Perceived Income Risks

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Not just the expected income but also income risks have important implications for the consumption and portfolio choice of households who are intertemporally risk-averse. This is particularly relevant when the risks are imperfectly insured, which is one of the cornerstone assumptions in the heterogeneous-agent models. These models have long taken estimates of income risks from cross-sectional income inequality as inputs. But this implicitly assumes that the agents in the model perfectly understand thus agree on the income risk profile imposed on them. As shown by the mounting evidence on heterogeneity in economic expectations held by households, this assumption seems to be too stringent. To the extent that agents make decisions based on their *respective* perceptions, understanding the *perceived* income risk profile and its correlation structure with other macro variables are the keys to explaining their behavior patterns.

This paper's major goal is to examine if the subjective income risk profiles perceived by individuals reflect the true nature of their stochastic environment, or they are also driven by certain perceptual patterns that come from reasons such as imperfect understanding and information rigidity. My agendas are twofold. On the empirical side, I intend to document the empirical patterns of perceived income risks and characterizing its potential deviations from some well-defined benchmark. On the theoretical side, I seek to understand the mechanisms that lead to the observed pattern of income perceptions. Then I will build it into an otherwise standard heterogenous-agent model with uninsured risks to explore its implications for consumption insurance and stock market investment.

In order to undertake the empirical agenda, this paper employs the recently available density forecasts of labor income surveyed by New York Fed's Survey of Consumer Expectation (SCE).[1] What is special about this survey is that household heads are asked to provide histogram-type forecasts of their earning growth over the next 12 months together with a set of expectational questions about the macroeconomy. It is at a monthly frequency and has a panel structure allowing for consecutive observations of the same household over a horizon of 12 months. When the individual density forecast is available, a parametric density estimation [2] can be made to obtain the individual-specific subjective distribution. And higher

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[1] Manski (2004), Delavande et al. (2011), Manski (2018) have advocated for eliciting probabilistic questions measuring subjective uncertainty in economic surveys. Bertrand and Mullainathan (2001) and other works have shown respondents have the consistent ability and willingness to assign a probability (or "percent chance") to future events. See Armantier et al. (2017) for a thorough discussion on designing, experimenting and implementing the consumer expectation surveys to ensure the quality of the responses.

[2] This follows Engelberg et al. (2009)'s approach which fits the respondents' answer to a uniform distri-

moments reflecting the perceived income risks such as variance, as well as the asymmetry of the distribution such as skewness allow me to directly characterize the perceived risk profile and compare it with external estimates from cross-sectional microdata. This provides the first-hand measured perceptions on income risks that are truly relevant to individual decisions.

Although any worry about measurement errors in eliciting subjective density distribution is understandable, my analysis of the SCE data thus far demonstrate patterns that are intuitive and relatively consistent. For instance, Figure 1 together with regression results not included here, confirm stylized patterns that males, individuals from high-income households and high education have lower perceived risks.

It is natural to ask further questions. First, to what extent this heterogeneity in perceptions align with the true income risks facing different population groups, or at least partly attributed to perceptive differences due to heterogeneity in information and information processing, as discussed in many models of expectation formation? [3] Second, are the perceived risks permanent or transitory? If I can decompose these perceived risks into different components, I can examine such questions as if agents overestimate their permanent income risks, or if the persistence is overestimated (Rozsypal and Schlafmann (2017)). Finally, not just the risks of labor income itself, but also its covariance with macro-environment and risky asset returns, matter a great deal. For instance, if perceived income volatility or tail risks are counter-cyclical, it has important labor supply and portfolio choice implications (Guvenen et al. (2014), Catherine (2019)).

One of the key challenges when addressing these questions is to separately account for the "truth" and the "perception". The former refers to the true underlying risk profiles facing individuals. The later has to do with mechanisms of how agents receive and processing information and form their perceptions. The most straightforward way seems to be to compare econometrician's external estimates of the income process using realized data and the perceived from the subjective survey. But this approach implicitly assumes that econometricians correctly specify the model of the income process and ignores the likely superior information problem discussed above. Therefore, in this paper, instead of simply assuming the external the estimate by econometricians is the true underlying income process, I characterize the differences between perception and the true process by jointly recovering the process using realized data and expectations based on a particular well-defined theory of expectation formation. The advantage of doing this is that one neither needs to make stringent assumptions about agents' full rationality nor the econometricians' the correctness of model specification.

Theoretically, there are two major questions this paper plans to tackle. First, what particular mechanisms account for the heterogeneity in perceived risks conditional on the difference in true income profile? In this front, I will explore the implications on perceived income risks from a variety of theories on expectation formation that features deviations from

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bution, an isosceles triangular distribution, and a generalized beta distribution, respectively, depending on the number of bins with positive probabilities and whether they are adjacent.

[3]This echoes with but is different from the "insurance and information problem" (Pistaferri (2001), Kaufmann and Pistaferri (2009), Meghir and Pistaferri (2011)), which states that in empirical tests of consumption insurance, there is always a worry that what is interpreted as the shock has actually already entered the agents' information set or exactly the opposite.

full-information rationality benchmark, such as sticky expectation (Reis (2006), Mankiw and Reis (2002)), noisy information (Woodford (2001), Lucas Jr (1972)), learning (Evans and Honkapohja (2012)) and so forth. For instance, one major prediction from information rigidity models is that agents do not incorporate instantaneously newly realized shocks in their information set. If this is the case, perceived risks should be systematically higher than the rational benchmark. Or in the context of learning, could it be the differences in the sample sizes of learning for agents of different income and education levels that lead to a different degree of perceived risks? This can be seen as a cross-theory validation in a similar spirit to Coibion and Gorodnichenko (2012) in the context of a micro variable, i.e. labor income. It will also contribute to the existing literature on mechanisms of expectation formation.

Second, I will introduce one certain mechanism to an otherwise standard life-cycle model involving consumption/portfolio decisions to explore its macro implications. This shares a similar theme with other literature [4] that incorporates imperfect expectations and perceptions in traditional consumption/saving problems. But compared to these work the novelty of my paper lies in the primary focus on the implications of heterogeneity in perceived higher moments such as risks and skewness.

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[4]For instance, Rozsypal and Schlafmann (2017) found that households' expectation of income exhibits an over-persistent bias using both expected and realized household income from Michigan household survey. Carroll et al. (2018) reconciles the low micro-MPC and high macro-MPCs by introducing to the model an information rigidity of households in learning about macro news while being updated about micro news. Lian (2019) shows that an imperfect perception of wealth accounts for such phenomenon as excess sensitivity to current income and higher MPCs out of wealth than current income and so forth.

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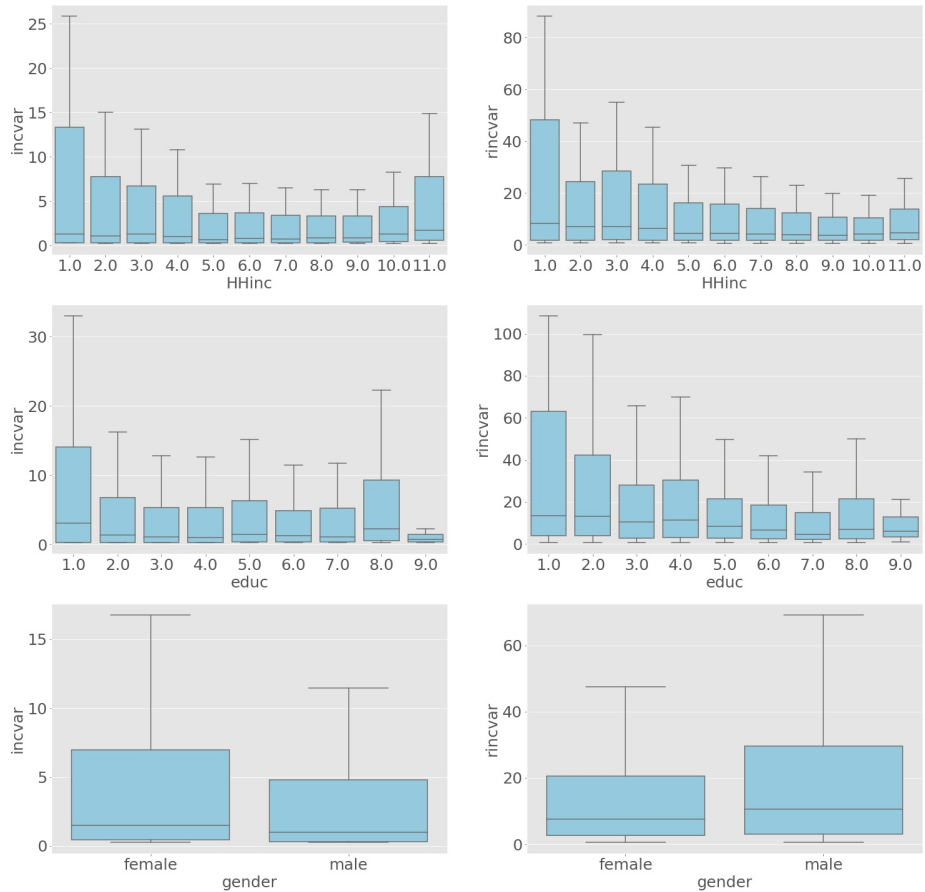
Figure 1: Perceived Income by Group

Note: this figure includes box plots of perceived nominal (on the left) and real (on the right) income risks grouped by household income (the top row), by education (the middle row), and by gender (the bottom row). Household income and education groups ranked in ascending order from left to the right. Perceived income risks are computed as the variance of the individual density. Real income risk is the sum of perceived nominal risks and perceived variance of inflation.