



Director's Message

For the third year running, LAEF has held a macro/finance conference in cooperation with the Tepper School of Business at Carnegie Mellon University in Pittsburgh. The conference, organized by **Nicolas Petrosky-Nadeau** and **Lars Kuehn**, both assistant professors at the Tepper School, once again brought together young researchers in macroeconomics and finance, pairing them with senior academics in opposite fields to discuss their work. This year's conference was held in Santa Barbara. This issue of *From the Lab* summarizes the ten presentations, along with the discussion taking place during the presentation of each paper. Topics included production economies; exotic preferences; time variation in expected returns; learning; and the pricing of currencies, commodities and sovereign debt. Here's a taste of what went on at the conference:

In the current context of unresolved budgetary negotiations at the Federal level, this year's conference saw timely research precisely about uncertainty in government actions as a policy tool. In a paper presented by Jaromir Nosal, and co-authored with Guillermo Ordoñez, delay by a government in acting during an unfolding crisis may lead economic agents to take precautionary measures ex-ante, thereby diminishing the likelihood of a crisis occurring in the first place. Under what the authors call "government uncertainty", studied in the context of a banking crisis, a government may want to delay rescuing banks in order to learn more about the shocks the system is facing and then take the appropriate action. This leads to strategic restraint by banks, which reduce the riskiness of their portfolio relative to their peers in order to avoid being the worst performers in a crisis. These novel forces allow a government optimally to exploit uncertainty so as to avoid endogenous systemic events. This analysis will, no doubt, carry over and lead the way to new insights in other spheres of government policy.

Several papers bridged the gap that sometimes exists between finance and macroeconomics. For example, Andrea Eisfeldt and co-author Tyler Muir find that at both the aggregate and the firm level, corporations tend simultaneously to raise external finance and accumulate liquid assets. This is a rather surprising new empirical fact because standard models imply that firms only raise external equity when there is a need, such as real investment. To resolve this puzzle, the authors emphasize the role of shocks to the cost of external finance in matching the empirical moments that describe the joint dynamics of internal and external finance.

The fourth in the series of macro/finance conferences organized jointly by LAEF and the Tepper School will take place in Pittsburgh on September 20 and 21, 2013. It was interesting to see the



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following notice from the National Bureau of Economic Research: "The recent financial crisis has highlighted the connections between financial markets and the macroeconomy. While these connections are studied by specialists in both finance and macroeconomics, few conferences are designed to mix these two groups. To increase this interaction, the NBER will host a one-day meeting at the Summer Institute on Finance and Macroeconomics on July 12, 2013 as part of the Monetary Economics program." Others are catching on!

Four years ago (Fall 2008), I reported on two exciting trips: attending the first ever Kavli Prize events in Oslo, and participating on a panel organized by the Copenhagen Consensus Center, headed by Bjørn Lomborg. Since then, my wife and I have attended the Kavli Prize events two more times (the prizes are given out biannually), the last in September, and I participated in Copenhagen Consensus 2012 in May. Fred Kavli is an important supporter of UCSB. In particular, he contributed to creating UCSB's Kavli Institute for Theoretical Physics. The Kavli Prizes are analogous to Nobel Prizes, but in the fields of nanoscience, neuroscience, and astrophysics. At the award ceremony, replete with entertainment, the Prizes are formally awarded by the King of Norway. In the evening, a gala dinner follows.

As in 2008, Copenhagen Consensus 2012 set out to rank solutions to world problems. In particular, a panel consisting of Robert Mundell, Thomas Schelling, Vernon Smith, Nancy Stokey, and me was asked to answer the following question: What are the best ways of advancing global welfare, and particularly the welfare of developing countries, illustrated by supposing that an additional \$75 billion of resources were at their disposal over a 4-year period? In advance of the panel meeting, experts had been

asked, in the form of challenge papers, to propose and justify solutions in ten challenge areas: armed conflict, biodiversity, chronic disease, climate change, education, hunger and malnutrition, infectious disease, natural disasters, population growth, and water and sanitation.

In ordering the proposals, the panel was guided predominantly by consideration of economic costs and benefits. In setting priorities, the panel took account of the strengths and weaknesses of the specific cost-benefit appraisals under review, and gave weight both to the institutional preconditions for success and to the demands of ethical or humanitarian urgency. As a general matter, the panel noted that higher standards of governance and improvements in the institutions required to support development in the world's poor countries are of paramount importance.

Based on very high benefit-cost ratios, the panel chose to give its highest ranking to Interventions to Reduce Chronic Undernutrition in Pre-Schoolers. The panel merged this solution with a similar proposed investment contained in the Education paper. For about \$100 per child, this bundle of interventions (including micronutrient provision, and also complementary foods, treatments for worms and diarrheal diseases, and behavior change programs) could reduce chronic undernutrition by 36 percent in developing countries. The panel noted that the educational benefits as well as the health benefits should be taken into consideration. Even in very poor countries and using very conservative assumptions, each dollar spent reducing chronic undernutrition has at least a \$30 payoff.

The next four highest-ranking solutions were all taken from the Chronic Disease paper. The panel was impressed by the high benefit-cost ratios even with the conservative assumptions used.

A high priority is to reduce the relative prices that poor countries face for new artemisinin combination therapies. Every \$1 million spent means about 300,000 more children treated, 20,000 of whom with severe malaria. This would prevent 1,000 deaths. Thus, spending \$300 million a year on The Subsidy for Malaria Combination Treatment would prevent 300,000 child deaths, with benefits, put in economic terms, that are 35 times higher than the costs. This analysis suggests it is one of the best returns on health that could be made globally.

Another high priority is Expanded Childhood Immunization Treatment, where spending about \$1 billion annually would save 1 million child deaths and have benefits 20 times higher than the costs. The panel noted that the benefits from the fourth-ranking solution, Deworming of Schoolchildren, would come not only from the health effects, but also from making education more productive. Finally, while the benefits for Expanding

Tuberculosis Treatment are lower than in the Copenhagen Consensus 2008, this remains a very worthwhile investment.

After this whole process was over, each of the five panel members was asked to submit some personal reflections on his or her own priorities. I chose not to focus on the very top-ranking ones, for reasons you can see:

Reflections on CC12

Finn E. Kydland

Ten of the first 11 solutions on the panel's ranking are related to hunger and diseases. Implementing these solutions would be hugely important not only in saving lives and preventing various forms of agony among millions of people, but also in making educational attainment much more efficient and beneficial in the longer run. Personally I felt that this time, in comparison with four years ago, the estimates of benefit/cost (BC) ratios had become more accurate and credible, removing some of the uncertainty that otherwise might make one reluctant to rank a particular solution highly.

Rather than talk in detail about these solutions (I'm sure others will), let me focus on the two for which the discrepancy between my ranking and that of the overall panel was the greatest. One is "Increase Availability of Family Planning," ranked #5 by me and #18 by the panel. While population growth doesn't seem to be a global problem any more (Malthusian outlook outdated), the micro problem is that so many women don't have access to any kind of birth control. This is a huge problem for female education, productivity, and income, and is a financial burden when kids aren't affordable. My reading from the experts is that estimates from smaller programs suggest the reduction in child and maternal mortality yields BC ratios of 30:1 to 50:1. Estimates for larger programs that could change population dynamics predict significant impacts on GDP per capita. Reductions of population growth rates of 1% could increase the growth rate of GDP per capita by about 1 % in high-fertility countries. This suggests BC ratios of 50:1 to 100:1. Combining the above analyses yields overall BC ratios ranging from a little under to well over 100:1.

Admittedly, there is a great deal of uncertainty associated with such estimates. It's natural that different panel members take that into account to various degrees. In my case, it was hard not to be influenced by something the others hadn't seen, namely a research paper by two of my most respected colleagues at UC Santa Barbara, Henning Bohn and Charles Stuart, entitled "Global Warming and the Population Externality." According to their abstract:

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We calculate the harm a birth imposes on others when greenhouse gas emissions are a problem and a cap limits emissions damage. This negative population externality, which equals the corrective Pigovian tax on having a child, is substantial in calibrations. In our base case, the Pigovian tax is 21 percent of a parent's lifetime income in steady state and 5 percent of lifetime income immediately after imposition of a cap, per child. The optimal population in steady state, which maximizes utility taking account of the externality, is about one quarter of the population households would choose voluntarily. As always, such estimates are only as reliable as the model and the data on which they're based. But even much lower estimates would be worthy of note...

The largest ranking discrepancy, however, was for the solution "Sanitation as a Business," ranked #3 by me and #21 overall by the panel. (The reader may recall that, as the basis for the panel ranking was medians of panel members' rankings, once it was established that I was above the median, it didn't matter for the overall ranking whether my ranking was 3 or 20. If instead the mean had been the criterion, then that would have moved this solution up somewhat in the overall ranking.) By way of background, one-third of the world's population, 2.5 billion, does not have access to basic sanitation, and one billion defecate in the open. Improved sanitation could prevent 1.5 million deaths a year from diarrheal illness, enhance dignity, privacy, and safety, especially for women and girls. Modern water indoor sanitation systems cost \$50-\$100 per month, putting this technology out of reach for those living on, say, \$1-2 per day. Conventional water waste treatment plants are expensive to construct and operate. One must look to latrines and septic tanks, investments for which the homeowner shoulders the responsibility of cost and maintenance. Developed nations use vacuum trucks for full septic tanks, but these trucks are

expensive and not well suited for latrines. It is estimated that 200 million latrines and septic tanks are emptied manually, with a worker descending into the pit with a bucket and spade.

The "Sanitation as a Business" solution proposes a service provided by entrepreneurs at a cost of no more than \$10 per household per year. It consists of emptying sludge to a treatment plant and treating it to acceptable levels before dispersal into the environment. Assume it is feasible to invest in innovation to achieve the following: bring annual cost of vacuum truck down from \$35-90 to \$20 as a result of more efficient markets, bring it down further to \$10 with improved technology that is currently in design state. As subsidies necessary for introduction of the services, one is looking at a \$320 million investment for improving service for 200 million people in low-income urban areas, giving a BC ratio of 46:1. Assuming technological advancement doesn't pan out, so that it costs \$20 per year instead of \$10, then the BC ratio falls to 23:1. Even under that more conservative estimate, this strikes me as an eminently worthwhile solution.

The area of sanitation has received a welcome burst of visibility lately with the news of the engagement of the Gates Foundation. In particular, as reported by *The Economist*, Bill Gates will provide seed money for the reinvention of the toilet in an attempt to make it cost-effective in low-income countries. Of course, one of the solutions considered by our panel was "The Reinvented Toilet," ranked #14 by me and #24 overall by the panel. But we were informed of Bill Gates' involvement, which suggests that, in spite of high potential BC ratio (40:1, but with high risk), the involvement of CCC would not be crucial. Moreover, a factor, at least for me, is that it could take decades before this solution would be sufficiently cost effective to make inroads, for example as an alternative to "Sanitation as a Business."

Third Annual Macro-Finance Tepper-LAEF Conference

SEPTEMBER 14-15, 2012

VISITING CONFERENCE PARTICIPANTS

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Braz Camargo — *São Paulo School of Economics-FGV*

Yi Li Chien — *Federal Reserve Bank of St. Louis*

Wouter Den Haan — *London School of Economics*

Andrea Eisfeldt — *University of California, Los Angeles-Anderson*

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Ron Giammarino — *University of British Columbia-Sauder*

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Raoul Minetti — *Michigan State University*

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Emiliano Pagnotta — *New York University-Stern*

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Ariel Zetlin-Jones — *Carnegie Mellon University*

Lu Zhang — *The Ohio State University-Fisher*

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Aggregate Issuance and Savings Waves

by **Andrea Eisfeldt** and Tyler Muir

Eisfeldt and Muir consider the joint dynamics of liquidity accumulation and external finance at the firm level and document two new stylized facts. First, there is a high positive correlation between liquidity accumulation and externally raised funds, both in the aggregate and at the firm level. This is surprising since it seems unattractive for firms to raise relatively expensive external funds just to invest them in low yielding assets. Second, the time series of the cross-sectional correlation between liquidity accumulation and external finance is strongly negatively correlated with traditional

measures of the cost of external finance. This is intuitive, since it implies that the positive relationship between cash accumulation and external finance becomes weaker the higher the cost of the external funds.

The paper proceeds to build a dynamic partial equilibrium model to rationalize the stylized facts. The model features a risk-neutral firm that decides about its investment, financing and liquidity accumulation policies. The authors compare the implications of a baseline model with a single shock to TFP to those of a model that adds a shock to the cost of external finance, and they argue that financing cost shocks are necessary in order to explain the observed facts.

The baseline model features (1) persistent productivity shocks, (2) fixed cost of external finance, and (3) convex adjustment costs for investment. Firms raise more external finance than they need for current investment in order to avoid again paying the fixed cost of external finance. The additional funds raised are accumulated as liquid assets and used to smooth investment over time. The model can replicate the aggregate correlation between external finance and liquidity accumulation of 0.6 in Compustat data (excluding the top 10 percent of firms). However, the baseline model comes up short in explaining the level of liquidity accumulation as well as the second stylized fact.

Compared to the baseline model, the full model adds an aggregate shock to the costs of external finance and sets fixed cost of external finance to zero. The addition of the financing cost shock decreases firms' tendency to hedge productivity shocks by accumulating (high return) capital rather than (low return) liquid resources, raising the level of liquidity accumulation to align it more closely with the data. This occurs because the additional source of risk increases firms' motives for holding a buffer stock of liquid assets. The addition of the financing shock further lowers the correlations between external finance, liquidity accumulation and investment at the firm level to more realistic levels by breaking the stochastic singularity of the baseline model. Lastly, the stochastic cost model is able to produce the second stylized fact, i.e. a high positive correlation between the cross sectional correlation between liquidity accumulation and external finance and the level of the cost shock. The authors conclude that a model with stochastic financing costs is necessary to replicate the empirical findings.

The last part of the paper provides an estimate of the time series of the cost of external finance. Specifically, at each date, the value of the financing cost is inferred as the one that generates model-simulated cross-sectional model moments that are as close as possible to the data. The resulting time series spikes during episodes one would reasonably expect to have featured elevated levels of the cost of external finance.

The discussant, Wouter Den Haan, stressed the critical importance of the modeling assumption that external finance is subject to a fixed cost, while investment is subject to a convex cost. He noted that it would be nice to see empirical evidence of the relative importance of fixed costs in external finance vs. investment. Relatedly, he suggested exploring two additional implications concerning the assumed cost structure in the data. First, the model implies that bursts in external financing are followed by several periods of increased investment. Second, external financing in the model is lumpier than investment. Evidence of these features in the data would strengthen the reader's belief in the mechanism of the model and make it easier to compare it to alternative explanations for the empirical facts.

Den Haan's second main comment revolved around the quantitative importance of the documented stylized facts. He pointed out that the authors' use of correlations masks the magnitude of how much liquidity increases when external finance increases (or vice versa). He suggested the use of regression coefficients to get a sense of this magnitude for both stylized facts.

External Financing and the Role of Financial Frictions over the Business Cycle: Measurement and Theory

by Ali Shourideh and Ariel Zetlin-Jones

Shourideh and Zetlin-Jones present new empirical evidence suggesting that representative firm models may be inappropriate for studying the relationship between financial constraints and the business cycle. To do so, the authors measure the amount of external funds that a firm requires to finance its investment. They define a firm's available funds (AF) as current cash flow from operations minus interest payments and taxes. In the aggregate, firms' AF exceeds investment at almost any point in time for both U.S. and U.K. data. The authors argue that this fact presents a challenge for representative firm models whose mechanism relies on binding collateral constraints. Using a statistic based on the difference between AF and investment for each firm, the paper shows that in both the U.S. and the U.K., roughly 20 percent of investment by public firms is financed externally. For private firms in the U.K., data from Amadeus covering the years 2001 to 2009 shows that 70-95 percent of investment is financed externally. The authors argue that empirically plausible financial frictions must thus prevent the allocation from public to private firms while keeping the representative firm unconstrained.

The authors build a dynamic model featuring a continuum of heterogeneous firms that replicates the empirical findings. The model is used to study the role of financial frictions for the business cycle. In the model, firms are subject to idiosyncratic productivity shocks, which make it desirable to reallocate

capital from low productivity firms to high productivity firms. The reallocation is hindered by a financial friction in the form of a collateral constraint. The model features both private and public firms. Publicly held firms are owned by diversified households and are risk neutral; privately held firms are owned by individual entrepreneurs who cannot diversify their portfolios and are thus risk-averse and impatient. Firm types are given exogenously and do not change. Importantly, each firm has a monopoly in producing a differentiated output and uses the goods produced by other firms as an intermediate good in production, which makes firms interconnected.

Shocks to the tightness of the collateral constraint are shown to induce sizable economic fluctuations. Specifically, a shock to the collateral constraints which generates a one standard deviation decline in the aggregate debt-to-asset ratio leads to a 0.5 percent decline in aggregate output on impact. The mechanism works as follows: In the stationary equilibrium of the model, public firms are unconstrained and thus are not directly affected by shocks to the collateral constraint. However, the firms are indirectly affected because they use inputs of private firms. In response to a financial shock, some private firms are constrained and have to reduce investment. The resulting fall in the rental rate of capital as well as the wage rate represent a negative wealth shock to households, who reduce their demand for the final good. Because goods are not perfect substitutes, demand for goods produced by all firms falls, tending to lower output of unconstrained firms.

The discussant, François Gourio, focused on the paper's empirical measure of external funds, and questioned its usefulness as an indicator of financial constraints. The discussion was based on the accounting identity

external funds = AF - investment = dividend payments - net debt/equity issuance + change in cash balance.

Gourio emphasized that while external funds are not generated this period, they could come from cash resources. Thus, external funds need not be informative about which firms access capital markets. To validate his concern empirically, he showed that in Compustat data, a sizable fraction of firms with negative external funds does not issue long-term debt, while a large fraction of firms with positive external funds does issue long-term debt. He concluded that, contrary to what is implied in the paper, firms with positive external funds would still be affected by financial market shutdowns in reality.

Uncertainty as Commitment

by Jaromir Nosal and Guillermo Ordoñez

Bailouts to financial institutions have been prevalent in United States history since the nineteenth century, with the numerous bailouts enacted during the 2008 financial crisis being the most recent examples. Yet no one would disagree

that bailouts are socially costly. Such costs may comprise tax distortions that arise from financing the bailouts, compulsory transfers among the population, and loss of reputation of the government. Given these phenomena, it is natural to ask: What are the incentives of the regulator to provide bailouts to financial institutions? Nosal and Ordoñez study this question in an environment that builds on Farhi and Tirole (2012) but includes two realistic features unmodeled in the previous literature. First, the authors allow for banks to experience financial distress sequentially. Second, it is assumed that whenever a bank is in trouble, policymakers are uncertain whether they are facing an isolated or a systematic event, a situation they refer to as government uncertainty. The latter friction is essential, as in the authors' model an isolated event of distress can be solved by mergers and acquisitions within the financial system (there is no need for government intervention), whereas a systematic event calls for a bailout since there is not enough liquidity in the financial system to rely on takeovers.

In this framework, it is shown that when the government lacks the ability to commit to "no bailouts" policies, it may want to delay rescuing banks and let the first bank(s) in trouble fail. Intuitively, deferring intervention allows the regulator to learn about the type of shock (idiosyncratic vs. aggregate) from market outcomes. Given such delay, banks are induced to restrict the relative riskiness of their portfolios to avoid being the worst performers. The authors call this competition strategic restraint. The main result of the paper is that under certain conditions, the resulting equilibrium outcome coincides with the ex-ante optimal one under full commitment. Put differently, the presence of government uncertainty may induce the economy to behave as if the government had the ability to commit (hence the title of the paper). Nosal and Ordoñez also extend their benchmark model in a number of dimensions which are relevant for policy analysis. These include the presence of securitization, industry concentration, asymmetric banks sizes and financial contagion.

The paper was discussed by Ron Giammarino. He first pointed out that the idea of the paper was insightful, but quite difficult to follow. In particular, he questioned whether Farhi and Tirole (2012) was the right framework since, unlike in that paper, Nosal and Ordoñez focus less on liquidity and money markets, and more on capital infusions for real investment. In turn, Giammarino inquired if it would be possible to simplify the model, for example by assuming out limited pledgeability and the existence of households (two elements in the authors' paper). To these comments, Nosal replied that the model does need a lot of moving parts. For instance, limited pledgeability is a crucial friction in a liquidity model, and households in their environment are

essentially different from banks since the former cannot run projects while the latter can. Giammarino also questioned the fact that in the model an isolated event of financial distress is best handled within the financial system through takeovers. In his view, it was not clear how enough liquidity in the system translated into a takeover.

Furthermore, Giammarino posed broader questions and concerns about the paper. For example, while the model focused on interest rate policy and taxes to implement bailouts, he suggested that the authors could endow the regulator with other policy tools, such as direct transfers or capital structure restrictions. He also wondered what would be the implications of allowing for bank runs, to which Nosal replied that the main results would go through by reinterpreting the model accordingly.

A conference participant suggested that the authors should make contact with the existing literature on moral hazard and limited commitment when there is lack of information by the principal. Nosal agreed with this comment. Another participant asked about the special role of the government in the model. Nosal responded that the government was basically an agent with taxing powers.

Reference:

Farhi, E. and J. Tirole (2012): "Collective Moral Hazard, Maturity Mismatch and Systemic Bailouts," *American Economic Review*, 102(1), 60-93.

Short-term Debt and Financial Crises: What We Can Learn from U.S. Treasury Supply

by Arvind Krishnamurthy and Annette Vissing-Jorgensen

The financial sector borrows predominantly using short-term debt instruments, such as checkable deposits, savings and time deposits, and money market mutual funds shares, to name but a few. Data constructed by Krishnamurthy and Vissing-Jorgensen suggests that in the United States, the ratio of the financial sector's short-term debt to GDP between 1914 and 2011 averages 65.6 percent, compared to roughly 7 percent for long-term debt.

Why is there so much short-term debt financing of the financial sector? Krishnamurthy and Vissing-Jorgensen build a model where the key driver behind this phenomenon comes from the demand side: investors value the liquidity and safety of those assets. The authors provide a test for this argument based on the variation in the supply of safe and liquid government debt, mainly U.S. Treasuries. Specifically, a central prediction of their theory is that an increase in the supply of U.S. Treasuries should crowd out the private sector's supply of short-term debt. Intuitively, a reduction in Treasury supply reduces the aggregate of safe and liquid assets. Given the assumed special demand for those assets, the latter reduces their yields, which in turn increases the private sector's supply of short-term debt. This prediction

is verified using U.S. data from 1914 to 2011. After constructing an overall balance sheet for the entire U.S. financial sector for that period, the authors show that the net supply of government debt is strongly negatively correlated with the net supply of private short-term debt.

The data is then used to test two additional predictions of the model. First, it is shown that the financial sector's liquid short-term debt (and more generally M1) is crowded in by the Treasury supply. This relationship emerges because the financial sector uses Treasuries to back liquid deposits and other forms of short-term debt. Interestingly, it is also shown that accounting for the effect of Treasuries on M1 can help to resolve the "missing money" puzzle of the post-1980 period. The final result confirmed by the data is related to predicting financial crises. More precisely, it is proven that when forecasting financial crises in the U.S., private short-term debt has more explanatory power than standard measures based on private credit growth. Basically, due to the mismatch between liquidity and risk inherent in the financial sector's balance sheet, the risk of a financial crisis is not primarily driven by loan growth per se, but rather by loan growth funded by short-term debt.

The paper was discussed by Burton Hollifield. He first urged the authors to think carefully about the implications of endogenizing the supply of Treasuries, given that there is no government budget constraint in the current version of the model. Hollifield also questioned the validity of assuming that both the special demand of investors for safe and liquid assets, as well as the payment technology, were stable relationships in the model. He was therefore concerned about "pushing the model too far."

A conference participant wondered why the authors did not discriminate between the effects of changes in the Treasury supply of different maturities. The participant prefaced his question by remarking that average maturity changed significantly along the time period considered in the paper, and also that while risk does not change much across maturities, liquidity does. Vissing-Jorgensen first responded that in fact long- and short-term securities are not that different in terms of liquidity, but might differ in terms of risk. She then alleged that the main reason why Treasuries of different maturities were not used as regressors in the paper is because that would potentially give rise to endogeneity issues.

Sovereign Debt Crises and International Financial Contagion: Estimating Effects in an Endogenous Network

by Brent Glover and Seth Richards-Shubik

Motivated by the recent European sovereign debt crisis and the fear of contagion in sovereign debt markets, Glover and Richards-Shubik ask how important and large in magnitude is contagion risk. They claim what is missing from the existing sovereign debt literature is this interdependence whereby a default of a sovereign nation imposes externality on the rest of the system by increasing the default probability of the other countries. This channel is different from purely correlated shocks and the difference between the two implies not only different model mechanisms but also different policies. Hence, if the contagion channel is not significant, then it may be harder to justify bailout policies.

By using a model, one can isolate the contagion channel from countries just loading up on one common shock. The authors build a model of an endogenous network of borrowing and lending in which N countries populated by a representative household have investment projects that they finance with loans from other countries. A country's solvency depends on the solvency of the others to whom they lend. Glover and Richards-Shubik estimate the model by minimizing the distance between the observed solvency probability (imputed from Credit Default Swap – CDS – prices) and the solvency probability implied by the model, while taking as given the lending and borrowing behavior for which they use Bank of International Settlements data of bilateral international borrowing and lending.

As is standard in the network literature, eigenvector centrality is used to measure the importance of a particular country - normalized relative to Germany - per dollar of debt. Glover and Shubik find that since 2009, Ireland, Portugal, Spain, and specifically, Greece have become more important. This implies that Greece defaulting now, for example, has more adverse consequences for the rest of the countries in the network than if it had defaulted pre-2009. With the estimated model, the authors simulate Italy's and Spain's default and assess the effect on the probability of default of the other countries in the network. They find different countries respond differently: for example, Portugal's default probability increases by three percent in response to Spain's default versus by only 0.3 percent in response to Italy's. The sum of all countries' increases in default probabilities due to the default of a particular country correlates with the centrality measure. Thus, generally there is evidence of a contagion effect although it is not large because the countries do not have correlated shocks.

The discussant, Raoul Minetti, commented that the paper currently is between a fully specified GE model and an

endogenous network model. He suggested streamlining and better justifying assumptions such as the assumption of increasing and the convex cost of making loans. He questioned the validity of the assumption that the agents and the government are the same and agents take the default probability as given, and he wondered how this explains the sovereign debt crisis because it is not a model of governments per se, or the strategic behavior of governments. He also suggested that the authors think more about the assumption that households can extend loans but cannot self-finance or act as intermediaries, and can repay only with revenues. Finally, he suggested showing metrics of interconnectedness and completeness of network.

Several conference participants asked how to interpret the centrality measure. The interpretation is as follows: first, more diverse countries hold Greek debt and, second, if a rich country A lends to B through a fragile country C that cannot handle B's default, then country B's centrality is higher – i.e. B's default is more important – than if A directly lends to B.

A number of other questions were posed by conference participants: Were the default probabilities imputed from CDS prices supposed to capture just independent probabilities or contagion risk as well, and which of the two is the model trying to target? Related to the recovery rate, is there seniority in repayments? Does the direction of flow (in vs. out) matter for the centrality measure? Glover's responses to these questions were: Default probabilities derived from CDS prices do capture contagion risk and that is what the authors want because default probabilities implied by the model incorporate a contagion channel. There is no seniority in repayments. The measure of centrality is one-directional. Finally, a participant suggested to Glover another way of quantifying contagion risk which is to calculate by how much, for example, Germany's GDP decreases in response to Italy's default.

Why Doesn't Technology Flow from Rich to Poor Countries?

by Harold Cole, Jeremy Greenwood and Juan M. Sanchez

Countries in different stages of economic development, such as the United States, Mexico, and India, employ production technologies that systematically differ by productivity, average plant size, and age distribution of firms. For example, the average plant size is a lot smaller for less developed countries and younger plants make up a larger fraction measured by employment in poorer countries. This raises the question of why poor countries do not adopt the technologies of rich countries. Cole, Greenwood and Sanchez propose that the efficiency of financial markets plays an important role. The authors build a dynamic costly state verification model of technology adoption with corruption (firms can retain some of the cash flows). In their model, firms' choice of technology

is an equilibrium outcome that depends on input costs and more importantly on the efficiency of monitoring and the ease of diverting funds (i.e. the extent of corruption). They calibrate their model to data from the United States, Mexico, and India to match distribution of firms by plant size and age. For the authors' results, it is important to have both the costly monitoring and corruption frictions, otherwise differences in monitoring efficiency alone will not result in differences in technologies.

The discussant, Harjoat Bhamra, commented that the discount rate is the same for countries, but the authors could instead make the discount rate higher for India. They could also have a stochastic discount factor that is dependent on the aggregate state. This would allow an analysis of welfare losses associated with frictions in their model and also how aggregate uncertainty shocks impact their results, i.e. whether with aggregate uncertainty shocks firms adopt worse technology.

Conference participants asked a number of questions, among them: Empirical facts the authors show may be capturing more of a cohort effect, and once it is controlled for, the cross-country differences in a firm's life cycle may disappear. So, are the authors sure that the empirical facts that they are trying to explain are capturing the firms' life cycle effect, vs. cohort effect? What are the authors getting from a more complicated dynamic model that they cannot get from a static setting? How close is India in adopting a better production technology? Some of Sanchez's answers were: The authors take the empirical facts at face value and assume they are capturing life cycle effects. The authors could get some of their results from a static setting. It is not trivial to figure out how close India is using their current model set-up because the authors do not consider transitions between technologies.

Subsidizing Price Discovery

by Braz Camargo, Kyungmin Kim and Benjamin Lester

Two losses that result from a freeze in the trade of an asset: unrealized private gains between the two trading partners and a social loss associated with the lack of information generated through realized trading prices. This paper focuses on the second type of loss and policies designed to address it. Specifically, Camargo, Kim and Lester examine the effects of the Public-Private Investment Program (PIPP), introduced in March 2009, designed to restore private sector price discovery in the market for real estate loans and mortgage backed securities. Under the program, the FDIC subsidizes the purchase of these troubled assets by offering investors a non-recourse loan to finance a fraction of the purchase. Since the loans were non-recourse, the maximum potential loss an investor faces is his initial investment. The

authors develop a simple, static framework to understand the implications of a policy that effectively subsidizes trading losses, such as PIPP, on information acquisition.

The model consists of a seller, who owns one asset, and many buyers. The seller has private information about the quality of the asset, which can have a high or low payoff. Buyers are ex-ante identical in their beliefs about the asset's quality, yet each can independently acquire a noisy signal about the asset's true payoff at a cost that differs across buyers. After information is acquired, buyers compete in a sealed bid, first-price auction, in which the seller can either choose to accept the highest bid or reject all offers. To capture the effects of a subsidy program such as PIPP, the authors introduce a policy in which the winning buyer pays only a fraction of the bid price and borrows the remaining amount in the form of a non-recourse loan. In the event that the asset is of low quality, the buyer defaults with no punishment. Otherwise, the full loan amount is paid back. All policy parameters are common knowledge.

In equilibrium, an increase in the subsidy has two opposing effects on information acquisition. First, a higher subsidy increases insurance from downside risk. This insurance increases the expected payout from winning the auction and hence strengthens the buyer's incentives to acquire information. Secondly, the information acquisition decision of an individual buyer is a strategic substitute to the decisions of other buyers to become informed. As more investors become informed, the incentive to acquire information for any individual investor decreases. In general, the subsidy level that maximizes information acquisition is in the interior. The authors imbed this framework into a larger market setting in which there are many sellers of assets segmented across markets. If trade takes place sequentially across markets and the quality is correlated across assets, the trading price of a single asset can contain useful information for other market participants. This spillover effect increases the social surplus of trade. In general, as the size of the market, and therefore the gain from information spillovers, increases, the level of the subsidy approaches the level that maximizes information acquisition.

A conference participant suggested that another important attribute of price discovery is that investors are able to rank many assets along the risk/return spectrum. Lester suggested that he and his co-authors could easily introduce additional markets characterized by different types of assets. Buyers would, then, be faced with entry decisions. In this type of environment, one of the effects of price discovery is to provide a ranking.

The discussant, Philip Bond, presented a version of the model and posed the question of whether the government's objective should consider boosting buyer profits instead of

only participation. He shows that under a case with many assets in which the buyers of assets are risk-averse, a policy that subsidizes losses such, as the PIPP, does exactly this. The subsidy allows buyers to take larger positions and in turn boosts profits.

Competing on Speed

by Emiliano Pagnotta and Thomas Philippon

Over the past decade, the speed at which trades occur in securities markets has greatly increased. Most major exchanges have invested in new computing platforms that shave fractions of a second off of execution times. For instance, in 2009, the New York Stock Exchange (NYSE) instituted the Super Display Book System Platform that reduced the time it takes to execute an order by five milliseconds. Additionally, the trend in trading speed has been concurrent with increased market fragmentation. Historically dominant exchanges such as the London and New York Stock Exchanges have lost market share to new entrants offering faster execution speed. In their paper, Pagnotta and Philippon study the effects on investor participation, market fragmentation, asset prices, and welfare in a general equilibrium model in which trading venues compete for investors by differentiating execution speed and membership fees.

In the authors' model, trading venues offer intermediation services and are differentiated by the expected speed by which trades take place. Investors buy and sell a single security in a competitive market and must choose to trade on a single platform. A platform's trading speed determines the rate at which investors are able to trade. Investors are heterogeneous along two dimensions. First, to generate gains from trade, investors are subject to preference shocks that alter the marginal utility of holding the asset. Buyers (high marginal utility investors) and sellers (low marginal utility investors) choose trading venues and then meet according to a random process dictated by the trading venue's execution speed. All investors value speed since faster expected execution times increase the expected gains from trade. However, not all investors value speed equally. The second form of heterogeneity is in the volatility of each investor's preference shock. The authors show that investors with a higher volatility process value speed more, *ceteris paribus*, and sort themselves toward trading platforms that offer faster execution speeds. In general equilibrium, trading platforms move first, choose optimal entry and investment in speed, and then compete à la Bertrand, by setting membership fees. In comparison with a monopoly setting, competition leads to lower fees and greater investor participation. Faster venues charge a higher membership fee and attract investors with greater preference shock volatility. This in turn results in higher equilibrium asset prices.

Motivated by the Regulation National Market System (Reg. NMS) adopted by the SEC in 2007, Pagnotta and Philippon analyze the welfare implications of regulation that aims to protect investors by instituting a uniform price across trading platforms. Reg. NMS mandates that if a stock trades on multiple platforms, then the effective ask price must equal the lowest amongst all platforms. In the authors' model, this type of price protection acts as a subsidy for the relatively slow venues. Since trade occurs across venues with different trading speeds, price protection causes investors to be more willing to join platforms with slower execution speeds. Additionally, price protection encourages entry of new trading platforms and increases investment in speed. This leads to greater market fragmentation. The authors show that, in general, a planner would choose a single trading venue and therefore higher fragmentation is welfare decreasing.

The discussant, Pierre Olivier-Weill, suggested that it is important to consider the nature of the costs of speed. The paper assumes fixed costs of speed regardless of the number of investors a trading platform serves. If, on the other hand, these costs vary with the number of investors, market fragmentation could be welfare improving.

Can Investment Shocks Explain the Cross-section of Stock Returns?

by *Lorenzo Garlappi and Zhongzhi Song*

The asset pricing literature disagrees on the role of investment shocks in accounting for the cross-sectional distribution of stock returns. On the one hand, the literature purports a positive price of risk for these shocks based on the existence of cross-sectional predictability of returns by firm characteristics and the value premium – the fact that high book-to-market firms earn higher returns than low book-to-market firms. On the other hand, the literature purports a negative price based on the existence of the momentum effect – the fact that stocks that have performed well in the recent past are likely to continue performing well in the near future. These theories are inconsistent because the value premium and the momentum effect co-exist in the data. Garlappi and Song attempt to address the inconsistency by studying the role of investment shocks empirically using stock price data from 1930-2010. The authors find that the sign of the price of risk depends on the time period studied: It is positive from 1930-1962, negative from 1963-2010, and positive from 1930-2010. The authors also find that the magnitude of investment shocks is too small to account for the cross-sectional distribution of stock returns.

The authors assess the role of investment shocks in three different ways. First, following the macroeconomic literature, they measure the shock as the drop in the price of investment

goods relative to consumption goods. They compare this measure to the rate of consumption growth and find a positive correlation between the two, indicating a positive price of risk. Second, following the asset pricing literature, they measure the shock as the spread between the stock returns of investment good producers and consumption good producers. The authors directly estimate the price of risk using this measure by sorting firms based on their exposure to risk and find that the price is insignificant. Third, the authors sort firms by capital intensity and compare the rate of return, the value premium, and the momentum effect across firms. They do not find significant differences across firms along either dimension, indicating that investment shocks may not be an important determinant of cross-sectional returns. Following the presentation, a conference participant asked if the authors' capital measure included intangible capital. Garlappi replied that it did not. He added that cash and inventories were not included either.

Garlappi and Song also use a simple reduced-form valuation model to identify three channels through which investment shocks affect equity returns: i) the volatility of the shock, ii) the cross-sectional dispersion in investment opportunities, and iii) the market price of risk. With this framework in place, the authors show that existing calibrations match equity returns by choosing parameter values which grossly overstate the role of at least one of these three channels.

Lu Zhang, the discussant, attempted to replicate the authors' results independently. In addition to book-to-market ratios, he repeated the analysis using higher frequency data by sorting firms using firm size and momentum profits. His analysis confirmed the authors' conclusions. He suggested that the authors explore the robustness of their conclusions in regard to higher frequency data, a larger cross-section, alternative test portfolios, and alternative measures of shocks.

One conference participant asked if the authors were using the Gordon series or the NIPA series to measure the price of investment goods. He added that the Gordon series starts in 1954 and is quality adjusted. Garlappi replied that they were using the NIPA series which is also quality adjusted. The participant followed up by noting that even though both series are quality adjusted they are very different: the Gordon series has a stronger equipment price depreciation. Garlappi said that he and his co-author will explore this series in future versions of the paper. He added that the conclusions of the paper are not specific to the NIPA series; they also hold for financial data. Another conference participant asked how the nature of growth firms and value firms had changed over time according to the analysis. Garlappi replied that further work was necessary to comment on the nature of growth firms and value firms. The participant then asked if the authors

had conducted the analysis for another country. Garlappi replied that they had not and added that it would be interesting to do so.

The Nature of Countercyclical Income Risk

by Fatih Guvenen, Serdar Ozkan and Jae Song

Average labor earnings for American male workers dropped by 6.5 percent during the Great Recession, which was the largest postwar drop in earnings. The drop in earnings for 10 percent of male workers was more than 55 percent. During the same time period, however, earnings for about a quarter of workers rose by more than 16 percent, and 10 percent of workers experienced a rise of more than 65 percent. In spite of the drop in mean earnings, median earnings rose by 0.1 percent during the same time period. Motivated by the dispersion in worker fortunes during the Great Recession, Guvenen, Ozkan and Song ask how the entire distribution of income shocks changes over business cycles. Using a confidential data set from the United States Social Security Administration, the authors find that the idiosyncratic income shock distribution becomes more left-skewed during recessions, reflecting an increased likelihood of large income drops and a decreased likelihood of large income increases. Moreover, the median shock decreases slightly during recessions and the variance of the shock is unaffected. The authors also ask if observable characteristics of an individual, prior to recessionary or expansionary episodes, can predict how he or she fares during an episode. They find that the average income level of an individual prior to an episode is an excellent predictor of his income growth during the episode.

The authors use a representative sample drawn from a large confidential data set maintained by the Social Security Administration. The representative sample is a panel data set that contains 10 percent of all U.S. males from 1978-2010. The U.S. economy experienced four recessions and three expansions during this period. The authors divide individuals into groups based on three observable characteristics: i) age, ii) average income prior to an episode, and iii) income growth prior to an episode. They regress log-income on the observable characteristics to decompose business cycle risk into a predictable component and an idiosyncratic component with permanent and transitory shocks. The estimation procedure is non-parametric, so it does not restrict the way in which the distribution of shocks varies across groups of individuals. The authors find that the pre-episode average income of an individual is an important predictor: During the Great Recession, prime age male workers in the 10th percentile of the pre-episode average income distribution fared 18 percent worse than workers in the 90th percentile. The average income loss for individuals in the top one percent of the same distribution, however, was 21 percent worse

than that of individuals in the 90th percentile. The same pattern can be seen in other recessions. The idiosyncratic component of the analysis shows that income shock variances are not countercyclical; instead, the left-skewness of the shock distribution increases during recessions. Following the presentation, a conference participant asked if the unemployed were included in the analysis. Guvenen replied that everybody with positive annual income was included.

Yi Li Chien, the paper's discussant, noted that understanding how individual income risk varies over the business cycle is important for asset pricing, cost of business cycles, and for design of policies that aim to reduce uninsurable risk. He added that the key finding of the paper was that the left-skewness of idiosyncratic risk is countercyclical. This finding challenges the currently held view that the variance of idiosyncratic risk is countercyclical. Chien constructed a model economy to compare the asset-pricing implications of the two differing viewpoints. The endowment economy featured aggregate shocks, and solvency-constrained agents who faced idiosyncratic shocks. Chien considered idiosyncratic shocks that were: i) independent of the aggregate shock, ii) countercyclical in variance, and iii) countercyclical in left-skewness. The auto-correlation and the unconditional variance of the shocks were identical in all three cases. He found that the market price of risk was similar for both types of countercyclical shocks. The equity premium, however, was higher in the skewness case because the risk-free rate was countercyclical. Chien concluded by noting that it would be interesting to see how countercyclical left-skewness affects models with segmented markets, heterogeneous trading abilities, heterogeneous preferences, etc.

Following up on Chien's exercise, Guvenen added that he and his co-authors were working on deriving the asset-pricing implications of their finding. He noted that while a two-point aggregate shock distribution was a good start, it would miss the large kurtosis found in the data. A conference participant suggested that the authors measure consumption for the rich using their data. Guvenen agreed that it would be interesting to do so. He added that their data was inadequate for this exercise because it contained W-2 based labor income only. The same participant followed up by noting that it might be possible to combine data sets and get data on capital income. Another participant asked if the authors could combine pairs of individuals to generate household incomes. Guvenen replied that the data is accessible through an agreement between the IRS and the SSA. The W-2 can be used to match people. However, the IRS prohibits them from doing so. Another conference participant added that such data is available for Canada.



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