From the Lab
Laboratory for Aggregate Economics and Finance
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Director's Message

by Finn Kydland

This issue is devoted in large part to summaries of the sessions of our conference on "Financial Frictions and Segmented Asset Markets." Different approaches have been used to incorporate financial market imperfections into tractable general equilibrium models, emphasizing different frictions in asset markets: lack of commitment in financial contracts, limited participation and market segmentation, and informational asymmetries. The idea of this conference was to bring together researchers who have experimented with various approaches, to exchange ideas, explore different applications, and discuss how to confront these models with the data. In charge of putting together the program was Guido Lorenzoni of MIT. The conference included twelve presentations over two days.

In September, LAEF had the pleasure of hosting Richard Fisher (more on page 10), the president of the Federal Reserve Bank of Dallas, who gave a public speech that drew a large audience consisting of members of the university and the wider community of Santa Barbara. The title of his talk was "Post-Traumatic Slack Syndrome and the Economic Outlook (With Thanks to Finn Kydland, Dolly Parton and John Kenneth Galbraith)." A transcript is available on http://dallasfed.org/news/speeches/fisher/2009/fs090903.cfm

Financial Frictions and Segmented Asset Markets conference participants in May, 2009.

Most of the LAEF visitors come for a month or less. An exception is our current visitor Espen Henriksen who is with us for the whole academic year 2009-10. You can read more about his interests on page 11.

In the previous *From the Lab*, we report on the early-2009 visit by Morris Davis. Also he gave a well-attended speech under LAEF auspices, in this case on the housing situation. In my director's message to that issue, I raved about the manuscript of Morris's new textbook, Macroeconomics for MBAs and Masters of Finance. It is now in print. My inclination would be to use this text in combination with giving the students hands-on experience in running computational experiments so as to understand the dynamics of business cycles better. Programs have been designed for class purposes, in co-operation with the Institute for Information Science and Media Studies at the University of Bergen, to do exactly that. An ongoing LAEF project is to expand the set of modules that can be used in class to illustrate aggregate phenomena with which students typically have difficulty, most often because of the dynamics involved. For more information about its current status, you may visit http://melon.uib.no/projects/melon/

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In October 2009, LAEF hosted a conference entitled "Health and the Macroeconomy." The proceedings will be summarized in the next issue of From the Lab. Our next conference, "Firm Financing, Dynamics and Growth," takes place on February 20, 2010.

Director's Message (continued)

Twice before, I have reported on the outcomes of panel meetings organized by the Copenhagen Consensus Center. The purpose of these meetings is to rank, in terms of benefit-cost ratios, solutions to major problem areas. The first meeting in which I participated dealt with Latin-American solutions, and the second with solutions to world problems. Then, in September, I participated in the Copenhagen Consensus on Climate, on a panel with Jagdish Bhagwati, Thomas Schelling, Vernon Smith, and Nancy Stokey. As always before the panel meeting, experts had been assigned to propose and evaluate solutions in different areas, in this case eight possible areas: carbon cuts, forestry, black carbon cuts, methane cuts, adaptation, technology-led policy, climate engineering, and technology transfers. In the end, we had 15 solutions to rank. Some were extremely long-range solutions. Others were aimed at keeping temperatures from rising too much while the long-range solutions are being developed. Ranked number one and three were two solutions in the latter category: research on marine cloud whitening, and stratospheric aerosol insertion research. They may sound rather exotic, perhaps even far-fetched to some, but the panel was convinced by the experts that if these solutions don't have side effects to speak of, the potential for them to contribute to keeping temperature increases within reason at low costs is very promising.

Number two in the ranking is energy technology R&D (in fact, the top four solutions all involved research), which obviously aims to deal with global warming in the long run. This research, according to the proposal, would be financed by a carbon tax that starts out low, but then grows exponentially. In addition to financing research directly, the idea is that the resulting need to consider the growing cost of carbon emission in the future would provide incentives for the private sector to make investments in green technologies sooner rather than later. A big question, of course, is whether such a time path for the tax rate is politically credible.

Especially interesting to me is the Technology Transfers (TT) solution. A week before the panel meeting, after having read all the papers, the panel members were asked to make a preliminary ranking. In this ranking, I had TT as number one. Such a high ranking in part reflects my general economic belief that there is a lot of technological knowledge available in general which can be transferred to less-developed nations. Making use of it, perhaps with the addition of some research and development to adapt to the local circumstances, is how those nations can hope to make progress in narrowing the income gap with the more well-to-do nations. So why wouldn't something like that work also in the context of technology to abate global warming?

In my notes after reading the experts' papers, I had jotted down a few questions for them. The main problem to me and, as it turned out, to the other panel members as well, was the lack of concreteness. The whole thing seemed too much like a "black box." We wanted to know in much greater detail how it would work in practice. The experts had emphasized, for example, the importance of technology transfers to shift the marginal cost curve rather than moving along it. What are examples of such technology improvements? We also had issues with the political implementability of the solution. We even called the presenters back for further questioning, but in the end, I, at least, felt too many of our questions by and large were still unanswered. As a consequence, this, to me initially very promising, solution ended up only number seven (virtually tied with the solution in sixth place) in our ranking.

Many of the issues discussed during the panel meeting are obviously in great need of further research. It seems to me this need is especially urgent in the case of the TT solution. Perhaps, in the end, it will turn out that my initial ranking was quite appropriate anyway!

For more detailed information about the panel meeting, including the expert papers, you can visit http://www.copenhagenconsensus.com/CCC Home Page.aspx

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Financial Frictions and Segmented Asset Markets

MAY 1-2, 2009

In May 2009, the Laboratory for Aggregate Economics and Finance sponsored a conference entitled "Financial Frictions and Segmented Asset Markets." The conference organizers were UCSB Economics professor Peter Rupert and Christian Zimmermann, Associate Professor of Economics at the University of Connecticut. Professor Rupert also serves as Associate Director of the Laboratory for Aggregate Economics and Finance.

The conference included twelve presentations over two days. UCSB Economics Department faculty and graduate students participated.

VISITING CONFERENCE PARTICIPANTS

V.V. Chari – *University of Minnesota and the Federal Reserve Bank of Minneapolis*

João Gomes – *University of Pennsylvania*

Zhiguo He –*University of Chicago – Booth*

Hugo Hopenhayn – *University of California, Los Angeles*

Weerchart Tee Kilenthong – *University of California, Santa Barbara*

Yong Kim – *University of Southern California*

Nobuhiro Kiyotaki – *Princeton*

Paul Klein – *University of Western Ontario*

Arvind Krishnamurthy – *Northwestern – Kellogg*

Guido Lorenzoni – *MIT*

Guillermo Ordoñez *Yale and the Federal Reserve Bank of Minneapolis*

Lukas Schmid – *Duke*

Yongseok Shin – *Washington University, St. Louis*

Jae Sim – *Federal Reserve Board*

Pierre-Olivier Weill – *University of California, Los Angeles*

Summaries of each of the presentations follow. Note that speakers are highlighted in author listings.

FRIDAY, MAY 1, 2009

Intermediary Asset Pricing
Zhiguo He and **Arvind Krishnamurthy**

Aggregate Implications of Micro Asset Market Segmentation
Chris Edmond and **Pierre Olivier Weill**

Tsunami
Yong Kim

Uncertainty, Credit Spreads, and Investment Dynamics
Simon Gilchrist, **Jae Sim** and Egon Zakrajšek

Liquidity, Business Cycles, and Monetary Policy
Nobuhiro Kiyotaki and John Moore

Equilibrium Default
Hugo Hopenhayn and Iván Werning

SATURDAY, MAY 2, 2009

Confronting Models of Financial Frictions with the Data
Patrick Kehoe and **V.V. Chari**

Productivity Growth and Capital Outflow: The Case of a Small Opening Economy
Francisco Buera and **Yongseok Shin**

Larger Crises, Slower Recoveries: The Assymetric Effects of Financial Frictions
Guillermo Ordoñez

Equilibrium Credit Spreads and the Macroeconomy
João Gomes and **Lukas Schmid**

Market Based, Segregated Exchanges in Securities
Weerchart T. Kilenthong and Robert M. Townsend

Credit Crises and Liquidity Traps
Guido Lorenzoni and Veronica Guerrieri

PRESENTATION SUMMARIES

Intermediary Asset Pricing

by Zhiguo He and Arvind Krishnamurthy

He and Krishnamurthy create a model to study the dynamics of risk premia in the event of an asset market crisis. The authors explain two phenomena: the nonlinearity of risk premia during crisis episodes and the speed of adjustment in risk premia from a crisis back to pre-crisis levels. In an environment where households must use the services of an intermediary to invest in risky assets, moral hazard limits the amount households can invest. Household investment must be met by some proportion of intermediary investment, making possible household investment increasing in intermediary capital. Specialists put all their wealth in the intermediary, and make the portfolio decisions. The marginal investor prices risk rather than a representative household doing so. When the household investment constraint binds, indirect household investment in the risky asset falls, so the specialist increases exposure to the risky asset. The price of the risky asset must fall to induce this type of investment, and expected return rises. When a negative shock occurs, households decrease investment with the intermediary, but the risky asset must still be held by the intermediary sector, so intermediaries borrow from the debt market. The authors model a liquidity crisis by matching the risk premium observed in the data. The nonlinearity of risk premium during crisis and the speed of adjustment back to pre-crisis levels are both captured in this model.

Intervention policies analyzed under this framework include capital infusion, a borrowing subsidy, and direct asset purchase. The first policy is of particular interest as the United States Treasury has devoted billions of dollars towards the purchase of equity capital in response to the current subprime crisis. A numerical example with the calibrated model would predict that a $250*bn* equity infusion would lower risk premium from 20% to 11.2%. The second policy corresponds to the central bank lowering the target for the overnight interbank interest rate. If rates are already low, this policy cannot be pursued. The third policy, pursued by the United States government in response to the 2008 financial crisis, is direct purchase of distressed assets. The government purchases shares of the risky asset through borrowing. The specialist now bears less risk and the risk premium falls. In effect, the risk is transferred to households. The government rebates the households through lump-sum transfers. The equity infusion is more effective as it hits the problem of liquidity scarcity at its heart, but all three cases are effective in speeding up the recovery.

One conference participant inquired about the importance of the risk premium. Krishnamurthy responded that it is not the risk premium itself that is of interest, but its use as a proxy for the severity of a liquidity crisis. Questions also arose over the use of an equity friction over debt restrictions. Both households and specialists invest in the risky asset, but the households will never invest more than some proportion of specialist investment due to moral hazard. This equity constraint will bind before a debt constraint binds, so debt restrictions would be redundant. When asked why all agents do not pool their wealth and invest,

Krishnamurthy explained that this is indeed the benchmark, but when the equity constraint binds, households would like to invest more, but cannot. The specialist must borrow to increase the capital base required for further household investment.

Aggregate Implications of Micro Asset Market Segmentation

by Chris Edmond and Pierre-Olivier Weill

With the goal of understanding asset price fluctuations, Edmond and Weill consider the aggregate implications of a frictional financial system with a consumption-based asset pricing model. The majority of models of financial frictions have relied on one of two approaches – the microfoundations approach and the aggregate approach. The microfoundations approach seems to lack aggregate implications. The alternative aggregate approach relies on financial frictions faced by an intermediary or by households. Calibration requires the friction to be large, and may be hard to justify in the real world. This model is a hybrid of the two approaches, taking a standard consumption-based asset pricing model and segmenting the financial market into many smaller markets. Full risk-sharing is prevented by market-specific frictions. Each market is defined by an exogenous fraction of investment that must be done by specialists in that market. The remaining fraction of investment is shared over all specialists.

The economy is made up of families which consist of different specialists, which can be interpreted as the partially integrated financial system. Each trader must purchase the exogenously determined fraction of the asset of his market, and the remaining amount is shared among the family. This fraction represents the extent to which a trader cannot fully diversify, and creates a systematic risk. When the fraction of investment required to be undertaken by the specialist hits zero, the economy collapses to the standard Lucas-Breeden asset pricing model. The benchmark calibration sets a homogeneous fraction required for all assets, and it requires 21% of agent investment in the local asset. With fractions varying across assets, the average fraction needed across assets is only 11% to generate the same risk premium. Unlike incomplete market models, where idiosyncratic risk does not affect the equity premium, this model generates local stochastic discount factors, and can generate an unconditional equity premium of 3.7%.

A conference participant asked how this model differs from the asset pricing model of Krueger-Lustig, where the independence between idiosyncratic shocks implies an aggregate stochastic discount factor independent of local shocks. Here, there is a specialist in each family who holds untradeable risk, leading to a risk correlation between families, so the idiosyncratic component cannot be dropped from the aggregate risk premium. Questions arose as to how the stochastic discount factor is constructed: specifically, whether the usual Euler equation is being used. Weill replied that decisions, and therefore prices, are made at the family level. Traders take orders from the family, and each family forms different prices in response to shocks. Krishnamurthy commented that there might be some inconsistency if these are considered liquid assets. Some justification for the friction should be given.

Tsunami

by Yong Kim

Kim's paper seeks to understand fluctuations in asset prices using a search friction framework. The economy consists of a fixed stock of assets and agents transition between three states: buyer, owner and seller. Owners become sellers exogenously and buyers enter the market exogenously. The friction used for buyers of the asset is adjustment cost fluctuations, created by varying the entry rate of buyers. This causes the relative population of buyers to sellers to fluctuate, affecting bargaining power. Fluctuating sales prices result, even when assessment of asset returns and the interest rate remain constant. Steady state is governed by a constant market tightness, or the ratio of buyers to sellers. As the price of the asset is a function of market tightness, asset price will also be constant in steady state. When the inflow of buyers changes, the tightness parameter changes, and will adjust as the model returns to steady state.

The concavity of the match rate in the market tightness parameter drives interesting out-of-steady-state results. In the case of high entry, the ratio of buyers to sellers increases. Sellers are matched out faster, further exacerbating the problem. This implies that the ratio could actually increase before it eventually decreases back to steady state. This divergence before conver-

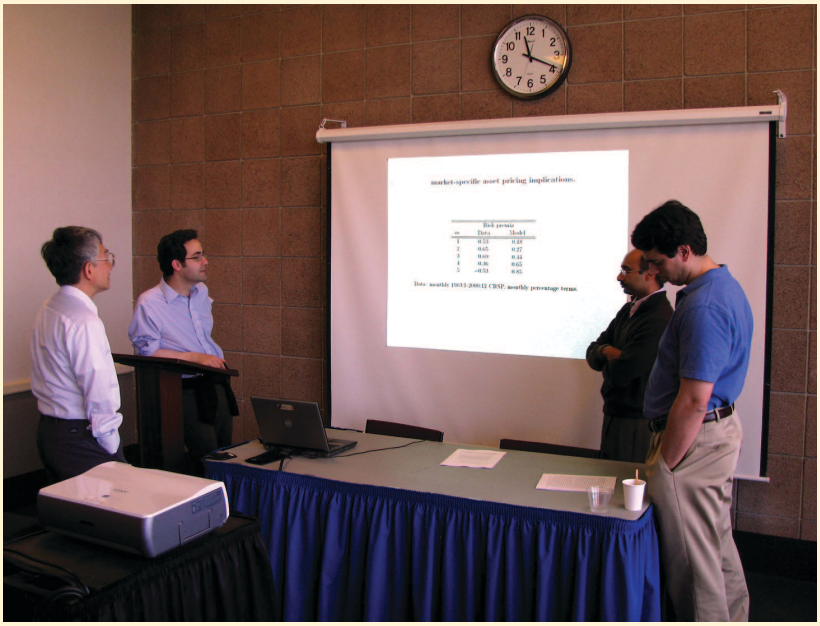
gence maps into asset prices, offering an explanation for the high variance in asset prices. By focusing on out-of-steady-state dynamics, the impact of the adjustment cost friction can be severe, even if the friction itself is small.

Discussion arose among conference participants over the out-of-steady-state dynamics. A crisis occurs because buyers disappear, not because there are too many. Kim agreed that the dynamics in this paper start with an influx of buyers, but emphasized that he is modeling both the boom and the crisis. There must be some phenomenon that raises bid prices before they crash. The incredible variation generated in asset prices was striking and Chari pointed out that the nonlinearity of the matching function was responsible. Kiyotaki noted that quantity does not respond to price, as there is a fixed supply of the asset always held by agents.

Uncertainty, Credit Spreads, and Investment Dynamics

by Simon Gilchrist, Jae W. Sim and Egon Zakrajšek

Perhaps risk alone is not enough to explain fluctuations in asset prices and investment. The Gilchrist-Sim-Zakrajžek work proposes that some business cycles may be driven by aggregate uncertainty shocks in the face of credit market frictions. Empirically, it is noted that uncertainty regarding return spread affects investment independently. Time-varying uncertainty is modeled by allowing the variance of the persistent idiosyncratic productivity shock to evolve according to a stochastic process. Agents are not able to observe the aggregate shock, only the firms' returns. The authors argue that during a recession, it is easier for a good firm to do relatively better, and likelier for a bad firm to perform worse. This leads to a higher dispersion during downturns, and independently influences investment.



The shock is aggregate in the sense that all firms face the same uncertainty level. However, it does not alter the economy-wide mean productivity level, differentiating it from an aggregate technology shock.

Investor concern over the return spread arises from the potential for both default and limited liability. When the spread widens, the default probability increases, making capital costlier. This hinders the firm from increasing capital via the traditional cost channel, but aids investment through the collateral channel, implying that a firm with a strong balance sheet position will fare much better when capital becomes costlier during high uncertainty periods. As firms increase their leverage ratios, the probability of default increases, and the bond price starts to fall.

For the calibrated model, an increase of 50-100% in equity issuance results during a high uncertainty regime. The credit risk premium doubles, matching the empirical elasticity, and the investment-to-capital ratio decreases. Default and recovery rates are overestimated, leading Chari to suggest that the results from this model be compared to one with first moment shocks instead of second moment shocks. The importance of maintaining the mean preserving spread was also debated.

Liquidity, Business Cycles, and Monetary Policy

by Nobuhiro Kiyotaki and John Moore

The Kiyotaki-Moore model of money and liquidity is meant to facilitate the understanding of how aggregate production and asset prices fluctuate with shocks. The authors offer an explanation for anomalies such as the risk-free rate puzzle, the excess volatility of asset prices, savings behavior and low participation in asset markets in an economy where money is essential. In addition to money, there exists both physical and human capital. The opportunity to produce new capital arrives randomly. There is a need to transfer resources to the entrepreneurs with an opportunity to invest, but there are two frictions at work. The first is a borrowing constraint; only a fraction of future returns from the new capital can be pledged. The second is called a resaleability constraint; at any given time, only a fraction of equity can be sold. In this sense money is more liquid than equity. Liquidity shocks are the changes in the fraction of sellable equity.

A standard assumption is made that the entrepreneur has to invest a certain amount for each unit of outside investment in his project. Constrained by how much of his equity can be sold, an investing entrepreneur trying to make his down payment will find money more valuable than equity. The gap between these two assets is the liquidity premium, and may help explain the low risk-free rate puzzle. Workers who never have investment opportunities will never hold either asset, explaining low participation in asset markets. More importantly, asset prices and investment are vulnerable to the liquidity shocks. In response to a negative liquidity

shock, a government policy to purchase equity by issuing money can restore the value of assets and expand investment. A few years ago, considering such a policy might have seemed strange.

Chari commented that the same results could be obtained with a shock to the borrowing constraint. Kiyotaki agreed, and replied that he chose shocks to the resaleability constraint in an effort to mimic the mortgage-backed securities market. Another participant inquired about solving for the steady-state monetary equilibrium. Kiyotaki pointed out that when shocks are shut down, the model can be solved analytically. He called this the onion assumption: The aggregation of assets implies you don't have to keep track of the distribution. Even if a layer of an onion is peeled off, it is still an onion.

Equilibrium Default

by Hugo Hopenhayn and Iván Werning

Many principle-agent problems address the potential for default, but default never actually occurs in equilibrium with the optimal contract. Most assume both the principal and agent are able to commit. Hopenhayn's and Werning's paper allows for a lack of commitment and imposes the constraints that arise naturally under private information. Outside opportunities available to entrepreneurs are always assumed to be less socially efficient; thus, with commitment, these opportunities would never be taken. They may be privately efficient, however, and without commitment the entrepreneur may take them. The optimal contract will be forward-looking, taking these opportunities into account. Without this asymmetry of information, the model would collapse to the standard limited commitment case with either the first-best allocation or no lending at all.

Default will still occur along the equilibrium path, but the probability of default will decrease over the life of the principal-agent relationship. Long-term debt and capital will also rise over time. Two points in particular separate this work from previous literature. First, in this paper, contracts are not restricted to be non-contingent. They are endogenous and derived from the asymmetry of information. Second, relationships are allowed to be long-term, so that debt can mature. Results can be interpreted similarly for a worker-employer relationship. As the worker gains more human-capital specific to her position, the less likely she is to walk away from the job.

During the conference, questions arose over the consistency of period-by-period zero profit for lenders when the nature of the contract is such that the lenders receive higher payments early on, and lower payments later. The zero-profit condition arises from the competitive lender assumption and the ability to roll over debt. The idea is that an agent can pay off debt to the initial lender by borrowing from a new lender. Competition ensures that this new lender will earn zero expected profit. Only initial lenders have the ability to extract a surplus. Furthermore, agents are less likely to be liquidated with possible debt rollover. The result highlights the importance of long-term debt when contracts cannot be made state-contingent. A participant asked: What would happen if the outside opportunity were observable? Without private information, the contracts could be made contingent on these opportunities, and result in either the first best immediately, or no lending.

Confronting Models of Financial Frictions with the Data

by Patrick Kehoe and V.V. Chari

The real world has one purpose, and only one purpose for us as economists, which is to provide data to calibrate our models.
– V.V. Chari

With the abundance of emerging financial friction models that try to reconcile asset pricing, business cycles, and intermediation, Chari and Kehoe point out that these models must replicate what is observed in the data. The talk started with two observations. First, the average difference between available funds and capital expenditure is about 2% of GDP. Second, available funds almost always exceed capital expenditures. These imply that access to financial markets is not critical for investment decisions. Still, the difference between debt and equity should be taken seriously. Financial markets could play a big role in reallocating funds from cash-rich, project-poor firms to cash-poor, project rich firms. However, this interplay would not be seen in the aggregate.

Another important question addresses the heterogeneity of firms. For instance, are responses to liquidity tightness and recession different for small and large firms? Chari presented strong evidence that financial frictions matter and affect small firms more than large firms. Recessions, on the other hand, seem to have an equally negative impact on small and large firms. Economists need to write a financial frictions model where small firms contract more in response to financial tightening, and all firms fare similarly in response to business cycle fluctuations.

Debate ensued among conference participants over various types of investment and debt that may or may not be observable in the data and what it might mean for modeling. The

question was asked: How, exactly, are firms paying for intangible investment like research and development and advertising? Chari answered that a real business cycle model would have the decrease in intangible investment show up in the total factor productivity parameter. Participants also wondered if there are other means of raising capital during liquidity shortages, such as hiring freezes and wage renegotiations? These could make available funds go up. Chari agreed and pointed out that this is an extreme exercise in its generality; but one must ask why in the aggregate firms issue debt to buy back shares? How should one reconcile these data with the financial frictions model?

Productivity Growth and Capital Outflow: The Case of a Small Opening Economy

by Francisco Buera and Yongseok Shin

The standard neoclassical model predicts that capital should flow into countries with fast-growing total factor productivity (TFP). After observing empirical evidence to the contrary, Buera and Shin offer an explanation using an extended neoclassical growth model that incorporates heterogeneous production units and imperfect domestic financial markets. The model endogenizes TFP dynamics and international capital flows. The authors note that the periods of high TFP growth and capital outflows in the data usually follow large-scale economic reforms. One main element of such reforms is the removal of idiosyncratic distortions in the form of taxes and subsidies on select producers. Another is the liberalization of international capital flows.

Two quantitative experiments are performed on an economy that is initially closed, laden with idiosyncratic distortions, and financially underdeveloped. The first experiment removes idiosyncratic distortions and opens up the economy to international capital markets, but does not reform domestic financial institutions. Examples of such reform episodes can be found in the experiences of Chile, Israel, Korea, Mauritius, and Taiwan in the 1980s. The reform leads to TFP growth, reflecting better allocation of entrepreneurial talent and capital. However, the rise is gradual since domestic financial markets can reallocate capital only slowly. For this reason, capital will flow out of the economy after the reform. The second experiment improves domestic financial markets, in addition to eliminating idiosyncratic distortions and liberalizing capital accounts. TFP grows much faster than in the previous case and capital immediately flows in from overseas. One such example is the experience of Estonia in the 1990s. The results highlight the importance of domestic financial market reforms in conjunction with other liberalization measures.

An increase in TFP that is accompanied by a small increase in GDP seemed somewhat puzzling in the first experiment. This result was explained by the fact that a fraction of the capital owned by domestic residents was used for production overseas: Domestic financial constraints limit how much capital is used for domestic production. A conference participant had an empirical question regarding the choice of labeling the 1980s as the reform period in Korea. The first waves of reforms were much earlier, in the 1960s. Shin clarified that in the 1970s, Korea reversed many of its earlier reform initiatives and implemented industrial policies subsidizing heavy and petrochemical industries. The cessation of these policies in 1982 could be compared to the first experiment, since rampant distortions in domestic financial markets remained until the late 1990s.

Larger Crises, Slower Recoveries: The Asymmetric Effects of Financial Frictions

by Guillermo L. Ordoñez

Lending rates are more likely to experience big jumps than big falls. This asymmetry is more severe in countries with high agency costs and low financial development. Because these asymmetries may cause financial distress, banking crises and inefficient reallocations of resources, finding their source is nontrivial. Ordoñez's model introduces agency costs into a model with learning and endogenous information flow. Short-lived risk-neutral entrepreneurs observe a business opportunity with heterogeneous returns conditional on success. Probability of success only depends on the aggregate state. Perfectly competitive risk-neutral investors finance the venture cost in a model with costly state verification. Agents use information from project success over time. They also know states change from bad to good, or good to bad, with some probability, although the state itself is not observable.

When entrepreneurs have a bad outcome during good times, more is learned because of the high level of economic activity. The transition from good to bad times is fast. Alternatively, when the economy transitions from a bad state with low economic activity, to a good state, less is learned. Countries with higher monitoring and default costs find higher lending rates during a crisis, even when there is not much difference during good times. The model is calibrated to the order of 5% monitoring costs for developed countries and 30% for developing

countries, as observed in the data. This results in a mere 2% lending rate spread for developed countries, but a significant 25% spread for developing countries.

Krishnamurthy asked if these interest rates could be computed as spreads over the government bond. Ordoñez confirmed that this would be a viable alternative, and the picture would look the same. The role of the agency costs in the model was not immediately obvious. When asked, the author clarified that the high monitoring costs magnify the crises. In good times, the gap between lending rates is not that high; however, in bad times, high agency costs not only increase the magnitude of liquidity crises, but also prolong recovery time. When a bad shock hits, both countries observe the signals, but monitoring costs make recovery harder for one country over another.

Equilibrium Credit Spreads and the Macroeconomy

by João F. Gomes and Lukas Schmid

Stock and bond price data suggest financial markets lead the economy. Gomes's and Schmid's general equilibrium model incorporates asset pricing and real business cycles to endogenously link movements in output and investment to the prices of stocks and bonds. Heterogeneous firms make financing decisions under persistent idiosyncratic and aggregate productivity shocks. New firms wanting to invest in capital must issue debt or equity finance. There is some tax advantage to issuing debt, with a default cost trade-off. During good times firms expect high future profits and issue debt to finance capital investment. When the economy hits recession, many firms optimally default on their debt; bonds lose value and credit spreads increase.

Fluctuations are driven by the interplay between investment, firm distribution dynamics and financing decisions. The persistent shocks imply strong procyclical investment, and market value of firms. As in the data, firms are more likely to issue debt during good times. During recessions, investors incur larger losses on defaulted bonds, when marginal utility is high, leading to countercyclical credit spreads. Expected returns on stocks rise during these bad times with high default and it becomes very costly for firms to obtain debt financing. The credit spreads in the model are able to predict future equity returns from one quarter up to one year ahead.

Macro and asset pricing moments predicted by the model were close to the data, but conference participants wondered why the investment ratio was off. The answer lies in the asymmetry of the investment friction. Typically, models that match quantities have a hard time matching prices, and vice versa. Investors fear shocks to realized growth and also to expected growth, generating a high equity risk premium with a high volatility. Kydland noted that in 1987 the stock market dropped over a third without significant aggregate effects. This model is not able to generate this type of activity. However, Schmid did note that empirically, credit market movements are almost always followed by movement in the aggregate economy.

Market Based, Segregated Exchanges in Securities

by Weerachart T. Kilenthong and Robert M. Townsend

The Weerachart-Townsend work proposes a solution to the externality problem created by collateral constraints in a general equilibrium framework. Even when state-contingent contracts are tradable, limited collateral leads to a socially inefficient allocation of consumption. The decision to default on a promise is based on the value of collateral at the time of repayment. This value is determined by equilibrium in the spot-market. It is endogenous in that it depends on aggregate resources, or how much agents save from the previous period. The authors' paper allows for contracting that is contingent on these "market-fundamentals," or aspects of the market that determine price in each spot market. Restricting trade to state-contingent contracts is not enough to correct for the inefficiency. Here, agents contract on what price they will unwind their commitments, leading to a Pareto-optimal allocation.

Markets are organized by a market-maker who establishes price islands (clubs). Lotteries assign agents to islands where they trade among the other club members. Agents pay or are paid for their right to trade on a given island, depending on their influence on spot market prices. The collateralization structure allows for both "tranching" and "pyramiding," allowing one to interpret a contract as an asset-backed security. In fact, all arguments stated in terms of spot markets can be restated using asset-backed securities.

A conference participant inquired about the purpose of security exchanges. Why would agents be segregated? Killenthong

replied that maybe the best thing the planner can do is to create exchanges where consumption goods have different prices in different clubs. Questions also arose as to why spot markets are feasible but not used. The answer lies in the possibility for tranching and pyramiding. In such a market an agent can use a security that pays in the storable good as collateral to issue a security that pays in the non-storable good. The agent may also do the opposite: use a security that pays in the non-storable good as collateral to issue a security paying in the storable good. Hence all spot market trading is done in the first period.

Credit Crises and Liquidity Traps

by Guido Lorenzoni and Veronica Guerrieri

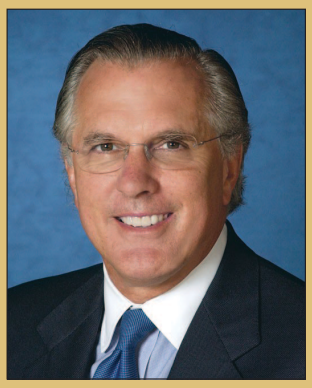
The goal of the authors' research is to create a model that will allow for analysis of policy responses to a liquidity trap. Lowering interest rates works until a certain point, then it becomes ineffective. The government still has the power to alter the money supply and aggregate bond supply to try to bring output back to some target level. Lorenzoni and Guerrieri ask: Can policy be successful in the face of a large recession aggravated by productivity-sensitive borrowing constraints?

Agents in this model face an idiosyncratic shock allowing some to be productive. Those with a positive shock would like to borrow but are constrained. An aggregate shock also influences productivity. Increasing the agents' productivity not only has the direct effect of an increase in efficiency, but it also indirectly relaxes the borrowing constraint. The complementary nature between total factor productivity and interest rates implies that monetary policy really does become ineffectual for large recessions. The idea is to increase productivity with real liquidity policies allowing monetary policy to play a stronger role.

Agents derive utility from both consumption and leisure in this model, which led a conference participant to ask: In what sense is some average level of production ideal? This benchmark follows from the linear production in labor. So why do agents with positive productivity shocks not work twice as hard to reach the efficient mean production? Those agents would choose to work less next period. The only way to get back to efficient production in the event of a liquidity trap is to relax the borrowing constraint of the productive population.

LAEF Hosts Richard Fisher

Chief Executive Officer, Federal Reserve Bank of Dallas



In September 2009, the Laboratory for Aggregate Economics and Finance presented a public lecture by Richard W. Fisher, president and chief executive officer of the Federal Reserve Bank of Dallas.

As the chief executive of the Federal Reserve Bank of Dallas, Fisher serves as a member of the Federal Open Market Committee, the Federal Reserve's principal monetary policymaking group. After beginning his career at the private bank of Brown Brothers Harriman & Co in 1975 he became assistant to the secretary to the Treasury during the Carter administration. In that capacity Fisher worked on issues related to the dollar crisis of 1978-79. After returning to Brown Brothers to found their Texas operations in Dallas, he created Fisher Capital Management and a separate funds-management firm, Fisher Ewing Partners, in 1987.

From 1997 to 2001, Fisher served as deputy U.S. trade representative with the rank of ambassador, overseeing the implementation of the North American Fair Trade Agreement (NAFTA) and various agreements with Vietnam, Korea, Japan, Chile, and Singapore. In addition, he was a senior member of the team that negotiated the bilateral accords for China's and Taiwan's accession to the World Trade Organization.

A first-generation American, Fisher is equally fluent in Spanish and English, having spent his formative years in Mexico. He attended the United States Naval Academy, graduated with honors from Harvard University, read Latin American politics at Oxford University, and earned his master's degree in business administration at Stanford University. In 2006, Fisher received the Service to Democracy Award and the Dwight D. Eisenhower Medal for Public Service, and in April of 2009 he was inducted into the Dallas Business Hall of Fame.

Fisher's talk focused on the economic outlook and current economic issues. His lecture was well-attended, attracting members of the campus and greater Santa Barbara communities, as well as local and national media.

Espen Henriksen, LAEF Research Economist 2009–2010

Professor Espen Henriksen makes a return visit to LAEF this academic year. Henriksen holds a Ph.D. from the Tepper School of Business at Carnegie Mellon University. While at LAEF, he will work on several research projects:

• Low- and medium-frequency movements in the current account, and net foreign *asset positions*. There is a popular argument in policy circles that global "imbalances"—international capital flows, to use more neutral terminology—are a threat to the stability of the global economy. Certainly we've seen more than a threat to stability in the recent past, but were international capital flows a cause of these events? In this project, the evidence on international capital flows is reviewed and extended in the hope of gaining a deeper understanding of their causes and consequences.

• *Demographic dynamics and equity home bias*. In most countries, individuals and institutions tend to hold smaller amounts of foreign equity than most representative-agents model economies would predict. This research investigates to what extent life-cycle savings and consumption can account for this home bias.

• *Cross-country movements of monetary and real aggregates at business cycle frequencies*. At business cycle frequencies, fluctuations in nominal variables, such as price level and nominal interest rates, are substantially more correlation across countries than real variables such as output. How these correlations can be accounted for and how they follow from a set of well-established empirical regularities is shown in this project.

• *Time-varying volatility and the business-cycle lead-lag structure of nominal variables*. Inflation and nominal interest rates tend to lead the business cycle negatively and lag the business cycle positively. The focus of this project is the investigation of the extent these cross-correlation patterns can be accounted for by time-varying volatility.

During the fall-2009 academic quarter, Henriksen taught a course in numerical methods for economic dynamics for advanced Ph.D. students. In the course, the students were taught basic tools of numerical analysis that can be used to address analytically intractable problems in economics. The generality with which the techniques were presented in this course makes them applicable to a wide range of fields, including econometrics, resource economics, labor economics, macroeconomics, finance, game theory, public finance, contract theory, and others. The course endeavored to explain not only when and how to use various numerical algorithms but also how and why they work; in other words, the course opens up the "black boxes" and provides the students with a versatile toolbox for their own research.

Paul Klein Visits LAEF

Paul Klein is an Assistant Professor of Economics at the University of Western Ontario. He obtained his Ph.D. in Economics from Stockholm University in 1997. During the 2009-10 academic year, Klein was a visiting scholar at the Institute for International Economic Studies at Stockholm University.

Klein' research interests include various aspects of fiscal policy, migration, risk sharing, and computational methods. His recent work includes a quantitative assessment of the welfare and output costs of barriers to international migration, and an evaluation of Germany's proposed expansion of subsidized preschool childcare. His research has been supported by the Jan Wallander and Tom Hedelius Foundation for Social Science Research, the Social Science and Humanities Research Council of Canada, and the Humanities and Social Sciences Fund at the University of Western Ontario. His work has been published in the *Review of Economic Studies*, the *Journal of Monetary Economics*, the *Journal of Economic Dynamics*, and elsewhere.

Klein visited LAEF twice in 2009. During his first visit, he presented the paper "Should Daycare Be Subsidized?" which is joint work with David Domeij. The paper combines a novel theoretical approach to analyzing childcare subsidies in the context of an economy with high taxes on labor income with a quantitative assessment of the impact on labor supply and welfare of childcare subsidies in Germany, where the availability of subsidized childcare is currently being expanded. He also began a new research project with Professor Marek Kapicka of UCSB, dealing with consumption risk sharing under asymmetric information and persistent earnings.

During Klein's second visit, he continued his research with Marek Kapicka, and worked with Irina Telyukova (University of California, San Diego) on a project whose purpose it is to investigate the significance of the frequency of decision-making in models of imperfect risk-sharing. The project also encompasses techniques for estimating high-frequency models using low-frequency data.

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