UC **SANTA BARBARA**
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FROM THE LAB

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XXIV Workshop on Dynamic Macroeconomics

Presentation Summaries

Note: speakers are highlighted in author listings

10th Advances in Macro-Finance Tepper-LAEF

Director's Message

Finn Kydland

The two conferences whose proceedings are summarized in this issue are examples that LAEF, under the right circumstances, will support events taking place far from Santa Barbara, in these cases Vigo, Spain, and in Pittsburgh. This last conference in Spain, in the castle of Soutomaior just north of Vigo, represented the 24th annual Advances in Dynamic Macroeconomics Workshop. From the very beginning, a driving force behind these workshops has been Tim Kehoe, University of Minnesota. He gets local assistance from Universidade de Vigo, in recent years through the tireless efforts of Jaime Alonso and his wife Susi. The idea behind the conference is to have advanced PhD students be allocated an hour to present his or her main paper in front of 6-8 "seasoned" professors. In principle, the students could come from anywhere in the world, but in practice mostly from Europe, with a sprinkling of a few students from the U.S. I'm sure most students who have gone through with this experience will attest to the fact that the sessions are intense, but that everyone surely appreciates the ultimate effect on presentation skills and final quality of the paper.

The "seasoned" professors this time, in addition to Tim and me, were Arpad Abraham, European University Institute, Juan Carlos Conesa, Stony Brook, Antonia Diaz and Evi Pappa, Carlos III, Franck Portier, Toulouse School of Economics, Pau Pujolas, McMaster, Victor Rios, Penn, and Kim Ruhl, Wisconsin. I had attended the second workshop, in 1996, but for various reasons had not participated until joining again in 2014. From then on, I've attended all of these workshops.

The funding had generally come either directly from Universidade de Vigo or from funds they were able to raise for that specific purpose. By 2014, fund-raising had become quite difficult (the Spanish economy being what it was), so that year Tim and I agreed to speak at an event for the general public organized by a major bank in Vigo. In return, the bank would fund next year's workshop. In the end, the bank reneged on its promise, and that's when I decided, through LAEF, to support the workshops and if necessary help with the funding (essentially guarantee that planning can proceed). It's hard to think of an event more worthy of such support. We know from years of experience that the 15 or so speakers every year are candidates to evolve into world leaders in the economics profession.

In practice, the Vigo workshop consists of a grueling first day, until well into night, then continuing next day until a late lunch. After lunch the second day

comes the big social event, as most participants head for the rafting trip down the Minho River on the border between Spain and Portugal. I say most, as I'm not a swimmer and would not be comfortable in a river even wearing a life vest. So I get some work done, and wait for everyone to return, at about 10. I may sneak into the restaurant and get a head start on the delicious jamon (Spanish ham) and other local delicacies, and then, after everyone has returned from the rafting, socialize for a couple of hours before the big scaring-away-the-witches ceremony at around midnight, in part featuring flaming liquids that turn into a strong drink. Of course, next day we're all set for the final sessions of the workshop.

The summarizing for the Vigo conference this time was shared between a Carnegie Mellon student, Nick Pretnar, who also presented his paper (co-authored with me) "The costs and benefits of caring: Aggregate burdens of an aging population," and UCSB student Travis Cyronek, who made the trip for that purpose and to take in the goings-on as a great learning experience.

Tim and I are in agreement that we'll do our best to make sure the 25th anniversary Vigo workshop will indeed take place. Then, presumably, new blood will take over. We've heard some tentative promises as to who they may be, so we're not worried!

The second conference summarized here is the 10th annual Tepper-LAEF Macro/Finance conference. And who would have thought, when we started it, after a suggestion by Lars-Alexander Kuehn and Nicolas Petrosky-Nadeau, that it would last that long. We seem to have been the first to put together a conference focusing on the intersection of those two fields in one event. It turned out to be a wildly successful combination. Researchers kept submitting great papers and nine conferences followed!

The academic organizers of this one are all Assistant Professors at Carnegie Mellon University: Tetiana Davydiuk, Selman Erol, and Deeksha Gupta. The invitation encouraged researchers from all over the world to submit papers – they could be theoretical and/or empirical on topics such as 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. Partly for historical reasons, the conference spends two years in Pittsburgh, then one year in Santa Barbara, then two years back in Pittsburgh, and so on. Thus, this 10th conference took place in Pittsburgh. LAEF did fly out two UCSB PhD students, Woongchan Jeon and Yongwook Kim, to take care of the summarizing.

XXIV Workshop on Dynamic Macroeconomics

July 8–12, 2019

Agustin Samano Penaloza – University of Minnesota
Ana Moreno-Maldonado – European University Institute
Andrey Alexandrov – University of Mannheim
Antonia Díaz – Universidad Carlos III de Madrid
Arpad Abraham – European University Institute
Baltasar Manzano – Universidade de Vigo
Carlos de Miguel Palacios – Universidade de Vigo
Christian Hoynck – Universitat Pompeu Fabra
Christine Braun – European University Institute
Diana Van Patten – UC Los Angeles
Eduardo Gimenez – Universidade de Vigo
Evi Pappa – Universidad Carlos III de Madrid
Finn Kydland – UC Santa Barbara
Francisco Javier Rodríguez Roma – Universidad Carlos III de Madrid
Ismael Gálvez Iniesta – Universidad Carlos III de Madrid
Jaime Alonso Carrera – Universidade de Vigo
José María Martín Moreno – Universidade de Vigo
José-Victor Ríos-Rull – University of Pennsylvania
Juan Carlos Conesa – Stony Brook University
Kim Ruhl – University of Wisconsin
María Jesús Freire Serén – Universidade de Vigo
María Montero Muñoz – Universidade de Vigo
Nicholas Pretnar – Carnegie Mellon University
Oliko Vardishvili – European University Institute
Patrick Moran – University of Oxford
Sergio Feijoo Moreira – Universidad Carlos III de Madrid
Stephane Bouche – Universidade de Vigo
Tim Kehoe – University of Minnesota
Timo Reinelt – University of Mannheim
Travis Cyronek – UC Santa Barbara
Vladimir Smirnyagin – University of Minnesota

Photo above: Castelo de Soutomaior. Credit: Xoan Anton Castro Barreiro. Wikimedia Commons

Uncertainty Driven Entry and Exit over the Business Cycle

Vladimir Smirnyagin

The author attempts to answer the question as to how time-varying macro-uncertainty affects the aggregate behavior of the economy. The main channel through which uncertainty is propagated is investment in firms. This idea distinguishes between investment in newer firms and in established, older ones, which is important for understanding how heteroscedastic, aggregate total factor productivity (TFP) shocks impact aggregate investment. The paper names several important results. First, volatility in aggregate GDP (output) growth rates impacts investment in newer firms more than in established ones. Second, by incorporating the channel of firm entry and exit, calibrations from the author's main workhorse model suggest an approximate 25% stronger decline in output and 100% stronger decline in investment relative to a model without firm entry and exit. During the seminar, the speaker responded to several questions pertaining to the underlying motivation for this exploration, for example why TFP shocks matter more than other aggregate shocks, such as those pertaining to changes in monetary policy, fiscal policy, or the consumption/savings behavior of households. The speaker noted the dearth of research examining how investment is affected by TFP shocks through both the entry/exit and firm age channels.

Using investment data for United States businesses obtained from the Compustat Quarterly dataset, a number of interesting empirical findings were presented. Foremost, the probability of spikes in investment due to GDP volatility decreases for young firms (age = 0) if aggregate volatility is greater than one standard deviation (s.d.) from the mean. For firms older than 12 years, investment is not strongly associated with volatility shocks. The magnitude of young firms' investment spikes is both statistically and economically significant as well, amounting to approximately 20% increases for a one s.d. shock. During the speaker's exposition of these novel data findings, the audience provided a few helpful pointers including an attempt to quantify the share of aggregate investment attributed to young firms more sensitive to GDP volatility. Concern over the lack of background knowledge about the firms in the Compustat sample, namely that many young firms may just be entrepreneurs setting up shop in somebody's garage was also expressed. For example, why should the audience take seriously the contention that the entry/exit margin is important, especially if a young firm's investment contributes little to aggregate investment? Further, it was suggested that improvements could be made to the data analysis if controls for selection due to endogenous entry/exit were implemented.

While describing his decision-theoretic general equilibrium, entry/exit model of the economy with firm age, the audience noted that the model really describes the aggregate effects of aging firms. Participants encouraged the speaker to elaborate and tie it into the literature. In calibration, the complex model appears to successfully match the key data moment the paper focuses on --- the life-cycle of firms and their associated, age-dependent investment rates. Due to this result, the audience agreed the paper could perhaps be refocused around the endogenous impact of aging firms on aggregate investment sensitivity over the business cycle. This may require mostly some changes to semantics. The speaker concluded in agreement, along with some suggestions for future research applications, perhaps to examine how the composition of startup businesses with different productivity levels is affected by business cycles.

Trends and Business Cycle Asymmetry

Andrey Alexandrov

The growth rate of the United States gross domestic product (GDP) is slower now than before the 1990s. Additionally, it appears that the distribution of annual growth rates is more negatively skewed than in the past. The goal of this paper is to provide a mechanism directly tying this negative skewness to the decrease in annual growth rates. The mechanism is built atop a fundamental observation from firm-level data: a positively skewed growth rate distribution is associated with faster growth in the labor stock. The author proposes that due to labor adjustment costs, firms will react stronger to shocks that work in the same direction as the trend, and weaker to those working in the opposite direction. In this way, the author proposes that firms have a sort of recency-bias against changes to aggregate trends. This bias induces changes in the observed asymmetry in growth rates around business cycles.

Initially, in the seminar, there was some confusion as to what the speaker meant. By focusing on third data moments (skewness) the speaker seemed to be ignoring the decline in the variance of growth rates since the mid-twentieth century, also known as the Great Moderation. One participant noted that while there have been changes in skewness to GDP growth rates, there have been no such changes in skewness to total factor productivity (TFP) growth rates. Therefore, the change in the distribution of GDP growth cannot stem from exogenous, economic shocks via technological evolution, but rather from something systematic, such as changes to labor or capital accumulation, for which data observations exist.

Participants suggested that there would be sectoral heterogeneity in how firms would react to changes in GDP growth rates. There were also suggestions that it was unclear what real-world mechanism the model was attempting to represent. The author explained that his model of labor adjustment costs, where firms keep their labor stock constant most of the time, only choosing to adjust in response to strong shocks associated with the trend, could be useful to explain other growth-related phenomena, such as secular stagnation or possibly the increasing severity of recessions. Generally, feedback suggestions requested clarification on the underlying mechanism and why firms wait to adjust in response to changes in the trend?

Look Who's Searching: Revisiting Unemployment and Labor Market Flows

Christine Braun

How should employment transitions be accounted for when a large number of newly employed workers were never previously counted as unemployed? Being "unemployed" means a worker is actively looking for a job while individuals "out of the labor force" are neither working nor searching for work. The United States Bureau of Labor Statistics (BLS) counts the forms among labor force participants, along with employed workers. The motivation for the main question involves a fundamental problem with labor force participation data: the number of hires attributed to individuals going straight from being "out of the labor force" to "employed" has increased due to active job searching and not having a job, just as reported unemployment has fallen. In fact, the speaker noted that 50% of new hires directly moved from not being in the labor force to being employed. However what constitutes active effort in terms of job search? Much of the discussion revolved around this question, the speaker turned to the American Time Use Survey (ATUS) featuring data on how respondents spend their time on a given day. The survey records how much time respondents actively spend looking for work. With this survey data, which also encodes whether a worker is employed, unemployed, or out of the labor force, the author finds that 25% of individuals out of the labor force actively search for jobs. This suggests that core unemployment data from the BLS may be downwardly biased.

Since the speaker was presenting relatively new research findings, a lively debate ensued between the speaker and audience members. Poignant insights were made regarding what constitutes an active search. One participant posed a hypothetical scenario to suggest that even ATUS data may be insufficiently capturing search efforts. Imagine a man is out of work and reported as not actively

searching. He is thus coded by the BLS as "out of the labor force." If he had a drink at a bar with a friend who unexpectedly informed him of a possible job opportunity, would the fact that this individual happened to unwittingly discover an available job to apply for mean that this individual were now "actively searching" for a job? How would such a person be measured by the BLS, or how would such search effort manifest itself in ATUS? The speaker responded that if indeed the person were serious after hearing about the opening from his friend, he would still have to go to the firm with the featured opening the next day and actively fill out paperwork to apply for the job. This search effort would be recorded as job search time utilization in ATUS, and would be captured by the speaker's measure of active search. However, the individual would still be classified as "out of the labor force" by the BLS. This example highlighted the need for more refined measures of job search proposed by the speaker.

Indeed, the author finds that using ATUS data to correct for mismeasurement by the BLS of the number of active job searchers decreases the relative importance of the labor force participation margin in accounting for employment rate fluctuations. Thus, a particular cyclical property of the labor market is dampened. Participants noted that this finding might be controversial since the BLS employs many highly-skilled economists to measure employment flows. One audience member suggested that there may be a disconnect between how people respond to the question of whether or not they are actively searching for a job and what they actually spend their time doing. Furthermore the gap between responses to employment surveys and actual search activities may be systematically correlated with the business cycle itself. Then, in such a case, the speaker, and other economists studying the labor market, would have to worry if the BLS conspired to have different measures of unemployment during different parts of the business cycle. The speaker and other audience members doubt such a conspiracy exists. So, the concerned audience member pointed out that, regardless of whether the BLS conspired to manipulate employment numbers, if people do respond differently during booms and busts, then the speaker should think about a theoretical model of why some individuals claim they are not searching for a job even when they are, given that such a response could still be systematic.

International Diffusion of Technology: Accounting for Heterogeneous Learning Abilities

Diana Van Patten

How do developing countries learn to adopt and use new technologies? The author hypothesizes that international trade induces learning. This causes total factor productivity (TFP) to grow faster in developing countries as they trade with more developed countries that use more advanced technologies. Heterogeneity between producers in terms of learning ability is the fundamental mechanism driving differentials in productivity growth and the adoption of new technologies. The author turns to several datasets to establish important facts about international trade, namely the World Input-Output Database (WIOD) for input shares and the Groningen Growth and Development Center's (GGDC) databases for country-specific sector share and KLEMS data. Using these datasets, the author establishes that dynamic gains from trade generated by productivity diffusion are highest when countries trade with others who have similar technological levels. By contrast, a very low productivity country that trades with a very high productivity country will not see the same gains from learning. Thus, the smaller the productivity gap, the greater the return to learning thus leading to higher TFP growth. Using the structural model, the author can match the dependency of productivity growth on this aforementioned productivity gap, a novel finding relative to the literature.

The audience was intrigued by the new empirical facts the speaker established relating the productivity gap to productivity growth and engaged in discussion as to why lower productivity gaps between trading partners induced higher returns to growth. One suggestion was that similar producers do not have too much to learn from each other, whereby another participant added that, if such is the case, we should expect smaller productivity gaps to be associated with lower returns to growth.

As the speaker described the theoretical model, there were suggestions to present a simplified version featuring only three countries, for example. It was unclear exactly

what mechanism would induce trade between which countries. In a three country model, would one country only trade with another country that has the highest productivity in a particular industry? There was also confusion as to why the model needed imperfect competition via the Bernard et al. (2003) (hereon BEJK) extension to Eaton and Kortum (2002) (hereon EK). One audience member suggested modeling the economy using a standard EK model with a modification to accommodate learning. This then prompted debate as to whether the pricing markups induced by imperfect competition affected the model results, which was unclear to most of the audience. The final suggestion was for the author to build the model using the EK framework and include the BEJK framework as an extension. Using the simpler EK framework could then help the speaker clarify how technology diffusion by learning in the model affected growth rates.

International Reserves and Central Bank Independence

Agustin Samano Penaloza

Previous studies on the adequate level of monetary reserves ignore the interaction between fiscal and monetary authorities by assuming either exogenous fiscal policy and/or consolidated government. Of course, the monetary and fiscal authorities may not have the same objective functions, which is the primary contention of the author. Possible incompatibilities induced by these different objectives could perhaps be costly to society at large, a fact which informs the need to better study and understand the competing trade-offs faced by fiscal and monetary policymakers.

To operationalize differences in fiscal and monetary policymakers' objectives, the author considers an environment in which the two policymakers face different intertemporal discount factors. Specifically, he assumes that the fiscal authority is likely to be more impatient than the monetary authority, which could lead to a higher level of sovereign debt issuance than is socially optimal. If independent, the monetary authority will then counter the fiscal authority by accumulating reserves to reduce overborrowing. The threat of sovereign debt default facing the fiscal authority is the only mechanism effectively keeping the two policymakers from engaging in endless retaliation measures. In a calibration exercise for the Mexican economy, the model can reconcile the key empirical fact that governments and monetary policymakers simultaneously issue high levels of debt and maintain large currency reserves.

Given the diverse set of viewpoints regarding monetary and fiscal policy in the audience, this seminar was on the more controversial side. The primary debate centered around the degree to which monetary policymakers were truly independent from fiscal policymakers' influence. The speaker pointed out an indexed measure of central bank independence noting relatively weak, yet positive, correlation between independence and the reserves to debt ratio. This datapoint motivated the idea that the more independent the central bank is with respect to fiscal policymakers' influence, the more likely central bankers are to counter high levels of sovereign debt by hoarding currency. One person asked why a country would ever hold any reserves if they had a floating, dollar-denominated exchange rate. The lively discussion continued with another audience member pressing the speaker to better define "central bank independence." It seemed that the mechanism presented here was less about independence and more about impatience. This is because differentials in discount rates, specifically higher intertemporal discounting by the fiscal authority relative to the monetary authority, are what lead the government to borrow at sub-optimally high levels until the borrowing limit is reached. This person commented that it was difficult to understand how the model could explain realistic incentives faced by the monetary authority when there was no actual money issuance. He then noted that, at its core, the novel innovation of the model was the policy game and how the paper should be more focused on the trade-offs and incentives associated with that game. The speaker agreed with that suggestion, noting that in the future he would consider including more analyses of the equilibrium trade-offs the various agents faced in such a game.

The Macroeconomic Cost of College Dropouts

Oliko Vardishvili

Assuming that approximately 40% of college students drop out before graduation, are these dropouts due to academic ability or financial constraints? The paper hypothesizes that if dropout decisions are even partly made due to an adverse financial shock, then observing such decisions will affect inference in the student's intrinsic ability. Thus, the speaker sought a quantitative framework to distinguish between these two separate forces driving college dropouts.

The speaker presented some key features of U.S. data. Using the National Longitudinal Survey of Youth (NLSY) from 1997, she showed that students from families with lower wealth levels enroll in college at lower rates and, conditional upon enrolling, drop out at higher rates. In addition to the NLSY, she examined the Beginning Postsecondary Students Longitudinal Study (BPS) which documents key data variation in terms of first and second year college students' qualification rates for Pell Grants over the 2003-2004 and 2004-2005 academic years: only 34% of first year full-time students who qualified for Pell Grants in 2003-2004 received the same amount the following year. In the paper, this evidence allows the author to explore how dropout rates are correlated with grant volatility.

Preliminary results were presented from a working paper featuring multiple regression specifications with various controls and instrumental variables to try to decompose the separate effects of ability and financial shocks on dropout rates. Some audience members expressed concern that the speaker was using mere linear regression techniques to contradict well-established results in the literature obtained from analyses of structural models arguing that financial frictions do not matter much for dropouts. Further, there was some concern that the presented analyses were not accounting for ways in which college financing has changed either due to changes in policy or technological change driving the evolution of financial services. One participant asked how the speaker controls for the failure to observe parents possibly giving students money. The speaker responded that she calibrates around such possibilities, to which the participant responded that such a feature would affect students' dropout decisions, perhaps even dynamically. Having received in-kind transfers from their parents once, they may expect them again in the future. The speaker acknowledged that she had thought about these issues and was in the process of improving the paper by including a structural model to better account for the students' underlying decision processes.

The Costs and Benefits of Caring: Aggregate Burdens of an Aging Population

Nicholas Pretnar

As the population distribution skews older over time, a larger fraction of the population will require some type of assisted-living care. How will the sheer number of people requiring such care affect aggregate GDP growth when it is already established that aging itself is a negative correlate? The paper is motivated by popular concerns among those in the medical profession that diseases, such as Alzheimer's and dementia, will impose substantial "costs" on society. The speaker noted that these "costs" were not well-defined by those in the medical profession, so considering this phenomenon in a rigorous economic model would clarify how aging and the need for living assistance jointly affect growth. The findings of this paper suggest that aging itself is the predominant driver of declines in the aggregate growth rate. Counterfactual simulations eliminating the risk of contracting diseases, such as Alzheimer's and dementia, show slight long-term growth changes, independent of aging itself.

There was some concern among audience members that the underlying mechanism through which demand for assisted living affected GDP was not clear at the outset. The speaker explained that young, working age adults, spend some fraction of their off-market time caring for infirm seniors. He noted that this was an empirical fact which could be seen in U.S. time use data, amounting to approximately half an hour per week spent by young people caring for seniors, and averaged across all working age adults. There were some additional questions about how this could affect aggregate growth with concern that the paper had been presented in a style more

common for microeconomic research. The speaker eventually noted that the aggregate demand for living assistance would increase as the number of old people in the population increased. If more young people were willing to supply time to care for their elders, then the aggregate labor margin would be affected, potentially driving down output. This was the key mechanism affecting growth. One person suggested that the framing of both the paper and the talk should revolve more clearly around this key mechanism. Macroeconomists care about how certain mechanisms affect all the moving parts of the aggregate economy. He noted that the speaker had presented a large amount of data and facts regarding both growth and time use without explicitly mentioning how he would link such facts in a structural model. Eventually, this became clear as the model was explained and its features discussed. Further suggestions included framing the paper around endogenous growth where growth was strongly affected by population aging and associated aggregate health dynamics.

The Role of Immigration in Deep Recession: The Case of Spain

Ismael Galvez-Iniesta

The increase in the foreign born population was one of the main socioeconomic changes in many developed countries in previous decades. In this paper, the author documents during the Great Recession in Spain, immigrants were more affected by adverse labor market outcomes. Immigrants faced a greater increase in job separation rates than natives while foreign immigration into Spain dropped and return migration by immigrants already present at the onset of the Great Recession increased. With these data observations, the author builds a model of the labor market to simulate the Great Recession. The goal is to answer the following question: how would the Great Recession have affected labor market outcomes if the immigrant share of the labor force had been lower? The model leads to several interesting findings: 1) the presence of immigrants in the economy lessens the impact of recession on native workers, leading to counterfactual welfare improvements relative to the actual, observed baseline; 2) had the immigration boom prior to the Great Recession not taken place in Spain, the native unemployment rate would have been two percentage points higher during the recession; 3) firms' job creation incentives during the recession are altered by the presence of a large, low-skilled immigrant population that commands lower average wages. The main driver of these results is the return-migration channel.

During the seminar, the author's empirical focus strictly on Spain was not without controversy. An audience participant noted that while Spain may have experienced decreases in foreign immigration during the Great Recession, other countries in Europe experienced increases. Why was Spain different? Is there something specific about the Spanish economy that makes immigration more sensitive to recessions? The author acknowledged that these were questions to be considered in future revisions.

The model used to understand immigration effects on employment is a modified search and matching model with job-vacancy persistence and endogenous return migration choices. The author models immigration as exogenous, though emigration is endogenous. That is, immigration is something that happens to the economy independent of the decision processes of agents within the economy, though current immigrants who live in the economy optimally choose to leave if such a choice maximizes their utility. Audience members expressed concern over this modeling assumption: immigration happens because new immigrants move to find better opportunities. Thus, immigration rates should depend on the country's state of the economy. The suggestion was to somehow make immigration endogenous as well.

After calibrating the model, the author ran counterfactual exercises simulating the impact of a Great Recession under different immigration levels. Several key findings were discussed. In the baseline, calibrated economy, the model predicts that native job-finding rates are higher than the "no immigration" economy immediately after a negative shock. This is due to the fact that in the baseline economy, immigrants leave, freeing up jobs for natives that had previously been created. The author also assessed the impact of a recession on aggregate inequality in both baseline and counterfactual scenarios, finding that without immigration, and thus return migration, inequality is more pronounced 30 quarters after the recession.

Mums and the City: Female Labour Force Participation and City Size

Ana Moreno-Maldonado

The paper focuses on how female labor force participation rates depend both on the size of urban areas in which women reside and the number of children women have. While labor force participation (LFP) increases with city size in general, it declines for women with children, a phenomenon coined by the speaker as the Big City Child Penalty (BCCP). The speaker presented both these key facts and a spatial equilibrium model to explain location choice.

There are two key drivers of BCCP. First, larger cities are associated with longer commute times to and from work. Secondly, the author finds that the composition of job types depends on city size and is also an important determinant of BCCP. While these are observable data facts, they are also incorporated into the author's model as key mechanisms driving demographic sorting. The speaker's modeling choices led to some discussion. One audience member pointed out that commuting time was modeled as an exogenous characteristic of cities, yet city size is associated with greater congestion which could endogenously affect commuting time. Where workers choose to live endogenously affects the commuting time they experience. Another audience member noted that this was a general problem with spatial equilibrium models: if commuting time is an important mechanism driving a model outcome, the degree to which it affects that outcome may be incorrectly quantified. This is because often commuting time and productivity are taken to be exogenous when they each depend on the underlying location choice. Additionally, it can be argued that productivity itself depends on commuting time.

The model environment relies on several assumptions. First, the speaker assumes perfect assortative mating for couples, which is not qualitatively problematic relative to the model results because lower degrees of assortative mating will increase incentives for intra-household specialization. There was a suggestion that this could change the equilibrium distribution of female labor force participation conditional upon occupation and that the speaker should follow up on this. The author described another modeling assumption wherein the quantity of children present in a household is measured simply by the time cost of caring for them --- a continuous variable. Further, this time cost is constant and conditionally independent on city size. Several participants were concerned about this latter assumption, noting that large families will typically move out of big cities, needing more space than featured in a typical urban apartment. The speaker noted that the definition of a city in her model is a greater American metropolitan area, which will include places like suburbs and even exurbs, featuring large houses on large lots. The location choice thus involves choosing between metropolitan areas of different sizes, each presumably featuring similar degrees of urban and suburban environs.

The model is calibrated to match observed wage premiums across cities of different sizes, average hours worked by a household, share of time spent with children, housing expenditure, childcare expenditure, and the average population ratio between big and small cities. The calibrated model is used in counterfactual exercises to understand the role that commuting times and long working hours play in contributing to the BCCP. The author finds that each factor contributed around 67% of the observed gap. The technical procedure used to assess this difference was the subject of controversy during the seminar. The speaker noted that she simply changed a calibrated parameter and simulated the model, leaving the other estimated parameters the same. Two participants cried foul, arguing that the parameters were all jointly calibrated to match a series of data moments, so changing just one parameter could lead to a spurious quantitative interpretation of the new counterfactual outputs. Other audience members, however, noted that the speaker's method, changing one parameter while leaving the others fixed then simulating equilibrium outcomes anew, was just a way to observe partial differentiation. The debate, however, ended in a stalemate with each half of the audience agreeing to disagree, though the discussion continued later in the afternoon over coffee and pastries. While shining light on LFP and the BCCP, the seminar possibly prompted some to re-think several interesting econometric questions pertaining to calibration as well.

The Sex Ratio, Marriage and Bargaining: a Chinese Story

Francisco Javier Rodriguez Roman

What is the impact of changes in the sex ratio on marital sorting, female labor supply, and resource allocation within the household, specifically with regards to China? A model of marriage, bargaining, and time allocation was presented in an attempt to quantify the economic importance of changes in the sex ratios to paid work, housework time, leisure time, and assortative matching. Among the findings, the author highlights that changes to the sex ratio can explain approximately half of the changes in the amount of paid work married women engage in along with their amount of overall leisure time. Up front, audience members expressed concern that the research question may be too broad, given there are a lot of potential impacts to the declining sex ratio phenomenon. The audience participants, nonetheless, acknowledged the complex nature of the model the speaker built. Specifically, the model endogenizes marriage decisions, bargaining within households, off-market time allocation, and home production decisions.

The model distinguishes between males and females as well as single and married households. Each agent and by extension, each combination of agents in a household is characterized by continuous, measure-zero productivity types. The model has several unique features that ensure that marriage, under certain circumstances, can yield greater utility to household members. First, single households only have the off-market time of one agent to engage in home production and leisure, while married households can pool their time together to engage in home production activities. Through the marriage channel, the sex ratio thus impacts what the author calls "bargaining" within the household with respect to who is going to perform chores, go to work,or enjoy leisure time. Married households choose how to allocate each partner's time by solving a household welfare function subject to Pareto weights separately associated with the personal utilities of the wife and husband.

One modeling assumption is that wives and husbands are randomly matched with agents of the opposite sex on the marriage market who have the same productivity type. In the model, marriages are randomly broken in a process independent of intra-household bargaining. One audience member expressed concern that bargaining incentives in the model were a bit divorced from the actual intra-household bargaining incentives faced by real world married couples. This is because in the real world if bargaining breaks down divorce often occurs. Thus, bargaining can endogenously affect the marriage rate. Participants acknowledged that incorporating additional endogenous features into an already-complicated model could make it more difficult to computationally solve and thus calibrate. A suggestion was made to narrow the focus of the question so that a more tractable model of marital sorting and female labor supply could be analyzed.

After calibrating the model to two steady states using 1990 and 2010 Chinese demographic data, the speaker presented the results of several exercises designed to deconstruct the separate effects of changing the sex ratio, distributions of skills, wage structure, and home production efficiencies. Changes in the sex ratio appear to play an important role in explaining the observed changes in paid work time and leisure but not housework time. Wage effects are the opposite for married men and women. As married women make more money they substitute paid work for housework, while it is the opposite for men. Some audience members suggested that counterfactual exercises should be met with caution due to the non-dynamic nature of the model: it is essentially a sequence of steady states where expectations are not considered. Still, it was suggested that moving forward, the primary focus of the researcher should be to narrow the question, which may or may not involve introducing forward-looking decision-making by households.

Housing and Savings: Breaking the Commitment Device

Patrick Moran

Housing is the largest asset most households own, and recent innovations in financial services have offered new channels to liquefy home equity for consumption. Since the housing boom of the 1990's and 2000's, mechanisms permitting access to home equity have proliferated, though over the same period savings rates have substantially declined. Given these mechanisms, the author's goal is to better understand the link between housing and savings. The author hypothesizes that easier access to liquidity through home equity withdrawal has weakened housing as a traditional store of value, or as a savings mechanism. This is due to the fact that saving in liquid assets is difficult when lacking self-control. To assess how the availability of home equity withdrawal affects savings rates, the author exploits unique data variation corresponding to the abrupt legalization of home equity withdrawal in Texas in 1998. The sudden legalization led to a 3% spike in nondurable consumption, as reported by the predictions of the theoretical model in which agents have temptation preferences over consuming home equity. The paper concludes that the cost of succumbing to this temptation leads to a long-run welfare decline that is directly tied to the freedom at which consumers can withdraw home equity.

The paper offers a novel variation on a hyperbolic discounting model, the parameters of which are easier to pin down computationally. The main feature is that household utility flow under temptation depends on both actual chosen consumption and housing, as well as the most feasible tempting consumption and housing alternatives given budget constraints. It is assumed that these tempting consumption and housing alternatives only maximize current utility, not the discounted stream of lifetime utility. A parameter governs the degree to which households are tempted or, as one audience member suggested, myopic. Technically, the speaker demonstrated that temptation preferences are time consistent, so standard welfare analysis can be conducted.

The temptation preference structure was debated in the audience. There was concern that the preference structure was specified simply to facilitate more straightforward calibration and welfare analysis than could be undertaken in a hyperbolic discounting model, such as the one by Laibson (1997). One audience member noted that the behaviorally poignant characteristic of the Laibson model (1997) is that consumers are playing a game against their future selves, engaging in savings because they know they will eventually misjudge and consume too much. Another person sarcastically declared such a characterization by Laibson was unfair because people are more sophisticated.

Another discussion involved differences in utilization of home equity between Americans and Germans, the latter of whom have higher savings rates. One participant was skeptical that Germans could not be tempted to use home equity. The speaker responded that there were probably Germans who withdrew and consumed home equity just less so than Americans did. Therefore, they have different temptation preference parameters.

In conclusion, audience members appreciated the author's flexible approach to what appears to be a preference phenomenon involving time inconsistency. The data observations and model used to explain them certainly generated a lively dialogue.

Assessing the Network Effects of Monetary Policy

Christian Hoynck

How do input-output linkages across sectors transmit monetary policy shocks? While much of the literature has focused on how such linkages transmit aggregate productivity shocks, the relation between policy shocks and production networks has only been minimally studied. To better understand how monetary policy affects the production network, the author constructs an equilibrium model with a finite number of sectors and sector-specific Phillips Curves to describe the price-setting of each sector, along with an aggregate, dynamic investment-savings (IS) equation as in standard New Keynesian (NK) models. Naturally, such a model generates a sector-specific inflation rate that can be written as a function of the sector's real marginal cost and the slope of

the sectoral Phillips Curve. The model generates expressions for price-rigidities depending on the prices of other sectors (or firms) and whether strategic complement or a substitute for other firms. The speaker uses this model to estimate Phillips Curves that account for the network structure of the economy.

This paper was subject to serious empirical debate. The speaker claimed that service prices were structurally more rigid than goods to which one audience member replied that goods and services were just labels: with definitions that stay the same but properties which change over time. Prices of these products change over time as well, and yet service A is still called service A and counted as such in aggregate economic data. This comment by a participant generated an extensive debate over how or even whether such problems can be accounted for, since we rely on the Bureau of Economic Analysis (BEA) to properly measure these changes and make the appropriate corrections --- a job easier said than done.

The paper's primary modeling contribution is to extend the standard NK model to a sectoral environment, where the prices set by firms in different sectors depend on the input choices of different intermediate firms. An industry-specific price index is generated from the solution to various firms' expenditure minimization problems resulting in demand functions describing the inputs that firms want in equilibrium. The model relies on CES aggregators to ensure closed form solutions for the sector-specific price indices. In the paper, the author shows how aggregate consumption prices respond to monetary policy shocks depending on how strong consumer price inflation reacts to firms' marginal cost changes from changes in input prices. Specifically, the larger that a sector's share of intermediate goods used in production is, the less a firm's posted prices for its products will deviate from upstream intermediate prices. Through these channels, inflation depends on the structure of the production network. This is the main theoretical contribution of the paper.

The Misallocation Channel of Monetary Policy

Timo Reinelt

Why do we observe a negative correlation between aggregate total factor productivity (TFP) and monetary policy shocks? The authors present a theory whereby market power can distort measured changes to TFP due to imperfect competition. In their theory, somewhat ironically, actual TFP can remain unchanged while measured TFP can still rise or fall as a result of any non-productivity shock. Though the authors focus on shocks to monetary policy, the theoretical mechanism driving changes to measured TFP is generalizable to any non-productivity shock that affects either aggregate output or capital accumulation (or both) while actual underlying TFP remains fixed. As the speaker described the mechanism affecting measured TFP, there was some confusion among audience members as to the semantics used to describe the phenomenon. The speaker, at one point, equated TFP with the Solow residual from a classic constant returns to scale aggregate production function. An audience member noted that the Solow residual was just one way of measuring TFP. As a result of this comment, a suggestion was made that the speaker could more clearly distinguish between actual, underlying TFP and measured TFP by referring to the latter as the Solow residual. The phenomenon could then be framed in terms of how price markups affect inference on the Solow residual in an economy where firms have market power.

Much of the talk presented empirical evidence in support of the theory that monetary policy shocks can affect the Solow residual, despite actual TFP remaining unchanged. The speaker started by showing that monetary shocks themselves lower measured TFP on aggregate. He then turned to empirical microeconomic evidence to attempt to understand whether markup dispersion across firms can account for aggregate TFP declines. Presumably, different firms in various sectors have dissimilar markups due to heterogeneity in both firm size and sectoral market concentration. This assumption, however, was met with some criticism. One audience member thought it sensible that markups between industries were different yet struggled to comprehend how firms in the same industry could each have varied price markups. Additional audience members were also not convinced that the empirical findings presented were consistent with the existence of markup heterogeneity within an industry. One audience member

noted that it was apparent that the existence of differences in markups between firms within an industry was a key feature of the speaker's mechanism. This is because the main channel through which markups affect the Solow residual is heterogeneous input misallocation between firms due to friction that prevents firms from setting an optimal price markup. It concluded with suggestions that the speaker take a deeper dive into the data to understand whether there is indeed such markup heterogeneity between firms within an industry.

Inside the Decline of the Labor Share: Bringing the Tales Together

Sergio Feijoo

It is still relatively unknown how various economic forces have simultaneously contributed to the decline in the labor share of United States' aggregate income and a structural transformation toward a service-dominated economy. The author addresses this gap in the literature with a parsimonious two-sector model in which changes in technology and within-industry competition levels jointly explain the decline in the labor share of aggregate income and the aforementioned structural evolution of the economy.

The speaker noted that the decline in the labor share since 1998 has been most pronounced for the manufacturing sector, with the service sector exhibiting comparatively modest declines. The rate of decline in the aggregate labor share more closely resembles the rate of decline in the labor share of the service sector. This is due to the service sector share of aggregate output increasing over this period. This particular widely-recognized data observation prompted a serious debate. First, audience members expressed concern that identifying the primary channels driving labor share decline and corresponding structural change would be difficult. One person noted that data limitations made it difficult to measure the degree to which differences in capital deepening between sectors have contributed to labor share declines. This is because the value of the total capital stock has gone up, but the price of individual machines has decreased. Today, there are more machines in the economy that can perform more advanced tasks than in the past, but the cost of purchasing them has fallen. Any measures of the degree to which capital deepening has contributed to the decline in the labor share may then be downward biased.

Another audience member suggested it may be helpful to use the model to construct a measure of model-implied aggregate GDP which mirrors that in the data. The speaker promised to address these points in future revisions.

In general, the subject matter presented generated lively discussions. At certain points the debate was also robust. Understanding the causal mechanisms driving structural change, specifically the decline in the manufacturing share of U.S. output, is controversial, noted one audience member. The reason for this stemmed from the difficulty of identifying the exact cause with data. The same audience member observed that the decline in the manufacturing share of output (structural change) can be explained by consumers' non-homothetic preferences for goods and services, which has been mentioned in Herrendorf, et al. 2013 and Boppart 2014. More than just having and explaining a model, this participant suggested that the speaker needed to convince people why his story, involving an interaction between market concentration and technological change, was better than others. Some audience members acknowledged the challenge of such an endeavor, given the difficulty in identifying causal mechanisms from data.

10th Advances in Macro-Finance

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Gain Luca Clementi – New York University
Adrien d'Avernas – Stockholm School of Economics
Roberto Gomez Cram – London Business School
Tetiana Davydiuk – Tepper School CMU
Selmon Erol – Tepper School CMU
Michael Gofman – University of Rochester
Deeksha Gupta – Tepper School CMU
Zhengyang Jiang – Northwestern University
Zafer Kanik – MIT
Finn Kydland – UC Santa Barbara
Tim Landvoigt – University of Pennsylvania
Ye Li – Ohio State University
Erik Loualiche – University of Minnesota
Daniel Neuhann – University of Texas, Austin
Carolin Pflueger – University of Chicago
Matt Rognlie – Northwestern University
Lukas Schmid – Duke University
Dejanir Silva – University of Illinois
Alp Simsek – MIT
Alireza Tahbaz-Salehi – Northwestern University
S. "Vish" Vishwanathan – Duke University
Nancy Wallace – UC Berkeley
Colin Ward – University of Minnesota

Photo above: Pittsburgh, Pennsylvania. Courtesy of Carnegie Mellon University Tepper School of Business.

Late to Recessions: Stocks and the Business Cycle

Roberto Gomez Cram

The notion that stock prices lead the business cycle and that expected returns are counter-cyclical is a fairly standard view. However, this paper argues that stock prices fail to fully lead the business cycle. The author proposes a new measure of expected returns that links expected return variations to business-cycle fluctuations. For this measure, the author identifies business-cycle turning points using Bayesian methods and optimal filtering techniques and allows for state-dependent autocorrelation in returns.

In a model, the state of the business cycle follows a Markov-process. Since the state variable is latent, the author inferred states from observable economic variables. He assumes that the common factor of observables depends on the state variable, and variable-specific shocks follow an autoregressive process. Then, the author filtered the probability of recession. For stock returns, the excess returns on the aggregate stock market depend on the unobservable equity premium and unexpected excess return. Given the probability of a recession, the author filtered expected return using Bayesian techniques for posterior inference. Two forces affect the filtered expected return: discount-rate effect and predictability. During recessions, returns exhibit momentum since predictability dominates. Accordingly, past returns are positively weighted to predict future returns optimally. During expansions, returns exhibit reversal since the discount rate effect dominates. Thus, recent returns are negatively weighted to predict future returns optimally.

The author finds that excess returns are negative for the first four months after the start of recessions and positive for the subsequent twelve months. Regarding autocorrelation in the business cycle, there is strong momentum in recessions and mild reversals in expansions. With the out-of-sample test between 1980 and 2016, a market-timing strategy earns an annualized alpha of 7.43%, and the Sharpe ratio increases by 58%. A mean-variance investor is willing to pay 33 basis points monthly to gain the additional utility of the optimal strategy, as it outperforms the passive buy-and-hold benchmark. The author argues that the fact that some investors are slow to trade in response to macroeconomic information can explain these findings. He shows that this is consistent with surveys of investor expectations. As a counterfactual, if the NBER indicator is available in real-time, annualized alpha is 8.3%, and the Sharpe ratio increases by 62%. That is, better measures of business-cycle turning points increase the strategy's overall performance.

An audience member asked why the author didn't introduce more variables to forecast expected returns, and the author answered that significant factors were all used. Another participant was curious about which variable in the model drove the higher value of alpha than the benchmark case. Others asked whether investors underreacted or overreacted during expansion or recession and what types of investors exited the market.

Government Risk Premium Puzzle

Zhengyang Jiang, Hanno Lustig, Stijn Van Nieuwerburgh, and Mindy Z. Xiaolan

Observing a puzzling discrepancy between the negative value of a claim to government surplus and the positive market value of outstanding government debt during recessions, the authors show that the introduction of a small, but persistent component in expected government spending growth helps to explain the discrepancy through a stabilization mechanism. The authors also derive the optimal maturity structure of government debt and investigate to what extent the actual bond portfolio and the optimal portfolio differ.

In the model, a representative investor buys all new bonds issued and receives all redemptions. This investor receives payments when government budgets run in surplus, and he makes payments, essentially purchasing new government bonds, while budgets run deficits. To filter out the latent component in expected government spending growth, the authors use the market value of government debt data, since actual government spending growth data are not informative to infer the persistent component in expected government spending growth. To value the claim to future surpluses, the authors specify the dynamics of tax revenues, government spending,

and a stochastic discount factor. This model is used to identify the optimal maturity structure of government debt. The optimal debt portfolio minimizes the variance of the government's funding needs when the values of the outstanding bond portfolio and the surplus claim share the same sensitivities to macroeconomic shocks.

State variable dynamics are estimated using vector autoregression on a sample between 1947 and 2017. With the assumption that all shocks are permanent, the authors estimate that the magnitude of the government risk premium discrepancy is more than nine times the annual GDP. However, results with cointegration show that discrepancy shrinks to 1.66 times annual GDP. The divergence of the actual bond portfolio from the optimal portfolio is the only risk, according to the authors' model. The dollar duration of the U.S. government debt portfolio is 10.29 times the annual GDP, whereas the dollar duration of the surplus is 9.69 times GDP. That is, the government has to reduce the average duration of its debt portfolio by 0.6 years to establish the optimal debt portfolio.

The authors find more significant deviations between the actual and optimal bond portfolios in response to macroeconomic shocks, such as shocks to inflation and GDP growth. In other words, when government bond investors are exposed to macroeconomic shocks, the government has to reduce the average duration of its debt portfolio further than with interest rate shocks alone.

An audience member asked whether the assumption that the transversality condition holds is too restrictive. Another audience member suggested using three potential resolutions (bubble, convenience yield, and Peso problem) at the same time instead of using them separately to explain the government risk premium puzzle. Some members were suspicious about the possibility of coordination between investors once the economy has a bubble. Finally, one of the members was worried about whether the puzzle is made worse with the presence of inelastic foreign investors.

Agency in Intangibles

Colin Ward

High average Q predicts high physical investment in a neoclassical Q model when we assume complementarity of physical and intangible capital in production. However, this feature does not hold in the data; high Q firms have high intangibility, but actual physical investment rates are relatively flat. This paper provides a micro-foundation for the high profitability, high valuation, yet low physical investment rates of highly intangible firms through the lens of optimal contract theory.

The author argues that intangible assets promote agency conflicts between outside investors and inside specialists. Intangible capital is not directly observable to investors (principals), and it is developed at the expense of specialists (agents) who may have their own private interests. Principals need to rely on observable metrics, such as cash flow, to make an inference on intangible assets. Given the history of profits, a contract prescribes agents' compensation and termination, and the firm's physical investment. Previous studies in dynamic contracting literature assume that specialists are rewarded with high compensation after a sequence of positive shocks, which grant them more effective ownership of the firm while lessening the agency frictions. In this paper, however, a good history is driven by developments in intangible capital, and agency frictions do not necessarily diminish. One way to reduce the agency conflicts associated with high intangible capital is to reduce the tangible capital.

This work is an extension of Demarzo et al. (2012), where agency frictions directly affect the total factor productivity shock. When agents shirk, they receive a constant fraction of profits. Unlike previous studies, the author treats private benefits as a function of tangible and intangible capital, rather than as a parameter. In addition, his model with agency friction better fits the data than one without it. However, the discussant pointed out that compensation rates in the calibrated model are much higher than in the data. If the agency friction is about the whole firm, then it should be relevant not only to top management, but also to sales and administrative departments. The discussant suggested the author make it clear whose agency problem he is looking at to explain this gap.

For calibration, the author uses a first-best model as a benchmark and compares it to his model with agency frictions. The discussant suggested an alternative benchmark where agency cost does not depend on intangible and tangible capital. The author may consider an intermediate agency cost model with fixed outside shirking. This would give us a better idea of whether the specific functional forms of agency cost that the author proposes

matter or not. In addition, implicit in the paper is the idea that agency frictions have increased a lot, and marginal Q has fallen. The discussant thinks that there could be alternative explanations for the same empirical observations by looking at the cost of capital, rather than rate of return on project. In particular, intangibles are not collateralizable and hence cannot support much incremental investment, which may lead to the decline of investment. This analysis could come out of a variation of Rampini and Viswanathan(2013), where user cost of capital of different types varies.

The author houses agency conflicts into a macroeconomic model and quantitatively accounts for recent macroeconomic trends. He concludes that the increase in intangible assets has likely promoted agency frictions, which explain half of the abnormal decline in investment rate.

Q: Risk, Rents, or Growth?

Alexandre Corhay, Howard King, and **Lukas Schmid**

Motivated by the recent debate on whether declines in interest rates, risk premia, or optimistic growth projections drive higher valuation ratios, such as price-dividend ratios for example, the authors study the driving forces for these movements through a structural model. This paper contributes to the literature by providing a quantitative decomposition of the drivers behind recent shifts in aggregate activity and investigating endogenous linkages between these drivers.

The paper structurally estimates an innovation-based endogenous growth model with endogenous price markups and realistic aggregate risk premia by employing the simulated method of moments. To generate a sizable risk premium, a risk-averse representative household in this model has Epstein-Zin preferences. The final consumption goods are produced in a perfectly competitive market using a continuum of industrial goods. Firms in an oligopolistic market structure hire labor and invest in physical and intangible capital to produce industrial goods, and they set their prices through Bertrand competition. The only exogenous shocks in the model apply to technology. Entry costs endogenously determine industry concentration, markups, and profits.

By decomposing the driving forces into profits and markups, investment and innovation, growth expectations, and risk premia, over two subsamples (1984-2000 and 2001-2016), the authors estimate that a more-than-doubling of the entry costs parameter since 2001, relative to 1984-2000, led to a decline in entry rates. Lower entry rates explain the rise in industry concentration and profits in the last two decades. According to their estimates, higher profits have been driven by rising rents rather than by rising returns to intangible investment. The paper also concludes that the changes in market structure explain weak investment and innovation seen in recent years.

The authors find that the change to market structure, and the higher profits that accompany it, ultimately raised valuation ratios. Declines in competition and lower growth expectations contribute to the drop in interest rates, and the raising of aggregate risk and risk premia. The authors propose an extension of the benchmark model with sticky prices and a monetary policy rule to investigate the lagged inflation rate and rises in asset valuations in bond markets. In this extension, markups reflect both movements in the competitive environment and in nominal rigidities. The paper shows that the interaction between firms' market power and nominal rigidities amplifies the role of price markups for growth and risk. Nominal rigidities create further distortions by deviating firms' markups from their targets.

One audience member asked why the interpretation of total factor productivity as intangible is essential to answer research questions. Another audience member was curious about how the tractability is restored in a model that allows firms to accumulate capital.

Risk-Sharing and Investment According to Cournot and Arrow-Debreu

Daniel Neuhann and Michael Sockin

Recently, we have seen increasing evidence that financial markets are not perfectly competitive, and that market participants frequently take into account that their transactions affect asset prices. This paper investigates how market concentration affects main functions of a financial system such as risk sharing and capital allocation.

The model is populated by a number of risk-averse strategic agents and a deep-pocketed competitive fringe of traders. Strategic agents invest in either storage with risk-free return or risky technology, where uncertainty is represented by a set of states of the world. For simplicity, the authors assume that the fringe does not invest. There exists a full set of Arrow-Debreu securities in financial markets. The fringe trades financial claims taking price as given, and their residual demand for each state-contingent claim is represented by a well-behaved downward sloping curve. Strategic agents also trade these claims. An agent is a seller for a specific claim if the quantity held by her is negative, and a buyer otherwise.

The market clears when the aggregate demand of a particular security by strategic agents and the residual demand by the fringe sum to zero. Inverting the residual demand of the fringe with respect to the aggregate net demand of insiders delivers pricing relationships. Agents choose investment levels and a portfolio to maximize their expected utility from consumption. In particular, strategic agents internalize price impacts by choosing how much they want to trade a particular security, which affects the price at which it trades.

Optimality conditions can be summarized using state prices that encapsulate how much one values consumption in a particular state of the world tomorrow relative to consumption today. Agents set current state prices with consideration to current marginal price and price impact. The impact scales with position size, and its sign depends on whether an agent is a buyer or a seller. Imperfect competition hampers risk sharing as agents strategically distort asset supply to capture price rent.

This paper assumes a complete market, where the number of states of nature equals the number of Arrow securities. We can use redundant assets to price Arrow securities by arbitrage. If markets for the redundant securities are competitive, market power will disappear.

A participant questioned how much market segmentation the authors needed to support market power in the model and also asked what production meant in the paper. If we assume that large firms in the model are financial firms, production would be lending to nonfinancial firms or households. Then, the assumption that production technology is given may not be tenable, as loan portfolio is also a firm decision. In addition, if these loans are traded in markets, market power is less likely to exist.

In response to these concerns, the authors said that the risk-free storage technology in the model plays a role, to some extent, in choosing production technology. In essence, the choice does not depend on uncertainties. The authors assume that market structure, including the number of firms in the model, is exogenous. Profits vary with cross-sectional variation of production risk, productivity, and risk preferences. More heterogeneity will lead to more profits as it increases scope for trade, which feeds back into market structure. Superimposing a theory of market structure would allow the number of financial firms to adjust when profits change. A participant suggested that the authors endogenize market structure for more meaningful comparative statics.

Interbank Trading, Collusion, and Financial Regulation

Dean Corbae and **Michael Gofman**

In the market for interbank loans, there exists a trade-off between efficiency and stability. Interbank trading creates cross-exposures among banks, leading to contagion risks and potential financial crises. This paper proposes a new cost of interbank trading. The authors theoretically characterize and empirically show that interbank loans provide a channel for banks to collude in the market for business loans.

In their model, banks collude by transferring resources to other banks through interbank lending. This is a credible commitment device to not compete and to split surpluses from monopolistic profits. They also allow interbank lending for liquidity provision. If there is a mismatch of monitoring technology and deposits, the lack of operation problem can be avoided from interbank trading. In their model, bank entry into the market for business loans is endogenous, and banks can invest in monitoring technology that allows them to verify the outcome of an entrepreneur's project. The theoretical prediction is that positive correlation between entry and business loan profitability results in higher spreads on the interbank loans for collusion purposes compared with loans for liquidity sharing purposes.

A participant suggested looking at the potential role of asymmetries in monitoring costs in multi-loan markets. Bernheim and Whinston (1990) showed that if each bank has advantages in different loan markets, tacit collusion is possible without interbank transaction by operating in specialized markets. Even in this case, collusion via interbank markets could occur depending on loan market conditions, monitoring costs, and monitoring advantages, by transferring resources to more profitable markets. Along this line, one of the audience members suggested that the authors study market concentration and networks by extending the model to accommodate multiple banks.

In order to identify collusion from the data, the authors exploit staggered adoption of leniency programs. These programs increase the cost of regular collusion as they grant amnesty to one of the firms in cartel activity if it comes forward first and reports the collusion. The hypothesis is that when it becomes more difficult to directly collude, collusion through interbank loans becomes more likely. The authors construct an interaction term of the collusion dummy with the staggered adoption of leniency programs in the country of the lead arranger (in the syndicate that lends to the firm). The spreads on business loans are statistically higher when banks collude after the introduction of leniency programs. They randomly assign the years of adoption of the program and run a placebo test. They do not find any significant effects from the placebo test. They argue that their empirical results support the antitrust nature of the interbank trading.

This paper shows interbank trading is not only a source of contagion risk but also creates inefficiencies from collusion. However, a complete ban on interbank lending may not be optimal because not every interbank loan is for the purpose of collusion. The authors suggest usury laws that limit interest rates on bank loans, making them less effective for collusion.

Unconventional Monetary Policy and Funding Liquidity Risk

Adrien d'Avernas, Quentin Vandeweyerz, and Mattieu Darracq Paries

Money markets work as a mechanism whereby banks manage to mitigate funding liquidity risk. They hold long-term illiquid assets on the balance sheet, while issuing relatively short-term liquid liabilities, like demand deposits. In the presence of a negative liquidity shock, this may lead to the risk of not being able to raise funds to pay maturing debts. There are two ways to cover this funding gap. In normal times, banks can access money markets at a negligible cost. Because of information asymmetry, lenders in the money markets require collateral to secure the trade. In the event of a financial collapse, high volatility can cause the value of collateral to fall short of the requirements to access these markets. Lack of collateral and limited access to money markets may force a costly fire-sale of securities.

This type of funding liquidity shock is a major problem in the shadow banking sector, where institutions conduct credit, maturity, and liquidity transformation without direct or explicit access to public sources of liquidity. Central banks are not able to reach these institutions through conventional monetary instruments, which motivates them to extend their monetary policy toolbox, including large-scale asset

purchase policy.

This paper proposes an intermediary macro-finance model with heterogeneous banks to investigate the efficiency of unconventional monetary policies in the presence of a sizable shadow banking sector when money markets are not well-functioning. The authors suggest that when bank capital is low, an endogenous haircut spiral arises between declining asset prices and funding liquidity risk. Liquidity injection and better discount window conditions help absorb liquidity shock in traditional banking sectors, but it fails to reach shadow banks. The authors claim that central bank engagement in large-scale asset purchase can address systemic liquidity crises, especially when money markets are impaired and shadow banking is large.

An audience participant pointed out that the Fed intervened in the repo market during the Great Recession and there were spillover effects to the Fed funds market. Though the model features rich monetary policy instruments in money markets, it misses the market for Fed funds, an interbank over-the-counter market for unsecured loans of reserves. This is important, as the interbank market can handle idiosyncratic liquidity shocks that the authors mainly consider as liquidity risks for pre-crisis implementation.

The paper emphasizes the limited access of shadow banks to central banks. However, after the crisis, these distinctions nearly disappeared, as the Fed created overnight reverse repo facilities to supplement interest on excess reserves, allowing a broader set of institutions to park money at the central banks. The audience participant said that the model was suitable for extensions that allowed for this overnight reverse repo program in the post-crisis regime.

One of the audience members brought up an interesting question on why shadow banks exist. They may be complementary to regular banks, as they can be more efficient in managing certain types of assets. In addition, post-crisis, the Fed has attempted to extend all of the facilities to erode the difference between these sectors. The authors argued that the extension basically implied the transformation of shadow banks into regular banks, in which case the funding risk that the paper highlighted would cease to be.

Prudential Monetary Policy

Ricardo J. Caballero and **Alp Simsek**

This paper attempts to show that, under appropriate circumstances, prudential monetary policy can be as effective as macroprudential policy. Relative to the costs of prudential monetary policy, such as slowing down the economy and insufficient factor utilization during a boom, the benefits are less understood. Among potential benefits, the authors specifically focus on an asset price channel and establish that the beneficial effects of softening a recession outweigh the adverse welfare effects of inefficient factor allocation.

In a model, the authors consider the economy transitions from a boom with high asset prices into a recession with low asset prices. The boom and recession feature financial speculation among optimists and pessimists and interest-rate frictions. Under these features, optimistic investors' wealth share can be a crucial state variable for the economy, according to the authors. Larger wealth share for optimists increases asset prices and aggregate demand and possibly softens a recession through aggregate demand externalities. The fact that individual optimists do not consider the welfare effects of wealth losses during the recession justifies macroprudential policy interventions, in the view of the authors.

Since these interventions can be imperfect in practice, prudential monetary policy can additionally insure optimists' risk-exposure during a recession. There are two prudential channels policymakers can use to increase optimists' wealth share. First, they can reduce the optimists' leverage ratio through macroprudential policy. Second, given a fixed leverage ratio, they can introduce a prudential monetary policy that reduces asset prices during the boom, if a macroprudential policy or financial frictions are binding. Though both policies can achieve the same allocations, the prudential monetary policy gives more room for monetary policy to react to adverse asset price shocks during recessions.

As a benchmark, the authors illustrate that a macroprudential policy that tightens the leverage limit can internalize the aggregate demand externalities. Then, they show that a prudential monetary policy can accomplish similar financial stability objectives to macroprudential policy in an economy with a leverage limit. The authors numerically characterize the optimal prudential monetary policy in their settings and investigate three comparative static results for a particular level of optimists' wealth share. Comparative statics reveal that the planner utilizes prudential

monetary policy more when leverage limits are at an intermediate level; when she perceives a higher probability of transitioning into a recession; or when investors disagree about the risk of a recession.

An audience member asked whether a central bank sticking to a decision rule like the Taylor rule is also likely to use prudential monetary policy during a boom. Another audience member suggested studying trade-offs between imperfect leverage ratios, such as a looser leverage limit on some participants and a tighter leverage limit on others.

Credit Cycles with Market-Based Household Leverage

William Diamond and **Tim Landvoigt**

During the boom of the early 2000s, highly levered households could borrow cheaply. For a period after 2008, loans became more expensive. This paper investigates how these higher borrowing costs affected household leverage and consumption. Unlike most quantitative work on the 2000's credit cycle, which employ exogenous loosening or tightening of borrowing constraints, in this paper supply and demand of loans determine household leverage. Financial intermediaries offer households a menu of competitively priced mortgage contracts, in which the severity of the intermediaries' financing constraints endogenously determine the risk premium they charge. This approach allows the authors to study how asset price fluctuations affect household leverage choices.

The authors use a quantitative general equilibrium model in which the price of credit offered by the financial sector affects the quantity of leverage chosen by households. Intermediaries issue risk-free deposits, invest in risky assets, and face frictions in raising the equity capital required to bear the risk in their portfolios. The capital of intermediaries is a key state variable that drives asset price fluctuations. Households in overlapping generations have different sensitivity to the supply of credit.

The authors explore three scenario comparisons. For the first, the authors find several differences between a productivity-driven recession and a housing crisis. A productivity-driven recession eventually leads to an increase in the risk-free rate, reflecting high growth expectations as the economy returns to trend. In a housing crisis, intermediaries lose equity because of mortgage defaults and supply less safe assets, which decreases the risk-free rate. All households have similar drops in consumption in the productivity-driven recession, while borrowing-constrained young households experience a sharper drop in consumption in a housing crisis. The mortgage market is nearly unaffected by a productivity-driven recession, while the leverage of all households decreases in a housing crisis.

For the second scenario, the authors study the effects on the economy of a 40% drop in the equity capital of financial intermediaries without any other exogenous shocks. This drop leads to a more extensive spread between risk-free rates and mortgage rates. Then, mortgage default rates sharply decline, as households reduce their leverage in response to the more extensive spread. Since households cannot borrow as much against their homes, the home's value as collateral decreases. As a result, house prices experience a moderate decrease.

For the third scenario, the authors study the indirect effects of growing demand for safe assets on intermediary leverage and risk-taking, household leverage, consumption, and house prices. The size of the financial sector, the amount of outstanding mortgage debt, the leverage of households, and the price of houses each increase in this scenario.

One audience member asked whether the authors could detect statistical features of data and whether they had checked for idiosyncratic shocks. One of the authors answered that they used cross-sectional data to match default rates and that, although idiosyncratic shock could matter during recessions, they did not quantify it. Another participant asked whether there were any other types of collateral than houses, and whether the model imposed any additional requirements to obtain a loan. Last, several people asked about the driving forces in the model that would cause home prices to collapse.

Interbank Networks in Shadows of the Federal Reserve Act

Haelim Anderson, **Selman Erol**, and Guillermo Ordonez

This paper belongs to the growing literature on how financial networks can cause shocks to spread across institutions. These interactions between financial institutions have macroeconomic implications for understanding how the architecture of a network generates systemic risks. Previous studies take a network as a model primitive and investigate how financial shocks propagate. This assumption is reasonable if we assume that financial shocks are unanticipated. Realistically, financial interlinkages are endogenous and change in response to shocks, policies, and regulations. In order to address this issue, we need to construct a model where banks can readjust their relationships with other banks in response to shocks. In addition, exogenous variations in financial shocks or policies are needed for causal identification, and detailed data on networks are needed in order to trace out the effects of changes in regulations on the whole financial system.

This paper studies how the introduction of central banks' lending facilities through a discount window affects a financial network. The authors show that public liquidity provision to regulated member banks works as a substitute for privately held liquidity (cash or interbank deposits). Nonmember (shadow) banks can access the discount window via short-term borrowing from the member banks. An increase in public liquidity unambiguously reduces the likelihood of costly liquidations, decreasing financial fragility. However, it increases the reliance of the financial system on central bank assistance, making the network more vulnerable. In addition, provision of public liquidity replaces a big single core in New York City with smaller regional core-periphery structures, making the network more dispersed. This network fragmentation crowds out cross-regional private interbank insurance, inducing higher reliance on public assistance to hedge against regional liquidity shocks.

The authors collect data from a financial network of state banks in Kansas in the periods before and after the Federal Reserve. They document shifts in the fraction of correspondences from central reserve cities to regional reserve cities after the introduction of the Fed. They also take reduction in average geographic distance between respondent state banks and correspondent banks as evidence of fragmentation of the network. The assigned discussant pointed out that all of the empirical evidence is about extensive margins (for example, the number of links and pairwise geographic distances). These measures are sensitive to mergers and entry/exit, especially when the number of respondent banks is not large. He suggested taking into account the volume of deposits as a measure of the intensity of a connection.

The authors found that after the introduction of the Fed system, systemic risk increased by reducing aggregate liquidity, intensifying the lending relationships between banks, and crowding out private insurance. The discussant asked whether this identification strategy could be questioned since the Federal Reserve Act did not change the regulations on state banks, whose reserve requirements remained the same. The act was a major overhaul of the system at that time: not only in terms of membership, but also in terms of bank portfolios and other structural details about the economy. The discussant questioned how much of the variation in the outcome variable could be attributed to the regulation on membership. He suggested providing some anecdotal evidence on how this change in policy worked as a causal mechanism.

The empirical evidence in this paper shows that restricting the public provision of liquidity to member banks does not prevent shadow banks from accessing public liquidity. Indeed, this type of policy may have hampered the functioning of interbank relations, as more a fragmented network crowded out cross-regional private interbank insurance.

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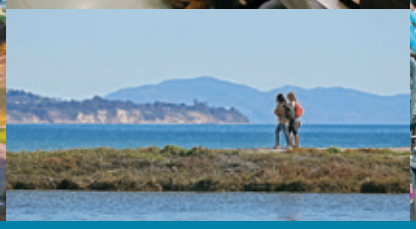

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