A COMMENT ON: "Economics and Measurement: New measures to model decision making"

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Andrew Caplin, February 21 2024

Almas, Attanasio and Jervis make the case for economists going beyond standard choice data in a highly model-based manner due to inherent limits of traditional forms of behavioral and administrative data. Their central claim is that "Measurement is not a substitute for rigorous theory, it is an important complement to it, and should be developed in parallel to it". They trace the history of attempts to convince the profession of the proposition that standard administrative and survey data on choices and outcomes alone is far too restrictive to identify modern economic models, a proposition with which I heartily agree (Caplin, 2024). They provide several broad categories related to the decision-making structure of households, separation of preferences and beliefs, and impacts of the broader environment. They also make note of the importance going forward of additional research aimed at understanding income- relevant skills, both cognitive and non-cognitive. In this supporting note I follow up on measurement of beliefs and skills. I reiterate their main points: that little can be known without model-based data innovation; and the high potential to know more with particular forms of such innovation. These measurement innovations are very different in the two cases. For beliefs, the key is to introduce appropriate new survey architectures linked with administrative data on standard outcomes and choices. For skills, an additional challenge is to measure them in a precise model-based manner. The first road is increasingly well-traveled, while the second is in a more nascent phase.

Survey Measurement of Subjective Beliefs about Future Earnings

Earnings from work are of fundamental economic importance. They are central drivers of consumption, savings, wealth, inequality, etc. In recent years researchers have made massive progress in characterizing patterns of earnings over the life cycle in administrative data. For example Guvenen et al. 2021, use rich administrative data to characterize the distribution of earnings growth in the US. In the course of doing this they provide information on just how uncertain earnings appear to be. They document that higher-order moments, skewness and kurtosis, in addition to mean and variance, are important for describing the distribution of earnings growth in the population. They then show how these moments vary with age and the level of earnings to help characterize labor market risks that workers face.

Insightful as it is to identify patterns in administrative data, there are important reasons to dig deeper. In particular, **objective** data on outcomes is not the same as **subjective** data on beliefs. It is the latter that drive key decisions, such as whether or not to go to college and if so what subjects to study, what skills to hone, what type of work to engage in, where to apply for jobs, as well as such day to day decisions as whether or not to search for a new job, how to negotiate in the existing job, take time out of the workforce, retire, etc. What matters for choice of education, acceptance of job offers, and retirement, and other decisions are beliefs about future income, not ex post outcomes. Methods of inferring subjective risk from administrative data rest on strong identifying assumptions, typically full information rational expectations and homogeneity within sub-populations defined from observable characteristics such as age and the level of earnings. The question of how appropriate these assumptions are, and hence the validity of standard measures of subjective risk, which are what matter for decisions, remains open. Indeed the identifying assumptions are effectively impossible to test without subjective expectations data.

Given their importance and the strong and untested assumptions required to recover them from administrative data, expectations concerning future earnings from work represents a paradigm case in which the measurement problems highlighted by Almas, Attanasio, and Jervis have come to the fore. These problems were explicitly noted by Dominitz and Manski 1997 when they effectively launched the modern era of expectations measurement by eliciting probabilistic estimates of the cumulative distribution of total household income, before taxes, over the next 12 months. After posing questions on the maximum and the minimum possible values, they asked for several points on each respondent's subjective cumulative distribution.

While their work has indirectly seeded a massive and important new literature on expectations measurement as highlighted in Manski 2004, progress in the original area of application has been slow. Two key challenges have stood in the way of measuring subjective earnings risk. One challenge relates to credibility. Almas, Attanasio, and Jervis emphasize that it is

essential to assess the **credibility** of measures of subjective probabilistic beliefs since they are neither standard behavioral data nor factual administrative data and as such relatively unfamiliar to economists. Given the limitations of the survey architectures in which they launched their pioneering instrument, Dominitz and Manski were not in position to compare subjectively assessed earning risk and its counterpart as it is standardly inferred from administrative data. The second challenge relates to job transitions and time out of the labor force. Guvenen et al. document the prominent role of such job transitions for earnings risk, in particular for higher order moments.

Once one recognizes the need for new forms of data, research infrastructure becomes hugely important. Recent advances in such infrastructure are finally allowing both issues that have stood in the way of measuring subjective earnings risk to be addressed. Particularly compelling is the ability to design targeted surveys that sample from and link back to administrative data in the Danish population registries (Andersen and Leth-Petersen 2021). The population registries contain complete histories of labor market performance with employer-employee links and with information about earnings, hours, employer, and industry for each job. All public registries are linked to a universal social security number that all Danes are equipped with. This makes it possible – for research purposes only – to get detailed information about wealth, education, and more. In addition to allowing one to set expectations in the larger individual, family, and geographic context, the link with the registry allows for structured sampling, appropriate population re-weighting where needed, and credibility checks.

Taking advantage of the opportunities that this link between survey and administrative data opens up, Caplin, Gregory, Lee, Leth-Petersen, and Saeverud 2023, revisit the proposal of Dominitz and Manski on measuring subjective earnings risk. They implement survey instruments in the Danish registries to measure subjective expectations of year ahead earned income, with a particular focus on the impact of quits, layoffs, and job transitions. The main instrument opens by measuring respondents' current work status (essentially at the start of the year). For those working for pay, measures are elicited of the probability of continuing in this work all year, quitting from this work during the year, and being laid off from this work at some point during the year. In the condition in which the job is kept all year, the question about income is simple and direct, with the feature that it asks both for annual earnings in the upcoming year. The instrument is more intricate in the quit and layoff branches since there is interest both in how long the period out of work is expected to last, and in earnings prospects once back in employment. With regard to time out of the labor force, the question concerns probabilities of working for pay again at a variety of time horizons between one month and two years.

As much as infrastructure matters, so does measurement technology. A particularly important development in the case of probabilistic surveys is the innovative balls-in-bins interface introduced by Delavande and Rohwedder 2008. This is a visually simple device that allows in principle for rich elicitation of probabilities without insisting on subjects being probabilistically sophisticated. We implement this highly intuitive method of measuring probabilistic conditional earnings expectations in all three branches. This allows us to put together a complete holistic probability distribution over year-ahead earnings by appropriately simulating individual beliefs on all branches. It also allows us to aggregate back up to the population level using the appropriate sampling weights to link back to the registry.

The single most important question to answer relates to the credibility of survey responses. While there is no perfect method for validating survey measures, there are many ways of invalidating them. Reassuringly, we find our data to survive the most obvious paths to invalidation. Last year's survey-reported earnings match closely with their administrative counterparts. Average survey-reported probabilities of switching jobs in the next year tightly match historical averages as does the average time between jobs. When we suitably aggregate survey-reported earnings variability to the population level, it replicates key patterns in the administrative data. Finally, we find a match between life cycle patterns of skewness and kurtosis in addition to mean and variance, so that subjective data mirror standard findings in administrative data. Hartmann and Leth-Petersen 2022, and Wang 2023, also provide positive findings when matching subjective income expectations with administrative data, so that confidence is growing in the value of these measurements.

Of course replication of registry-based patterns is not the ultimate research goal. Rather we are interested in first order differences. The most essential finding suggests a first order limitation of standard methods of inference from administrative data. We find administratively-estimated earnings risk to be between two and six times higher than its survey-based counterpart (see also Wang 2023). The main source of this difference is that, even within narrow sub-groups, there is significant variation in mean survey-measured subjective earnings growth. These differences in mean growth rates raise administratively-estimated earnings risk, as ex ante heterogeneity is erroneously assigned to chance. In confirmation of this

channel, the gap between subjective risk and its administrative counterpart is particularly high for groups with highly heterogeneous expected growth rates in earnings, such as younger workers. When we calibrate Menzio et al. 2016, a canonical model of search over the life cycle, to administrative data on job transitions, and back out the implied beliefs about earnings risk in the face of any job transition, we find that the model calibrated to administrative data produces far higher estimates of individual earnings risk than do our subjective expectations measures. Whether workers stay in their current employment or make a job transition, they subjectively perceive earnings risk to be far lower than the model implies. Key next steps include understanding the implications of subjective earnings risk for precautionary savings, for models of search and turnover, and for updating in light of experience, following up on Hartmann and Leth-Petersen 2022, Kosar and Van der Klaauw 2023, and Wang 2023.

DECISION-MAKING SKILLS, RATIONAL INATTENTION, AND EARNINGS

The topic of what drives medium-run and long-run changes in earnings focuses by and large on better understanding sources of worker productivity. Given how much has been changing in recent decades in terms of income inequality and loss of traditional jobs, it is little wonder that understanding the productivity-based roots of changes has become so central. For a long time now the central explanation for increases in inequality has been related to trends in human capital (Becker 1964). In the Becker model, firms take capital and labor as inputs into a production function and direct these factors toward their most productive use. Additional years of education are modeled as increasing the ability of labor to produce with any given level of capital. Human capital augments the marginal product of labor in a firm's production function.

Important as is the impact of education, recent years have seen interest in a more granular understanding of mechanism, as Almas, Attanasio, and Jervis highlight. For that reason the focus is gradually shifting from formal education to a variety of skill-based characteristics that are significantly harder to measure. Duckworth, Heckman, and Kautz. 2011 illustrate links between personality inventories (e.g. the Big Five) and income. Weidmann and Deming 2021 employ a combination of experimental and personality measurement methods in their work on whether some people are good team players. They note that observation in the field of teamwork skills is fraught with difficulty. For that reason they use psychometric measurements and laboratory experiments in their efforts to identify "team players": in essence this is part of the movement that Almas, Attanasio, and Jervis discuss to use the experimental laboratory in a manner that is tightly linked to applications in the field.

The experimental paradigm of Weidmann and Deming involves a set of tasks designed to be feasible to administer to both individuals and groups, to have correct answers allowing performance to be readily ranked, and to allow for cooperation among group members to improve performance. In the experimental design they randomly assign people to multiple teams and predict team performance based on previously assessed individual skills. They identify "team players" who consistently cause their team to exceed its predicted performance based on individual skills. They use a number of personality and intelligence inventories to show these skills to be very different from, and roughly as important as, standard measures of IQ in terms of productivity. The broader agenda of the Skills Lab that Deming heads is to find new measurement methods to assess the importance of variety of skills in determining patterns in lifetime income.

An important point to note is that the experimental paradigm measuring team skills links tightly with rational inattention theory. The experimenter knows the correct answer to all experimental tasks: this is the state of the world. Patterns in actual choices conditional on this constitute **state dependent stochastic choice data**. This is precisely the form of data that Matejka and McKay 2015, use in identifying optimizing choices and that Caplin and Dean 2015, and Caplin, Martin, and Marx 2023 use in deriving general tests of rational inattention theory. In effect, what a team player does is to lower costs of learning in the given tasks by getting the answers closer to optimal.

The link between rational inattention theory and measurement of skills that impact earnings may go beyond the case of team skills. In fact Deming 2021, recently proposed a broader thesis on the source of earnings power in the modern world that is directly related to rational inattention theory. He argues that decision-making skills are the new key to earnings power. He argues that the ability to process information strategically by appropriate choosing what to focus on and what to ignore, is critically important. He treats decision-making skills, which effectively lower these costs, as key to understanding patterns of earnings over the life cycle.

Some of the supporting evidence that Deming marshals derives from administrative data. Formally, he models decision-making skills as taking longer to accumulate in high variance, non-routine jobs. He finds that life-cycle wage growth in jobs that he identifies as decision-intensive has increased over time. By itself, this evidence is not dispositive. Differential patterns in lifetime income growth across professions may largely reflect differences in how long it takes to accumulate the specific skills that earn higher pay over the course of the career, rather than general decision-making skills. To get further evidence on the channel, Deming uses evidence from other sources, such as job postings, CVs, and surveys of firms. For example, in an annual survey of large employers, skills like problem-solving and critical thinking are ranked as the most desirable qualities of new hires.

In narrow settings, Deming's hypothesis on decision making skills links with the learning by doing model of Jovanovic and Nyarko 1994. Recent evidence in fact shows evidence that decision-making skills are important in medical decisions. Currie and MacLeod 2017 use standard administrative data to study C-sections to identify doctors whose decision-making is significantly worse than the norm using detailed information about health conditions. They examine both the quality of decision-making and the quality of execution of those decisions. This is an important distinction. To be aware of what operation is best to perform requires a form of decision-making skill, while to be able to perform successfully is a task skill. Yet outside of medical and sporting settings, there are few settings in which there are detailed measures available of individual decisions and their quality. For that reason administrative data only rarely reveal what role the worker's own decision-making skill play in determining income growth.

The open question is how to operationalize decision-making skills in studying earnings over the lifecycle. One intriguing opportunity links this research back with the work of Guvenen et al. on periods out of the labor force and job transitions. Topel and Ward 1992 find quitting is closely related to wage growth in the early years of workers' careers, as workers try to climb the job ladder. LaLonde, and Sullivan 1993 show that layoffs have lasting negative effects. Gregory, Menzio, and Wiczer 2021 find great heterogeneity in workers' patterns of job switching over the life-cycle. This suggests that skills in identifying and making successful job transitions are therefore of real interest. Job search skills may include: threat identification (noticing an impending layoff); opportunity identification (searching while on the job); realism (accurately anticipating contingencies); and adaptability (adjusting strategy in light of experience).

Looking forward, there is great promise in combining research paths to get a bigger picture of how income and income expectations evolve over the life-cycle. To set the baseline, one should have some variant of the rich combination of registry and survey data that the Danish infrastructure allows. On top of this, one needs to model the decision making skills that matter using a variant of rational inattention theory. One can measure the corresponding skills in laboratory settings and develop corresponding survey instruments to field and link to link actual labor market outcomes. One can also look to measure subjective awareness of skills and of risks associated with different decisions. Going beyond this, one can broaden the work of Wiswall and Zafar 2018, on choice of college major to measure subjective beliefs about the kinds of skills that are important for later life income and how well they match research findings. This indicates just how rich are the possibilities as we follow through on the proposal of Almas, Attanasio, and Jervis to develop new measures to model decision making.

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