-group comparison provides a hint of behavioural responses to the presence of government support programs. Suppose parents have at least as strong an incentive to insure their households against income shocks as non-parents do, then the smaller family market income insurance for parents, despite the large proportion of partnered households within their composition (89.07%), relative to that of non-parents suggests a crowding-out effect of government insurance on family insurance (i.e., work disincentive effect on secondary earners).[32] This would be aligned with our earlier results and the findings by De Nardi et al. (2021) that family insurance effect is stronger in the US than in the Netherlands, the latter of which has a bigger and more pervasive welfare system. The authors point to the potential crowding-out effect of government insurance.

4.2.2 Partnered and lone parents

The prior subsection reveals that parenthood, to a considerable extent, determines the size of government transfer insurance against transitory and persistent income risks in Australia. Provided that the majority of lone parents are female and that female headed households benefit greatly from government insurance, we dedicate this segment to an extended examination along the dimension of marital status.

Figure 17 shows the second- and higher-order moments of the annual income shocks for partnered parent (left) and lone parent (right) households. The standard deviation measures on the top row display a stark contrast between insurance effects for the two groups. Lone parents confront a significantly greater pre-government second-order risks than partnered parents within the same bracket do. More interestingly, while family insurance against the second-order risk is missing for lone parents, their government insurance is strikingly large, especially for poorer households. In fact, the insurance magnitude is sufficient to close the initial disparity in pre-fiscal risks between partnered and lone parents such that their household disposable income shock distributions end up at virtually the same level of dispersion. Its effect on partnered parents, on the contrary, is significant only for the bottom decile who appears to benefit equally from family market income and government transfer insurance.

Pearson skewness statistics on the second row of Figure 17 yield a similar conclusion. The left panel shows that the dominant insurance against the third-order risk for partnered parents is family market income while their government insurance is relatively small and intermittent. In contrast, for most lone parent households, a large portion of insurance stems from government transfers. Therefore, in terms of insurance against the third-order risk, the main beneficiary of the government transfer programs is the lone parent households.

[32] In fact, it is plausible that parents have a stronger incentive to insure their households against shocks.

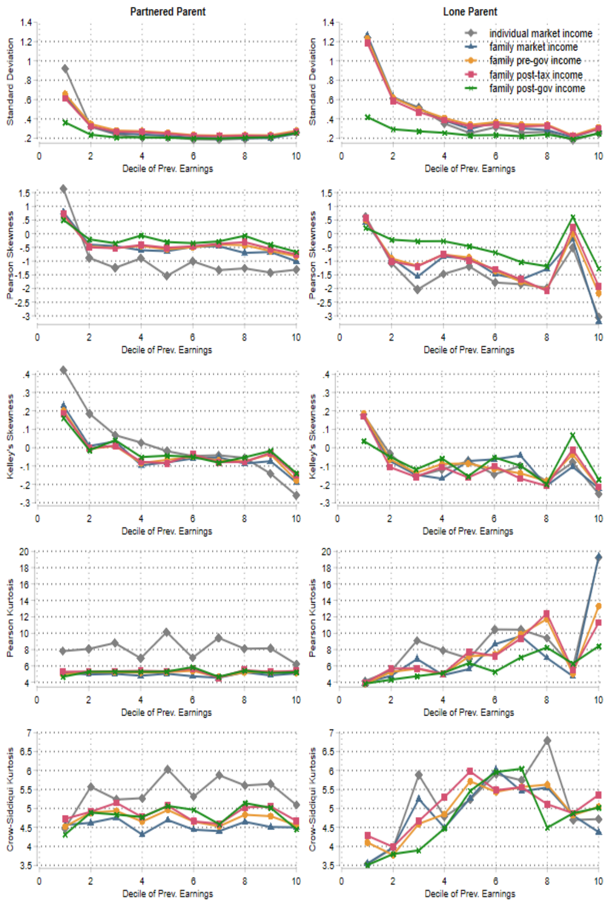

Figure 17: **Second- and higher-order moments of the distributions of annual income shocks of partnered parent (left panel) and lone parent (right panel) primary earners (P1-P99 Pearson statistics).**

Looking at Pearson kurtosis, we observe that government transfers do not lead to any changes in the kurtosis of pre-transfer income shock distribution for partnered parents. While it appears to reduce kurtosis for some lone parent households, the irregular pattern (likely due to the small sample size of lone parents) does not allow us to establish a good baseline for comparison. A more reliable message is that family market income is still the dominant fourth-order risk mitigating factor. Further examination into the empirical distribution of shocks once again suggests this result could be driven by the lower peakedness of the distribution of family market income shocks relative to that of primary earner's market income. Simply speaking, while family market income does reduce the thickness of the tails to a certain degree, it simultaneously introduces a larger probability of moderate shocks. This complication makes it difficult to arrive at a precise interpretation of insurance effect against the fourth-order risk using descriptive statistics.

In overall, our findings indicate that parent households benefit the most from the Australian government transfer program insurance effect against risks, and the bulk of the benefits goes to lone parents. This in turn equalizes the risk outcomes between partnered and lone parents as manifested by the comparability between their disposable income risks despite the fact that the latter group starts off with much higher pre-transfer income risks. What is equally intriguing is that the government transfer insurance extends to the upper income lone parents, perhaps a result of the means-tested and targeted transfers. Furthermore, because female lone parents constitute the majority of the group, the public transfer insurance should affect them the most. This can deteriorate human capital of the existing and potential female workforce by increasing the proportion of mothers exiting the labour force. However, the insurance also potentially improves the well-being of children and lone mothers themselves. The pros and cons of the transfer programs can be ascertained with quantitative models that capture behavioral responses to such policies and their welfare implication. Using the current work for guidance, this subject is explored in our forthcoming paper.

5 Conclusion

This paper documents evidence of non-linear and non-Gaussian income dynamics using Australian household survey data, HILDA. Similar to other studies on OECD countries, earnings risk varies across age and income group. Moreover, the income processes of specific groups such as the poorest, richest, youngest, and oldest exhibit distinct dynamics.

Our findings also points at the distinct roles of wages and hours in explaining income dynamics in Australia. Wage changes drive the second-order earnings risk, whereas hour changes contribute significantly more to the third- and fourth-order risks. In addition, wage changes constitute the main factor explaining the upward and downward movements of earnings changes, while the contribution by hour changes is relatively small. Another difference between Australia and the countries studied by previous work is related to the roles of family and government insurance against earnings risk. In general, both family market income and government transfer are major sources of insurance against earnings risk. However, government transfer appears to be the dominant mechanism insuring against the second-order risk, whereas family market income insurance is more effective against the third- and fourth-order risks.

Our paper further extends the existing literature on income dynamics by analysing the importance of demographic characteristics in determining risk and insurance. First, we show that government insurance against the second- and higher-order earnings risks is generally larger for parents, and family insurance tends to be more pronounced for non-parents. Along the same line, we highlight the passiveness on the part of spouses and the strong response from public transfers to primary earners earnings shocks. Given the family-oriented nature of the Australian transfer schemes, these could imply a crowding-out effect of government insurance. Second, groups such as female heads and non-parents (not mutually exclusive) experience quite persistent risks that are difficult to self-insure. Third, although the social security system seems to redistribute resources from female to male headed households based on first moment statistics, we show that the former group does benefit substantially from the public transfer insurance when (i) the persistent pre-fiscal earnings risks they face and (ii) the government insurance effect against these risks are taken into account.

In this research, we provide a collection of empirical facts on earnings dynamics and insurance. We offer some conjectures as to what may have generated the observed income process, but causality study is beyond the scope of this paper. Besides, we restrict our sample to primary earners and consequently exclude retirees and the largest transfer program in Australia, the Age Pension. Accounting for the Age Pension may enlarge the role of government insurance. We also condition the moment statistics on past income. Conditioning on wealth can enrich our understanding. Furthermore, we abstract from consumption risk. An analysis of consumption contains crucial economic elements pertaining to family and government, namely, consumption equivalence scale, non-cash transfers, and indirect taxes, among others. We leave these issues for future research.

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