1 Overview

I am an empirical microeconomist who uses observational and experimental data to advance our understanding of labor supply. More specifically, I use structural estimation of theoretically grounded models of individual and household labor supply to understand better the determinants of labor supply behavior. I then use the new insights to explore how governments can improve public policies and how employers can motivate their workers more effectively.

In one stream of research, I design and run laboratory experiments to investigate labor supply behavior. The degree of control offered by the laboratory allows me to identify cleanly determinants of labor supply that are difficult to study using observational data. For example, I have provided new evidence on how disappointment shapes labor supply. I have investigated how individual characteristics such as cognitive ability and personality influence learning in simple strategic games that capture important aspects of labor market interactions, and I have explored how labor supply responds to different payment schemes and to performance feedback. This allows me to study how firms can improve the design of their incentive schemes and workplace organizational structures.

In a second stream of research, I use observational data to understand how labor supply responds to government policy. Importantly, the models that I estimate include sufficient structure to allow counterfactual policy evaluation. In more detail, I use data collected from longitudinal household surveys to understand how the labor supply of individuals and households responds to social insurance, social assistance and pension policies. I then leverage the estimated models to help governments to design effective public policy instruments. For example, I analyze how pension systems can be adapted to offset costs arising from improving longevity and I study how social insurance and assistance programs can be designed to take account of the ability of households to react to shocks by adjusting the labor supply of both spouses.

2 Research using experimental data

2.1 Disappointment and labor supply

A disappointment-averse worker dislikes being paid less than expected more than she likes being paid more than expected, that is her expectation acts as a salient reference point. My paper titled “A Structural Analysis of Disappointment Aversion in a Real Effort Competition” (with David Gill; American Economic Review, 2012, henceforth Gill and Prowse, 2012) explores how disappointment aversion affects labor supply when workers compete for a prize, such as a promotion or a bonus.1 We develop a specific theoretical setting in which a worker who suffers from disappointment aversion exhibits a ‘discouragement effect’, meaning that she reduces her labor supply in response to her competitor’s

1This paper is discussed in a chapter of the Handbook of Labor Economics by Charness and Kuhn (2010) and in a new OUP textbook on behavioral economics by Dhami (forthcoming).
effort. Critically for our identification strategy, in the setting that we study a worker with standard preferences ignores her rival’s behavior.

We then design and run a laboratory experiment that matches closely our theoretical setup: workers compete in a real-effort sequential-move tournament with a probability of winning function that is linear in the difference between the workers’ efforts. Our reduced-form analysis shows that workers lower their effort provision when the competitor that they are matched with works harder, thus confirming the qualitative prediction of our model of labor supply with disappointment aversion. Structural estimation based on the Method of Simulated Moments shows that workers are significantly disappointment averse on average. The estimation results also reveal significant heterogeneity in the strength of disappointment aversion across the population. Our results have important implications for the design of labor market incentive schemes. In particular, employers with disappointment-averse workers will want to design schemes that lower workers’ expected disappointment in order to soften their participation constraints.

This paper fits into a broader literature that studies how disappointment-averse preferences, or reference-dependent preferences more generally, influence labor supply in the laboratory and in the field, e.g., Camerer et al. (1997), Goette et al. (2004), Farber (2008), Abeler et al. (2011) and Crawford and Meng (2011).

In the process of designing the experiment used in Gill and Prowse (2012) we developed a novel computerized real-effort task that overcomes many of the drawbacks of existing real-effort tasks. In particular, our real-effort ‘slider’ task provides a finely gradated measure of effort within a short interval, thus making it feasible for researchers to collect rich panels of real-effort choices from the laboratory. Panel data methods can then be used to control for persistent unobserved heterogeneity, which facilitates robust statistical inference. Our slider task has been used in around 50 subsequent experiments by other authors, including studies of tax compliance, peer pressure, social insurance and delegation.

Building on my published work on disappointment aversion, work in progress (with Damon Clark, David Gill and Mark Rush) examines how a desire to avoid disappointment from failing to meet a goal affects effort in the classroom. Specifically, we are using a large-scale randomized field experiment to evaluate the effect of goal-setting nudges on the educational performance of college students. The interventions that we study are low cost and scalable and we therefore hope to identify feasible ways of improving higher education outcomes.

2.2 Cognitive drivers of labor supply

Success in the labor market often reflects performance after some period of learning to operate successfully. My paper titled “Cognitive Ability, Character Skills, and Learning to Play Equilibrium: A Level-\textsuperscript{k} Analysis” (with David Gill; Journal of Political Economy, forthcoming) is the first to show how cognitive ability and character skills, i.e., personality, affect how people behave and learn in repeated strategic interactions, where individual success depends on everyone’s choices.\textsuperscript{2} We use a large lab-
Laboratory experiment to study how cognition and character affect behavior in a learning environment based on the Beauty Contest game. This game represents a simplified market mechanism in which timing is important: people have an incentive to move a little earlier than their rivals, but not too early. In a job market, for example, there is an advantage to making job offers a little earlier than competitors, but moving too early is costly (in terms of missing out on new information about job candidates). As in repeated labor market interactions, success in the Beauty Contest game requires both analytic reasoning (to deduce how best to respond to beliefs about how others will behave) and a good theory of mind (the ability to judge well the intentions and beliefs of others to predict accurately how others will in fact behave).

Our reduced-form results show that more cognitively able individuals make choices that are closer to equilibrium, learn faster, and earn more even as behavior approaches the equilibrium prediction. Character skills also help to explain behavior: we find that more agreeable and emotionally stable people perform better and learn faster. To understand more about how people with different cognitive abilities and character skills learn differently, we estimate a structural ‘mixture of types’ model of learning based on level-$k$ reasoning. Following Nagel (1995), we assume that level-0 types “follow the crowd” in the sense that they copy average behavior in the previous interaction, level-1 types best respond to the choices of level-0 types, level-2 types best respond to the choices of level-1 types, and so on.$^3$ The estimation results show that agreeableness and emotional stability positively predict people’s level-$k$ choice rules. We also find that people of high cognitive ability follow higher level-$k$ choice rules than people of low cognitive ability. Interestingly, people of high cognitive ability respond to information about the ability types of their opponents, while people of low cognitive ability do not.

Our findings on personality fit with recent evidence that links agreeableness to a better theory of mind, thus providing a channel through which agreeableness might help performance in settings like ours that require strategic reasoning. More generally, our findings help to rationalize the results of recent studies that show that cognitive ability and character skills predict workplace outcomes (see, e.g., Heckman et al., 2006, Mueller and Plug, 2006, Borghans et al., 2008, Cunha et al., 2010, and Heckman et al., 2013). Indeed, to the extent that success in the labor market depends on the capacity to learn to use a combination of analytic reasoning skills and the ability to understand well others’ patterns of thinking and behavior, our findings start to unpack the underlying processes that explain why cognition and character matter and how they interact.

In ongoing work with David Gill I am studying how cognitive ability and character skills predict when people choose dominated strategies. The results will help us to understand whether and how cognition and character predict extremely poor performance in strategic interactions.

### 2.3 Performance feedback, payment schemes, and labor supply

In further work using data collected from laboratory experiments, I have explored how labor supply responds to information about previous performance and how labor supply is shaped by the perceived fairness of the employer’s payment scheme. The results of these projects give new insights about how workers respond to employer policies and give employers valuable guidance on how to attract, moti-
vate and retain their workers.

My paper titled “Gender Differences and Dynamics in Competition: The Role of Luck” (with David Gill; *Quantitative Economics*, 2014) explores how men’s and women’s labor supply responds to success and failure in previous competitions. By applying an Arrelano-Bond dynamic panel data estimator to the data collected for Gill and Prowse (2012), we show that women reduce labor supply after losing both high-stakes and low-stakes competitions. Meanwhile, men reduce labor supply only after losing high-stakes competitions. These striking differences in how men and women respond to previous competitive outcomes help to explain both female underperformance in environments with repeated competition and the tendency for women to enter into competitions at a lower rate than men. More generally, our results suggest that gender gaps in labor market outcomes may be driven partly by actual and anticipated responses to the process of success and failure during competitions for jobs and promotions, alongside more traditional explanations such as discrimination, ability differences and heterogeneity in preferences.

In a new working paper titled “First-place Loving and Last-place Loathing: How Rank in the Distribution of Performance Affects Effort Provision” (with David Gill, Zdenka Kissova and Jaesun Lee; submitted) I continue to explore how performance feedback affects subsequent effort provision. In this paper we leverage random variation in the allocation of rank among people who exerted the same effort and show that workers who are told that they are among the best or worst performers respond by increasing effort provision substantially, relative to workers who are informed that they rank in the middle of the pack.

Our findings have implications for how firms might choose to design their performance feedback policies. In particular, it might be profitable for employers to emphasize feedback of very high or very low relative performance, e.g., by awarding symbolic prizes to the best performers or scheduling regular appraisal meetings with senior managers for the worst performers. Our results also have implications for optimal organizational design. For instance, firms might want to divide workers into small comparison groups, e.g., by adopting a decentralized organizational structure or designing highly specialized jobs, in order to reduce the number of middle ranks that solicit relatively low subsequent effort provision. Employers might also find it productive to organize workers into groups with similar abilities, so that all workers have a realistic prospect of obtaining top ranks.

In a paper titled “Cheating in the Workplace: An Experimental Study of the Impact of Bonuses and Productivity” (with David Gill and Michael Vlassopoulos; *Journal of Economic Behavior and Organization*, 2013) we show that exposing workers to a compensation scheme based on random bonuses makes them cheat more but has no effect on their productivity. We link our findings to the literature on procedural fairness, which shows that workers respond negatively to unfair treatment and bad intentions.
3 Research using observational data

3.1 Labor supply and social insurance, welfare and pension policies

The design of social insurance, social assistance and public pension policies rests on a well-known tradeoff between providing insurance against shocks, such as job loss and health shocks, and distorting incentives for labor supply, saving and other behaviors. In a series of papers, I explore how behavior responds to public policy instruments that provide insurance, and I offer insights on how to improve the design of specific public programs. Each paper starts with the specification of a structural model of life-cycle labor supply in which the constraints and incentives created by public programs appear alongside the intertemporal incentives to accumulate both human capital and program entitlements.\(^4\) I estimate the parameters of the model using Indirect Inference on a longitudinal sample of households.\(^5\) Finally, I use the estimated model to predict behavior in counterfactual policy environments and thus to understand how governments can design effective public programs.

Many public pension systems are being strained by cost increases driven by rising life expectancy. In “Longevity, Life-cycle Behavior and Pension Reform” (with Peter Haan; *Journal of Econometrics*, 2014) we use a rich dynamic structural model to understand the relationship between life expectancy, the public pension system and individuals’ employment, retirement and consumption decisions over the life-cycle. Drawing on this framework, we are the first to analyze how changes in life expectancy affect labor supply over the life-cycle. Furthermore, by looking at how individuals respond to changes in individual-specific and cohort-specific life expectancy, we break new ground by exploring the desirability of changes to the public pension system that are designed to cope with the financial challenges created by increasing life expectancy. This paper draws on previous studies that have used life-cycle models to investigate the effects of public pension systems on labor supply, retirement and consumption decisions without looking at how behavior responds to life expectancy, e.g., Rust and Phelan (1997), French (2005), and van der Klaauw and Wolpin (2008).

Our results reveal that people increase labor supply, postpone retirement and accumulate more wealth as life expectancy increases. These behavioral responses partly mitigate the increases in pension costs associated with increases in life expectancy. We calculate that the fiscal impact of the increase in life expectancy that is anticipated to occur over the next 40 years can be offset by an increase of around 4 years in the full pensionable age. We also compare the welfare implications of a variety of pension reforms that address the fiscal challenges presented by increasing life expectancy. The pension reforms that we consider combine adjustments in the full pensionable age with changes in annual pension benefits, minimum pension provisions and early retirement rules. The public pension system that individuals value most highly involves strong labor supply incentives for people with the lowest propensity to work.


\(^5\)For similar estimation approaches see, e.g., van der Klaauw and Wolpin (2008), De Nardi et al. (2010), Eckstein and Lifshitz (2011), and Altonji et al. (2013).
In an ongoing and related project with Peter Haan and Daniel Kemptner I am studying how public pension systems moderate the inequality in lifetime income due to health and employment shocks. The results of this analysis will allow policy makers to design pension systems and other social support programs to better insure important lifetime risks.

In a working paper titled “Optimal Social Assistance and Unemployment Insurance in a Life-cycle Model of Family Labor Supply and Savings” (with Peter Haan; submitted) we analyze the optimal design of social insurance and assistance programs when married couples make labor supply choices for both spouses, a so-called ‘family labor supply decision’ (Blundell et al., forthcoming). Our paper extends an empirical literature that explores the insurance-incentive tradeoff underlying the design of social insurance and assistance programs when households make a single labor supply decision (see, e.g., Lentz, 2009, Low et al., 2010, and Low and Pistaferri, forthcoming). A further novelty of our analysis is to consider simultaneously the optimal design of social insurance and assistance programs. We consider two key programs: social assistance, which guarantees minimum household income; and unemployment insurance, which is a temporary earnings-related benefit. Previous work has studied program interactions without considering the implications for optimal program design (see, e.g., Keane and Moffitt, 1998, and Low et al., 2010).

We embed a social insurance and assistance system in a dynamic model of the life-cycle labor supply and savings choices of singles and couples. In our model, couple households may adjust either one spouse's or both spouses' labor supply in response to wage and employment shocks. Based on the estimated model, we explore household behavior and the welfare effects of social insurance and assistance programs. We find that households increase the wife’s labor supply when the husband experiences a negative wage or employment shock (and vice versa). In terms of policy implications, we find that the optimal policy mix focuses more on social assistance than on unemployment insurance. We also show that the optimal generosity of social assistance is decreasing in the proportion of married couples in the population. Finally, we show that the link between optimal policy design and marital status is strongest in low-educated populations.

In a related paper titled “A Structural Approach to Estimating the Effect of Taxation on the Labour Market Dynamics of Older Workers” (with Peter Haan; Econometrics Journal, 2010) we explore how tax reforms affect the labor supply and retirement decisions of low-income older workers. We find that tax cuts increase the rate of employment for individuals under 60 but cause people over 60 to switch from non-employment to retirement. We also show that labor supply starts to adjust up to 3 years in advance of anticipated tax reforms.

### 3.2 Further work on labor supply using observational data

I have published two further papers that study labor supply using observational data (both papers are single-authored). The first paper builds on an established literature that decomposes the observed persistence in labor force participation into a contribution from unobserved individual characteristics and a contribution from state dependence. State dependence arises when previous labor force participation changes current prices, preferences or constraints, thereby causally affecting current choices (see Heckman, 1981). The strength of state dependence is policy relevant because it drives the

Maximum Simulated Likelihood estimation using a panel sample of British women shows that a rich specification of unobserved heterogeneity, including random coefficients and autocorrelated unobservables, is needed to understand women's employment transitions. After controlling for persistent unobservables, I find that part-time work provides a better route out of long-term non-employment than full-time work. This result is notable in the context of the debate surrounding the low status of part-time work. In particular, while part-time jobs are typically poorly paid relative to full-time jobs, my results suggest that part-time work does not entail weaker attachment to the labor market.

In “Modeling the Allocation of Time under Rationing: A Structural Model of Time Allocation Behaviour” (Canadian Journal of Economics, 2009) I develop and estimate a model of the time allocation decisions of single and married men and women. The paper extends existing studies of time allocation behavior by recognizing the time constraints on household behavior. The estimation results show how the wage elasticity of labor supply depends on households' non-market time allocation behavior.

References (to works by other authors)


