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FROM THE LAB

UC Santa Barbara | Laboratory for Aggregate Economics and Finance

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at UC Santa Barbara*

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at UC Santa Barbara*

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Director's Message

by Finn Kydland



Often, the most fruitful and profound advances and insights are obtained when getting together researchers who have thought about, or simply are interested in, reasonably common questions and issues, but coming at them from distinctly different perspectives. This principle was part of the idea behind both of the LAEF conferences whose proceedings are summarized in this issue. They were both held in Santa Barbara.

The recent global financial crisis and the ensuing Great Recession suggest that accounting practices may have real economic consequences. Lax enforcement and outright fraud have been advanced as contributing factors both to the initial crash and the subsequent slow recovery, as many firms were found to be obscuring or misreporting their liabilities and exposure to risk. The purpose of the **Accounting for Accounting in Economics** conference was to bring together researchers from the fields of economics and accounting to discuss common methods and topics, including the effects of financial misreporting on asset prices, the importance of credit reporting for economic activity, and the role of disclosure requirements in industry dynamics. The academic organizers of the conference were **Eric Young**, Associate Professor of Economics at the University of Virginia, and **Bo Sun**, Assistant Professor in the Department of Finance, Guanghua School of Management, Peking University.

The program for the second conference summarized in this issue, **Dynamic Policy Design with Human Capital**, was selected by **Marek Kapicka**, Associate Professor of Economics, University of California, Santa Barbara; **Lance Lochner**, Professor and Director, CIBC Centre for Human Capital and Productivity, University of Western Ontario; and **Peter Rupert**, Professor of Economics and Associate Director, Laboratory for Aggregate Economics and Finance, University of California, Santa Barbara. This conference brought together the following two groups to discuss optimal dynamic policies for fostering human capital formation. One group uses the mechanism design of optimal policies with human capital, typically with a limited framework for human capital production, while the other thinks more deeply about human capital formation (cognitive vs. non-cognitive skills, early childhood investments, etc.), but typically considers ad-hoc policy reforms. The idea was that having a mix of presentations and participants from both of these areas over two days would be especially fruitful.

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Accounting for Accounting in Economics

NOVEMBER 8-9, 2013

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Who Benefits from Fair Value Accounting? An Equilibrium Analysis with Strategic Complementaries

Frank Gigler, Chandra Kanodia and Raghu Venugopalan

Under fair-value accounting, also known as mark-to-market, a firm's balance sheet is evaluated at the prevailing prices at each reporting date, rather than at the original acquisition prices. Over the last decade, the shift from historical cost to fair-value accounting has happened without much skepticism about possible costs. The underlying assumption is that more information allows stakeholders to make more informed decisions based on accurate capital market valuations. Gigler, Kanodia and Venugopalan introduce a realistic environment where fair value accounting may be welfare reducing.

In the authors' model, consumers purchase a good whose value depends on the current wealth of the firm. This may be because consumers require continued service from the firm, and firms require a minimum net worth to continue operating. The good is therefore more valuable if the firm survives to provide that service, although this is not explicitly modeled. The firms first make a portfolio allocation decision between a risky and a safe asset. Consumers then receive a noisy signal of the return on the risky asset, which is interpreted as the reported (fair) value of the firm, and make their purchasing decision. The shift to fair-value accounting is interpreted as a decrease in the variance of the noise signal the consumers receive.

The equilibrium effects demonstrate the possible costs of fair-value accounting. An increase in the accuracy of the consumers' signal increases their response to the signal, which manifests itself in their purchases of the firm's good. To the firm, this means more variable revenue, and risk-averse firms decrease their investment in the high-return risky asset in response to the increased accuracy of the consumers' signal. The firms are unambiguously worse off in equilibrium. For consumers, there are two effects at play: the benefit of more information at the time of the purchasing decision and the cost of lower expected wealth of the firm. If the accounting information is too precise and the firms drastically reduce investment in the high return risky asset, it may even be the case that the consumers are worse off.

One conference participant mentioned that it could be the case that a positive shock may not necessarily be a good thing. A large positive shock to a firm's wealth could signal that the firm's wealth is very volatile, making buying from that firm less desirable. Kanodia responded that if consumers were risk-averse, this channel may be important, and that this would be incorporated in future work.

Another commenter suggested that the firm should be taking into account the future liabilities associated with future servicing, and that if this were explicitly modeled the problem may disappear. Kanodia agreed that this may be the case, but argued that we could think of this as already being incorporated into the profit function, and that the framework is only meant to capture the idea that consumers want the firm to continue operating.

A final commenter noted that the authors' framework is not specific to fair-value accounting, and could be applied to any

informational release setting. This is indeed the case, and the lesson we should take from the model is that we should consider the possibility that some information systems increase the ex-ante variability of firms' wealth.

Asset Measurement, Real Effects and the Financial Accelerator

Jeremy Bertomeu and Edwige Cheynel

After the recent financial crisis, several prominent policymakers stated that accounting standards generally make the financial sector more procyclical and may have contributed to the crash. Indeed, the goal of accounting standards has traditionally focused on the accurate revelation of information, with nothing to say about financial stability. In the past century, this drive has led accounting standards to evolve from purely historical cost to impairments, and most recently to fair-value. A historical cost standard values assets at their acquisition cost, while impairment standards report when assets lose value, and fair-value standards report assets valued at current prices, so each subsequent system reveals more information. Bertomeu and Cheynel search for an optimal standard, and ask whether the standard should respond to macroeconomic conditions.

In the authors' model, firms are endowed with a productive asset and must decide whether to use the asset to generate a random cash flow or to sell the asset and liquidate. If a firm chooses to operate, it must borrow some additional liquidity from capital markets. To do so, it must offer some standard debt to creditors, which it repays at the end of the period, then sells its asset. Because of a moral hazard problem, creditors are only willing to lend to firms whose asset has a relatively high market value. Under full information, there may therefore be three categories of firms, defined by their asset value. The highest-value firms liquidate at the start of the period, as the market value of their asset is higher than the expected returns to producing. The moderate-value firms choose to operate, and have an asset value high enough to serve as collateral, so they are able to borrow from capital markets. The lowest-value firms would like to operate, but do not have an asset value high enough to serve as collateral, so are not able to borrow the liquidity needed to operate. These firms therefore liquidate involuntarily at the beginning of the period.

Full information is then inefficient, as the firms with a low asset value get a higher surplus from operating, but are prevented from doing so. The question then becomes whether an alternate accounting standard can restore efficiency. The optimal standard will always be an impairment system where only low-asset values are revealed, or a write-up system where only high-asset values are revealed. In addition, if feasible, write-ups dominate all impairments. The intuition is that while write-ups may force some high-value firms to operate inefficiently, they do not force any low-value firms to liquidate involuntarily. In contrast, impairments force all high-value firms to operate inefficiently, while also forcing some low-value firms to liquidate.

The optimal choice of standards depends on the interest rate. If the interest rate is low enough, write-ups will be able to achieve the efficient outcome. As the rate rises, write-ups may lose efficiency, but remain better than impairments until some upper bound when

write-ups become infeasible, and impairments become the optimal standard. There may be up to three capital market equilibria, with three corresponding interest rates, although only two are stable, with the lower interest rate being a write-up equilibrium, and the higher rate corresponding to an impairment standard.

The model lends itself well to experiments, including both capital crunches and collateral squeezes. In the write-up equilibrium, there is no financial acceleration which is defined as the marginal effect of the credit market event on investment. However, in the impairment equilibrium, capital crunches lead to financial acceleration, and under certain conditions so do collateral squeezes. Because the two equilibria correspond to different interest rates, the paper provides a cautionary tale about regulatory traps and managing expectations. In particular, regulators should try to drive the market towards the low interest rate, write-up equilibrium. In addition, regulators must be willing to adapt the measurement system to credit market conditions, as high interest rates may lead to the infeasibility of write-up systems and a switch to impairments. In this sense, the paper advocates for flexible accounting standards that are adaptable to credit market events.

Following Bertomeu's presentation, the bulk of discussion focused on the definition of asset value in the paper. All firms are able to generate the same cash flow with their asset, so the market value of the asset is measured per unit of output. In this sense, the firms classified as low-value have a very high output per unit of productive asset, thus the asset can be thought of as more productive. Since the paper advocates for a non-traditional write-up standard, a conference participant wondered whether this effect may cause the story to flip and instead be consistent with traditional impairment advice. Bertomeu agreed that this definition was an important issue and that it may affect the way we think about the model, but thought that the model could not be used to argue for impairment due to the way the collateral constraints operate.

Banker Compensation and Bank Risk Taking: The Organizational Economics View

Arantxa Jarque and Edward S. Prescott

Controlling bank risk via regulation of compensation arrangements is a new focus of bank regulations, motivated by the belief that bank compensation practice is a significant contributory factor to the recent financial crisis. Jarque and Prescott utilize the tools in organizational economics to analyze the connection between bank risk and compensation to bank loan officers, whose decisions together can have a significant impact on a bank's performance. The authors' paper focuses on loan officers instead of CEOs because the majority of labor compensation paid out by a bank goes to its loan officers. Moreover, there has been a lot of literature on CEO compensation compared to very limited studies on loan officer compensation.

A bank consists of depositors, equity holders and a continuum of loan officers. Each of the officers has an infinitesimally small effect on the performance of the bank. Loan officers perform investments that are financed by insured deposits together with equity. The return of a loan officer's project consists of three components: his/her unobservable effort, an idiosyncratic shock

which is the officer's private information, and a common shock observed by the bank. The bank chooses a compensation scheme for loan officers to maximize its expected profit, i.e., the return to a risk-neutral equity holder, which is the total revenue net of the compensation and secured deposits. The loan officers choose their effort levels according to the compensation scheme to maximize utility. Because of deposit insurance and limited liability, the bank's preferences are not socially optimal. The risk-neutral equity holders have to compensate the risk-averse loan officers to take actions that generate risks. Prescott's presentation showed that the specific scheme of this compensation depends on the correlation among each loan officer's return. Prescott elaborated about the effect of return correlations on the optimal compensation plan. When there is no correlation among loan officer returns, the bank's objective is socially optimal. This is because when there is no variation in a bank's total returns, limited liability will not distort bank decisions. In this case, the optimal compensation chosen by the bank is also the socially optimal compensation, and there is no reason to regulate it. On the other hand, when the returns are perfectly correlated (there is no idiosyncratic shock), the bank can infer a loan officer's action from his/her return together with the common shock. Since there is no asymmetric information, the bank can pay each loan officer a certain wage if his return is what it is supposed to be and zero otherwise.

When loan officer returns are partially correlated, the compensation scheme depends on the bank supervisor's knowledge. In order to design a meaningful scheme, the supervisor needs to understand the loan officer's investment technology and how the compensation contract may generate correlation of returns. One example is when officers' efforts affect the mean of the overall return. Successful loan officers, whose return is higher than average, will receive a constant level of pay, while unsuccessful officers, whose return is lower than average, will see their pay drop with the success of the bank, which indicates that the overall compensation decreases with bank performance. Another example is when the officer can choose how much his loan is correlated with the bank's performance, the bank can separate the effort of the officers by the correlation level they choose. This means the bank will reward the loan officer when the signal indicates no correlation and punish him when the signal indicates correlation.

To shed a light on the trend that most banks employ specific people to monitor lending and risks, Jarque and Prescott then extended their model to include a loan reviewer for each loan officer to jointly audit the investment project. The result is that both the loan reviewers and loan officers should be paid based on their project performance. Although theoretically intuitive, this result is interesting since it goes against the regulators' common perception that risk management employees and those in similar compliance positions should not have their pay tied to the performance of the line of business that they monitor.

Prescott concluded his presentation by generalizing the implication of the aforementioned organizational economic analysis: compensation and its effect on bank performance depend on the way that the bank organizes its production. More empirical studies are needed to determine the right model for the optimal compensation scheme.

One conference participant asked if loan officers can hedge against the compensation risk since the common shock is observable and persistent. Prescott responded that the authors' paper partially answers this question. The ability of hedging also depends on the production function of loan officers. In some cases, part of the compensation can indeed be hedged against.

Another participant pointed out that although there are multiple agents in the model, they all act as one single agent. He was wondering how the sub-game perfect equilibrium among the loan officers works and whether there are multiple equilibria such as collusion. Prescott agreed that the model works as a single-agent one in the sense that every officer takes the same effort level and takes each other's effort as given. In terms of multiple equilibria, he said that the results might change if the agents can collude. Although he was not sure how specific the changes might be, he agreed that it should be an important issue for this topic.

Regulatory Intensity, Crash Risk, and the Business Cycle Bo Sun and Xuan Tam

Regulatory investigations play an important role in shaping the information structure in financial markets. On one hand, investigation detects financial misreporting and reveals hidden negative information. On the other hand, it imposes adverse consequences for executives involved in manipulation, and thus helps limit managerial incentives to manipulate performance ex-ante. Sun and Tam propose a model to study the asset pricing implications of regulatory responses to business cycles for stock market dynamics.

Sun showed cases where financial regulations and revelations of fraud appears to be "procyclical", i.e., most fraud and misrepresentation are concealed or encouraged in a boom, and are revealed by the ensuing recession. Taking this as a point of departure, the authors build a model with regulator-manager interaction that generates cyclicity in regulation. In the model there are common shocks (business cycle), which are observed by everyone, and firm-specific idiosyncratic shocks (firm performance) which are managers' private information. Managers would or would not choose to report true performance in order to maximize their private gains for inflated reports given their expectations of regulators' investigation intensity. Regulators would choose investigation intensity to maximize the prevalence of truthful reporting, given the managers' response function and cost of investigating. The model also assumes that the investigation cost is higher when the economy is in a good state. This can be interpreted as managers having larger cash flows available to conceal manipulation when the economy is doing well. The equilibrium of this game indicates that the regulators will initiate more intense investigation during bad periods because a high detection rate makes investigation more cost-effective in preventing manipulation than in good times. Also, manipulation by managers will be more prevalent in good periods not only because it is the optimal strategy against regulators, but also because the private benefits from manipulation for managers are higher in the good aggregate state.

After setting up the game between regulators and managers, Sun explained how the authors expanded the model to include investors in order to study asset pricing. The timeline goes: Each period the public and private shocks take place first, then regulators commit to a certain investigation frequency, and managers report their performances. After the moves of regulators and managers, the investors infer the firm's performance based on the common shock, the firm's performance history, and previous investigation results. The investors' decision, together with the shocks and actions of other parties, determines the asset price. At the end of each period, investors bear losses if the firm is found to be manipulating its performance, and dividends are paid out. The model is then calibrated to fit U.S. data. Results show that cyclical regulatory activities would lead to a much higher percentage of firms that suffer from return crash during recession and to gradual booms and sudden crashes for the whole economy. The second result is because regulatory investigations detect all the past manipulation and reveal negative information in large lumps. The asymmetric regulatory responses to business cycles cause more negative information to be revealed during bad times, resulting in large, negative returns during episodes of weak economic conditions. Moreover, infrequent regulatory actions in booms fuel managerial incentives to manipulate, causing more aggressive manipulation only to be revealed and reversed at the beginning of recessions when investigations become intense. Cyclical regulatory activities would also result in a higher return volatility during recession, because intense regulatory actions in economic downturns reveal substantial hidden negative information that managers stockpiled in booms due to loosened regulation, causing stock returns to become increasingly volatile as economic conditions deteriorate.

Sun concluded her presentation with the model implications. The state-dependent detection difficulties give rise to cyclical regulatory intensities, which in turn leads to cyclical frequencies of financial manipulation. Thus, the seeds of the strains during downturns are actually sown during the preceding upswing. Regulations have to be cycle-proof in order to fix the aforementioned situation.

A conference participant questioned the definition of "recession" in the paper. According to the model, fraud and manipulation were detected during a recession because the investigation cost is lower. However, in reality, it is usually revealed fraud that leads to the recession, which means the fraud is actually identified before recession. Several other participants also raised similar questions and provided different mechanisms for fraud detection aside from the one from the paper, such as media, whistleblowers and a more aggressive SEC. Sun agreed with the comments and responded that the paper focused on the same problem but from the perspective that the cycle itself would have an impact on the fraud identification.

Who Should Pay for Credit Ratings and How?

Anil K. Kashyap and Natalia Kovrijnykh

After the recent financial crisis, many government inquiries have assigned at least some blame to credit rating agencies. Recent work has found that rating mistakes are due in part to insufficient effort by rating agencies. Other work has also shown that rating accuracy differs depending on who pays for the rating; competition in the rating business reduces rating accuracy; mistakes are more common for newer security types; and agencies are slow in downgrading their ratings. Kashyap and Kovrijnykh present a model that sets out to explain these five facts.

In the authors' one-period model, firms have a project that requires some level of outside investment. The project may be either good or bad, with different probabilities of success. The output is such that it is profitable to finance a good project, but not a bad one. Since the project type is private information, a rating agency may be used to get a signal of the project quality. The signal received is dependent on the agency's effort level, and the agency gets disutility from effort.

The authors investigate optimal compensation outcomes when different agents order the rating: the social planner, the firm and the investors. Whoever orders the rating, the timing is as follows. First, the rating agency sets the fee structure. Then, the agent decides whether to order a rating. If a rating is ordered, the rating agency exerts an unobservable effort level to obtain the rating, and reports this rating to the agent. The agent then decides whether or not to announce the rating, investors offer interest rates, the firm decides whether to borrow, and if the project is financed, the success or failure of the project is observed. At the end of the period, investors are repaid and the rating agency collects fees.

In the optimal compensation scheme, it is optimal to give the entire surplus from production to the rating agency in the event of a good outcome in order to elicit the highest possible effort in rating. In addition, the rating agency receives no payment if it gives a good rating, and the project turns out to be bad. Outcomes are then compared depending on who orders the rating. The results are consistent with the previous research: when investors order the ratings, greater effort is obtained than when firms order, although investors continue to order ratings even when the ex-ante probability of a good project is very high. This means that the total surplus depends on the quality of projects. For moderate probabilities, the extra effort by the rating agency yields a higher surplus, but for high probabilities, the investors order ratings when the firms would not, thereby reducing the surplus.

Conference discussion focused on other realistic aspects of the ratings process that one might want to accommodate in this model, including the difference between securities and projects, structured finance projects, and non-binary project outcomes. Kovrijnykh thought that all of these features could be investigated using this basic structure, although it was not yet done.

The model is also extended to multiple ratings agencies that compete on fees. As a result, fees are lower in equilibrium, and the agencies exert lower effort, and therefore accuracy is reduced. This seems to suggest an argument for a single rating agency.

One conference participant pointed out that many of the stories told in the media involve rating agencies competing on ratings instead of fees. Kovrijnykh responded that it would be difficult to incorporate that into the model as it is, but is an idea worth investigating in the future.

Accounting for Executive Compensation

Kevin Murphy

Two major trends in CEO pay have developed over the past 20 years. The first was a spike in equity-based pay in the 1990s along with a continuing increase in mean CEO pay. In the early 1990s, equity-based pay comprised about one-fourth of CEO pay, whereas by the early 2000s, it made up around 50 percent of pay for CEOs of S&P 500 firms. For startup firms, this number is around 70-80 percent. The second trend is the leveling out of mean CEO pay after the early 2000s but a shift away for stock options to restricted stock (vesting only with the passage of time). There are two theories that try to explain these trends. The first theory is based on managerial power, arguing that high-powered CEOs are setting their own compensation, which explains the rapid increase in mean pay. The second theory is the concept of efficient contracting which argues that these trends are all efficient and reflect changes in the market for managerial talent. Murphy claims that these two theories are missing an important aspect of CEO pay: accounting. Accounting rules are an important component in determining both the level and structure of CEO pay.

Murphy argues that CEO pay cannot be explained without understanding equity-based pay. He shows that stock prices react strongly to positive small changes in earning surprise: when a firm beats a forecast by one percent the stock price rises on average by about 5.5 percent. Similarly, stock prices fall by about eight percent when a firm misses the forecast by about one percent. This relationship defines how beating or missing analyst forecasts affects the value of managers' equity-based holding and incentivizes managers to shift revenues or expenses across quarters in order to manipulate expected earnings.

Murphy also argues that equity-based pay cannot be explained without understanding accounting. Beginning in the 1980s, there have been many changes to accounting rules that have no effect on cash flows but do affect managerial behavior. Before there were accounting rules that addressed stock options as a form of compensation, firms could pay employees using options without an expense. In 1984, the Financial Accounting Standards Board (FASB) started floating the idea that there should be an expense on stock options which should be calculated using the minimum value approach. Two years later, FASB proposed using the fair market value instead of the minimum value approach. This proposal was strongly opposed by all of the Big Eight accounting firms. The proposal was dropped and it was not until 1995 that FASB recommended firms expense stock options at fair market value. Options continued being treated as not having an associated expense. However, when options were exercised, firms received cash and could deduct the difference between the market price and the exercise price from their corporate taxes. It is this "best of both worlds" aspect of stock options that Murphy argues can

be attributed to the increase in option-based pay and overall increase in executive pay. Murphy attributes the shift away from options to restricted stock in the mid-2000s to the stock market crash associated with the internet bubble, which left many of the outstanding options underwater. Since executives naturally prefer restricted stock to options when they have low expectations for future firm performance, their equity-based pay shifted away from options to restricted stock. In addition, in June 2005, FASB began requiring firms to recognize an accounting expense when granting stock options. This requirement significantly leveled the playing field between options and stocks from an accounting perspective, which Murphy argues is another reason for the dramatic shift away from options in equity-based pay that began in the mid-2000s.

A conference participant was unsure how these changes in accounting rules would not have an effect on cash flow as many contracts use accounting variables as inputs. Murphy responded that contracts that use accounting variables such as earnings as an input variable often continue using the earnings calculated with previous accounting rules. Another conference participant mentioned that many people have argued that when firms make employees equity holders they are being paid for their labor and effort and therefore this transaction should be made below the line in the equity section and should not be expensed. Murphy replied that this argument does not deny that stock options have an expense but that the expense is borne by the shareholders and not by the firm. Finally, another conference participant asked about the difference between the firms who were prosecuted for violating FASB and those who weren't prosecuted but were in violation. Murphy answered that in many cases the claim was that the CEOs never knowingly benefited from receiving stock options and often claimed they did not understand the accounting rules.

Consumer Default Effects of Capital Income Tax Changes

António Antunes, Tiago Cavalcanti, Caterina Mendicino, and Anne Villamil

The effects of changes in capital income tax have long been discussed in macroeconomics. However, the discussion about unsecured consumer credit with default is far from complete. When given the option of declaring bankruptcy, a household can discharge its financial obligations and increase its ability to smooth consumption across intra-temporal states. The trade-off is that the bankrupt household will lose access to the credit market in the future and thus its ability to smooth consumption over time. This degree of freedom would alter the factor prices in a general equilibrium framework and thus change the effect of capital income tax cut. Antunes, Cavalcanti, Mendicino, and Villamil address this issue by using a general equilibrium model with unsecured consumer credit with the option of default to study the effects of a reduction in capital income taxes.

The model consists of four sectors: production, household, banking, and government. The production sector features a standard representative firm with constant returns to scale production technology. The household sector is inhabited by a continuum of households who are ex-ante identical and face two idiosyncratic shocks: one labor productivity shock and one

expense shock that affect the household's asset positions (e.g., divorce). Households can borrow or save through the banking sector. Each period after the shocks are revealed and production takes place, households can decide whether or not to default. If they choose to default, all of their debts including expense shock will be discharged, all assets will be liquidated, and the households will be prohibited from borrowing in the future (bad credit score) with a positive probability. If they choose not to default, households will have to pay the expense shock and decide its current period asset position. In the banking sector, there is assumed to be one representative bank that maximizes the present value of current and future cash flows by choosing capital holdings, loan contracts and deposit contracts. The government finances an exogenous expenditure through taxes on labor and capital income. To close the model, a service provider (such as courts or hospitals) is designed to collect the expense shocks.

Villamil presented the model calibration. The parameters were chosen such that in the long run they match some recent key empirical observations in the United States. One featured result in the steady state is that over time borrowers and savers would switch states when facing certain productivity shocks. Two experiments were made to the baseline model to study the effects of permanent unanticipated changes in the capital tax rate. First, the capital tax is eliminated and no other changes are made to the model. In the second experiment, the elimination of the capital tax is accompanied by an increase in the labor tax rate so that the overall tax revenue is constant.

The first pass results of the model resulted in several implications, though the exact numbers had not yet been perfectly determined at the time of Villamil's presentation. The author said it takes a considerably long period of time (20-30 years in the model's results) for the economy to adjust to the new steady state. The ex-post heterogeneity of the households implies that there is a distribution for the welfare gain induced by the tax change. These implications point to the political impact of experimented policies since the proportion of households that are in favor of certain policies can be explicitly determined.

Villamil concluded with a description the work in progress for this paper. She mentioned that the authors plan to test the model with alternative specifications of the borrowing constraint, adding in bankruptcy filing cost, intermediation costs, and labor supply, in order to make the framework more robust.

One conference participant asked why the authors chose the assumption of random "bad credit" in each period instead of a fixed duration once the household defaults. Villamil responded that it is actually a trick specific to this literature. The randomness of "bad credit" in the paper will ensure that the model will function regardless of the risk-averse assumption, while a fixed time "bad credit" will only work under the assumption of constant relative risk aversion.

Another participant noted that in a revenue-neutral experiment, an increase in labor tax will inevitably alter the labor supply, while the model assumes a perfectly inelastic labor supply. Villamil agreed with the comment and responded that the authors will indeed test the robustness of the model by adding an elastic labor supply in future work.

Relational Contracts as a Foundation for Bonus Pools

Jonathan Glover and Hao Xue

Bonus pools and other rewards are often discretionary or based in part on information that is non-verifiable to the employer. Much of the thinking about this relationship between pay and performance is based on a simple principal-agent problem. Glover and Xue explore optimal pay-for-performance contracts for a team of agents working together to produce a single output. Using a team of agents instead of a single agent can result in mutual monitoring (beneficial to the principal) or collusion (harmful to the principal). Repeated interactions in a game theoretic approach to bonus pools introduce two important features into the model: they facilitate trust between the principal and the agents needed to make discretionary pay contracts an equilibrium and facilitate either mutual monitoring or collusion play between the agents. The model predicts that when the relationship horizon is long, the optimal contract uses joint performance evaluation which incentivizes agents to mutually monitor each other, and does not reward agents for poor performance. As the horizon shortens, the solution converges to a static bonus pool which rewards agents for bad performance to keep the principals' promises credible.

For intermediate horizons, the discount rate is an important factor in determining the optimal contract. The principal minimizes the expected wage paid by choosing wages when both agents work (w_{HH}), both shirk (w_{LL}), one works while the other shirks (w_{HL} , w_{LH}), and whether to induce team incentives between the agents. When team incentives are optimal, i.e., mutual monitoring is optimal and the discount rate is small, pure joint performance evaluation (Pure JPE) is optimal. As the discount rate increases (the agents and principal become less patient), the optimal contract increases the wage when both agents work, but also rewards poor performance by paying non-zero wages when both agents shirk from working. As the discount rate increases further, the optimal contract becomes a JPE contract in which own wages are non-zero when the other agent shirks and zero when both shirk. When team incentives are not optimal and all parties are patient enough, individual performance evaluation is optimal. Again, as the discount rate increases, contracts that pay for poor performance become optimal which creates incentives for the agents to either jointly shirk or alternate between working and shirking, i.e., cycling. Relative performance evaluation (RPE) combats joint shirking by creating strategic substitutability between agents' payoffs. The cost of RPE is how much the principal must increase w_{HL} to also combat cycling. "Pay without performance" contracts (BP) are optimal for combatting the cycling problem but are costly since they require large increases in w_{HH} to combat the joint shirking problem. Both of these contracts are optimal at high interest rates but RPE is thought of as the better outcome since it does not reward agents for poor performance. For RPE to be optimal for all discount rates, the principal must make the agents' payoffs strategically independent, requiring setting wages such that RPE and BP are equally costly to the principal. The overall optimal contract, that is, whether the principal chooses to induce mutual monitoring, depends on the discount rate along with the relative credibility of

the principal to keep his promises of truthfully reporting output and the agents' promises of non-collusive behavior. Glover gives numerical examples to illustrate cases in which mutual monitoring is optimal and cases when it is not.

Conference participants asked a number of questions, among them: What is collusion in this model? Glover clarified by explaining it is tacit collusion, meaning that the agents must be able to enforce the ex-ante contract in each sub-game perfectly and that agents' actions are collective but self-enforcing. A lengthy discussion about cycling followed, which was instigated by the question: Why would agents choose to switch between working and shirking? Since the agents alternate in periods, there will be one agent getting less from this collusion, assuming the wage for shirkers is lower for than for workers. The agent getting less from the collusion would be the one who shirks first. Glover explained that once the agents have decided on cycling, they are always better off alternating than deviating from the collusion since their actions are self-enforcing.

Accounting for Policy in Accounting, Economics and Law

Shayam Sunder

Both the economics and accounting professions have endeavored to discover "laws" of behavior, and in order to serve as a basis for social policy, these laws must be robust. However, social science has the peculiar feature that our findings about human behavior are sometimes used to alter those very same behaviors. Sunder argues that only findings which are robust to this sort of adaptation should be used as a basis for policy-making. At the conference, he led an engaging discussion showcasing several examples of this phenomenon.

The first point of emphasis was on the collective struggle of the economics profession to overcome the inherent circularity between choices and preferences in our pursuit of building a theory of choice. Sunder noted that even in this most basic pursuit, economists have struggled for a half century to develop a theory that can make predictions across different contexts. Sunder then connected this problem to the principle of optimization. He noted that this principle, while considered structural in the physical sciences, is less clearly fundamental in economics. In auction experiments, groups of students perform only marginally better than randomizing computers. Sunder's conclusion is that the structure of the market, not the behavior of the participants, accounts for the first order magnitude of outcomes in competitive settings. The resulting conclusion is that while economic theories may have predictive power at the aggregate level, individual behavior is not predictable. This relationship between the aggregate and the individual level may have important consequences in accounting.

While it has not yet been shown, Sunder argued that we should be concerned about the aggregate level properties of accounting systems. Traditionally, the accounting profession has emphasized the partial equilibrium effects of changes, but it may be the case that the general equilibrium effects are more important. Sunder summarized his 1973 paper on the adoption of LIFO standards in this context. He also considered a paper examining the effects of

common knowledge of rationality (Amershi and Sunder 1987), which found that managers may believe that shareholders may want them to attempt to maximize earnings, and follow suit.

Finally, Sunder discussed the regulation of the auditing profession. He noted that through the 1970s, most professional services organizations had non-compete clauses. In 1979, at the behest of the economics profession, this was outlawed. However, as we learned from Akerlof (1970), in markets with asymmetric information, competition may often worsen outcomes. The consequences of competition were sharp declines in audit prices and in the number of accounting students. Accounting firms therefore shifted their emphasis to consulting, lowering the quality of auditing work, as firms used auditing to get new students in the door, then moving them to consulting jobs. The conclusion is that auditing is very costly to measure for quality, and therefore the increased competition makes the market inefficient. This outcome was caused by both policy makers' lack of understanding of accounting, as well as the failure of accountants to consider policy implications.

Disclosure Policy and Industry Fluctuations

Jeremy Bertomeu and Pierre Jinghong Liang

In practice, firms often release quarterly reports such as earnings forecasts that contain a fair amount of information about future demand. These types of reports are voluntary from the point of view of firms. Bertomeu and Liang model this type of firm behavior by relating industry cycles to firms' decisions to share information about the demand in the product market. The model uses the framework of Rotemberg and Saloner (1986) in which N firms compete in a product market, for which the demand is subject to stochastic shocks, over an infinite time horizon. Bertomeu and Liang's model departs from Rotemberg and Saloner by assuming that the information about the upcoming cycle is private and known only to one firm. The timing for the model is as follows:

1. The state of the industry is realized and learned by one firm.
2. The informed firm decides whether to publicly disclose the information or stay silent.
3. The firms simultaneously choose prices.
4. The state is revealed publicly and industry profits are shared among the firms charging the lowest price.

The authors assume that disclosure is costless and always truthful. In a single period interaction and under perfect price competition, disclosure is not an issue since prices will be driven to marginal cost as firms undercut each other. The relationship between disclosure and cycles is introduced using repeated firm interactions in a setting where firms not only care about current market conditions but also about future market conditions. In this setting, firms discount future profits and can coordinate their prices and disclosure agreements in a way that is individual incentive-compatible, but also allows them to sustain higher prices. This type of agreement is referred to as a tacit agreement, which includes a punishment such as a price war if firms deviate from the agreed upon price or disclosure agreement.

Whether or not the tacit agreement involves firms publicly disclosing the information depends on the discount factor and the number of firms in the industry. Bertomeu and Liang show that monopoly prices and profits cannot be attained with a full-disclosure agreement, however, there does exist a minimum discount rate, increasing in N , for which monopoly pricing can be attained with non-disclosure. Intuitively, when there are high shocks, i.e., the market is large, full disclosure increases the firms' incentives to deviate from the agreement by undercutting. However, non-disclosure leaves the uninformed firms in the dark about market conditions, therefore decreasing their incentives to deviate. In this case, the informed firm must be patient enough to forgo increased profits by undercutting in the current period. As competition increases, the deviation profits for the informed firm increase, meaning the firm must become more patient. Therefore, the minimum discount rate is increasing in N . In cases where monopoly profits are not attainable by the industry, disclosure may play a role in terms of coordinating prices. Bertomeu and Liang show that efficient full-disclosure equilibrium specifies prices that vary with market size. In such an agreement there exists a maximum shock for which monopoly pricing is sustainable. When market size is larger, the individual firm's incentive to undercut is too large to be sustainable and therefore prices must be lower for larger realizations of the shock. The third type of equilibrium the authors establish is a partial disclosure equilibrium in which the tacit agreement establishes a range of shocks for which the firms publicly disclose the information and establish prices for each shock. At the extremes of the shock distribution, that is, for small and large markets, firms do not disclose and the price is set low to ensure that the informed firms do not undercut. For medium-sized markets, the efficient tacit agreement consists of full-disclosure and prices decreasing in market size. In this case, monopoly prices are attainable for the smallest markets in which disclosure is sustainable and decrease as market size increases toward the region of non-disclosure. Bertomeu and Liang conclude their study by showing that policies with non-disclosure are desirable in industries with a low discount rate or a large number of firms, and policies with partial- or full-disclosure are desirable in industries with high a discount rate or a small number of firms.

Conference participants had several questions about the environment in which the firms were competing. Most notable was: Is the monopoly price time invariant? Liang clarified by stating that the market shocks affect the underlying demand, multiplicatively, not changing the functional form of demand therefore, not changing the price that maximizes total profit. A question arose concerning the price set by the informed firm. In the non-disclosure setting, can the price set by the informed firm be informative about the shock? Liang explained that shocks and prices are independent and that shock realizations are not needed to find the monopoly price, therefore, prices cannot be informative about shocks. A conference participant asked how firms are punished if they deviate. Liang explained that, for each equilibrium, the punishment is a price war which drives prices to marginal cost; in essence, the dynamic game reverts to the static game in which the issue of disclosure is moot.

Intrafirm Trade, Pay-Performance Sensitivity and Organizational Structure

Tim Baldenius and Beatrice Michaeli

Division managers often transact within a firm. Such interaction is the focal point of the incentives literature which looks at the issues of eliciting operating effort from each manager and intrafirm trade between divisions. These two aspects have, for the most part, been separate studies with the justification that the operating effort is calibrated by pay-performance sensitivity (PPS) which has no effect on the relevant costs and revenues guiding intrafirm trade. Baldenius and Michaeli argue that an important link between these two incentive problems has been overlooked: risk. The link arises as follows: greater specific investment increases the expected intrafirm trading quantity which in return increases the associated compensation risk for managers. This investment/risk link implies that there is a trade off between managers' efforts and investment incentives. Earlier literature has shown that relationship-specific investment contracts create the typical hold-up problem; the investing manager bears all the fixed cost of investing but splits the surplus with other managers, thus leading to underinvestment. Baldenius and Michaeli show that with incomplete contracting and delegated investment choice, the investing manager cares only about his own risk and externalizes the remaining portion stemming from the investment/risk link, resulting in overinvestment. The opposing forces of the hold-up problem and the externalized risk premium ultimately determine the direction of the equilibrium investment distortion.

Baldenius and Michaeli build a static model of unilateral trade which entails a principal contracting with two division managers. Manager A, the upstream manager, produces an intermediate good which is transferred to the downstream manager B. Without loss of generality, manager A is the investing manager. The timing is as follows: (1) the principal contracts with the division managers; (2) the managers choose their effort levels and manager A can choose to make a relationship-specific investment; (3) the managers observe the trade-related uncertainty; and (4) managers negotiate over the quantity and price of the intermediate good to be traded. Managers in both divisions face operating risk associated with each division's stand-alone operations and trade-related uncertainty. These risks ultimately determine which effect dominates. The model shows that when investment is non-contractible and both divisions face sufficiently large operating uncertainty, there will be underinvestment. Intuitively, since operating risk is large, managers' PPS is low so the externalized risk premium effect is low, however the hold-up problem persists. Conversely, the investing manager overinvests if he faces high operating uncertainty resulting in low PPS. Intuitively, the investing manager, A, is insensitive to the incremental trade-related uncertainty relative to manager B, therefore the externalized risk premium dominates the hold-up problem. Baldenius and Michaeli touch on optimal PPS with high operating uncertainty and high trade-related uncertainty.

The model also makes predictions about organizational structure, i.e., whether each division should be its own investment

center (IC-IC), or whether one division should have all investment authority and the other just a profit center (PC-IC) when investment is bilateral. Under the IC-IC structure, investments are strategic complements which exacerbate the hold-up problem and lead to underinvestment. On the other hand, under the PC-IC structure, the low PPS manager can be made the investing manager. Since the low PPS manager tolerates more risk, he is willing to invest more. This is the risk tolerance effect of PC-IC. The low PPS manager bears both fixed costs. The model predicts that IC-IC is preferred if the divisions face similar operating risk. PC-IC is preferred if operating risks across the two divisions are sufficiently different.

A conference participant asked if it was customary to split the surplus evenly across the managers. Baldenius replied that earlier studies also assume division managers split the surplus. He stated that this was one of the limitations of the model and that it is a natural question for future work. Another participant asked if there is a way to insure managers by hedging the trading risk they face. Baldenius responded that the only way this could be possible was if there were some ex-post signal of the realization of the trading risk which would make the problem contractible. The last question raised was whether or not this model can predict anything regarding contracts over time, in essence adding dynamics to the underlying structure. Baldenius responded that the model cannot capture the spirit of dynamics. However, there is another branch of research that focuses on how to delegate investments over time to managers. This approach requires finding the minimum sufficient information needed to structure a performance measure that aligns managers' incentives over time.

Optimal Reputation Systems

Andrei Kovrijnykh and Natalia Kovrijnykh

A. Kovrijnykh and N. Kovrijnykh design a reputation system that maximizes an agent's expected utility under asymmetric information. Reputation system design has been a quite practical topic in the area of computer science. For example, every transaction on Ebay has a binary rating about both the buyer and the seller. Amazon has implemented a five-star rating and review system for every seller, with a further rating of the reviews. The counterparts of this practice in economics can be divided into two branches: Bayesian belief update and trust among agents under repeated games. The authors' paper brings together different strands of literature on reputation and develops a framework that allows for a unified treatment of reputation in a variety of settings with imperfect monitoring.

The model is populated with many competitive firms and one worker. If the worker is employed by a firm, his/her observable production consists of his/her own unobservable effort and a random shock. The firm pays the worker a wage that equals the expected production, which is referred to in the model as "reputation." The labor market observes the realized output in each current period and updates its belief about the agent's expected production in the next period. The authors ask how to find a reputation system that maximizes the worker's initial utility. A. Kovrijnykh gave a simple example where the shock is

uniformly distributed with mean zero. Under this assumption, there is a “grim trigger” reputation system in which firms will never trust workers to exert any effort from that point forward if worker production is under a certain threshold. Firms believe the worker is still exerting a “certain level” of effort (a^*) otherwise. Thus, the reputation system is binary – zero or a^* . In this reputation system, the worker’s best response is to play along with a^* level of effort forever. A. Kovrijnykh showed that there exists a binary reputation system for any distribution of shocks, reducing the problem to a choice between the “grim trigger” threshold and the effort level a^* . He also showed that this binary reputation system is always optimal.

A. Kovrijnykh then made two extensions to the baseline model. The first extension concerns uncertain ability. It assumes that worker’s ability follows an AR(1) process instead of a fixed constant. The solution to this problem is the same as the one in the baseline model if the AR(1) process is stationary. The second extension is anonymous reputation. It assumes that the agent

can freely create new identities and dispose of existing ones. This problem is essentially the same as increasing the “grim trigger” threshold because the worker’s initial reputation is his worst. The solution to this extension depends on the reputation level of the new identification. If it is high enough, there will not be an optimal binary reputation system because the threat of the “grim trigger” is simply not credible.

One conference participant asked why the authors call the problem “reputation system” design when the problem seems to be a belief mechanism design. A. Kovrijnykh agreed that the term belief would be more appropriate in the context of economics, but reputation would be more intuitive in practice. Another participant argued that in the e-commerce area, reputation lobbying exists when the seller would compensate unsatisfied buyers for better reviews, and questioned how this will affect the model. A. Kovrijnykh responded that the model had not yet considered lobbying and noted that it may serve as another extension.

Dynamic Policy Design with Human Capital

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Constrained Optimal Education Systems

Marti Mestieri

Developing and poorer economies are known to have lower-quality education systems in addition to an inefficient allocation of talent that results in lower-quality higher education institutions. In his paper, Mestieri attempts to explain how these phenomena may arise as optimal responses to realistic frictions and constraints an economy may face. In particular, he studies how wealth inequality in the presence of private information and borrowing constraints might cause an education system to fail to achieve the first best within the economy. He shows that borrowing constraints may cause low-wealth agents with high ability, both of which are unobserved, to be unable to attain higher education, thus decreasing overall welfare in the economy. He further discusses how a social planner may use entrance exams and school fees as mechanisms to achieve a higher level of welfare than when these mechanisms are not available.

Rather than approach the problem using a dynamic model, Mestieri chooses to consider constrained education systems in one time period only. In his base model, agents are given the opportunity to obtain human capital from both a primary school and an institution of higher education. Each agent is endowed with some level of innate human capital and is able to produce more human capital as a function of his own ability and the school he attends. Because human capital is linked one-to-one with consumption in production, all agents would prefer to attain higher education. The key to these welfare considerations is the human capital production function: agents produce human capital based upon their own ability and school choice, but also as a function of the least-able agent at their school. By including this complementarity in the production function between agents, it becomes optimal for the social planner to implement some segregation among tiers of education in the economy. It is assumed (under some specifications of the model) that neither an agent's wealth nor his innate ability is observable.

Mestieri compares the feasible outcomes when ability and wealth are perfectly observable, and when borrowing constraints are present, in addition to wealth and ability being unobservable. For the situation in which ability and wealth are observable, the social planner maximizes output (and welfare, by linearity of consumption) by assigning agents with ability above some threshold to higher education and less-able agents to primary education, regardless of wealth. When ability and wealth are unobservable, but agents have access to perfect credit markets, the first-best is again possible for the planner. This is done by appropriately setting the "fee" to enter higher education such that the returns to education justify only agents of high-enough ability obtaining more human capital. However, when one imposes borrowing constraints in the form of autarky, the first-best is no longer available to the planner. In this

situation, the planner must change the education system to be incentive compatible: wealthy-enough agents must not deviate and pretend to be poor, high-ability agents in order to receive reduced entrance fees at higher education schools. Additionally, the planner wants to implement a system so that some impoverished agents with high ability will still be able to attain higher-education, which will increase overall output in the economy. In order to do this, the planner offers a guaranteed spot in higher-education to agents for those who pay a fee that only the wealthy in the economy can afford. Below some threshold, the planner picks a mechanism such that agents can have the opportunity to attend the better school with some probability. This "gamble" allows some higher-ability agents to attend the better school, improving the problem of misallocation in the economy. This suggests that many of the perceived failings of education systems in poorer economies may be caused by optimal responses to borrowing constraints and private information. In addition to using fees, Mestieri discusses the use of exams that agents can use to signal their ability. Agents can pay a cost contingent upon their ability level and obtain a score (or a pass, depending on exam type) with certainty. This allows high-ability agents with little wealth to signal that they should attend the better tier schools and allows attendance to be less expensive than when the only tool the planner has is school fees. The planner still cannot achieve first best, but if the cost of implementation isn't too high, this scheme will improve welfare.

Conference participants were skeptical of the complementary present in the human capital production function. One asked what such complementarities were doing in the model, to which Mestieri responded that if this weren't the case, all agents would optimally attend the better school if they could afford it. Another participant did not believe that the model accurately captured the differences between education systems across countries, noting that the higher education system in the United States is vastly different than the equivalent system in Latin America. Mestieri explained that in this model, these differences are proxied by borrowing constraints. Other participants suggested that the "wealth friction" caused by the inequality in the economy could be avoided if the planner simply set the required fee to zero, and that this would be optimal in the case of observable ability. Mestieri referred them to the complementarity problem, showing that all the low-ability agents would attend the better school.

Taxing Top Earners: A Human Capital Perspective

Alejandro Badel and Mark Huggett

Badel and Huggett respond to a paper on optimal taxation by Diamond and Saez (2011), who suggest that the revenue maximizing tax rate on the richest percentile of the economy is 73 percent. Badel and Huggett note that the static formula of optimal taxation used by Diamond and Saez is not valid in environments where agents make labor market decisions over more than just their number of hours worked. In particular, the authors consider an economy in which agents change their human capital levels in response to the changing tax environment, thus impacting the environment dynamically, causing the previous formula to be invalid when considering more than just the present generation. By deriving a Laffer Curve that considers changing skill levels, they find a revenue maximizing tax rate of 65 percent, and note that this is associated with both a drop in human capital among all but the smartest agents and a drop in aggregate output.

The authors construct a life-cycle model in which agents work and make human capital choices during the first part of their lives. The agents work, and then receive transfers from the government after they retire. During each time period of their lives, agents consume and divide their free time between leisure, labor supplied, and time spent in school (acquiring human capital). Agents in the economy are endowed with initial conditions that describe both their starting level of human capital as well as their ability to learn in the future. Depending upon specification, the distribution of learning ability and innate ability may be correlated. Agents pay income taxes, which are composed of a tax on wages as well as a tax on capital gains taxes and then receive lump-sum payments upon retirement. Agents also pay a social security tax in order to best match the tax environment. Changing their taxes as well as the tax structure will generate a behavioral response by agents over their choices of human capital.

Badel and Huggett calibrate the model in three stages. First, they select values for the set of parameters governing demographics, technology and the tax system in order to be consistent with the previous literature. They match demographics generated by the model to observations in the data such that agents enter the model at age 23, retire at age 63, and die at age 85. They authors select a population growth rate of 12 percent. They also include setting capital share, baseline TFP and depreciation so that they match data on the capital share and the real interest rate. They calibrate the tax function so that the top tax rate equals 42.5 percent, which is consistent with the tax rate faced by individuals in the United States. Additionally, they set the capital income tax rate to be consistent with a roughly 15 percent tax at the federal level and a 5.9 percent tax at the state level. Second, the authors assume that after working for a number of years, agents choose to no longer attend school, which pins down the distribution of human capital and also the parameters of the human capital production function, as shocks will be

unrelated to their learning. Finally, the remaining preference parameters are calibrated by attempting to reproduce facts about earnings and hours in the data, as well as a Frisch Elasticity consistent with survey literature. The authors consider two alternative tax programs in order to estimate Laffer Curves and welfare gains or losses: one in which only the income tax is changed, and another in which the capital gains tax is also changed. Setting the Frisch Elasticity to 0.7, they experiment with changing the tax rate on earnings and find that tax revenues are maximized by a top marginal tax rate of 65 percent. Such a tax rate is welfare increasing for the seven lowest ability levels, with roughly a two percent loss in welfare for the second-highest ability group and an eight percent loss for the most able group in the economy. At the same elasticity estimate, they consider a change in both the earnings and capital income tax rates. They find a top marginal tax rate of 58 percent is welfare maximizing and is associated with welfare losses of roughly the same magnitude for the two most able groups as in the other tax change scheme. They do note, however, that an alternate calibration with a Frisch Elasticity of 0.2 results in a top marginal tax rate very similar to the results of the Diamond and Saez paper. The authors then decompose changes in labor input due to these tax hikes. They find that the second-highest ability agents would decrease both their human capital and number of hours worked. The highest-ability agents, however, increase both their hours worked and their human capital levels. The authors attribute this dichotomy to the fact that the highest-ability agents are born with very high initial levels of human capital and thus cannot leave the top marginal tax group by obtaining lower levels of human capital. They see similar results when considering the alternate tax scheme.

The last result had audience members a bit confused, some of whom did not believe that the highest-ability agents would adjust their learning levels up instead of down. Huggett noted that these agents obtain high levels of human capital very early and are already substantially beyond the earnings limit for the top tax bracket and thus are unlikely to have their behavior affected. One conference participant was concerned that the difference in suggested tax rate between this paper and the Diamond and Saez paper was pretty small, which may have undermined aspects of the paper. Another conference participant was worried that the dataset may contain too few of the highest earners to accurately draw inference. Huggett responded by saying that the Social Security data the authors used was the best for such a project. Overall, the audience seemed to agree that the validity of Diamond and Saez's results should be called into question precisely because such a tax scheme could cause dynamic changes in the economy.

Equalizing Outcomes and Equalizing Opportunities: Optimal Taxation when Children's Abilities Depend on Parents' Resources

Alex Gelber and Matthew Wienzierl

Gelber and Wienzierl generalize the dynamic Mirrleesian optimal taxation model by endogenizing the ability distribution of agents. They analyze how the cross-generational transmission of earnings ability evolves through time due to the parent-child correlation in economic outcomes, and characterize an optimal dynamic tax policy that takes this correlation into account. Using a utilitarian objective function, the authors show that implementing their tax policy in the United States can bring large expected welfare gains.

In the authors' model each household has one parent, or generation, who maximizes utility by choosing a consumption-leisure bundle. These choices influence the level of ability of their children (which depends on their parents' ability), after-tax consumption, and a stochastic term. Parents don't save or make any educational decisions for their children; instead, children take their ability levels as given and become parents to a new generation. Taking the actions of these households as given, a social planner finds the optimal tax by maximizing their aggregate welfare using a Utilitarian objective function. The solution to this problem shows that three forces shape marginal taxes: the revenue effect, the relative return effect, and the ancestor incentive effect. The first effect shows that reducing taxes on low-ability agents will encourage low-ability parents to produce high-ability children from whom society can exact higher taxes in the future. The second effect also reduces marginal taxes; the incentive problems for low-ability agents are reduced because children's outcomes are part of the marginal utility of disposable income. The third effect opposes lowering marginal taxes on low-ability agents because doing so increases the incentives for the high-ability agents to work less, reducing aggregate productivity and increasing the probability of low-ability agents in the future.

The authors evaluate the effect of these three forces on the optimal tax schedule by estimating the evolution of ability over time. They build a transition matrix of parent-child ability using the National Longitudinal Survey of Youth (NLSY) and use it to simulate a 10-generation version of their model with households of four different ability types. They find that the optimal tax policy is substantially more redistributive than the status quo policy in the U.S.: average taxes levied on the top quartile of the ability distribution are 37 percent, and at the bottom quartile are -192 percent, differing from the status quo of 16 percent and -42 percent respectively; marginal taxes are zero for the top quartile and 32 percent at the bottom quartile, compared to 32 percent and 21 percent respectively. In addition, the authors find that early generations borrow from later generations to generate growth in the population's ability distribution. This creates an upward shift in the ability distribution, increasing

productivity and welfare over time. Compared to the current US tax schedule, implementing the tax schedule described above raises expected discounted aggregate welfare by 22 percent, of which 1.75 percent can be attributed to the changes in the ability distribution over time and the remainder to the redistributive efforts of the social planner.

A conference participant asked Gelber what he thinks about intergenerational transfers in this setting. Gelber responded that this paper is totally focused on intra-generational tax policy: the policy does not depend on multiple generations, their assets, or other characteristics. Another participant asked if the model could be interpreted as an individual's investment in his own ability stock, or human capital, through time. Gelber agreed that this could be one of many interpretations. However, he noted that the calibration in this paper measures the correlation between parents and children's ability using intergenerational data, making the parent-child interpretation most fitting. At the end of the presentation, a participant asked why the authors used the correlation of parents' wages and children's test scores as a measure of the correlation of child-parent ability instead of using the correlation of parents' and children's test scores. Gelber answered that he and his co-author wanted the empirical estimation to closely resemble the structure of their analytical model, and thought that economic outcomes would best serve that purpose.

Childcare Subsidies and Household Labor Supply

Nezih Guner, Remzi Kaygusuz and Gustavo Ventura

Several European countries, in particular the high-income Scandinavian countries, devote a substantial amount of resources toward providing subsidized childcare for their citizens. For example, Sweden devotes just under 0.9 percent of aggregate output towards childcare assistance (or about 6,000 US dollars per child in 2008). In contrast, the United States devotes less than 0.1 percent of aggregate output toward these subsidies, which amounted to less than 900 US dollars in 2008. Some of the literature, Rogerson (2007) being one example, attributes the high levels of female labor supply in Scandinavia to the substantial levels of childcare subsidies. The aggregate implications of an expansion to the U.S. childcare subsidy program are largely unexplored. Guner, Kaygusuz, and Ventura seek to fill this gap in the literature.

To explore the implications of expanding childcare subsidies, the authors develop a life-cycle model with heterogeneous married and single households. In the model, both males and females are endowed with an education level, idiosyncratic productivity, initial asset holdings, and a marriage status. Their marriage status is constant over their lifetimes and both the education and idiosyncratic productivity of their partners are exogenous. Females face the possibility of being exogenously assigned children. Children are purely a burden in this model. Females must provide childcare for their children, either by purchasing it

in the market or by providing it themselves, in which case the mothers cannot work, and after three periods children are gone. The government provides subsidies for childcare to single mothers and married households that are below a certain income threshold.

While males in the model always work and have an exogenous productivity profile, females can enter and exit the labor force and have an endogenous human capital level that evolves over their lifetime. The female human capital production function is increasing in both education and current human capital and non-decreasing in labor supply. Because of this technology, women face skill depreciation due to childbearing disruptions, and expanding childcare subsidies can help alleviate some of this skill depreciation.

To calculate childcare costs for U.S. households, the authors use data from the Survey of Income and Program Participation. These data suggest that employed mothers with children between the ages of zero and five pay about 10 percent of their average household income toward childcare payments. With children between the ages of five and 14, this childcare cost falls to about 7.7 percent of average household income. The calibrated model endogenously generates an elasticity of labor force participation with respect to changes in childcare costs of -0.15, which matches estimates from the data of between -0.1 and -0.2. The calibrated model also endogenously generates a gender wage gap (the ratio of female wage to male wage) that grows with age, moving from about 0.86 between the ages of 25-30 to 0.75 between the ages of 50-55. This result in the model matches most of the increase in the gender wage gap over a female's life-cycle as seen in the data which is surprising because the only mechanism that generates this result in their model is the decline in female skills due to childbearing disruptions.

To attempt to understand the macroeconomic effects of childcare subsidies, Guner, Kaygusuz, and Ventura conduct policy experiments by adjusting both the income threshold at which households qualify for subsidies and the amount of the subsidy they give to these households. The benchmark economy, which is parameterized to match current policy, has a subsidy level of 75 percent (i.e., the government pays 75 percent of childcare costs for these households) with an income threshold of 21 percent of mean income. In each of their various economies, the authors impose linear income taxes that make the childcare subsidy program revenue-neutral. By eliminating the income threshold, the authors find that married females increase their hours worked by 4.7 percent with a 50 percent subsidy, and 7.6 percent with a 100 percent subsidy. In each regime that expands childcare subsidies, the authors see declines in total male work hours with large increases in married female work hours and an overall slight increase in total work hours. The effects on output are typically small or negative. These outcomes can be explained by the increase in labor taxes, married households reallocating labor from males to females, and females with children working prior to the expansion reducing their hours. For married households that worked prior to the expansion,

childcare subsidies act as a positive income effect which leads to a reduction in their labor supply.

Expanding childcare subsidies draws the largest labor force participation response from low-educated married females. Married females with less than a high school degree increase labor force participation by between 12 percent and 32.3 percent, whereas married females with a college degree increase labor force participation by between 1.3 percent and 5.9 percent. Welfare effects of these policies are similarly asymmetric, with some groups seeing substantial welfare gains but the majority of households seeing welfare losses.

Several conference participants pointed out difficulties in using data to identify married individuals. There has been a recent increase in the number of couples who live together with children but are not married – the Scandinavian model as Finn Kydland calls it. Ventura stated that he and his co-authors have seen fairly steady marriage and divorce rates in the U.S. data. There were also some concerns that fertility is exogenous in this model. Childcare subsidies would likely impact fertility choices, thus endogenizing this choice could have some additional impacts on aggregate outcomes. Two other model features that were discussed were the assumption of constant skill depreciation for all skill groups and the choice of five-year periods. Most data suggests that different occupations have quite different rates of skill depreciation and this could extend to differences in human capital depreciation across skill groups. Additionally, the assumption that females must drop out of the labor force for five years to provide childcare services could lead to excessively large skill depreciation.

The Option Value of Human Capital Donghoon Lee, Tim Lee and Yongs Shin

Over the last 40 years in the United States, the college enrollment and dropout rates increased, with the fraction of the population with a four-year degree being flat. Moreover, the college premium and wage among college graduates increased. Within-group wage dispersions have increased significantly since 1980, especially among college graduates. Lee, Lee and Shin consider these facts to analyze the impact of college education on labor market outcomes and the impact of expected labor market outcomes on college enrollment/graduation. The authors build a model in which individuals differ in their returns to investment in a college education and make sequential decisions to first enroll in, and then graduate from, college.

After presenting facts based on the Current Population Survey, Shin explained the model in detail. Each individual in the model may choose to attend college to earn individual-specific college return or to work as a high-school graduate to earn an unconditional wage. An important assumption is that individuals do not learn their college return before enrolling, thus they will have two options after they have entered college and gained information about their college return. First, they may choose to drop out and have their

college return revealed, but they cannot go back to school. Second, they may choose to stay until graduation and have their return revealed, take a job requiring a college education, or become underemployed (take a job that does not require a college degree). This underemployment option essentially makes one's wage distribution as a college graduate stochastically dominate his wage distribution as a mere high-school graduate. These two options yield important implications due their interaction from an increase in the variance of ex-ante college returns distribution. A mean-preserving spread in ex-ante college return results in an observed increase in the realized returns to college ex-post. Those who learn that their individual returns to college are lower than expected either drop out of college (and also out of the calculation for the average wage of college graduates), or become underemployed (which prevents them from falling into the left tail of the college returns distribution, thereby increasing the average wage among graduates).

Shin presented the results of the authors' quantitative analysis. The model was calibrated to the U.S. in 1980 as a benchmark, and to 2005 as a comparison. Results show that the increase in the observed college premium since 1980 can be explained by the rising wage dispersion among college graduates interacting with the option-like features of college education, as much as it can be explained by an increase in average returns. This result can explain why the fraction of men with college degrees did not increase in spite of the much higher college wage premium. As mentioned above, a rise in the dispersion of individual returns increases the observed college premium in the presence of dropouts and underemployment. However, it also represents a risk to the student who is not fully informed of his own returns precisely because it becomes more likely that he subsequently drops out or becomes underemployed. This dampens the increase in enrollment caused by an increase in average returns, as well as the increase in college completion.

In conclusion, Shin discussed several policy implications resulting from the analysis. Since the calibration shows that option-like features can explain a lot of the college premium, it is important to consider the optimal amount of enrollment in college and intervention of dropouts in early stages.

One conference participant noted that it would be interesting to experiment with different counterfactuals that shut down different options in the model, as the value provided by them would be revealed. Shin agreed it would be an interesting analysis. Another participant commented that there is a possible correlation between information and major for college students in a sense that high-ability agents would tend to choose majors with higher and less risky return (such as science and engineering). Shin responded that the literature is moving toward this direction but, to his knowledge, there was not enough strong evidence to support such a correlation. He agreed to check the data for potential.

Education Policy and Intergenerational Transfers in Equilibrium

Brant Abbott, Giovanni Gallipoli, Costas Meghir, and Gianluca Violante

Human capital investment is a key source of aggregate productivity growth and a powerful vehicle for social mobility. Motivated by these considerations, governments promote the acquisition of education through a variety of interventions with vast resources. Abbott, Gallipoli, Meghir, and Violante attempt to accurately quantify the long-run effects of policies intended to advance college enrollment by providing an empirical and quantitative analysis in a long-run general equilibrium framework.

Abbott presented the four factors affecting the impacts of education policy: the long-run changes in private sources of funding; general equilibrium feedback effects; individual heterogeneity and uncertainty in returns to college investment; and imperfections in financial markets. Empirical literature provides insights into the latter two factors but has trouble shedding light on the first two. The authors address these factors by building a life-cycle, heterogeneous agent model with incomplete markets and with inter-generational links.

At the beginning of each period, young individuals receive transfers from their parents and make education decisions (whether to continue with high school or college) based on their productive abilities (inherited from parents), psychic costs of schooling, and wealth. Imperfectly altruistic parents make inter vivos transfers (IVTs) that determine their children's initial wealth. Working while in college, government grants and loans, and private educational loans complement parental transfers, providing sources of funding for a college education. After completing their education, agents permanently enter the labor market. During their working lives, individuals make labor supply and consumption/saving decisions, and repay student loans. They also face uninsurable random fluctuations in their labor productivity throughout their work stages. Workers with different levels of education are imperfect substitutes in the aggregate production function. Wages and the real interest rate clear input markets. The parameters of the model are obtained by estimating key components such as the education specific stochastic wage processes and the aggregate production function by combining data from the PSID, the NLSY, the CPS and the macro economy.

The authors conduct several policy experiments in which changes were made in the size and nature of the federal grant program (need-based/merit-based) and government-sponsored loan limits. These experiments yield five main results. First, existing federal grant programs improve welfare and, by promoting skill acquisition through college education, add about 1.5 percent to aggregate output. Second, the expansion of tuition subsidies induces nontrivial crowding out in both parental IVTs and in the labor supply

of college students. It is estimated that a \$1,000 reduction in tuition fees lowers annual hours worked by college students by four percent. Further, every additional dollar of government grants crowds out 20-30 cents of parental IVTs on average. One important note is that richer parents' transfers are crowded out considerably more than poorer parents' transfers. This introduces a regressive element in grants. Third, expansions of the grant program may have sizeable effects on enrollment in the short run, but long-run general equilibrium effects are 3-4 times smaller. Fourth, government-sponsored loans are a valuable source of college financing for high-ability children whose parents cannot afford to fund the entire cost of college. Fifth, it is more effective to condition aid on family means than on student ability. This result follows from the fact that, given the existing institutional and credit environment, most high-ability individuals would choose to attend college regardless of the additional transfers, meaning that ability-testing targets many individuals who are infra-marginal to the education choice.

One conference participant asked about the transition path between steady states since it was not well explained in the presentation and it was quite important in terms of policy implementation. Abbott responded that the current paper did not calculate the transition path since computation would take too long in the policy experiments. Another participant suggested that it would be good to add parents' ages into the model or policy experiment since parents who have children at a younger age tend to have relatively less endowment compared to older parents. Abbott agreed and responded that parent's ages would be addressed in future work.

Optimal Dynamic Taxation and Human Capital Policies over the Life Cycle

Stefanie Stantcheva

There is a two-way interaction between human capital acquisition and the tax system. On one hand, workers' human capital acquisition policies affect the pre-tax income distribution, which is a major input for tax policies. On the other hand, tax policies affect both return and risk of human capital acquisitions. Stantcheva's paper takes into account the two-way feedback and provides a joint analysis of optimal income taxes and optimal human capital acquisition policies over the life cycle. The paper complements the optimal taxation literature by incorporating endogenous productivity as the product of investment decisions throughout the life cycle

Stantcheva specifies a dynamic life-cycle model of labor supply and human capital acquisition. In the model, agents are endowed with heterogeneous innate abilities that are subject to persistent and privately uninsurable shocks. Throughout their lives, they can invest in human capital with risky returns, through either money expense or time spent training at a disutility cost. Each agent's wage is a function of endogenous human capital and stochastic ability.

Meanwhile, the government maximizes a standard social welfare function under asymmetric information about an agent's initial ability level and his labor efforts. Therefore, the government needs to design a dynamic mechanism with incentive compatibility constraints. Wedges, i.e., implicit taxes, are analyzed to describe the distortion in the resulting constrained efficient allocations.

Stantcheva discusses two cases for the dynamic mechanism design problem from the perspective of whether human capital acquisition is observable to the government. During the presentation, she focused on the observable human capital case, proposing two ways of implementing the constrained efficient allocations. If human capital acquisition is observable to the government, i.e., human capital can be acquired through training (both time and money expense), there is an additional direct interaction of training with labor supply, which affects government's optimal policies. This is because training may increase the marginal disutility cost from working in the case of "Learning-or-Doing," or may decrease it in the case of "Learning-and-Doing." In this case, two implementation strategies are proposed: Income Contingent Loans (ICLs) and a "Deferred Deductibility" Scheme. For ICLs, the loan repayment schedules are contingent on the past history of earnings and human capital investments. For the Deferred Deductibility scheme, only part of current human capital investment can be deducted from current taxable income, leaving the remainder to be deducted from future taxable income to account for the risk and the nonlinearity of the tax schedule.

The model calibration is based on U.S. data to illustrate the optimal tax policies under different assumptions regarding the complementarity between human capital and ability. Numerical analysis shows that the full dynamic risk-adjusted deductibility is most closed to optimality, and simple linear age-dependent human capital subsidies, as well as income taxes, achieve the most welfare gain from the full second-best optimum.

Conference participant discussion was centered around the theoretical model setup. One participant asked whether the wage function is selected by the government, i.e., the planner in the model. Stantcheva made it clear that the wage function is common knowledge, and that it is like a technological production function that turns human capital into the labor market earnings. Another question addressed the difference between workers' abilities and the skill prices. A participant suggested distinguishing between the two terms. Although the two terms are similar from the perspective of complementarity of ability and human capital acquisition, they are different in the sense that the stochastic ability shock in the model also includes the labor market shock (such as an unemployment shock during a worker's lifetime). Stantcheva was receptive to the suggestion and would incorporate a multi-dimensional ability shock to close the model better.

Optimal Taxation in a Life Cycle Economy with Endogenous Human Capital Formation

Marek Kapicka and Julian Neira

Kapicka and Neira perform a normative analysis of taxation using a framework with endogenous human capital accumulation that has been used successfully in positive analysis by Huggett, Ventura and Yaron (2011). Following the Mirrleesian tradition, the social planner's choices are constrained by an adverse selection friction due to unobservable labor effort and agents' ability levels. As a novel feature of the authors' model, the social planner is also constrained by a moral hazard friction arising from unobservable learning effort and observable human capital. The authors characterize the optimal tax system, implemented through a risk-free savings tax and a history dependent labor tax, and calibrate their model as a counterfactual to the U.S. tax system. They show that the welfare gains of implementing their tax system in the U.S. are equivalent to an 8.4 percent increase in aggregate consumption.

In their paper, the authors model human capital as a stochastic process that depends on agents' learning effort. Agents are ex-ante heterogeneous in their ability, constant through time, and ex-post in their human capital stock. In turn, agents use their accumulated human capital to enhance their wage, which is represented as human capital multiplied by an agent's ability.

In this dynamic model, Kapicka and Neira find that the optimal tax system provides consumption insurance for low-ability agents and work incentives for high-ability agents. The social planner provides low-ability agents with a more equitable consumption distribution and reduced learning and labor effort. On the other hand, high-ability agents face a high variance of log-consumption due to the risky nature of their human capital. The social planner encourages these agents to self-insure by exerting learning effort, and imposes marginal labor taxes, increasing in age, and a positive marginal savings tax that increases with ability. The intuition behind this mechanism can be illustrated by three facts. First, variance of log-consumption is increasing in ability. This, in turn, provides incentives for high-ability agents to self-insure in the previous period. Second, by imposing a savings tax that increases with ability, the social planner encourages self-insurance in human capital accumulation rather than savings. Finally, the intratemporal and intertemporal incentives get aligned by imposing a labor wedge that is increasing with age.

In addition, the authors find that labor distortions at the top of the income distribution depend on the complementarity of labor and learning effort. If they are complements, or the cross-partial derivative of labor and learning effort utility is positive, labor marginal taxes are positive. On the other hand, if they are substitutes, labor marginal taxes are negative. Finally, if the cross-derivative is zero, then labor marginal taxes at the top of the distribution are zero.

During the conference, a participant asked why a large variance in log-consumption is needed to elicit a small change in learning effort. Neira explained that log-consumption variance is not the only determinant of effort, there are also consumption levels working in the opposite direction. Thus, if there were not a high log-consumption variance, the effort induced would be even lower. This is consistent with the authors' evidence that adverse selection seems to be more important than moral hazard: alleviating only the adverse selection yields much higher welfare gains than alleviating the moral hazard by itself.

Another participant asked: How important is a savings tax in eliciting changes in learning effort and how does eliminating a savings tax change the results and welfare gain estimates? Neira responded that the savings tax is crucial to incentivize self-insurance through human capital accumulation rather than savings. He also suggested that it would be interesting to study the welfare gains of a partial tax reform with only labor taxes and no savings tax.

Optimal Income Taxation with Asset Accumulation

Arpad Abraham, Sebastian Koehne and Nicola Pavoni

Several authors have noted that with modern international asset markets more accessible than ever, high capital taxes may induce investors to hide their wealth in foreign tax havens. In addition, there are many non-observable low return assets such as cash or gold that investors may choose to invest in to avoid capital taxes. Abraham, Koehne and Pavoni build a model that has the feature of imperfectly observable assets and investigates implications for optimal taxation.

The basics of the model are standard in the optimal taxation literature. Agents live for two periods, and their second-period income depends on an unobservable effort level. Second-period income is stochastic, however, creating a moral hazard problem. In the standard case with observable assets, the optimal consumption profile faces a tradeoff between consumption insurance and the moral hazard friction that results in frontloaded consumption to illicit high effort levels. The authors then introduce their unobservability of assets as an additional incentive constraint in the planner's problem. The planner must now respect the agents' Euler equation, which leads to less frontloading of income, and must change the cross-sectional nature of consumption to create incentives for high effort. Whether this is accomplished by rewarding high earners and convexifying the consumption profile or punishing low earners and concavifying consumption depends on the absolute risk aversion function. A more concave profile is interpreted as a more progressive tax structure, so this is an important policy question and is tackled with a calibration exercise.

The key barrier to calibration is that the process linking effort and income is not directly observable. The authors

use two strategies to get around this. The first is to interpret effort in the model as labor effort, and assume the data is generated by a world with unobservable assets. Under this interpretation, the parameters are structurally identified with only one cross-section of consumption and income. Another option is to interpret effort as a human capital investment, and use some exogenous variation on the return of effort. Using this strategy, they assume the 1981-82 Reagan tax reforms were an unexpected event, and use the 1979 National Longitudinal Survey of Youth (NLSY79) to distinguish between cohorts who had already made their human capital investment when the reform hit, and those who were able to respond to the decreased progressivity of the new system. The authors find that optimal capital taxes are implausibly high if assets are observable, and conclude that the current system must correspond to a world with unobservable assets. In addition, they find large (up to six percent) welfare effects of switching to the optimal capital taxation structure, which is a considerably less progressive system than is currently in place.

Conference discussion centered on the identifying assumption that cohorts who graduated from high school before the Reagan tax reforms only differed from their younger counterparts by the different perceived taxes. One participant suggested that including even younger cohorts might help to strengthen this part of the paper. Abraham responded that there were two important difficulties in doing this. The first is that the measure of income the authors use is an estimate of lifetime income, which requires a long time-series of incomes, and may not be possible for very young cohorts. The second is that the NLSY79 does not capture these younger cohorts, and they are therefore not as comparable. So, while it would certainly be desirable to include this comparison, for the current project it is not feasible.

Providing Efficient Incentives to Work: Retirement Ages and the Pension System

Ali Shourideh and Maxin Troshkin

Many of the papers at this conference consider how to design optimal taxation with agents choosing only their intensive margin of labor supply. Retirement age is another labor supply decision that could also be considered. Shourideh and Troshkin extend the dynamic optimal taxation model to consider the extensive margin of retirement age. The authors postulate that the social planner can use labor taxation in addition to the pension system to illicit optimal retirement behavior from participants. Giving the planner more policy flexibility by adding another policy instrument could help to relax the incentive compatibility constraints and allow for fewer distortions on the intensive margin. The major tradeoff that the social planner must consider is whether to make more productive individuals work more years but fewer hours, or whether to incentivize an earlier retirement age with more hours worked per year. A key finding of this paper

is that the current retirement age distribution is far from the efficient retirement age distribution but that this allocation can be improved with a fairly simple policy change.

Shourideh and Troshkin study their policy design question using a life-cycle environment with active intensive and extensive labor supply decisions, similar to Rogerson and Wallenius (2009). Agents are born with a type, and based on his/her type, each agent has a different fixed cost of working and a deterministic lifetime productivity profile. In the authors' empirical exercise, this type will represent various lifetime earnings groups. For each type, the fixed cost of working is zero up until a certain date and then constant afterwards, making it so that the extensive margin only plays a role for retirement and not entry into the labor force.

The government designs an information-constrained pareto-efficient tax system to maximize social welfare by setting labor taxes and pension benefits. The tax system is information-constrained because it cannot depend on the agent's type. The optimal tax and pension system are then backed out from the solution to this mechanism design problem. The first analytical result in the paper is that the private-information economy can be related to an economy with full information where the productivity profiles and fixed costs are modified to account for informational rents. The next analytical result comes from the much-easier-to-work-with full information model. Shourideh and Troshkin show that as long as fixed costs of working are decreasing in productivity, then it is optimal to have retirement age increasing in productivity because this increases overall productive efficiency. This result is fairly straightforward under a full information economy because the planner does not have to worry about any agent's shirking and can force more productive agents to work longer. Some of the other analytical results from this paper show that the retirement wedge is smaller than the labor wedge. As is standard in the public finance literature, it is desirable to distort what is less elastic. Since the authors find that the extensive margin is more elastic, it is optimal to distort it less.

Shourideh and Troshkin then take their model to the data. The key object to calibrate is the fixed cost of working, since it determines optimal retirement age for each productivity type. Depending on the calibrated values, the model allows for more highly productive workers to retire earlier or later than less productive workers depending on the various fixed costs of working. Under the current regime, less productive workers retire older than more productive workers (age 70 for the lowest decile and age 63 for the highest decile). The suggested optimal policy has the opposite trend, with retirement age increasing in productivity (age 62 for the lowest decile and 69.5 for the highest decile). Shourideh and Troshkin find that they can implement this retirement age using an actuarial unfair pension system that generates welfare gains of one percent to five percent and output gains up to 1 percent. This increase in output is uncommon in most optimal taxation papers where switching from the status-quo to the optimal system leads to output drops.

Discussion centered primarily on some data issues. The authors base their calibration on data from the Panel Study of Income Dynamics where they observe most individuals for only nine years. They then have to make predictions about the lifetime earnings of an individual which may occur at different stages of the life cycle. There were also some questions about who in the data is in the lowest decile and retiring at such a high age (average of 70). The authors mentioned that when looking at only full time workers, the average retirement age looks relatively flat across income deciles.

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Transfers to Households with Children and Child Development

Daniela del Boca, Christopher Flinn and Matt Wiswall

One of the repeated messages from both this conference and the literature is that early investments in childhood development can have a large impact on outcomes later in life. It is not yet as clear in the literature how to best design policy that increases these early investments. The empirical literature has explored the effectiveness of three types of policies – unrestricted, restricted, and conditional cash transfer (CCT) programs – but it is still unclear which of these programs is most effective and able to be implemented. Unrestricted programs transfer a fixed amount of dollars to families with a child of a certain age and impose no restrictions on how the money is spent. Restricted programs only differ in that the eligible households must spend at least some of the funds on child investment goods. The CCT programs require eligible households to satisfy a performance target to receive funds, i.e., they target outcomes instead of subsidizing inputs. CCTs seem like the obvious choice but it can be difficult to design a proper incentive system taking into account who receives awards, the size of rewards, and which performance measures to target. Del Boca, Flinn and Wiswall attempt to explore this policy design question using a model of the cognitive development of children embedded in a fairly standard life cycle model of parental behavior.

The model used by Del Boca, Flinn and Wiswall is based largely on their earlier work (2011). In this model, parents value their leisure, consumption, and the level of child quality. They then choose in each period how much time to devote to labor, leisure, "active" child care, and "passive" child care, as well as their expenditures on "child" goods. Parents make these decisions over the development phase of the child, which lasts from age three to age 16 and then stops, leaving the child with a final child quality level. Since there is no savings in this model, parents use child quality as their only source for consumption smoothing.

Del Boca, Flinn and Wiswall estimate their model using measures of child quality, parental wages, labor supply of parents, and time spent with the child by each parent separately and together. They get this data from the Panel

Study of Income Dynamics and the first two waves of the Child Development Supplement. The estimated parameters for the child quality production function show that active care from mothers is much more productive than active care from fathers early in the child's development process but, as the child ages, care from the father and mother are almost equally productive. Passive care is almost equally productive throughout the child's life from both mothers and fathers, but is significantly less productive than active care early in the child's life, and slightly more productive than active care later in the child's life.

Part of Wiswall's presentation focused on how to achieve an optimal input mix that maximizes child quality. The fundamental problem with this policy design question is that the government cannot choose the input mix of the parents to maximize child quality. The government must go through the parents who choose the input mix while maximizing their household utility. The policy design question in this paper is how to design policy that achieves the best input mix from the perspective of the child. What Del Boca, Flinn and Wiswall find is that the optimal policy is to set up conditional transfers. With a per capita cost of \$100 for the subsidy program, conditional transfers generate about a 12 percent increase in child quality compared to a less than a three percent increase in child quality with the other two transfer programs. One problem with the conditional transfer program is that it can be difficult to reach some low income households because the quality of the child could be too low for the parents to find it worth the effort to achieve the CCT program's target. Because of this, the restricted and unrestricted transfer programs will affect the low income households more than the CCT program.

Discussion revolved primarily around a few of the authors' critical assumptions. The first of these assumptions is that the parents know exactly how the child development process works. If parents do not understand how to increase child quality, then this could hurt the conditional transfer program since parents could change their input mix in a way that they believe will increase child quality when in reality the changed input mix does not improve child quality. Another key assumption is the Cobb-Douglas form of the child quality production function. This implicitly suggests an elasticity of substitution of one across all the inputs, but it is likely that there could be some complementarity among the inputs. Wiswall cited some of Heckman's work on child development, in particular Cunha, et. al (2010), in which the authors test different functional forms for the production function. Heckman's work suggests that the Cobb-Douglas is a good representation of this production function. The assumption that was questioned by conference participants was that latent test scores can be perfectly observed by both parents and the government. The authors work hard to try to remove noise from the measured test score to calculate a latent test score, but then assume that participants in the model can perfectly observe this latent score. If parents believe they can choose the optimal input mix and generate

a high quality child, but the test used by the CCT produces a noisy signal, parents may have a reduced incentive to satisfy the test score requirement. The authors note that this is a concern they also have about CCTs.

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What Accounts for the Racial Gap in Time Allocation and Intergenerational Transmission of Human Capital?

George-Levi Gayle, Limor Golan and Mehmet A. Soytas

Understanding the sources of lifetime inequality is essential to many economic and social policies. Difference in an individual worker's pre-market human capital is an important source of lifetime inequality. While much literature explores the long-existing substantial achievement gap between the black and white youth populations in the United States, Gayle, Golan and Soytas estimate the impact of parental time investment in young children, socioeconomic status and family structure on long-term outcomes of children. The authors find that parental behavior affects the education outcomes of children and their labor market earnings, as well as their marriage market outcomes. The paper contributes to the literature by accounting for assortative mating and the quantity-quality tradeoff involved in fertility decisions when analyzing the cost and returns to parental time investment.

Gayle introduced a dynastic model framework of intergenerational transmission of human capital. In the model, adults from each generation live for T periods. They derive utility from their own consumption and leisure, and from their children's welfare when their children become adults. Over the life cycle, adults make labor supply and time investment decisions in children each period; only females make birth decisions. Adults may be single or married, and divorce and marriage evolve according to a stochastic process which depends on individual choices. Couples' decisions are modeled as a complete information non-cooperative game and are made simultaneously. Once children become adults, education levels are realized, which is a stochastic function of parental time input, parental education level, and labor market skills. In addition, the skill level of a child and the education level of the child's spouse are a stochastic function of the child's education level. From this perspective, parental time investment and characteristics indirectly affect labor market outcomes and marriage market outcomes. The model framework aggregates different aspects of children's outcome in terms of a discounted valuation function, which is a measure of returns to parental time investment.

Gayle specified the estimation strategies, data sources and results. The estimation involves a multi-stage estimating procedure. Conditional on the other players' strategies, the estimation problem is reduced to a single agent dynastic problem. Under the assumption of stationarity across generations and discreteness of the state space of the dynamic programming problem, the authors obtain an analytical representation of valuation function. The Hotz-Miller estimation technique for a dynamic single agent is then applied toward the estimation of the structural parameters of the representation of the ex-ante valuation function. Using data on two generations from the Panel Study of Income Dynamics (PSID), the estimation shows that despite the fact that the valuation function is higher for whites and the fact that blacks earn less than whites conditional on education, there are no significant race differences in the rate of return to parental time investment on the margin. Additionally, blacks have a higher return to maternal time investment compared to whites. The estimation also shows that the returns to maternal time investment are significantly higher for boys, which implies that mothers act in a compensatory manner, favoring low ability children in the family. Moreover, a significant quality-quantity tradeoff is seen in the findings: the level of investment per child is smaller the larger the number of children. And, the quality-quantity tradeoff for blacks is significantly larger than that of whites.

A conference participant asked about the state space dimension of the dynamic programming model. Gayle responded that the state space dimension is quite large, therefore the assumption of stationarity across generations is imposed to reduce the dimension of the state space. Another participant inquired about the non-cooperative repeated game in the model. Gayle made it clear that it is a game between husbands and wives, in which children are public goods while consumption and leisure are private, and that a pure strategy Markov-perfect equilibrium contract will rule out couples' incentives to take free rides. A participant asked if the Pareto-efficient equilibrium is being played given that the model has multiple equilibria. Gayle responded that it is not necessary for the sake of estimation because all the estimation part needs is that the same equilibrium is played conditional on all the observable characteristics. However, he admitted that future work on the model may be done to test whether the equilibrium being played is indeed Pareto-efficient.

FROM THE LAB

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