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

Volume XV
No. 4
Spring 2022

FROM THE LAB

IN THIS ISSUE

11th Advances in Macro-Finance Tepper-LAEF
conference held April 8–9, 2022

LAEF
Laboratory of Aggregate Economics and Finance
UC **Santa Barbara**

Volume XV
No. 4
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FROM THE LAB

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Director's Message

Finn Kydland

On April 8-9, 2022, the Tepper School of Business at Carnegie Mellon University and the Laboratory for Aggregate Economics and Finance at the University of California Santa Barbara held the *11th Conference on Advances in Macro-Finance*, designed to bring together leading scholars at the intersection of macroeconomics and finance. When we first embarked on these conferences more than a decade ago, who would have thought they would be that "durable"? The combination macro-finance clearly struck a chord. I recall Lars Kuehn and Nicolas Petrosky sitting with me at CMU, conspiring to try to make it work. Ex post, it's not such a great surprise it did work. At CMU, there was always considerable interaction among faculty officially listed in macroeconomics and those listed in finance (at CMU that field is called Financial Economics, a sign that the economics aspect is regarded as more essential than in the typical finance department at other universities). This 11th conference consisted of selected papers, with a formal discussant for each paper. Welcomed were both theoretical and empirical research on topics including, but not limited to: impact of financial and investment frictions; labor markets; credit risk and corporate financing; models of risk premia; determinants of income and wealth inequality; household finance; and taxation. In addition to Lars and me, the academic organizers included three enthusiastic members of the Tepper School: Tetiana Davydiuk, Deeksha Gupta, and Ariel Zetlin-Jones.

11th Advances in Macro-Finance Tepper-LAEF

April 8–9, 2022

Dean Corbae – University of Wisconsin
Joel David – Federal Reserve Bank of Chicago
Ricardo De La O – University of Southern California
Thomas Drechsel – University of Maryland College Park
Vadim Elenev – John Hopkins University
Deeksha Gupta – Carnegie Mellon University
Lukas Kremens – University of Washington
Lars-Alexander Kuehn – Carnegie Mellon University
Shohini Kundu – UCLA Anderson School of Management
Finn Kydland – UC Santa Barbara
Ye Li – Ohio State University
Lars Lochstoer – UCLA Anderson School of Management
Konstantin Milbradt – Northwestern University
Stavros Panageas – UCLA Anderson School of Management
Nick Pretnar – UC Santa Barbara
Lawrence Schmidt – MIT
Liyan Shi – Carnegie Mellon University
Alessandro T. Villa – Federal Reserve Bank of Chicago
Ariel Zetlin-Jones – Carnegie Mellon University

Photo above: Campus Point, UC Santa Barbara. Credit: Tony Mastres. UC Santa Barbara

Competition, Stability and Efficiency in the Banking Industry

Dean Corbae and Ross Levine

A policy change that leads to bank openings or closures affects the degree of competition in the banking market, where more competition increases the market's efficiency at the cost of stability. Policymakers tend to take the market structure as given when deciding on a new policy, rather than accounting for the policy's potential to make the market more or less competitive. Corbae and Levine's research recognizes that banking regulations can change the number of banks in the market and provides a tractable dynamic model of the banking industry to determine the optimal degree of competition.

Corbae presented a model in which bank managers Cournot-compete for insured deposits and choose the riskiness of their loan portfolio, which determines the probability of bank failure. Banks choose riskier portfolios in a more competitive market. A participant asked whether the probability that the bank succeeded increased with the size of the loan portfolio. Corbae explained that the answer depended on the slope of the probability function and the amount of deposits. Policymakers in the model choose entry barriers, governance, leverage constraints, and the cost of external funding.

The model produces a Cournot equilibrium that is the solution of a system of three equations with three unknown variables: risk taking, deposit funding and the number of banks in the market. A participant asked about the role of friction in the economy, specifically in the form of depositors underpricing in risk due to the availability of deposit insurance. Corbae responded that frictions were not included in the model, even though deposit funding tended to be insured in the real world for both large and small banks.

When Corbae displayed the results of his model calibration, a participant asked how he used the data to create a stability parameter in order to define the probability of a bank's success. Corbae clarified that he used the variance of the return on the bank's stock. The participant suggested that the probability function could be parameterized using data on the policy parameters set by the government. Corbae explained that he prioritized simplicity in creating and calibrating this model, and that a more complex framework would be required to incorporate the policy parameters into the probability function. He acknowledged that using the variance of the return on the bank's stock led to a poor calibration, and said that he was unsurprised by the poor calibration given the model's simplicity.

Corbae showed counterfactual analysis demonstrating that policies that affected a bank's profitability led to long-run changes in the number of banks in the market. He also presented the results of an empirical analysis of contractionary monetary policy, which showed that a shock in the form of an increase in the federal funds rate made banks more likely to take on risk, and that a more competitive environment reduced both the likelihood of receiving a shock and the likelihood of assuming more risk. He concluded by explaining that his framework was consistent with other empirical work on competition and stability in the United States and provided a new and tractable analytical framework to understand the interaction between competition, stability and efficiency.

The Geography of Bank Deposits and the Origins of Aggregate Fluctuations

Shohindi Kundu, Seongjin Park and Nishant Vats

Bank balance sheets, which determine the bank's ability to survive shocks, consist of assets and liabilities. This paper introduces a new dimension: geographic concentration of bank deposits, which makes banks vulnerable to local shocks in the areas where they have many branches. The key finding is that local deposit shocks can account for aggregate fluctuations in economic growth, with frictions leading to the aggregation of idiosyncratic shocks.

Kundu provides evidence that banks are geographically concentrated, using data from the Federal Deposit Insurance Corporation. Participants had several questions about the cause of this concentration. One asked whether this result was driven by small banks, rather than an unequal distribution of deposits at large banks. Kundu provided evidence that the four largest banks exhibited geographically concentrated deposits. Another asked whether deposits were always raised and reported in the same place, or whether misreporting simply created

the appearance of geographic concentration. Kundu noted that mismeasurement could occur, but said that it would conservatively bias her results if it were present.

One participant suggested that the concentration of bank deposits was likely to align with the geographic concentration of the population, and that the concentration of bank deposits was therefore not an interesting phenomenon on its own. Kundu responded with a map of the areas with high concentrations of deposits, showing that these areas were scattered across the country rather than appearing only in major population centers.

Kundu used natural disasters to examine the effects of local shocks on aggregate deposit growth. She showed that natural disasters resulted in both immediate and long-run declines in local deposits. A participant asked whether depositors who left the local area after a natural disaster would contribute to the deposit shock if they did not switch banks, but did switch the address on their account to their new location. Kundu explained that the bank's internal accounting practices determined whether individuals who changed their addresses were classified as having switched to another branch, and that anyone who moved their deposits to a new location was considered part of the deposit shock.

Kundu explained that even individuals who did not move when a natural disaster occurred typically consumed more from their savings in the disaster's aftermath, which also lowered deposits. A participant suggested that Kundu provide an event study to show whether the shocks' impacts depended on the number of banks in the area. Kundu responded that her current results were already sufficient to show that the mechanism was the large shocks hitting large-deposit counties with large banks.

When Kundu presented evidence that granular shocks to banks could explain 3.3 percent of the variation in economic growth, participants questioned whether she was able to separate the effects of reduced bank deposits from the various other effects of natural disasters on economic growth. Kundu showed that a regression of gross domestic product growth on the disaster shock itself had null results, suggesting that the effect of natural disasters on economic growth occurred through only the deposit channel.

Waiting for Capital: Dynamic Intermediation in Illiquid Markets

Barney Hartman-Glaser, Simon Mayer and **Konstantin Milbradt**

Time and information costs limit firms' access to capital markets, but many firms have access to an intermediary that can provide on-demand financing at a higher cost than capital markets. Konstantin Milbradt presented research with two goals: first, to determine the contract that should optimally arise between an intermediary and a cash-constrained firm with infrequent financial market access; and second, to study how frictions in financial market access interact with the risk of firm liquidation and an intermediary's incentives to lend.

Upon hearing the research goals, a participant asked about the distinction between the optimal firm-intermediary contract and a credit line, which provides insurance against shocks. Milbradt explained that the optimal contract does resemble a credit line, with the addition of an equity stake in the firm.

Milbradt introduced his model, in which a firm is exposed to risky cash flows and only has access to outside investors at Poisson-distributed times. An intermediary with deep pockets supplies costly on-demand financing. A participant asked whether each intermediary matches with only one firm, and Milbradt explained that a single firm extracts the full value of one intermediary's contract. The intermediary lacks an outside option, so it is willing to stay with the firm as long as the contract delivers a value of at least zero.

Another participant argued that the intermediary should require positive value from the contract, because the intermediary has its own consumption needs. Milbradt clarified that the intermediary has savings that meet its consumption needs in his model, which allows him to separate the firm's and intermediary's needs for consumption smoothing. A participant compared the intermediary to a loan shark and argued that it should require compensation for the volatility of the income it receives from the firm. Milbradt explained that intermediaries in his model do charge a risk premium, but that the risk premium only depends on current risk rather than the amount of risk the intermediary has been asked to assume in the past.

In the solution to his model, Milbradt established conditions under which an intermediary is willing to lend to a firm that has run out of cash. He showed that the prospect of future refinancing in the market increases the intermediary's willingness to extend a

line of credit to the firm and take an equity stake in it.

A participant asked why the opportunity for future refinancing affects the intermediary's decision, and Milbradt explained that the intermediary is willing to accept short-term losses when it expects sufficiently large gains from a future sale of the firm. Another participant asked whether firms will ever borrow from the intermediary when they are not out of cash. Milbradt responded that the firm does not rely on the intermediary at all until it runs out of cash. Although the entire firm could be sold to the intermediary when it does run out of cash, the intermediary does not buy the entire firm due to a preference for risk-sharing and chooses an equity stake instead.

Bank Credit and Money Creation on Payment Networks: A Structural Analysis of Externalities and Key Players

Ye Li, Yi Li and Huijin Sun

A bank cannot control its depositors' transactions, which redistribute liquidity between banks. Banks experience payment outflows, in which their own depositors send money to other banks, as well as inflows, in which their depositors receive money from other banks. The transition from deferred net settlement to real-time gross settlement in payment systems has affected the credit supply by eliminating the mechanism that used to ensure that each bank's inflows offset its outflows. This paper studies how the credit supply depends on the network topology of payment flows between banks and provides evidence that strategic complementarity dominates strategic substitution in lending decisions.

When Li introduced his research question, a participant asked why inflows and outflows did not have a net effect of zero on the bank's total deposits. Li explained that frictions in the inter-bank lending market were the cause of the inequality between inflows and outflows. Another participant pointed out that, based on welfare theorems, prices in the interbank market should resolve any imbalances in deposits between banks by raising the price that a bank is willing to pay for a loan when it is low on credit. Li responded that he used evidence from the literature to support his assumption of frictions that would prevent the inter-bank market from solving the problem by setting prices. He pointed out that policymakers were aware of the market's inability to resolve the imbalance and that it had been a major motivator for the payment system reforms of the last thirty years.

Another participant suggested that strategic complementarity could create coordination failures, even in the absence of frictions in the interbank lending market. Li agreed that strategic complementarity could create a coordination failure by causing all banks to try to expand or contract their balance sheets at the same time.

Li explained his model, in which a loss of deposits increased demand for credit because depositors with less money in their accounts needed to borrow more from their bank. Banks also faced shocks that affected their willingness to lend, and all banks had common information about the set of shocks that could affect them and all of the other banks.

A participant questioned the importance of bank network topology in this model, suggesting that the network should only matter if it conveyed information about shocks. Li responded that he found empirical effects of network topology even in the absence of asymmetric information. Li used data that began after the transition from deferred net settlement to real-time gross settlement. A participant suggested that Li provide evidence of differences before and after the transition to support his claims about the transition's importance. Li agreed that finding data from before the transition for comparison would strengthen the paper.

To obtain his main results, Li compared a uniform network, in which all banks were equally connected, to the network in the data, in which connections varied substantially. He found that the topology of the real payment network did amplify volatility compared with the uniform network, but that the difference was smaller than he expected. His paper showed that payment topology determined banks' systematic importance for credit supply and that 90% of credit supply volatility is generated by just 10% of banks.

Earnings-based Borrowing Constraints and Pecuniary Externalities

Thomas Drechsel and Seho Kim

Firms face two types of credit constraints: asset-based and earnings-based. Drechsel studies the pecuniary externalities that arise from earnings-based borrowing constraints, upon which 80% of corporate debt is based. According to his research, firms with earnings-based constraints under-borrow. By not internalizing the effect of rising input prices, such as wages, Dreschel argues, they face a tightened constraint.

This differs from asset-based borrowing, which results in over-borrowing of firms as has been well-demonstrated in past research. Drechsel considers the labor market to explain his finding and suggests that regulatory authorities should encourage firms to borrow if they are under earnings-based constraints. In addition, he emphasizes the importance of understanding which constraints matter in which markets for proper macroprudential policy.

At the beginning of the talk, participants raised questions to understand the setting and the constraints. One participant asked about whether sticky wages were considered. Drechsel responded that the labor market in the study is a competitive market, but that they are staying away from sticky wages because incorporating sticky wages would alter their conclusions.

Another participant wondered what the difference would be if the problem were solved without the pecuniary externalities and whether the conclusions were merely the result of price change. The presenter answered that the planner can move allocations around and doesn't need to think about prices. However, there is a constraint that the planner cannot do anything about, and prices do appear in the constraint.

The presenter also received a question about whether they consider the setting where both earnings-based and asset-based constraints are present at the same time. He answered that they would compare the situation where there was one or the other constraint and look at some refinements of the earnings-based constraint.

Drechsel introduced the main model using intuition. He emphasized that agents' endogenous choices affect prices in equilibrium, which gives rise to the externality. The direction of this price change can vary depending on the constraint. He began explaining the asset-based constraint that was familiar to participants and explained that borrowing can be limited by some fraction of the resale value of capital. He said this is a typical Kiyotaki and Moore (1997) constraint, but one participant raised doubts about this, saying that the value of capital is in the next period in the Kiyotaki and Moore model. The presenter answered that it depended on the timing of the model and did not make a meaningful difference.

While giving empirical evidence, Drechsel referred to his previous work studying earnings-based constraints' effects on business cycle dynamics. In this framework, investment-specific shocks reduce the relative price of capital, but stimulate the economy and wage earnings. One participant asked whether there are a lot of cross-industry differences, and the presenter said that there is heterogeneity across firms. The participant followed up, asking whether that heterogeneity holds not only across industries but also across other variables, such as firm age. The presenter suggested that this topic is underexplored, adding that it is tricky to observe financial variables when you go to very young and small firms.

Risk-Taking, Capital Allocation and Optimal Monetary Policy

Joel M. David and David Zeke

David and Zeke extend the New-Keynesian real business cycle model with heterogeneity in firms' exposure to aggregate shocks and with the reallocation of the capital. Their research focuses on the endogeneity between aggregate dynamics in TFP (total factor productivity) and the micro-level allocation of capital. Because the two factors are functions of each other, they co-determine the fixed-point equilibrium, which can then be adjusted by monetary policies.

With this model in hand, the authors discuss the positive and normative implications for monetary policy. Optimal policy, they say, should depart from price level stabilization, but countercyclically, correcting the distortion of allocation from the TFP dynamics.

The main model follows the standard assumptions of typical households with separable CRRA utility functions on consumption and leisure under the sticky wage setting. The derived aggregate labor supply contains a "wedge" term that captures the effects of taxes and subsidies on wages. The solved marginal rate of substitution, or the stochastic discount factor (SDF), is the ratio of intertemporal consumption, adjusted with a risk attitude parameter and the time discount factor. Aggregate capital stock is fixed: the only decision in this economy is to allocate the capital among departments.

A participant asked if the model could be extended with the stationary SDF. David responded affirmatively, and the solution still worked fine. On the production side, there is a final goods producer, who aggregates all the intermediate goods production. For the intermediate goods producers, the firms are heterogeneous over the productivities, where the firms do not share a common aggregate productivity shock but have different loadings on the same shock. The firms may be more or less sensitive to aggregate shocks.

The paper introduces the "distortional wedge" in capital that captures nothing but distortions. Because the total amount of capital is fixed, the distortion factor only affects the allocation in capital. This distortional wedge has a constant elasticity to the shock in TFP. The paper claims that the wedge is countercyclical.

In the equilibrium, we can see that the aggregate TFP is determined by the distribution of the capital, and the distribution of the capital is also determined by TFP. It demonstrates the first main result of the paper, that the aggregate TFP and the capital distribution are endogenously determined.

To discuss the effect of monetary policies, it's convenient to decompose the fluctuations in outputs into the fluctuations in TFP and a gap between the actual and potential outputs, which comes from the sticky wages.

Using the second order approximation, the motion of aggregate TFP can be written as an affine function of TFP, which can be decomposed into the level and the volatility terms that depend on the capital allocation. Intuitively, if there is more capital allocated to the procyclical firms, it will also make the whole economy more procyclical and thus increase the volatility. The firm-level risk premium is determined by three things: the risk that the firm takes, the exogenous volatility of aggregate shocks, and the risk-adjustment terms. The risk-adjustment terms capture all sources of aggregate risks and contain three parts: TFP, the capital wedge, and the output gap that can be altered by the monetary policy.

Monetary policies, therefore, can affect the aggregate risk and the micro-allocation of the capital. For example, if a countercyclical monetary policy is implemented, which decreases the output gap, the firms will then be incentivized to take more risks. Monetary policy that incentivizes risk-taking can help align the firm level productivity and the capital closer, and this will increase the aggregate TFP. The effects from the monetary policies are long-run effects, as they influence the TFP through capital allocation. The other observation is that monetary policies will be less effective for stabilization.

Can Monetary Policy Create Fiscal Capacity?

Vadim Elenev, Tim Landvoigt, Patrick Shultz and Stijn Van Nieuwerburgh

The world has experienced massive fiscal expansions. How the resulting debts will be repaid is an important question. Elenev and his coauthors propose that quantitative easing, forward guidance, and an expansion in government discretionary spending contribute to lowering the debt-to-GDP ratio and reduce the fiscal risk. They built a dynamic stochastic general equilibrium model in a New Keynesian setting. It has a new feature in that it can deliver nontrivial risk premia, which was difficult to do with the standard New Keynesian model.

A participant asked for a definition of fiscal capacity, and the presenter replied that it meant being able to repay the debt without raising too much tax later. Another participant questioned what the downside of the unconventional policy is. Elenev then described a crowding-out effect: forcing banks to hold all the reserves will result in less private capital financing.

Elenev's model consisted of government, intermediaries, and households. Think of intermediaries essentially as banks. Long-term bonds and short-term bonds were held by households and intermediaries, respectively. Participants raised questions about this portfolio allocation. Elenev answered that the model in which banks can also hold long-term bonds would be computationally much more difficult to solve. Therefore, Elenev said, forcing households to buy long-term bonds and banks to buy short-term bonds is important.

On intermediaries, a participant raised a point that the supplementary leverage ratio (SLR) used for the regulatory capital requirement, only applies to about 40 banks, a very small subset. The presenter largely agreed.

Elenev provided an endogenous regime-switching model of fiscal policy. In their model, the average interest rate on debt would be lower than the growth rate. According to his claim, if you maintain the same interest rate while shutting down shocks, the government is going to be able to persistently run deficits and refinance the growth.

The presenter showed how, in their model, different policies with additional fiscal and monetary stimulus affected the economy's recovery path. He compared these paths with the cases of automatic stabilizers and of transfer spending along with unconventional monetary policy continuing post-crisis.

An audience member questioned whether it was accurate to think that the government determined the price of debts beforehand, and the presenter backtracked on that.

Government Debt Management and Inflation with Real and Nominal Bonds

Lukas Schmid, Vytautas Valaitis and **Alessandro T. Villa**

High inflation and questions about fiscal and monetary policy management are ever present today. Villa and his coauthors develop a model of fiscal and monetary policy where a government optimally manages debt in the presence of inflation concerns. In their setting, the government can issue long-term nominal and real non-state-contingent bonds, the monetary authority sets short-term interest rates according to the Taylor rule, and inflation has real costs, as prices are sticky.

In their framework, nominal debt can be inflated away, but bond prices reflect elevated inflation expectations. Real debt prices are higher and more stable, but such debt constitutes a real commitment ex-post. A participant asked whether the non-contingent aspect of the real bonds was a driving force in the model, and the presenter affirmed that. Their results suggest that the optimal government debt portfolio includes a substantial allocation to both real and nominal bonds, which lowers inflation levels but increases inflation volatility in equilibrium.

Villa introduced their novel DSGE model of fiscal and monetary policy, and a participant tried to get intuition through an example. He asked how having non-contingent bonds, or real bonds, would generate sufficient standards to complete the market, instead of having contingent bonds in case there is a possibility of default of the country. The presenter answered that there was no default in his assumption, and since there is a borrowing limit, one can think of other countries by tightening borrowing and lending limits.

Villa then proceeded to show simulation results with risk aversion. He showed that there was much more inflation volatility with the baseline model, compared to the model without non-contingent or real bonds.

An audience member asked why, and the presenter answered that it was because inflation's effect on nominal prices would not be relevant for the Ramsey planner when real bonds were available. The questioner asked whether the Taylor rule coefficient would be kept constant, and the presenter confirmed this.

Villa showed an exercise revealing the role of maturity on optimal inflation and taxes. As maturity increases, both inflation and taxes become less volatile. Longer maturity allows the planner to spread the inflation policy intervention across multiple periods. One participant pointed out that the authors are making two separate changes when increasing the maturity, adding the periods and introducing some new horizons. He suggested an additional exercise allowing maturity increases, while the number of assets remains fixed. Other participants added to the suggestion, mentioning the addition of a geometric coupon, which the presenter also liked. Villa pointed out what he may have missed in his model and said he wanted to consider geometric decay as the third component.

Sovereign Bond Restructuring: Commitment vs. Flexibility

Jason Roderick Donaldson, **Lukas Kremens** and Giorgia Piacentino

Sovereigns in distress often renegotiate or "restructure" the terms of outstanding debts when the status quo is likely to result in outright default. Restructuring debt gives sovereigns a mechanism to change either the schedule or level of repayment to creditors, potentially improving outcomes for both parties. However, the option to restructure debts has a theoretically ambiguous effect for bondholders; while it may provide a preferable alternative to outright default, it could also incentivize sovereigns to act strategically knowing that the ability to restructure debts allows them to expropriate creditors' claims.

A landmark ruling by the English High Court in 2012 allowed the researchers to estimate the effects of lower barriers to restructuring on sovereign bond yields. The 2012 ruling held that consent solicitations—cash transfers from sovereigns to bondholders that incentivize consenting to restructuring—were legal, upholding a common practice used in sovereign debt restructuring. The authors find that the yield on bonds treated by the court ruling (those issued under English law) rose 14 basis points relative to a control group.

In addition to this direct effect, the authors show the emergence of an indirect effect on the yields for bonds issued under other legal doctrines by sovereigns that had outstanding debts governed under English law. The authors found that this indirect effect was substantial; yields on non-English law bonds issued by countries that also had outstanding treated bonds increased 13 basis points. The authors show evidence that the magnitude of this direct effect is decreasing in the spread between local- and English-law bonds prior to the court ruling. For every one percentage point of prior yield spread between the two types of bonds, the effects of treatment decline by 2 basis points. These results suggest that the court ruling decreased not only the likelihood of treated sovereigns to repay English-law debt, but also any other debt.

Several participants had questions over whether there may have been other channels. Another noted that the ruling may simultaneously affect all bonds issued in a given country, affecting private credit access and, with it, the real economy. This mechanism might confound estimates of the effects of easier restructuring if the change in private credit conditions changed market expectations of future government revenue. Another commenter posited that increased use of consent solicitations may have increased reliance on loans or the covenants included in sovereign debt contracts.

The authors posit a one-period model, in which a country's social planner makes a decision over whether to default on outstanding debts after learning the country's income that period. Several participants noted that a static model of borrowing, taking outstanding debt as given, may have difficulty explaining the dynamics of sovereign debt issuance. The author agreed, but noted that this did not preclude reconciling the instantaneous increase in borrowing costs observed in their empirical estimates with a one-period model where investors price bonds according to the risk of default.

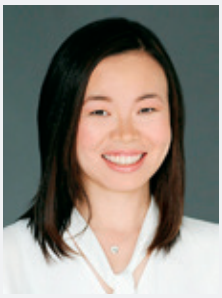
In the model, the sovereign enters the period with two types of outstanding debts due: those governed by English law and those governed by local law. The two are distinguishable in that the haircuts—the share of principal lost by the bondholder during a potential debt restructuring—differ. The authors assume that the haircut faced by creditors when local-law debt is restructured is larger than the one incurred by creditors on English law terms. The country's default decision is endogenous and determined after income is realized. These

endogenous default probabilities in turn determine the ex-*ante* bond prices investors demand in equilibrium. The authors show that the probability of default is strictly increasing in outstanding debts, decreasing the proportional cost of default, and strictly increasing in the magnitude of the haircut rate on either form of debt.

The researchers estimate sufficient statistics for the effects of increased haircuts on default probability. The authors find that the court ruling increased expected haircuts on treated bonds by 35 basis points. They further estimate that an ex-*ante* increase in expected haircuts of a percentage point leads to a 2.28 percentage point increase in the probability of default during the sample period. These findings suggest that commitment to not restructuring debt could both lower the costs of debt servicing for sovereigns, while simultaneously lowering the risk of default and corresponding litigation ensuing for all parties.

Fiscal Rules and Discretion with Risk of Default

Chiara Felli, Facundo Piguillem and **Liyan Shi**



The importance of fiscal rules has been highlighted amid the astonishing accumulation of debt in recent years. Imposing debt and deficit limits pose an important pair of philosophical questions: what degree of discretion should policymakers have when choosing government expenditure levels, and how can current policymakers seeking to discipline spending ensure that these rules will not be reneged on in the future?

Possibly uninsurable risks, such as pandemics, and democratic principles suggest that governments should have agency in allocating public resources. But what degree of tradeoff should be allowed when current borrowing takes resources from future, even unborn, generations.

Shi presents research using a model of sovereign borrowing to study optimal policies in a setting with fiscal rules and strategic default. In their particular setting, the government may choose to default instantaneously upon the arrival of a new political regime. Due to present bias in current government preferences, new regimes with different tastes may forgo the discounted value of future access to borrowing in order to increase present spending, leading to suboptimal default decisions.

In the model, governments enter the world with a random type that determines the marginal utility from government spending. While in office, the government chooses a path for spending and borrowing along with a discrete decision of whether to default on outstanding debt that maximizes their subjective welfare function. These two decisions in tandem determine the path of government debt and the interest paid on the debt throughout their term. At a constant arrival rate, the current government is replaced by a new government, which enters the world with a new type drawn independently of current debt levels or types. Seminar participants pointed out that the model may better reflect reality if spending could affect the arrival rate of new governments.

The authors offer a continuous-time model in which government borrowing takes the form of instantaneous revenue from net bond and interest payments on debt held by competitive, risk-neutral lenders. Lenders price debt according to expectations over the probability the government will default. As borrowing is also a function of the interest rate, this leads to two stylized facts in the model. The first is that a government, while in power, will never default unless it does so the exact moment it enters power. The second is that default probabilities are solely a function of outstanding debt, as this determines the set of types that will default in the event of a government turnover. To close the lending and borrowing portion of the model, re-entrance into debt markets after default is a random process with an arrival rate between zero and one.

The government's allocations and default decisions diverge from the first-best outcomes due to present bias in government preferences. In the model, the current government discounts the continuation value of welfare under future regimes by a factor between zero and one. This can lead to spending and default decisions that differ from optimal allocations from the perspective of a benevolent social planner with a constant discount rate.

A contribution of the paper is to characterize a principal agent constrained to instating rules that assign a level of government spending and a default decision solely based on a governments' revealed type and outstanding debt level each period. As the principal cannot observe government's types, this leads the authors to seek a set of rules that are Markov-perfect; under these rules each potential government, knowing the allocation and default rules, will have no reason to lie about its type. Explicitly, the rules are designed such that a government's subjective best decision

is always to reveal its true type to the principal agent. A participant noted that markets already should be able to infer government types based on spending paths – the authors agreed, but noted that this does not necessarily improve governments behavior with regard to social welfare.

The equilibrium solution has joint restrictions on spending and default. This manifests as a combination of a fiscal rule, which caps government spending based on outstanding debt levels, and a default rule, which mandates or precludes the government from defaulting.

Debate on the paper concluded with participants noting that it may be difficult in practice to enforce such rules given the inherent sovereignty of nations and the agency bestowed on governments representative of their populations. A debate emerged whether international bodies or monetary unions could be the appropriate governing bodies for enforcement of these rules.

When Do Subjective Expectations Explain Asset Prices?

Ricardo De La O and Sean Myers

The amount of variation in the prices of assets like stocks and bonds has long puzzled researchers. Ricardo de la O tries to help tackle some of these puzzles, presenting work co-authored with Sean Meyers.

The failure of traditional models using rational expectations to adequately explain the empirical behavior of markets has led to the adoption of behavioral models, along with models that incorporate imperfect information and learning. When asked an early question from an audience member, De la O pointed out that his research could not proclaim which of these various alternative models was correct, but rather could show that the predictability of previously unexplained fluctuations relied on errors of expectations.

A crucial point, De la O said, was that for subjective expectations to explain excessive variation, forecast errors must co-move with current prices. Errors in long-term inflation and in short-term nominal earnings growth played the largest roles, under the results of their estimation.

To measure these expectations, De la O looked to collections of professional forecast data. This drew some scrutiny from two audience members who raised concerns that these forecast data had well-established flaws, including tendencies for autocorrelation in their errors. One audience member asked whether the results of the paper could be driven by these problematic issues in forecast data alone. De la O responded that these concerns did not diminish the useful predictive power for prices of these forecasts.

Price in this realm is not a nominal asset price, but rather a multiple to some return of ownership. Price-to-earnings and price-to-dividend ratios were both considered here, and De la O seemed to agree with an audience member that price-to-dividend was a better choice, were it not for data limitations that made incorporation of price-to-earnings ratios necessary.

De la O largely seemed to agree with another point from the audience that subjective interest-rate expectations were a better choice as an explanatory variable than the inflation expectations from the Survey of Professional Forecasters that had been used.

Later, De la O discussed a behavioral model called fundamental extrapolation that could explain the long-term-inflation and short-term-earnings-growth errors. Under a fundamental extrapolation model, errors arise in long-run forecasts for persistent-shock variables, like inflation, and in short-run forecasts for transitory-shock variables like company earnings. After performing some structural parameter estimations on a fundamental extrapolation model, De la O said, the resulting dynamics were convincingly similar to those found in the time series for survey data and for empirical prices.

A few suggestions were made by audience members near the conclusion of De la O's presentation. First, the emphasis on R-square, or the explanatory power of the regression specification, should be shifted instead to the estimated coefficient. High R-square may mean little in the context of financial prices. And lastly, other potentially simpler specifications of subjective expectations could be considered as well, such as the use of a weighted average of past realizations.

The Real Channel for Nominal Bond-Stock Puzzles

Lars Lochstoer, Mikhail Chernov and Dongho Song

The correlation of stocks and bonds is a significant topic in finance, as the riskiness of owning both simultaneously is lower when the correlation is negative. Though this negative correlation has been the case for many years, there have been periods where this correlation flips to a positive sign, resulting in greater risk to a basket. Lars Lochstoer, in collaboration with Mikhail Chernov and Dongho Song, looks to changes in consumption dynamics, to help explain when this correlation would flip its sign, as well as other features of asset markets.

As a particularly relevant example, a shift in correlations that began in 1998 and seems to have persisted ever since could correspond to a shift in the makeup of consumption shocks, Lochstoer said. At any point in time, the economy could be subject to a combination of persistent and transitory shocks, and since 1998 consumption appears to be mainly affected by shocks that were persistent, with the exceptions of two transitory disaster periods of the financial and pandemic crises. Negative correlation in stocks and bonds that began around the same time could be reproduced by modeling standard neoclassical decision makers.

For more intuition about how this model would work, since the 1990s, negative consumption shocks resulted in longer bouts of weaker economic growth, and thus could be called persistent. In such an environment, bonds could hedge against reduced income. Owning stocks on the other hand would only compound the pain of negative income shocks. And the reverse of this is also true in times of growth. Prior to the 90s, however, in an environment where consumption shocks were followed by quick rebounds in growth, the attractiveness of bonds as a hedge would be drastically reduced.

To link their model to empirical prices, the authors selected preferences and calibrated their model parameters using standard assumptions in the literature and found they were able to replicate many qualities of actual asset markets. Much of this sort of work has been done in other papers in recent years, a point that Lochstoer acknowledged.

A discussant asked if Lochstoer had looked at whether the negative correlation had broken down in recent years, as inflation has increased amid the pandemic and the policy responses to it. Lochstoer replied that he hadn't tried to look into it yet.

An additional interesting feature of the model was that the consumption shock explanation for correlations would produce a flat yield curve in environments such as the post-1998 one, and an upward sloping yield curve in environments where there was risky, positive correlation between stocks and bonds.

While a few different audience members raised points throughout the presentation, the playfully contentious rapport with a particular discussant stood out, generating much of the conversation with Lochstoer. One key point that he raised was that real interest rates began falling rapidly around 1980, while the consumption growth decceleration began in the 2000s. Therefore a long-standing trend of the bond market preceded the dynamics in consumption that could purportedly cause this trend.

During this back-and-forth, another audience member mentioned recent research by an economic historian suggesting that real interest rates had in fact been falling for centuries. Lochstoer joked that he really didn't want to think about the implications of such research for his work, but perhaps would have to.

Technology-Skill Complementarity and Labor Displacement: Evidence from Linking Two Centuries of Patents with Occupations

Leonid Kogan, Dimitris Papanikolaou, **Lawrence D.W. Schmidt** and Bryan Seegmiller

In recent decades, U.S. output seems to have risen faster than wages. A rise in the skill premium and increased automation have worsened income inequality. Lawrence Schmidt presented work to reconcile these empirical observations in a model of skill-biased technical change, investigating how exposure to technological breakthroughs across workers and occupations affects labor displacement. By using textual analysis of patent data from 1850-2010, the authors claim to broaden the scope of technological innovations that can be studied.

A technological breakthrough is represented by a "novel and impactful" patent, distinct from previous patents but similar to subsequent patents. The problem of the patent distribution being truncated to the right was highlighted by an audience member. The authors deal with this issue by using a five-year time window on each side around the patent date.

These patents are then related to workers in specific occupations by comparing their similarity to occupation task descriptions using machine learning techniques. An audience member asked whether they assumed that occupations or tasks remain constant over time. Schmidt responded that this was so, due to data limitations. Another audience member wanted to know how patents could be assigned to industries that did not exist before a particular period such as electronics. Schmidt clarified that the authors directly use technology classes assigned by the patent office, harmonized over time.

The authors ran local projection analyses, projecting the growth rate of industry-level outcomes on the number of breakthrough patents. A one-standard-deviation change in breakthroughs results in a more than two percent change in output and productivity, but the labor share of output declines by 1.5 percent. An audience member was concerned about whether wages would mismeasure value added by new patents in more recent years. Schmidt argued that they find similar results when using W-2 data that includes stock options.

Another audience question related to the endogeneity of patents to economic conditions, but Schmidt clarified that their paper was not making any causal claims. They also included time fixed effects in their industry-level regressions and industry-time and occupation-time fixed effects in their worker-level regressions to account for labor demand changes. In response to a question about the interpretation of labor share declining, Schmidt explained that this effect pertained to the incumbent workers, not the workers in the new industries that emerged due to technological breakthroughs.

The regression results show that technological change is consistently negatively related to employment growth over the last 150 years, as well as negatively related to wage growth over the last 30 years. A standard deviation annualized growth in technology exposure results in a 43 basis point decline in the occupation's share in total non-farm employment per year over a 10-year horizon and 75 basis points over 20-year horizon. The pattern holds even after including industry-time effects, indicating that these changes were not specific to certain industries in decline. The authors can track the same workers over time and find that cumulative earnings decline by 1.5 percentage points in the five years after a standard deviation shock.

Effects are larger for non-college educated workers, older workers, and more highly-paid workers who face the most downside risk since their skills are more likely to become outdated and displaced. An audience member pointed out that their results for high-income workers were consistent with Guvenen et al. (2021), which examines the cyclicality of income risk. Schmidt agreed that while the empirical results are in line with other papers analyzing aggregate data, they may seem surprising in a canonical model of technology-skill complementarity until skill displacement is introduced.

By allowing for skill displacement in this model, workers who were previously highly-paid for their skills in a specific domain become outdated as a new technology emerges and then have to compete with lower-skilled workers. This raises the skill premium and wage growth of currently-skilled workers as they become relatively more scarce. Individual workers who experience skill devolution see large income declines. This redistributive aspect is often underanalyzed in the analysis of aggregate data.

To a question about whether it was workers who did routine tasks who were being displaced, in line with other studies, Schmidt responded that their paper looked at workers across the income distribution within an occupation, essentially controlling for the routineness of occupational tasks. He also highlighted that the definition of "routineness" was not stable over time. Another audience member was curious about effects for younger, high-skilled workers since age is correlated with wages. The authors find that conditional on age, the negative income gradient still holds for higher-paid workers.

Value without Employment

Simcha Barkai and **Stavros Panageas**

Stavros Panageas presented his work with Simcha Barkai on the secular decline in the share of aggregate employment contributed by younger firms since the 1980s, a phenomenon noted in prior work by Haltiwanger et al. (2013). Despite their outsize contribution to aggregate sales and stock market capitalization, there has been a fall in gross labor flows, as well as in firm entry and exit rates, indicating a general decline in business dynamism. This is attributed to the new cohort of firms having high average revenue product of labor and low marginal revenue product of labor, and raises questions about long-run outcomes for employment generation, output, and consumption.

An audience member asked if these effects were due to the extensive or intensive margin – whether there were fewer younger firms or younger firms tended to hire less. Panageas clarified that they found both effects to be relevant, but the intensive margin was especially important. In response to a question about non-publicly traded firm data, he stated that they include data from publicly traded firms, as well as data from exit events for venture-capital-funded firms. Another audience member asked if drivers for Uber would be considered employees. Panageas agreed that the existence of subcontracting was an issue, but only to the extent that it differentially affected young and old firms.

The paper uses data from firms traded on the NYSE, AMEX, and NASDAQ, combined with data on firms' founding year. They study contributions of young firms to market valuation, employment, and sales. The results for firms in Compustat show a drop in contributions to employment, which is consistent with Haltiwanger et al..

The authors supplement this analysis with Pitchbook data, which provides post-money valuations at the time of firm exits (IPO, mergers and acquisitions). Aggregate exit values for each firm cohort in each year are deflated by aggregate stock market capitalization. The cohort analysis shows that except for the 1995-99 cohort, which stands out, there does not seem to be much difference between older and newer cohorts in market value creation. The authors plan to do a similar exercise for sales using Census data. An audience member asked if a similar cohort analysis could be done for employment, but this was not possible due to unavailability of employment data in Pitchbook.

Employment data from the National Establishment Time Series (NETS) was used, but drew some debate about its quality. Panageas presented a simple model that could be empirically tested using the NETS data to show how the relationship between revenue and labor was changing by cohort. Consider two identical establishments, one of which is purchased by a young firm and the other by an old firm, at the same purchase price, indicating that the present value of profits is equal for both firms. If the establishment purchased by the younger firm has fewer employees, this must mean that its marginal revenue product of labor is lower whereas higher profits per employee indicate the average product of labor must be higher. This conclusion holds empirically for the post-2005 period.

To derive the long-run implications for output and consumption, the authors build a stylized model of firm dynamics based on Hopenhayn et al. (2018). There is a continuum of monopolistically competitive firms with both exogenous and endogenous exit. Firms are heterogenous in their productivity due to idiosyncratic shocks, but there is no aggregate risk. Firms choose capital, labor and endogenous exit to maximize market value. The representative final goods producer combines intermediate inputs with heterogeneous markups as per Kimball (1995).

An audience member asked if the cross-section showed that small, young firms had higher markups than bigger firms, unlike other papers that show larger firms have higher markups. Panageas clarified that firms had fixed labor costs in the model; so conditional on survival, labor share would mechanically go down. There is a closed-form solution for the steady state, but the transition path has to be computed numerically. In the simplest case with no capital and the model parameterized for lower demand elasticity to account for the declining labor share, there is a decline in dynamism indicated by declining gross labor flows, declining exit rates, and an increase in TFP dispersion.

The authors conclude that the drop in labor share by itself is not a matter of concern in the long run, but if the productivity or markup share was changing, then there may be a bigger impact on steady state consumption. In a multi-sector model, the within-sector rise in markups (intensive margin) has a much larger impact on the steady state than an across-sector shift (extensive margin). An audience member noted that this ignores the distributional impact of a fall in labor share, but the focus of this paper is on the aggregate long-run impact.

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Special thanks for their accurate and concise summaries of the presentations go to the following UCSB Economics PhD students:

Alexander Abajian
Akanksha Arora
Eunseo Kang
ChienHsun Lin
Sarah Papich
Ravi Vora

Copy editor **Ravi Vora**

Design and production: **Monica Pessino, Ocean o' Graphics, MSI**

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