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conference held in September 2017

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FROM THE LAB

UC **SANTA BARBARA** | Laboratory of Aggregate Economics and Finance

This issue summarizes the papers presented at two LAEF conferences. For eight years in a row, in co-operation with the Tepper School of Business at Carnegie Mellon University, we have organized conferences on the intersection of macroeconomics and finance. Even with such a long run of conferences, we don't seem to run out of exciting topics on which to focus. The Macro-Finance conference this past September took place in Pittsburgh (we alternate the locations). The local academic organizers were Laurence Ales and Jim Albertus, both of the Tepper School. Theoretical and empirical research topics included: Impact of financial and investment frictions; labor markets; credit risk and corporate financing; models of risk premiums; determinants of income and wealth inequality; household finance; and taxation.

The second conference summarized in this issue was designed to ask, broadly, "why the government does whatever it is that the government does (and should they be doing it)." As background, in 2017, the federal government budgeted $4.1 trillion for expenditures, or roughly 22% of GDP. With recent legislation, these figures are likely to grow significantly. Moreover, at least for a number of years, the "baby boomers" will be retiring in greater numbers and thus will represent a growing demand on the government budget. The goal of the conference was to bring researchers together to discuss the effects of such a large and expanding fiscal budget. How should these expenditures be financed? Should fiscal policy have a role in short-term macroeconomic stabilization? Is there a link between budget deficits and inflation? Academic organizers of the conference were Zach Bethune and Eric Young, both of University of Virginia.

Laurence Ales – Carnegie Mellon University – Tepper
Kartik Athreya – Federal Reserve Bank of Richmond
Yasser Boualam – University of North Carolina
Anna Cieslak – Duke University
Gian Luca Clementi – New York University
Ian Dew-Becker – North Western University
Antonio Falato – Federal Reserve Board of Governors
Giovanni Gallipoli – University of British Columbia
Arpit Gupta – New York University
Leonid Kogan – MIT
Lars-Alexander Kuehn – Carnegie Mellon - Tepper
Finn Kydland – University of California
Ellen McGrattan – University of Minnesota
Serdar Ozkan – University of Toronto
Edward "Ned" S. Prescott – Federal Bank of Cleveland
Gill Segal – University of North Carolina
Lucas Schmid – Duke University
Lawrence Schmidt – University of Chicago
Mathieu Taschereau-Dumouchel - Cornell University
David Zeke – University of Southern California
Ariel Zetlin-Jones – Carnegie Mellon University

Carnegie Mellon, Tepper School of Business

Misallocation or Risk-Adjusted Capital Allocation
David Zeke, Joel David, and Lukas Schmid

Standard, neoclassical theory of investment predicts that cross-sectional variation in the marginal product of capital (MPK) depends, not surprisingly, on risk. Further, as the price of risk fluctuates, theory also predicts it will be countercyclical. Differences in firms' exposure to risk, thus, may explain some of the observed dispersion of MPK in data. David, Schmid, & Zeke provide a new factor to account for this dispersion by exploring these predictions. They find that approximately 30% of the cross-sectional variation in MPK can be attributed to differences in firms' exposure to risk.

The authors focus on four predictions that are generated by established theory. First, that exposure to risk factors is a determinant of expected MPK. Second, that cross-sectional variation in MPK is related to differences in market betas. Third, that predictable variation in excess returns leads to predictable variation in expected MPK. Fourth, and last, that dispersion in MPK increases with excess returns. Indeed, the authors find support for these predictions: high MPK firms offer high expected stock returns, industries with high expected return and market beta variation have an associated high dispersion in MPK, the expected MPK is higher when expected excess returns are high, and that MPK dispersion is also higher when these excess returns are high. Using a simple, calibrated investment model, it is found that this channel can account for about 30% of the cross-sectional variation in MPK, typically chalked up to "misallocation.

In discussion of the research three major points were raised about the above findings. First, though the theme of the paper centers on differences in risk, could this factor be picking up size effects? Indeed, most of the dispersion seems to be coming from smaller firms. Second, there is concern that the authors' measure of capital might be flawed. For example, intangible capital (such as R&D) might be a large and important part of a firm's investment. In response, it was noted that should intangible capital enter the production function in a Cobb-Douglas manner, the results might not change too much, though there could be some interesting inter-industry differences. Last, there was concern about what

these results mean at an aggregate level. Instead of focusing on (relatively) small firms, how do these results align when using the 500 largest firms?

Altogether, the authors provide a new factor to explain part of the cross-sectional dispersion of MPK. While size effects might be underlying some of the estimated effects, their results are consistent with predictions from standard theory, helping connect literatures in macroeconomics and finance. ◊

Cascades and Fluctuations in an Economy with an Endogenous Production Network
Mathieu Taschereau-Dumouchel

A growing body of literature has recognized that production involves a complex network of firms, rather than a single representative firm, whose output is used in part as inputs for other firms in the network. Such networks can result in an amplification mechanism of microeconomic shocks to individual firms. The propagation and resulting aggregate consequences of these firm level shocks depends crucially on the shape of the network. In his paper, Mathieu Taschereau-Dumouchel provides a joint theory of production and endogenous network formation, and investigates the implications of such a model. Moreover, the author provides a novel reshaping approach to solve mixed integer nonlinear problems such as this.

In his model, firms pay a fixed cost to produce an intermediate good, which can be used in the production of a final consumption good or sold as inputs in production to other firms. In order to sell their output to another firm, however, a connection must exist between the two producers and both must be active. While no aggregate uncertainty exists, firms are subject to idiosyncratic productivity shocks. Key to the model mechanism is the fact that firms produce using CES technology, implying a benefit to a diverse set of inputs in production. As a result, complementarities exist among firms' operating decisions.

The model provides several important predictions. In particular, the efficient allocation calls for tight clustering among firms so that a large number of firms have many neighbors. These clusters are formed around the most productive firms so as magnify their impact as much as possible. Moreover, these clusters amplify small, firm-

level shocks through two channels. First, when firms face a higher marginal cost (i.e. bad productivity shock), they pass along the additional cost to their customers, who in turn pass the additional cost along to other firms in the network. Second, because of the role that a diverse set of inputs plays, firms who lose a supplier are also less likely to operate. Said differently, when a firm faces a sufficiently bad shock so that it shuts down, the set of inputs in the network decreases. Because the remaining firms face a more restrictive set of inputs, they are also less likely to operate. These two channels can cause cascading shutdowns. To prevent a severe loss in output, however, the social planner will drastically reorganize the network in response to these cascades. Thus, the model can generate large reorganizations of the network in response to small shocks with very little effect on aggregate output.

The author then calibrated the model to the U.S. economy using data from Factset Revere and Compustat. He finds that the in-degree and out-degree distribution exponents, and the global clustering coefficient fit that implied by the Factset data well, though deviates from the Compustat data. Moreover, compared to a random network, the power law exponents of the in- and out-degree distributions are 3.3% and 7.4% lower, respectively, whereas the global clustering coefficient is 50% higher. In addition, the calibrated model implies that the correlation between the in-degree, out-degree, and clustering coefficient with output are -0.1, -0.31, and 0.47, meaning that firms are more highly connected in expansions than recessions. Finally, the model with endogenous network formation predicts a standard deviation of aggregates that is 27.8% lower than that in a model with random networks.

The paper was very well received by the audience. Attendees had only minor concerns, chief of which being whether or not the comparison to a random network was the correct one when investigating aggregate fluctuations. In particular, some wondered if the benchmark economy should be one in which the ``pre-shock" network was as in the author's model, but no subsequent reorganization was allowed. The author acknowledged that this could be an alternative benchmark, though in some sense partially incorporates his endogenous network formation channel through the initial network structure. The discussant, Gill Segal, had somewhat more pressing concerns, though he acknowledged how considerable the contribution of the paper was. In particular, he argued that relaxing several assumptions in the model have large consequences for its predictions. Especially, the inclusion of risk averse households, aggregate uncertainty, or self-supplying firms may compromise the tendency to cluster. ◊

Equilibrium Corporate Finance and Intermediation
Gian Luca Clementi, Alberto Bisin, and Piero Gottardi

Models with incomplete financial markets and agency frictions are associated with some known complications within the macro-financial literature. The deviation from these assumptions generally means that the model's asset structure cannot span the set of possible returns. As a result, corporate asset prices are not computable by arbitrage, firm value is not straightforwardly defined, and the firm's objective (to maximize value) does not necessarily agree with those of investors. Bisin, Clementi, & Gottardi contribute to this literature by extending Makowsi's (1983) analysis, which showed that rational price conjectures imply that value maximization is unanimously supported by shareholders, to economies with asymmetric information and short-sale possibilities.

The authors' research makes several contributions. First, they theoretically establish conditions for existence, efficiency, and unanimous investor agreement with the firm's valuation objective. Next, they outline predictions for how investment, capital structure, and asset returns respond to investors' hedging demand, and how agency problems in capital structure choice depends on this demand. Last, they give conditions under which ex-ante identical firms specialize in the securities they offer to certain types of investors. The result is a methodological approach to handling collective decision problems in a general equilibrium framework. This, unlike what might be predicted in a partial equilibrium setting, can allow the wealth distribution to matter for financing decisions. Their results also give reason for intra-industry capital structure heterogeneity for firms with otherwise similar production sets.

In discussion, it was brought up that the paper's examples were only illustrative. Embedding their work in another framework, namely Prescott & Townsend (2006), the discussant of the paper shows that the unanimity problem doesn't arise as it does in the present research since these investors do not make any firm decisions. To this end, being able to connect both approaches, perhaps to better understand issues of agency, may be important. Also raised was the lack of discussion about the effects of business cycles in this model. As such, while the in-paper examples were illuminating, the generated predictions of

the model are potentially difficult to evaluate in terms of applied work. That said, the work does make large strides in establishing an equilibrium foundation to the study of corporate finance in the presence of incomplete markets and agency frictions. ◊

The Maturity Structure of Inside Money
Ariel Zetlin-Jones and Burton Hollifield

It is well known that banks engage in maturity and risk transformation. That is the risk/maturity structure of bank liabilities does not match that of their underlying assets. A number of explanations have been given. The standard explanation for this transformation is that banks act as insurers against household idiosyncratic liquidity risk. The question of whether or not the level of maturity-risk transformation is efficient remains unsettled. In their paper, Hollifield and Zetlin-Jones provide a new explanation for this balance sheet transformation. They first ask if banks have incentives to engage in balance sheet transformation to create desirable means of payment in frictional goods markets. They then consider if there is a need for policy to induce the efficient level of maturity-risk transformation.

To investigate these questions, the authors build a two sector model where bank liabilities act as inside money. In their model, banks finance a risky, productive asset using a mix of fixed equity and time- and state-contingent liability claims to the returns on their investments. These liability claims, however, are subject to limited commitment. Households on the other hand trade in decentralized goods markets a la Lagos-Wright. In addition to money, households use issued liability claims to alleviate liquidity constraints in frictional markets. In this way, aggregate risk on the bank asset side equates to liquidity risk for households.

The trading constraints faced by households cause them to be more risk averse to the coupon payments of bank liabilities and imply a risk sharing motive. Through this channel, banks engage in risk transformation by creating safer liabilities than the underlying asset. Additionally, banks commit to transferring returns on their inside equity to households in low return states while retaining some of the returns in good states of the world. The limited commitment problem, however, limits banks' ability to make these long term promises. To cope

with this problem, banks instead engage in maturity transformation to improve their risk transformation by liquidating part of the productive asset earlier. The authors find that the competitive equilibrium is constrained inefficient under the conditions causing maturity/risk transformation. In equilibrium, banks do not internalize their impact on the high liquidity premia and issue too many long-term liability claims. Said differently, banks engage in too little liquidation. This channel runs opposite the current literature where bank assets are mispriced rather than bank liabilities. The authors suggest several policies to correct for the lack of maturity transformation, including minimum short-term debt and liquidation floors.

Several concerns were raised by both the audience and discussant, Yassar Boualam. First and foremost, the authors don't separately consider the role of productivity risk and liquidity risk. As a result, some felt it difficult to determine how strong a role liquidity shock might play. Moreover, the authors use a stripped down model and abstract from other important frictions. The discussant suggested that the inclusion of features such as asymmetric information or fire-sale frictions may have first-order implications for the results of the model. The discussant also suggested incorporating several testable predictions in the analysis to provide evidence in favor of the theory. ◊

"Permanent Income" Inequality
Giovanni Gallipoli and Brandt Abbott

Much of the empirical literature studying inequality focuses on how observable characteristics affect income and wealth outcomes. These studies, however, ignore a potentially important component of economic inequality: unobservable heterogeneous future earnings potential (hereafter human wealth). Failing to consider differences in human wealth may have important implications for redistributive policies. Abbot and Gallipoli build on the inequality literature by emphasizing this channel and revisit inequality trends from 1989-2013.

To conduct their analysis, the authors rely on data from the Panel Study of Income Dynamics (PSID) and the Survey of Consumer Finances (SCF) to construct estimates of the age-adjusted annuity value of lifetime wealth. Using the PSID Abbot and Gallipoli first estimate

marginal utility and human wealth valuation functions non-parametrically, relying only on low-level assumptions rather than imposing specific functional forms on individual utility. Throughout the estimation procedure, the authors allow for state-dependent stochastic discounting, an improvement on simple measures of expected present value of future earnings and a key difference from Friedman's permanent income statistic. Applying these estimated human wealth functions to the SCF, the authors obtain estimates of lifetime wealth and permanent income for different households.

The results of this analysis show that simply focusing on asset wealth as a measure of inequality creates a more polar view of inequality. In fact, Abbot and Gallipoli find that the top 10% share of permanent income measured using their procedure was only 2/3 of that for asset wealth in 2013. Moreover, they find that the top 10% share of lifetime wealth was slightly less than 2/3 of that for asset wealth in 2013. In contrast, however, they find that permanent income inequality and lifetime wealth inequality grew 40% and 25% faster than asset wealth inequality, respectively, from 1989-2013. Using a simple accounting exercise, the authors find that the rapid increase in permanent income inequality is primarily driven by an increasing importance of financial wealth as a share of total wealth.

The talk was well received with relatively few concerns. The discussant, Kartik Athreya, provided a suggestion, which the presenter agreed needed to address. In particular, their analysis had no role for race, which the discussant argued is central when considering the determinants and evolution of inequality. Another participant wondered if the fact that the analysis did not allow for human capital accumulation severely biased their results. The presenter responded that while it is true that they take human capital as given, you could in principle add its accumulation to the analysis. His one reservation in doing so was that its inclusion would greatly complicate things. ◊

Technological Innovation and the Distribution of Labor Income Growth
Leonid Kogan, Dimitris Papanikolaou, Lawrence Schmidt, and Jae Song

Automation, and its effects for workers, has been the center of much discussion and debate. These concerns beget the idea that technological innovations, a key driver of economic growth, may increase earnings risk. As new firms, products, or technologies displace old ones, there is concern that a household's human capital might also be at risk. In the presence of incomplete markets, this risk can be uninsurable and, thus, may have first-order implications for welfare and asset prices. Kogan, Papanikolaou, Schmidt, & Song explore this topic by studying how workers' labor income changes in response to major technological advances by firms and their intra-industry competitors. They do this by combining direct measures of innovative activity from patent data with panel income information from Social Security administrative records. To understand the distribution of these effects across the population, they also look at how heterogeneity in worker age, lagged income, and the type of innovations made (for example, whether the technological advancement is product or process-centric) affect the above results.

The authors find that own-firm innovations are associated with an increase in the average wage growth, while competing-firm innovations are followed with declines. In addition, there is considerable heterogeneity in these effects across workers. First, the highest-paid workers are more likely to have negative wage growth following both own-firm and competitor innovation. The own-firm result is primarily driven by process-centric innovations. The idea here is that when there are improvements to the way tasks are carried out, higher paid workers, previously employed to carry out those tasks, are partially displaced and thus not compensated for such work. The effect is also driven by truly innovative findings: a high number of citations (presumably because the innovation was more valuable) is associated with an increased likelihood of declining average wages. Not surprisingly, the authors also find that the income drops are larger for workers who leave the firm (i.e. those workers whose tasks were more displaced) or for those with longer tenures (i.e. those with

a human capital portfolio more sensitive to automation). Correspondingly, these same workers are found to be more likely to experience long unemployment spells and file for disability insurance following innovations.

In discussion of the paper, one major issue with the empirical results concerns endogeneity and the (potential) need for an instrument. For example, part of workers' compensation package could involve stock options which are endogenously exercised. Thus, should a worker expect that the stock price will rise because of a new patent, she may postpone exercising the option. By effectively pushing this source of income to a later date, it might look as though wages are lower today. The discussant suggested an instrument, for example the worker's past income growth, to help alleviate these potential concerns. Finally, it is suggested that it might be interesting to determine what the net effect of this mechanism is in the aggregate. Addressing the above issues would allow for this sort of an analysis, which in the greater context of this work, looks promising. ◊

The Economics of the Fed Put
Anna Cieslak and Annette Vissing-Jorgensen

The Federal Reserve often faces the criticism that Fed policy is overly driven by financial market returns rather than by macroeconomic data. In this paper, Cieslak and Vissing-Jorgensen investigate the underlying economics of the "Fed Put" – the empirical observation that low stock market returns are predictive of easing monetary policy. The authors ask how market returns compare to other economic indicators in the extent to which they affect the Federal Reserve's monetary policy. They ask whether the Fed is reacting to stock market returns or if it is instead reacting to other correlated variables. Seeking to disentangle how the stock market drives Fed policy, the authors employ textual analysis on FOMC minutes in order to better understand how the Fed's thinking is shaped by various economic indicators, and how this thinking is reflected in the resulting monetary policy.

Cieslak and Vissing-Jorgensen show that, since 1994, stock market returns have been a more powerful predictor of Fed funds target rate changes than any other macro news events. However, they demonstrate that the Fed's macroeconomic expectations account for 80% of the impact that market returns have on Fed policy. Moreover, the authors find that "while the stock market

is a clear indicator of the Fed forecast updates, [there is] little evidence that Fed expectations overreact to the stock market relative to [corresponding private sector forecasts]." They observe that the residual impact could reflect an optimal policy response if either the Federal Reserve cares separately about the general stability of financial markets due to the outsized cost of bailouts, or if stock market performance independently affects the natural Fed funds rate.

The incidence of a negative stock market result is a strong indicator of the Fed responding with target rate updates. This relationship proposes a natural question: what is the mechanism through which market results feed into Fed policy? More succinctly, is the relationship causal? To study the mechanism through which stock returns affect the Fed's expectations and policy, the authors examine FOMC minutes and transcripts, categorizing stock market mentions as positive, negative, neutral, or hypothetical, and regress these mentions on Fed policy updates. They find that the Fed's attention to the market, as measured by the frequency of mentions, is correlated with action, and that the Fed put is ostensibly driven by the disproportionate attention which is given to the worst periods of market returns. The authors posit that the Fed likely views the stock market as a driving indicator of consumption (and to a lesser extent, investment), and it is through this channel that returns inform the Fed's macroeconomic forecasts.

Discussion revolved around the reasonableness of the Federal Reserve's policy response and whether the updates to Greenbook forecasts are overreacting to negative market outcomes. When questioned whether the Fed only responds to market declines, or also to rising volatility, the presenter clarified that, while policy responses are correlated with volatility, textual analysis reveals that the FOMC does not talk about volatility until later in the sample. Also discussed was the potential disconnect between words spoken and thoughts, wherein the discussion of market returns might be used to support the speaker's belief because the audience cares—not necessarily the speaker. Such a relationship may explain why Fed policy seems reasonable while the talk, at times, appears obsessed with the market. ◊

The Loan Covenant Channel: How Bank Health Transmits to the Real Economy
Antonio Falato and Gabriel Chodorow-Reich

There is a question as to how the health of the banking system transmits to non-financial firms. Chodorow-Reich and Falato observe that "at the start of the financial panic in 2008 only 10% of bank loans had remaining maturity of less than one year and the typical firm did not face the prospect of a maturing bank loan until 2011." Prima facia, we would expect that the restriction of credit due to the financial panic would not directly affect non-financial firms until such time that they need to raise additional credit. How is it, then, that financial turmoil can propagate to the broader economy as quickly as it does? The authors propose the following transmission mechanism: loan covenant violations allow lenders to contract credit from otherwise insulated borrowers, greatly reducing the maturity of their bank debt.

The authors investigate this channel using the Share National Credit Program data set of syndicated loans. While some 90% of loans in the sample have maturities greater than one year, over 25% of the loans are to borrowers who are in violation of at least one covenant, leading to the potential for technical default. To this end, Chodorow-Reich and Falato find that, among ex-ante similar lenders, those lenders which were in worse shape during the financial crisis were much more likely to reduce credit to covenant violators. Moreover, this result is robust to other financial and real factors. In Aggregate, the authors show that this effect is almost as large as the overall reduction in credit during the financial crisis.

Noting the novel channel of transmission from the financial system to the real economy, the discussant focused on the paper's identifying assumption. Namely, it is assumed that, conditional on observables, covenant violators are exogenously assigned to banks regardless of financial health. This, however, is not necessarily the case. Perhaps a bank finds itself in distress, for example, because it has a history of choosing poor quality borrowers. It was suggested that the authors regress the distribution of bank health against firm-level characteristics and covenant characteristics in order to provide a robustness check for this so described reverse causality. To this, the presenter responded in agreement that such robustness checks could be included in the future, and reported preliminary work which shows that elements of lender quality pre-crisis appear not to be correlated with the probability of credit restriction.

One participant suggested investigating how the severity of covenant violations affected the potential for a reduction in credit by observing the distance of a violation from common covenants, such as some financial ratio. Performing a logistic regression of the incidence of a credit reduction onto violation severity and other observables, could allow one to infer the order in which a bank restricts credit among its violators.

Another participant noted the identifying assumption that firms do not take into account the financial health of lenders when violating loan covenants. The robustness of this assumption could be tested by investigating whether the probability of violating a covenant, conditional on firm-level controls, differs based on observed lender health. In furtherance of this discussion, it was asked whether poor lender quality leads to a high incentive to manipulate around certain of the covenants, which could potentially be tested through a regression discontinuity design. The presenter agreed that such incentive for manipulation is possible, but noted that there doesn't seem to be much manipulation of covenants over time and posited that this could be due to the imperfect prediction of lender quality. ◊

Zachary Bethune – University of Virginia

Huixin Bi – Kansas City Federal Reserve Bank

Daniel Carroll – Cleveland Federal Reserve Bank

Gabriel Chodorow-Reich – Harvard University

Stefano Eusepi – New York Federal Bank

Mark Huggett – Georgetown University

Finn Kydland – University of California, Santa Barbara

Miguel Mascura – University of Virginia

Kurt Mitman – IIES Stockholm

Dan Murphy – University of Virginia

Gaston Navarro – Federal Reserve Board

Peter Rupert – University of California, Santa Barbara

Gustavo Ventura - Federal Reserve Board

Kieran Walsh – University of Virginia

Eric Young – University of Virginia

Conference Participants shown outside the Upham Hotel in Santa Barbara, CA

Geographic Cross-Sectional Fiscal Spending Multipliers: What Have We Learned
Gabriel Chodorow-Reich

The geographic cross-sectional fiscal multiplier indicates the impact of government spending on the local economy over a given time horizon. Although this value may be of interest to some, the multiplier for the aggregate economy is often a more desirable object of study. The issue with calculating the aggregate multiplier, though, is that fiscal policy is endogenous. The geographic multiplier, though, can exhibit much more heterogeneity, which makes it a better candidate for identification and estimation. The author explains how the geographic multiplier can be used as a lower bound for the aggregate multiplier, which requires considerations of the funding source, openness, and monetary policy. The author also surveys several previous papers on regional multipliers to construct a range of values for the lower bound of the aggregate multiplier. The author argues that people should update their preconceived notion of the value of the aggregate multiplier to a higher value, specifically around 1.7.

The motivation for using the geographic multiplier is that there is often variation in spending across multiple areas that are part of the same country or currency union. This is something that cannot often be seen when just considering the aggregate economy. The 2009 American Recovery and Reinvestment Act (ARRA) exhibits the necessary exogeneity and variation in spending to make it useful for study. The U.S. government spent $800 billion dollars, 75% of which was in 2009 and 2010, on fiscal stimulus. The formula for how and where to spend was based on the way the government spent money beforehand, so the amount of money an area received was not related to local economic conditions. Most of the stimulus came in fungible Medicaid transfers, which freed up money in the states' budgets, and transfers for highway spending.

Although calculating the regional multiplier is possible, there are some issues with extrapolating from it to the aggregate. To begin, regional spending can be viewed as externally funded since areas with more stimulus do not have to pay comparatively higher taxes, but national spending is funded internally. Also, regional economies are more open than national economies in terms of trade and migration. Further, monetary policy does not affect local and aggregate economies in the same way. To address the first issue, the author looks at both Ricardian and non-Ricardian agents and concludes that internally deficit- and externally transfer-financed stimulus will give approximately the same multiplier. This is because the difference for Ricardian agents is very small when spending is transitory and is also declining over time, while for non-Ricardian agents there is no difference at all. To deal with the second issue the author analyzes income and substitution effects as well as migration. Since income and substitution effects are not an issue for a closed economy, this makes the regional multiplier a lower bound for the national one. Migration would cause the regional multiplier to be an upper bound, but it is found to be approximately zero. This is probably since the spending is temporary and there is a fixed cost associated with migration. Finally, the author points out that monetary policy is at the zero lower bound, so it is a non-issue when comparing regional to aggregate. So, combining all of these stipulations, the author finds that the open economy, externally-financed fiscal multiplier is roughly a lower bound for the closed economy, deficit-financed fiscal multiplier when there is passive monetary policy. In other words, the regional multiplier calculated in this study can be considered a lower bound for the aggregate multiplier.

The author calculates some estimates of both the employment and output regional multipliers using a variety of instruments for ARRA spending. The instruments are for the different channels of pre-ARRA spending since those were the template for ARRA spending. The author also provides a formula for simple conversions between employment and output multipliers based on job costs and output per worker from the data. An audience member pointed out that higher multipliers could come from instruments that are correlated with Fed spending, but the author said that since the instruments are uncorrelated and give very similar estimates of the multiplier, this issue should not be present in the estimates.

The author's final contribution is to survey and summarize the previous literature on the geographic cross-sectional fiscal multiplier. The author concludes that the range for the regional output multiplier is somewhere between 1.5 and 2. A 2011 estimate of the national multiplier was between 0.8 and 1.5, which is notably lower especially if the regional range should be a lower bound for the aggregate multiplier. This leads the author to propose a rough lower bound of 1.7 for the closed economy, passive monetary policy, deficit-financed multiplier. ◊

The Heterogeneous Effects of Government Spending: It's All about Taxes
Gaston Navarro and Axelle Ferriere

Standard models in macroeconomics predict that private consumption decreases when public consumption increases. Contrary to private consumption, they predict a mild increase of output in response to a public consumption stimulus. However, empirical fiscal multipliers cannot support the predictions of standard models, especially for private consumption. According to previous literature, output multipliers range from 0.3 to 1 and consumption multipliers are typically less than 0.1. That is, standard models predict negative multipliers for private consumption, while multipliers for private consumption are positive in many empirical studies. In this paper, the authors first show the evidence that fiscal multipliers depend on tax progressivity and then try to reconcile theoretical predictions and empirical findings in fiscal multipliers.

To show the evidence that the effect of government spending on output and private consumption depends on tax progressivity, the authors use a local projection method and an agnostic VAR estimation. The authors suggest a tax progressivity measure as the ratio of the marginal minus the average tax rate, over unity minus the average tax rate. First of all, the authors show that tax progressivity matters for the effects of government spending by a local projection method, which computes impulse response functions in each state of tax progressivity. According to this methodology, the effect of government spending on output is significantly higher during periods of increasing progressivity. Second, starting from standard structural VAR, the authors impose a set of sign restriction on an agnostic VAR methodology, based on shocks: (1) a linear shock, (2) a progressive shock, and (3) a regressive shock. They show that output increases only if a progressive shock is imposed and private consumption decreases only if less progressive taxes are levied.

The authors employ indivisible labor supply and a distortionary tax in their model to reconcile the empirical findings. By the assumption of indivisible labor supply, the intra-temporal Euler equation holds with inequality, which helps the authors deliver larger output multipliers. Besides, heterogeneous labor income taxes generate a positive consumption multiplier by giving more tax burden towards wealthier households than poor ones. In other words, a tax increase on wealthier households will minimize a contraction in consumption as a whole since their marginal propensity to consume is smaller than poorer ones. To simulate their model, the authors do experiments for three different levels of progressive taxation schemes: (1) Constant Progressivity; (2) Higher Progressivity; (3) Smaller Progressivity. With higher progressivity, the government can decrease the level of the tax scheme to satisfy a balanced budget constraint. On the contrary, the government has to increase the level of the tax scheme with lower progressivity. Regarding output and consumption responses, the magnitude and sign of their movement are very sensitive to the taxation scheme used. Among three experiments, only higher progressivity can generate an increase in both public and private consumption.

Audience members have concerned that the authors control monetary policy differences to derive their results. Regarding deficit financing, one audience member was asking whether deficit financing is temporary or permanent. Finally, another one wondered whether there is no significant difference in the size of fiscal multipliers between when the authors impose progressivity on labor tax and when they augment it on capital tax. ◊

The Fiscal Multiplier
Kurt Mitman, Marcus Hagedorn, and Iourii Manovski

A government spending or a transfer stimulus produces a fiscal multiplier effect. That is, the total effect of this stimulus is higher than a direct effect on output itself due to an additional indirect effect on private consumption and employment. For the indirect multiplier effects to work, price rigidities and high marginal propensity to consume are required. Thus, the authors calculate the size of the fiscal multiplier in a dynamic equilibrium model with these two elements in various cases.

First, the authors compare the differences for the fiscal multiplier between complete markets and incomplete markets. In complete markets, the size of the fiscal multiplier is determined by the response of the inflation rate only. The problem of the complete markets model is that it does not have a unique solution for the path of inflation. To overcome the problem of

indeterminacy, the authors use an incomplete markets model which determines the price level uniquely where the real interest rate is determined by monetary and fiscal policy. In their model, the heterogeneity in the marginal propensity to consume together with the redistribution of wealth across population determines the aggregate effect of consumption and output.

Then, the authors compute the response of the economy to an unexpected and persistent increase in the path of nominal government spending. Since Ricardian equivalence does not hold due to the existence of a distortionary tax on labor income, the authors consider both tax financing and deficit financing. In the benchmark, which employs the New Keynesian model with household heterogeneity in marginal propensity to consume and labor productivity, the fiscal impact multipliers with tax and deficit financing are 2.28 and 2.8, respectively. The cumulative multiplier until consumption falls below steady-state level is equal to 0.19 with tax financing and 0.3 with deficit financing. For the aggregate results, the initial consumption response is 0.19% of output with tax financing and 0.26% with deficit financing. The indirect multiplier effects are 0.17 with tax financing and 0.13 with deficit financing. The results show that the fiscal multiplier is more substantial with deficit financing. For further analysis, the authors extend the benchmark in various ways. They first investigate how the size of the fiscal multiplier depends on the marginal propensity to consume. Then, they use a Taylor interest rate rule instead of a pegged interest rate at the zero lower bound. They also ask how the size of the fiscal multiplier depends on the timing of spending. In addition to government spending stimulus, they explore the effect of a transfer stimulus. Finally, they analyze the effect of a government spending under liquidity trap.

Audience members have concerned that the authors used efficiency unit or efficiency time for a labor income. One was worried that a household might be worse off by working than not working, asking whether workers are involuntarily employed. Another audience member was curious whether an economy can reach zero inflation rates at a steady state if there is no borrowing. Another audience member was asking how importantly nominal wages affect the results. Finally, one audience member wondered why there is a significant jump in the impulse response function of nominal interest rate in case of deficit financing and Taylor rule. ◊

Debt Burdens and the Interest Rate Response to Fiscal Stimulus: Theory and Cross-Country Evidence

Daniel Murphy, Jorge Miranda-Pinto, Kieran Walsh, and Eric R. Young

The near consensus in theory on government spending and interest rates is that government spending shocks raise interest rates. The standard channel is as follows: if the government uses resources, the interest rates need to rise in order for the market to clear. The resulting effect is that government spending might crowd out investment, implying a limited stimulus on the economy. On the other hand, economists fail to show the theory prediction in the data. The authors document substantial heterogeneity in the response of interest rates to government spending across OECD countries and show government bond yields fall in over half of OECD countries. General equilibrium models are generally unable to explain negative interest rate responses to fiscal stimulus.

The authors propose a theory of debt-burden households. More specifically, government spending increases income for borrowers and relaxes credit markets. When the borrowers are households with debt overhang, namely the savings-constrained households due to minimum consumption levels, government spending will induce them to save more hence lower interest rates. The authors use PSID data to show that the interest rate response to fiscal stimulus is falling in debt overhang, and the low-wealth households behave as predicted by the model.

One discussant asked whether the authors use real interest rates or nominal interest rates. The author noted that they only use real interest rates, but he suggested that nominal interest rates should display similar pattern. Another discussant raised a question on the model assumption. Specifically, he asked the difference between minimum consumption requirement and debt constraints. The author acknowledged that they could be equivalent in some situations, but they allowed for flexible consumption in their paper to examine robustness. The author also noted that they use the data of government bonds that have on average 1 year of maturity and the data spans 1960 to 2000.

A question was raised about the reason for abstracting from monetary policy. The author argued that monetary policy couldn't explain the feature in the data. The author also noted that they used consumption shock instead of other type of shocks because it gave rise to constrained households in equilibrium. One discussant was concerned about the proportion of durable good in the households' consumption data. The author suggested that they controlled for the durable good by including a lag term in consumption in their regression. ◊

Sovereign Risk and Fiscal Information: A Look at the U.S. State Default of the 1840s
Huixin Bi and Nora Traum

There is considerable debate as to what extent economic fundamentals determine sovereign bond prices, and recent debt crises such as was seen in the Eurozone underline the need to unravel this relationship. Questions about how rate hikes relate to fiscal fundamentals and about the role fiscal information plays in affecting sovereign rates are of significant policy importance. In their paper, Bi and Traum examine these concepts by looking at the default of nine U.S. states and territories in the 1840s, specifically analyzing the role of fiscal information on the pricing behavior of sovereign bonds. What's more, they take advantage of heterogeneity in state fiscal policy to examine the effect of fiscal information on bond prices for states with different economic fundamentals.

To conduct their analysis, the authors construct fiscal information indices to measure how much attention was being given to each state's fiscal position using contemporary U.S. and British newspaper articles. They do this by creating monthly counts of the number of articles containing key words surrounding fiscal policy in each newspaper. They then index the counts by the total number of articles written at the time.

The authors find evidence of a regime shift occurring at the onset of the crisis. Namely, their results argue that while on average throughout the entire period there is little evidence that fiscal information impacted bond prices, during the crisis fiscal information helped investors distinguish between defaulting and non-defaulting states. Fiscal information was positively correlated with bond prices for non-defaulting states, and negatively correlated for defaulting states. When examining solely the period before the crisis, Bi and Traum find that more fiscal information reduced prices for states that began issuing bonds earlier, noting that the entry of western states to the bond market resulted in increased competition.

Participants were interested in the role which safe interest rates might be playing in bond pricing. Dr. Bi explained that there isn't good data on that for this time period as the U.S. payed off their debt in 1835. One questioner then asked if because the U.S. was on a gold standard, if one could use the London rates and British bonds as the safe interest rate. They went on to say that this could be especially relevant considering foreign London investors could very well be the marginal investors.

Another participant pointed out that the fiscal indices as constructed do not differentiate between positive and negative news. This is significant as there could be heterogeneous effects. Dr. Bi noted, however, that at the moment the word search program used to construct the indices is unable to make the distinction. ◊

Fiscal Foundations of Inflation: Imperfect Knowledge
Stefano Eusepi and Bruce Preston
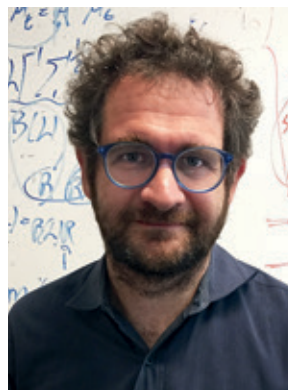
In the standard view, the monetary authority independently influences price stability, and the fiscal authority guarantees the intertemporal solvency of the Government. In an alternative view, nominal liabilities are not fully backed by future taxes. The nominal anchor, therefore, shifts to fiscal policy. Fiscal policy will then have dominance over the monetary policy. In "Fiscal Foundations of Inflation: Imperfect Knowledge," Stefano Eusepi and Bruce Preston formulate a model where imperfect knowledge and learning break the Ricardian equivalence. In particular, inflation and debt expectations are inconsistent with policy. This creates a link between nominal government's liabilities and inflation regardless of the policy regime. Predominantly, the average government's debt and its duration affect inflation.

The authors first analyze a simple endowment economy where the Ricardian equivalence holds. Agents maximize their lifetime utility. They also estimate a model of inflation and taxes using rational expectations and updating them given new shocks at each period. The fiscal policy is restricted to changes in lump-sum taxes in

response to debt and to debt issuance, which potentially can be composed of long duration assets. In this case, the monetary policy simply adjusts the short-term nominal interest rate more than proportionally to inflation shocks as in a Taylor policy rule. Authors consider a first-order approximation around a non-stochastic steady state to see the properties of this equilibrium.

In this simple benchmark model, inflation is independent of the size and duration of government debt. There is a Ricardian policy framework where monetary policy is active and highly sensitive to inflation, and the fiscal authority is passive to the bond level. Inflation is independent of the size and duration of government debt. Authors then analyze the impact of an inflationary shock in this economy. The only channel that works is the intertemporal substitution of consumption, while the wealth effect is shut down. There are no fiscal consequences for inflation. The monetary authority follows the Taylor principle and it is enough to stabilize inflation. This benchmark is only relevant when the uncertainty over the fiscal and monetary frameworks is low, which is an assumption that the authors argue is stringent for the current economic framework.

Agents may have uncertainty over the long-term equilibrium level of inflation and the debt level. This could arise from uncertainty about the policy regime or imperfect credibility about policy objectives. They use a simple bivariate autoregressive model of the inflation and the government's taxes. The unobserved long-term component is captured by the intercept of this model, which is estimated in each period as new data is available. These estimates are updated in response to past forecast errors. A participant raised the question if agents only estimate the drift in this model and if the slope can be affected by the fiscal policy. The speaker responded that it is assumed that agents know the rational expectations slope coefficients and that it might be affected by fiscal policy.

Under non-Ricardian effects of inflation expectations, there might be self-fulfilling prophecies in taxes and inflation expectations. A change in expected inflation creates a change in expected monetary policy, which shifts the price of long-term government bonds. This, in turn, modifies the path of government debt accumulation and taxes. As a result, there is a wealth effect on consumption demand which feeds back into inflation dynamics and expectation on nominal interest rates, and the loop starts again. This circle between expectations and the path of the fiscal and monetary policy creates instability. The authors called this endogenous circle as self-referentiality of taxes and inflation. A member of the audience asked about the meaning of stability in this model citing inflation variability as a bad public

good, which is present, for instance, in emerging market economies. The speaker answered that it depends on the metric for optimality. The monetary authority cannot follow a Taylor rule since it is not enough to stabilize inflation. Consequently, a more aggressive monetary policy is required. This relationship is modulated by the size and duration of debt.

The model is calibrated using quarterly US data between 1968 and 2007, thus avoiding the zero lower bound and the availability of some survey forecasts. Interest rates have measurement error. A participant raised the question that fiscal policy changed in this period. The calibrated parameters include inflation, real interest rate, GDP growth, the debt-to-GDP ratio, and the average debt duration. Since the authors log-linearize the model, solving the model is relatively easy (the parameter space is linear). A non-stochastic steady state is normalized around a zero vector in the taxes and inflation space.

The authors then proceed to run counterfactual exercises on inflation and debt in the Great Moderation period. Particularly, they are interested in what would happen had the debt being higher or characterized by shorter maturities. They conclude that, given the debt's maturity structure, if the debt-to-GDP ratio had been above 150%, the US economy would have had inflation volatility and potential output similar to those observed in the period 1955-1983. The speaker also mentioned that higher debt maturities can help restore the Ricardian equivalence regardless of the debt level. Nevertheless, this relationship can only be seen in the data for the UK. ◊

Taxing Top Earners: A Human Capital Perspective
Mark Huggett and Alejandro Badel

In "Taxing Top Earners: A Human Capital Perspective," Hugget et al. argue that the well-known Diamond and Saez (2011) formula for the revenue maximizing top marginal tax rate is incorrectly characterized and that the commonly cited estimate of 73% is much higher than the true optimal rate. They assert that this estimate is incorrect for both theoretical and empirical reasons. The authors address shortcomings of the traditional formula by employing a new formula that requires two additional elasticities. A theoretical model in which human capital investment decisions depend on the top marginal tax rate is described and a new estimate of 49% is found for the optimal top tax rate.

The traditional formula for the revenue maximizing top marginal tax rate depends on the elasticity of aggregate earnings beyond this threshold with respect to changes

in one minus the tax rate. Hugget et al. identify two problems with traditional estimates using this formula. The first stems from the fact that this traditional formula can only be applied in some static models. Hugget et al. develop a more general formula that is valid in steady states of dynamic models, as well as static models. They apply the formula to a dynamic model in which human capital investment depends on the top tax rate. As this top tax rate increases, the marginal benefit to human capital investment goes down for those who become top earners. Therefore, the top tax rate is revenue maximizing when the revenue from the top income group is still rising. The result is a flatter Laffer curve that peaks well before the benchmark rate. The second problem is that estimates using the traditional formula include as income capital gains and qualified dividends which are taxed at a different rate. The authors exclude these capital gains and qualified dividends from income during estimation.

Two additional elasticities are needed to characterize the optimal tax rate. The first elasticity represents how top earners' other income sources that are not taxed at the top marginal rate respond to changes in one minus the top tax rate. The second elasticity represents how non-top earners income responds to changes in one minus the top marginal tax rate. Using U.S. data, the authors estimate these elasticities based on an exogenous human capital model where skill investment does not depend on the top tax rate and for an endogenous human capital model where skill investment does depend on the tax rate. The fact that the new elasticities are positive results in a lower estimate than the commonly cited 73%. With the exogenous human capital model, the estimate is 59%. In the endogenous human capital model where skill investment depends on the top tax rate, the optimal rate is estimated to be 49%.

During the presentation, participants pointed out that human capital stock in the model is unidimensional, and may not fully capture the complexity of skill investment. The author responded that the model could be easily extended to include a more detailed description of human capital and that the results would still hold. A participant expressed interest in the empirical dispersion of time investment based on the model, but this information was unavailable during the presentation. There was discussion regarding the idea that top earners' income depends on factors unrelated to their marginal product of labor. Perhaps becoming a top earner depends on factors (family wealth for example) that are not related to skill investment. A participant added that because agents in the empirical exercise were age 25 and older, it would be interesting to know more about what skill investment represents after this age. Another participant

had an interest in comparing the estimated elasticities with micro estimates, but these micro estimates were currently unavailable. Finally, a participant suggested that it might be interesting to stratify the analysis based on educational attainment. Skill investment after the age of 25 for those with an undergraduate versus graduate education could have different dynamics. ◊

The Politics of Flat Taxes
Daniel R. Carroll, Jim Dolmas, and Eric R. Young

Tax systems around the world differ in their overall rates and in terms of the mix between consumption, labor income, and capital income rates. Consider Norway and the U. S. as two contrasting examples. In the first country both taxes and transfers are high, and in the second one they are low. Besides that, some countries raise revenue using relatively more distortionary capital taxes instead of more efficient ones, like consumption taxes. In their paper the authors study if the mentioned differences arise as consequences of political (voting) structures.

Previous literature has studied political outcomes in the growth model with interaction between inequality, mobility and policy, but those studies were restricted to a single policy variable. The authors extend that literature by studying the determination of flat taxes through multi-dimensional voting in a model with endogenous inequality and mobility, and non-trivial decisive voter types.

The authors extend the framework of Aiyagari (1994) by including elastic supply of labor and a government that finances its spending through flat taxes on consumption, and labor and capital income, and runs a balanced budget through a lump-sum transfer in every period. The economy is initialized at the average tax and transfer levels of the U. S. and households vote once-and-for-all over a wide range of policy options. For each tax policy the authors compute the final steady state, the transition path and the payoffs of each household, which determine the vote. Finally, a Condorcet winner (i. e. a tax policy that defeats all other in pairwise competition) is found by iteratively eliminating Pareto dominated policies and keeping the tax policies that survive under agenda setting (the Uncovered Set) and are played with strictly positive probability in some mixed-strategy Nash equilibrium (the Essential Set).

The Condorcet winner sets a tax on consumption of

16%, 0% on labor income and 19% on capital income. Additionally, in the long run transfers are zero. Taxes on labor income are set to zero since the middle class are reluctant to tax their primary source of income and the poor expect higher wages due to mean reversion of their labor productivity. Also, the non-working wealthy do not like high labor taxes, since these taxes reduce the return on capital by decreasing the supply of labor. Consumption and capital income taxes are non-zero, but low, for the following reasons. First, both taxes target the inelastic initial distribution of wealth, so they are preferred by the initially poor. Second, a tax on consumption is regressive, so voters are reluctant to set it high. And third, even though a tax on capital income is progressive, it reduces wages in the long run so voters do not set it very high. And finally, transfers are set to zero because it is appealing to everyone. The middle-class and the wealthy pay more in taxes than they receive in transfers, so they choose zero transfers. And while the initially poor receive more in transfers than they pay in taxes, the expectation of them to become middle class makes them to prefer zero transfers too.

One concern of the conference participants was that the zero transfers result depends on the initial distribution of wealth and on households' mobility. The presenter agreed and said that they ran a version of the model in which there is no mobility (that is, labor productivity is fixed), and as a result transfers and taxes on consumption and capital income are considerably larger, but labor income tax is still zero. ◊

Child-Related Transfers, Household Labor Supply and Welfare
Gustavo Ventura, Nezih Guner, and Remzi Kaygusuz

This paper discusses the effects of individual childcare transfers on household welfare in the US, and compares them to alternative policies. Using a life-cycle equilibrium model that incorporates labor supply decisions, heterogeneous education/productivity levels, marital status, as well as heterogeneous fertility and childcare characteristics, the authors consider two types of transfers: childcare subsidies and Child and Dependent Care Tax Credits (CDCTC), which are contingent on market work, and Child Tax Credits (CTC), which are incontinent on market work and childcare costs. Using US census data, they conduct a quantitative analysis to test the model's predictions. Their main findings are that while CDCTC transfers lead to a substantial increase of female labor supply, CTC transfers reduce female labor participation. In particular, expanding the CDCTC (CTC) subsidies by 75% leads to an 8.8% increase (a 2.4% decrease) of the female labor participation in the long run. This asymmetric effect is found to be especially noticeable at the bottom of the skill distribution. The authors further document heterogeneous welfare effects across households: While young and poorer households with children gain significantly from the transfers, an expansion would not receive a majority support across households.

One question that came up was whether households make endogenous fertility choices in the model. Dr. Ventura explained that children are exogenously given to households in the model, and that there are neither endogenous fertility differences, nor is there investment into children. He added that within a household, all children have the same age. Dr. Ventura further clarified that randomization occurs at the start of life, and individuals learn this at the beginning of the period.

One participant asked whether there exists a market of childcare service, which Dr. Ventura confirmed, pointing out that childcare costs increase in the number of childcare units in the model. Another participant was interested in how childcare was produced in the model. Dr. Ventura clarified that resources are taken away from production to finance childcare centers with it. In particular, households with children with receive lump-sum transfers, and people are taxed individually (via an income tax) to finance these subsidies.

Another participant wanted to know why the CTC performs always better in the model than universal subsidies, and Dr. Ventura answered that the reason is that the CTC transfer is a lump-sum.

The discussion then shifted to the absence of altruism in the model. When one of the participants pointed out that people in the model do not like their children, Dr. Ventura replied that nobody dislikes them either. Another participant highlighted that people might also exhibit social preferences towards their grandchildren or other people's children, and Dr. Ventura explained that people would need to be extremely altruistic to create a majority for childcare subsidies in the model. ◊

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