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LABORATORY FOR AGGREGATE ECONOMICS & FINANCE

UC SANTA BARBARA

FROM THE LAB

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conference held November 2018

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FROM THE LAB

Trade in Dynamic Stochastic General Equilibrium Models

Director's Message
Finn Kydland

In the previous issue of *From the Lab* we summarized two finance-related conferences. In this issue, we cover the third finance-focused LAEF conference in a row, this one entitled "Financing Macroeconomics." The academic organizers were Zach Bethune, Leland Farmer, and Eric Young, all of University of Virginia. The conference brought together researchers working at the intersection of macroeconomics and finance. While there has been a long history of studying how financial markets impact macroeconomic aggregates, and vice-versa, the financial crisis of 2007-2009 brought renewed attention to the importance of understanding macro-finance linkages. The conference covered a wide range of topics, including the transmission mechanism of monetary policy through asset valuations or mortgage rates, the determination of a country's exposure to international credit risk, measuring firm-level political risk and how it affects investment, investigating the growth and welfare effects of financial integration, and much more.

Also summarized in this issue is the conference on "Trade and Macroeconomic Dynamics." Recent developments in the world economy have underscored the importance of international trade as it relates to aggregate macroeconomic activity. Complex international supply chains among modern economies have significant implications for international business cycle co-movements and for the impacts of local and global economic shocks. In addition, international trade policy, including protectionism in the form of tariffs and quotas, can be seen as macroeconomic shocks that have spillover consequences for the global economy. Events in the last few years have called into question the rules-based global system of trade policy, and focused attention on how de facto trade policy is tied to macro activity. This conference, organized by Michael Devereux, University of British Columbia, and Fabio Ghironi, University of Washington, brought together leading-edge researchers on the nexus between international trade and dynamic macroeconomics.

Financing Macroeconomics

November 2–3, 2018

Snehal Banerjee – UC San Diego
Zach Bethune – University of Virginia
Nina Boyarchenko – New York Federal Reserve Bank
Maryam Farboodi – MIT Sloan
Leland Farmer – University of Virginia
Valentin Haddad – UC Los Angeles
Tarek Hassan – Boston University
Finn Kydland – UC Santa Barbara
Lars Lochstoer – UC Los Angeles
Sydney Ludvigson – New York Stern
Konstantin Milbradt – Northwestern
Jun Nie – Kansas City Federal Reserve Bank
Peter Rupert – UC Santa Barbara
Jules van Binsbergen – Pennsylvania Wharton
Eric Young – University of Virginia

Monetary Policy and Asset Valuation

Francesco Bianchi, Martin Lettau, and **Sydney C. Ludvigson**
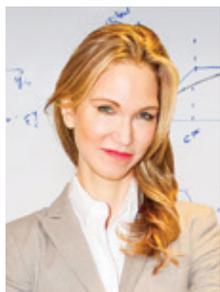
The paper presents empirical evidence of the role of macroeconomic variables on how far and how persistently asset values can deviate from values predicted by historical fundamentals. The authors first find evidence of long-term regime shifts in asset values in the U.S. economy. Then, they present the following three relationships between periods of persistently high asset valuations and specific macroeconomic variables: Periods with weak economic growth and persistently high macroeconomic volatility; periods with persistently low values for the real federal funds rate; and periods with lower equity-market-risk premia, are each associated with periods of high valuation.

Using a two-mean regime switching process, the authors first estimate periods of high and low asset valuations. Their metric is the mean of the consumption-wealth variable proposed in a previous paper by two of the authors (Lettau and Ludvigson, 2001). This measure is the residual of a co-integrating relationship, which they derived from the aggregate budget constraint between labor income, consumer spending, and household asset wealth. Using Bayesian methods with flat priors, they identify a low asset valuation period from Q2 1976 to Q2 2001, and two high asset valuation periods, Q1 1952 to Q1 1976 and Q3 2001 to Q3 2013.

They then link the determined asset valuation regimes to macroeconomic variables using a Markov-switching vector auto-regression (MS-VAR). In doing so, they impose the previously estimated regime changes, but estimate the parameters and transition probabilities. Their models include a real series of the federal funds rate, the GDP growth rate, the investment growth rate, the research and development growth rate, and the inflation rate. Also, according to the Taylor rule implied by their MS-VAR, high asset valuation regimes coincide with less monetary policy activism toward inflation and greater involvement toward output growth.

Given their results, they ask why frequent shifts in the central bank's expected policy rate coexist with infrequent shifts in asset valuations. They suggest that macroeconomic fundamentals play no role in asset valuation, and that regime shifts in discount rates might drive these correlations. In particular, their estimations are in line with the literature of "reaching for yield," which implies that downward shifts in the risk-free rate coincide with downward changes in risk premia.

The audience recommended using survey data to determine if the expectations that the model produces match those expectations from macroeconomic analysts' surveys. They also wondered about the stability of the estimated coefficients in the MS-VAR specification. A participant proposed modeling the transitional probabilities in terms of macroeconomic fundamentals. Similarly, the audience questioned how the results might change under the joint estimation of the regime identification and the MS-VAR model. The speaker answered that that exercise might capture other phenomena in the macroeconomy. The audience noticed that the regime dates seem to be specific and should reflect more uncertainty about the exact dates. The speaker mentioned that they used the Bayesian posterior mode and might use other parts of the posterior distribution to capture the effect of uncertainty.

Firm-Level Political Risk: Measurement and Effects

Tarek A. Hassan, Stephan Hollander, Laurence van Lent, and Ahmed Tahoun

How do increases in political risk affect firm hiring, investment, and political activity? Past research on this question has focused on aggregate political risk, using measurements such as news coverage and tax code uncertainty. In this paper, the authors construct a firm-level measure of political risk, validate that their measure captures economically meaningful content, and study how it relates to firm-level outcomes.

The authors analyze the transcripts of quarterly earnings conference calls to measure the share of the conversation that focused on political risk and uncertainty. Applying methods from computational linguistics, training libraries such as books, news articles, and speeches are used to identify two-word combinations (bigram) that show discussion of political topics. It gives each earnings call a political risk score based on how frequently a political bigram occurs

in proximity to a synonym for risk or uncertainty.

Conference participants had several questions about whether certain bigrams were included and the choice of the training libraries. The presenter emphasized that this paper takes a big data approach, with over 50,000 political bigrams and 100 synonyms for risk. He acknowledged that choosing training libraries was a judgment call. The authors experimented with different libraries and chose their preferred specification after humanly auditing a selection of transcripts. Top political bigrams include "public opinion," "interest groups," and "the EPA," and transcripts with the highest political risk scores center on a discussion about legislation, regulation, and government expenditure. The political risk score varies intuitively over time and across sectors. The mean score of all firms highly correlates over time with the news-based Baker, Bloom, and Davis EPU index, and the mean score in a sector correlates with the share of revenue coming from federal government contracts.

They associate the political risk score with outcomes that indicate reactions to political risk. A higher score correlates with higher stock return volatility, lower investment and employment growth, and increased lobbying and political donations. For example, they associate an increase in the political risk score by one standard deviation with a 0.7 percentage point decrease in employment growth from the previous period. Small firms are more likely to passively manage risk by entrenching hiring and investment, while large firms are more likely to actively manage risk through lobbying and donations.

One participant asked whether we should expect larger effects looking into future periods, particularly regarding investment. The presenter agreed that investment is realized with a lag, but said that the authors focused on contemporaneous effects as a first analysis. A different participant raised the possibility that they use discussion of political risk as cheap talk when a firm lacks good investment ideas.

Another participant inquired about the impact of controlling for firm fixed effects. The presenter responded that the results are robust to such effects. Most of the variation in political risk comes at the firm level, and particularly in the assignment of political risk across firms within a sector. These results suggest that aggregate measures of risk mask significant heterogeneity and volatility. In addition, dispersion in firm-level risk increases when aggregate political risk is high, which possibly results in inefficient allocation and thus decreased total factor productivity. A participant questioned whether political risk might be efficient from a welfare perspective. The presenter observed that the relevant counterfactual is unclear in this context.

The authors extend their approach to political risk around a specific topic. They identify top political bigrams and calculate risk measures for eight topics, such as economic policy & budget, trade, and health care, which are then matched to data on lobbying expenses. Firms that devote more time to discussing risks associated with a political topic are more likely to lobby on that topic but not other topics.

Heterogeneous Global Cycles

Maryam Farboodi and Peter Kondor

The authors explore the structure of credit cycles in advanced countries after the financial crisis of 2007 and the Eurozone crisis of 2010, asking why countries are exposed differently to credit cycles and how this heterogeneous exposure affects the economy.

In boom phases, countries experience large credit flows to the non-financial sector and a buildup of debt carrying low interest rates. In bust phases, yields jump, capital flees, and output drops for countries with high exposure to the credit cycle.

The authors focus on frictions in the supply of capital, categorizing countries into high- and low-exposure groups. This friction is characterized as information friction, a result of different degrees of expertise among global investors. Specifically, heterogeneous international investors possess different skills in identifying the quality of a firm's collateral. The investors' prudence is state-dependent, such that in high states they extend loans even to risky or unhealthy firms, and in a low state they are cautious.

In the model, low-skilled investors disproportionately lend to firms in opaque countries when the aggregate state is high, but lend more to firms in transparent countries in a low state. This exacerbates the boom-bust cycles, especially in opaque countries, and creates heterogeneous global cycles.

The model predicts capital flows, output and yields and demonstrates how credit markets are integrated in booms and fragmented in busts. Essentially, yields are similar in booms, but a spread emerges in busts. In busts credit is more concentrated within a country compared with in booms. The model predicts that there is heterogeneous portfolio

rebalancing by investors. During busts, for example, unskilled investors rebalance out of high exposure countries as documented by Ghallagher et al. (2018). Because of the spread arising during busts, skilled investors enjoy higher than average returns by lending at higher rates to firms with good collateral in opaque, high exposure countries.

The model predicts that total output, debt and investment are more cyclical in high exposure countries. The total value of non-performing debt is higher when issued during booms than debt issued during a bust, and it is greater in high-exposure countries than low-exposure countries in booms. This implies that aggregate economic activity is non-monotonic across countries.

One question concerned whether experts could see a firm's pledged collateral to another firm. The presenter explained that the experts could see the collateral unit by unit. Another participant asked whether the expertise in this model is similar to investors from certain countries specializing in firms from certain countries, and whether the signals are hierarchical. The presenter explained that such expertise is not present in her model because signals are specific to investors and do not affect other investors' signals.

Conditional Dynamics and the Multi-Horizon Risk-Return Trade-Off

Mikhail Chernov and **Lars Lochestoer**

The authors claim that there are essential dynamics of the stochastic discount factor that affect its multi-horizon empirical performance and prove that a multi-horizon returns-based test leads to a rigorous evaluation of conditional implications of a model. Motivating this approach is the fact that people make most economic decisions at multiple horizons. The authors demonstrate that MHR-based tests could be described as adding a set of instrumental variables to standard single-horizon tests and magnitude of the consequences of misspecifying transient dynamics in models of the SDF.

Using linear factor models, the authors impose the minimum requirement on a factor model at multiple horizons. The authors consider the same Euler equation at multiple horizons as with a single-horizon model. First, the authors compare the term structure of pricing errors between unconditional CAPM and unconditional CAPM plus the betting-against-beta factor for U.S. equity at a single horizon. From the inferior performance of a model with unconditional CAPM plus BAB factor at multiple horizons, the authors introduce a time-varying constant and coefficient in the linear factor model. Then, the authors compare implied variance ratios to variance ratios in the sample, under the assumption that there is no autocorrelation between returns at multiple horizons. To fix a problem of too much positive autocorrelation in the BAB factor, they use the multi-horizon returns to help estimate dynamics of latent SDF loading.

The authors find that successful models based on single-horizon returns do worse at multiple horizons. They also show that the dynamics of the factors are inconsistent with the dynamics under the null hypothesis of the constant factor model at a single horizon. The estimated factor loading has considerable variation and little relation to the standard conditioning variables in asset-pricing. The authors show that the standard factor construction methodology generates a persistent misspecification problem. They also show that they strongly reject the constant coefficient hypothesis in most cases, unless a factor comprises the market excess returns and the value and size factors.

Some audience members asked whether any GMM instruments satisfied moment conditions. One member asked whether the reason that there was no pricing error at zero horizons was because of normalization. Another member still suspected high pricing error at multiple horizons because of the high correlation between the unconditional market factor and the BAB factor. In addition, there were audience members asking whether too much positive autocorrelation in the BAB factor might come from mismeasurement.

Regulation of Charlatans in High-Skill Professions

Jonathan Berk and **Jules van Binsbergen**

The authors study the effect of licensing and certification on the price and quality of goods and services. The increase in the level of licensing and certification in the modern economy, combined with sizable cross-sectional variation in malpractice conviction rates and regulations, motivate their approach. Unlike previous literature on government regulation in a goods market, the authors attempt to show how higher prices caused by regulation can reduce the quality of goods and services by introducing charlatans in their model. For professions with skill in short supply and high demand, the study argues, disclosure requirements or other regulatory standards reduce consumer surplus. To understand cross-sectional variation in regulation, the authors model the tradeoffs that skilled professionals face in lobbying for regulation.

In the model, charlatans may optimally offer a particular service, knowing that they do not possess the necessary skill. Charlatans decide whether to enter a market by considering (1) opportunity cost of entry, (2) uncertainty about the professional's ability to offer the services, and (3) the extent to which the skill the professional offers is in short supply. As skilled professionals are in short supply, a signal could allow consumers to distinguish professionals from charlatans. If a government imposes a higher standard requirement, the price of the service increases, as consumers are less likely to meet a charlatan. This regulation reduces competition in the market by reducing the number of providers, making prices higher and consumers worse off. Information disclosure requirements have the same effect as higher standards by also causing prices to rise..

In the authors' quantitative analyses, professions with weak trade groups, skills in more abundant supply, shorter training periods, and less informative signals concerning the professional's skill are more likely to have charlatans. The authors also show that the malpractice conviction rate is not informative about the number of charlatans in a profession. Cross-sectional variation in wages, however, is informative concerning this number. The authors also show that with a high enough standard, a no-charlatan equilibrium can exist.

Several audience members asked whether there was heterogeneity in types in each profession. One was curious if there was any evidence that professions with severe settlement penalties were more likely to be fired. The audience was also inquisitive about international situations. A participant asked whether the authors considered pooling price or separating price in equilibrium. Some asked why a government would have incentives to disclose information on charlatans. Another audience member asked whether customers had zero or negative utility after buying from a charlatan, and whether they were risk-neutral. Finally, participants were concerned about the reason for market failure, arguing that people would do their best to arrive to a no-charlatan equilibrium.

Bank-Intermediated Arbitrage

Nina Boyarchenko, Thomas M. Eisenbach, Pooja Gupta, Or Shachar, and Peter Van Tessel

Following the financial crisis of 2007-2009, there has been a persistent deviation in a variety of basis spreads from the no-arbitrage benchmark. The goal of the paper is to show the connection between the persistence of these spreads and the post-crisis regulations imposed on the banking industry through Basel III and the Dodd-Frank Acts. The authors first show the increased cost of participation in spread-narrowing trades for the banks. They further argue that a regulated banking industry is not only more constrained to participate in arbitrage trades itself but also is less able to provide funding to its clients participating in these trades.

The authors find that the supplementary leverage ratio regime that comes with Basel III reduces return on equity to below 12 percent, a threshold that many financial institutions use when considering basis trades. This means that the profitability of such arbitrage trades is lower for the banks despite the increase in basis spreads following post-crisis regulations.

Next, the authors ask why less regulated arbitrage traders, such as hedge funds, fail to exploit this opportunity. They hypothesize that

these arbitrageurs rely on regulated institutions to finance such trades. They present two pieces of evidence consistent with this hypothesis: First, the size of hedge funds obtaining leverage from prime brokers associated with regulated banks has declined relative to hedge funds that use the same prime brokers but do not use leverage, and, second, the number of funds obtaining leverage from bank-affiliated prime brokers has declined relative to the number of funds obtaining leverage from other types of prime brokers.

An audience member pointed out that recent studies had focused on the role of regulatory constraints faced by intermediaries in perpetuating deviations from the no-arbitrage benchmark and asked how this study differentiated itself from those studies.

The presenter responded that the paper deviated from the existing literature on two dimensions: First, in showing how constraints faced by regulated institutions like prime brokers translated into constraints faced by their clients, and, second, in considering a broader set of arbitrage trades than previous work.

Efficient Bubbles?

Valentin Haddad, Paul Ho, and Erik Loualiche

The authors look into the abnormally high level of entry into the technology industry in recent years and ask whether markets naturally generate the optimal level of firm creation. To answer this question, they develop a framework that accounts for the possibility of speculation among investors about which firms will eventually be successful through heterogeneity in beliefs. Using a general entry tax formula for a non-paternalistic planner, the authors characterize the interaction between speculation and classic entry externalities from growth theory. These interactions can produce sharp reversals in the role of industry characteristics, such as labor's share, in determining the efficient level of entry. The authors emphasize that a planner relying solely on aggregate macroeconomic data to determine an efficient level of firm creation can easily be led astray.

The authors discuss that the wedge between the competitive equilibrium and efficient levels of entry can be decomposed into three types of externalities. The first externality is the business-stealing effect: firms do not internalize that they can displace other participants. This externality gets weaker as the level of speculation increases, because each investor increasingly believes that the firms she invests in are more productive than the average firm, and hence all investors are less worried about being displaced by new entrants.

Second, new entry affects the surplus of households in the economy: the appropriability effect. Under the assumption of fixed labor supply, this is a positive externality from new entry, as households that supply labor collect some of the surplus created by the firms. Higher speculation weakens this externality, as the households invest in what they believe are more productive firms, and a larger share of household income will come from investment rather than labor.

The third externality comes from general equilibrium effects. This externality captures the changes in firms' profits due to changes in equilibrium wages. Because this externality does not depend on the level of speculation, it is the only force that remains at the high-speculation limit.

Through the changes in these three externalities, speculation drastically changes and sometimes even reverses the conclusions of standard analysis of entry. Even though high speculation increases firm entry, it can imply less over-entry, often transforming an economy with over-entry into one with under-entry.

Because the main goal of the paper is to investigate the efficiency of the level of entry under heterogeneous beliefs, the welfare criterion the authors employ is fundamental to their analysis. They study efficiency under the Pareto criterion, which evaluates the utility of each household under their own beliefs. This is unlike the main alternative criterion, in which the social planner knows the true productivity distribution and evaluates allocations given the distribution, and the authors show that employing such a criterion leads to undesirable additional entry.

A participant asked if the authors had any policy recommendations based on their results. The presenter responded that he would hesitate to make a general policy recommendation. He added that most textbook conclusions reverse under speculation and his goal was to tease out the forces that led to these reversals. He stated that their results were based on heterogeneous priors of investors, and one should think about the sources of such heterogeneity before making policy recommendations.

Dynamic Information Acquisition and Entry into New Markets

Snehal Banerjee and Bradyn M. Breon-Drish

Snehal Banerjee presents a model of dynamic information acquisition and entry by a strategic trader into a new market. Banerjee notes that investors often delay entry into new opportunities. For example, the bitcoin network was created in 2009; however, trading volume and participation by institutional investors remained low until 2017. The authors want to understand the nature of these delays. Past research has noted that the slow arrival of investment capital to new trading opportunities can lead to less informative prices, which can decrease allocative efficiency.

The authors begin with a standard strategic trading model in continuous time. There is a single risky investment opportunity, traded by a risk-neutral strategic trader and a mass of noise traders. The acquisition of information and entry into the market are both costly and irreversible. The investor must invest in research, information technology, infrastructure, and relevant expertise before entering the market. Gaining information and entering the market immediately may not be optimal. The investor may prefer to wait until the market has a sufficient amount of trading by less sophisticated traders, which increases the value of participation.

Using the standard results on optimal stopping, the authors show that a cutoff rule exists. The investor acquires information only when public uncertainty reaches a threshold. By not entering immediately, the investor preserves her potential information advantage and can wait for uncertainty to rise, causing the value of the information and market entry to rise. An audience participant asked whether there would only be entry when the shares held by noise traders was sufficiently high, assuming investors have this knowledge. The presenter responded, no, gains are also affected by the variance of the number of shares held. There is generally a delay in entry beyond what would be given by a naive net present value rule.

Allowing for dynamic entry and acquisition of information results in qualitatively new economic implications relative to a model of static entry. The authors derive new predictions for the likelihood and timing of entry into the new market, and the optimal precision choice depending on news volatility and the expected trading horizon. The predictions of this model are broadly consistent with the entry behavior of large asset managers into cryptocurrencies in recent years: minimal initial participation, followed by a sudden spike in entry starting in 2017. These results are also consistent with the entry behavior of institutions into technology stocks in the late 1990s.

This analysis suggests that the main features of the standard strategic trading framework may not match the dynamic entry decisions made by large traders. This model predicts that the likelihood of entry is low when the cost of information acquisition is high and when the trading horizon is long, which matches what was seen in the market for cryptocurrencies. The model also predicts that sophisticated investors choose the highest precision signals available to them and thus remain out of new markets for longer than a standard model would suggest.

Growth and Welfare Gains from Financial Integration under Model Uncertainty

Yulei Luo, **Jun Nie** and Eric R. Young

The paper studies the effect of financial integration on growth and welfare, motivated by the empirical relationship between growth and volatility of growth. This relationship can be characterized as a negative correlation among developing countries, and a positive correlation among developed countries. The authors use model uncertainty to capture these features of the data and quantify the welfare effects of financial integration.

They extend the model used by Obstfeld (1994) by introducing a fear of model mis-specification. Now, agents have a model in mind, called the approximating model, and consider a range of models surrounding the approximating model, known as the distorted models. Other features include a stochastic production technology and a portfolio choice between a risky and non-risky asset. The key driver of the results of the paper is that the data is generated by the distorted models, not the approximating model, as is usual in the literature. This allows a better match to the data on volatility and growth.

The results point toward welfare gains from financial integration, but of smaller magnitude than in Obstfeld (1994). Welfare gains are higher for advanced countries with respect to developing countries. The key for the latter result is the different signs of

the correlation between growth and volatility for these groups of countries. In the model, financial integration increases the volatility of growth, so the relationship with growth is crucial.

There were intensive discussions on how to interpret the difference of the distorted model and the approximating model. Hansen and Sargent (2007) assume the approximating model generates the data, which means the "fear" about model mis-specifications is purely in the agent's head. However, the authors stated there was no definitive justification for either perspective. In their work, they tested which model was more likely to generate the data, and the results supported the distorted model.

There was a question on how to calibrate the robustness parameter. In the literature, once the detection error probability (DEP) is selected, the underlying robustness parameter can be pinned down. However, in this paper, they jointly estimate three model-derived equations to estimate three key parameters: the degree of risk aversion, the elasticity of intertemporal substitution, and the robustness parameter. Then, they get the associated DEP, which shows that developing countries face more uncertainty than industrial countries.

A Theory of the Mortgage Rate Pass-Through

David Berger, **Konstantin Milbradt**, and Fabrice Tourre

The paper studies the pass-through from short-term interest rates to mortgage rates. The authors develop a tractable model of the mortgage pass-through that produces a cross-section distribution of coupons in the economy consistent with the one observed in the data.

The model comprises a banking sector and households. Banks get financing at the short rate and get a mortgage rate when they originate a mortgage to a household. The authors consider both a competitive banking sector and an oligopolistic one. On the household side, the key point is that some households are inattentive: only a fraction of the households are attentive to mortgage rates and do not face costs to refinance. There is exogenous prepayment risk (e.g., default, moving). This model generates a cross section of coupons that can closely track the dynamics of the data between the years 2000 and 2006.

The results of the model show that monetary policy is state- and path-dependent. It is state-dependent as the mortgage rate is a non-linear function of the short rate, so the pass-through depends on the level of the short rate. It is path-dependent as the cross-section of mortgage rates determines the proportion of households that are refinancing. Hence, the aggregate pass-through is affected by the distribution of mortgage rates.

The authors related the main discussion to its application to monetary policy, in particular forward guidance. They pointed out that, in the model, banks were not anticipating that the monetary authority would use forward guidance. The author explained that it was a static comparative exercise held in the moment, but that a truly closed model would have to consider these dynamics eventually, as well as features like mortgage rates being determined by aggregate savings.

Finally, there was a discussion about the source of market incompleteness that justified the insurance of mortgages through government-sponsored enterprises in the US mortgage market, which might shed light on the research question of the paper.

Trade in Dynamic Stochastic General Equilibrium Models

October 12–13, 2018

David Baqaee – UC Los Angeles
Hui Chen – MIT Sloan
Selman Erol – Carnegie Mellon University
Benjamin Hebert – Stanford University
Bernard Herskovic – UCLA Anderson
Burton Hollifield – Carnegie Mellon University
Amir Kermani – UC Berkeley
Finn Kydland – UC Santa Barbara
Dmitry Livdan – UC Berkeley
Francis Longstaff – UCLA Anderson
Erik Loualiche – University of Minnesota
Mihai Manea – Stony Brook

Dmitry Orlov – University of Rochester
Peter Rupert – UC Santa Barbara
Batchimeg Sambalaibat – Indiana University
Yuliy Sannikov – Stanford University
Alberto Teguia – UBC Sauder
Johan Walden – UC Berkeley
Colin Ward – University of Minnesota
Pierre-Olivier Weill – UC Los Angeles
Randall Wright – University of Wisconsin Madison
Yao Zeng – University of Washington, Seattle

Brexit and the Macroeconomic Impact of Trade Policy Uncertainty

Joseph B. Steinberg

This paper is the first to use a dynamic general equilibrium model to estimate the effect of Brexit on the U.K. macroeconomic dynamics in both the short and long run, and the first to quantify the cost of short-run uncertainty about Brexit. Since the author considers increased post-Brexit trade costs only for the analyses abstracting from potential benefits the U.K. expect, there is some limitation to the results. However, the author contributes to the literature by incorporating a novel theory of export participation dynamics into a quantitative general equilibrium model.

The author develops a model with three countries: the U.K., the European Union, and the rest of the world. A representative household works, consumes, invests, and saves. Forward-looking heterogeneous firms produce differentiated goods and endogenously accumulate foreign customers in response to changes in bilateral trade costs. There are two kinds of trade costs, import tariffs and non-tariff barrier, depending on the realization of the history-dependent aggregate shock. Firms can sell their goods with no cost domestically but must pay advertising cost to export and sell their goods. The author accounts for both an extensive and intensive margin of export participation by introducing this entry cost for export.

The author calibrates the model's parameters so that its steady state matches an input-output matrix from 2011 and a set of facts about export participation. To assess the overall effect of Brexit, the author compares no-Brexit steady state to an equilibrium in which trade costs follow a stochastic process that captures two kinds of uncertainty about the outcome of the Brexit referendum and post-Brexit changes in trade policy. Under the condition that the Brexit referendum passes with probability 0.25 based on prediction market data, the author considers two scenarios for the new trade policy: soft Brexit and hard Brexit with equal probability. The author finds that real GDP will fall by 0.5-1.4 percent, consumption will fall by 0.5-1.3 percent, and trade flows with the rest of the European Union will fall by 8.2-44.8 percent in the long run. In the short run, the author finds that there is little impact on U.K. macroeconomic dynamic until Brexit occurs. The author measures the welfare losses from Brexit by 0.4-1.2 percent equivalent to 7,000-19,000 GBP per person. To test the impact of uncertainty about Brexit, the author compares a stochastic equilibrium and deterministic equilibrium. Uncertainty about Brexit has little effect in both the long run and short run. The author finds that there are 0.25 percent of the overall welfare losses from Brexit equivalent to less than 50 GBP per person.

Some audience members were concerned whether the results are robust to currency appreciation. One member asked why the author considers market penetration dynamics. The member also asked whether the law of motion of market penetration depends on price. Some members pointed out that the calibration on exit rate seems too high. Another member asked whether the author uses constant firms' productivity and a shooting method for each history. Finally, one member asked whether the results reconcile with Handley and Limao (2017) about U.S. welfare gains from accession.

Financial Frictions and Export Dynamics in Large Devaluations

David Kohn, Fernando Leibovici, and **Michal Szkup**

The authors study the roles of credit constraints and balance-sheet effects to explain the gradual pace of increase in exports seen after large devaluations. The focus is on these two features because firms in countries that experienced large devaluations from 1980 to 2013 had higher quantities of foreign-denominated debt. Devaluations increase the domestic value of the debt, resulting in credit constraints. The authors find that intra-firm reallocation of goods sold domestically and abroad is essential to explain the gradual change of aggregate exports observed after large devaluations. Their contributions are to examine both the transitional dynamics of a general equilibrium model with heterogeneous firms and the role of financial factors for the dynamics of international trade flows in response to an aggregate shock. The work complements prior explanations for the gradual response of exports after large devaluations.

The authors use financial frictions and foreign-denominated debt to create a standard general equilibrium model of international trade with heterogeneous firms in stochastic productivity. These firms choose whether and how much to export subject to the iceberg and the per-period fixed cost. Entrepreneurs have borrowing constraints in domestic or foreign currency, represented by a fraction of their physical capital. In the model, devaluations have opposing effects on firms' export decisions. On the one hand, devaluations increase exports by making them competitive. A reduction in investment and output through the tightened borrowing constraint decreases exports. The authors show that the effect of credit constraints on the dynamics of exports depends on the degree to which firms can reallocate sales across markets.

The model was calibrated to match critical moments of Mexican plant-level data for 1994. The authors compared the response of aggregate exports between a baseline model of an economy without financial frictions and one with debt that could only be denominated in domestic currency. The authors found that financial frictions and balance-sheet effects explain a small fraction of the export dynamics in the data. To demonstrate that the reallocation channel mainly drives this result, counterfactual economies with both alternative degrees of reallocation and alternative distributions of foreign-denominated debt were considered. Finally, the authors provide evidence to support the role of cross-market reallocation in export dynamics. Firms with lower initial export intensity showed higher average growth of exports than those with high export intensity.

Some audience members asked how to collect data on trade policy and whether the authors knew of any episodes where devaluation led to an economic crisis. It was also discussed whether elasticity of exports to devalue industrial sectors had any effect. Others were interested to know whether devaluation shocks were permanent and if a sunk cost existed for export. An audience member asked why the authors did not use prices in their model.

Firm-to-Firm Trade: Imports, Exports, and the Labor Market

Jonathan Eaton, Sam Kortum, and Francis Kramarz

Eaton and coauthors develop a general equilibrium model of trade transactions that captures both the heterogeneity and the granularity in individual buyer-seller relationships, while remaining consistent with observations at the aggregate level. Using data from French exporters, linked to customers in 23 European Union countries, the authors develop a model of product trade through random meetings. The model includes heterogeneity in technology at the firm level, firms matching randomly to get inputs and sell outputs, and two sources of trade frictions, iceberg and informational. The model generates predictions for imports, exports, and the share of labor in production consistent with observations of French manufacturers.

The authors model a firm's technology as combining a set of tasks, each comprising a set of subtasks that can be performed by labor, which can be of different types for different tasks. Labor must compete with intermediate goods produced by other firms that can also perform these subtasks. This leads to firms that can look very different from one another depending on the sellers of intermediate goods to which they are randomly matched. Therefore, a firm's cost in a market depends on underlying efficiency and on luck in being matched with low-cost suppliers. A result of this feature is that a reduction in trade barriers can reduce the share of labor in production because of an increase in exposure to more and often cheaper sources of supply. A conference participant asked if the sellers bore the cost of matching, to which the presenter responded that there was no cost of matching in this model.

Eaton begins with stripped-down model of firm-to-firm trade, consisting of a single country, a single input, a single type of labor and wage, and perfect competition. Next, a model of firm-to-household matching is developed that is like the firm-to-firm model, but alleviates the single-good restriction. Then, after applying the French exporters' data to the model, Eaton shows graphically that the model matches the data across many characteristics, including the mean number of buyers per French exporter, market size, and the distribution of skilled labor share in production cost in France.

Two sources of heterogeneity between firms, differences in efficiency and in luck finding cheap inputs, combine to create variation in a firm's cost to operate in markets around the world. This can explain why a firm may sell in a small, remote market, instead of a larger, nearby market. It can also explain why one firm may be very successful in one market and unsuccessful in another, while a second firm experiences the reverse. A conference participant suggested a possible extension: looking at the results of the simple model on the welfare of a nation.

Multinational Expansion in Time and Space

Stefania Garetto, Lindsay Oldenski and Natalia Ramondo

Stefania Garetto presents a study of how multinational enterprises (MNEs) expand in time and space. Multinational enterprises are the largest actors in the global economy, with foreign affiliates of U.S. MNEs accounting for 75% of U.S. sales abroad. Understanding the activities of MNEs is important for testing the short-run and long-run consequences of trade policies. Using data from the Bureau of Economic Analysis, the authors document three facts about the life-cycle dynamics of U.S. MNEs. First, MNE expansion occurs by entering new markets, not by expanding in existing markets. Second, MNE affiliates mainly serve their local market early and later expand to exporting. Third, the location of new affiliates is not dependent on the location of pre-existing affiliates. Using these three characteristics of MNEs, the authors develop a multicountry dynamic model of MNE expansion.

The firm's dynamic decision is modeled as a set of options. Firms can decide whether, when, and where to open foreign affiliates. A conference participant asked if affiliate-to-parent sales would be counted in exports, to which the presenter responded, yes. The model uses two important assumptions: First, firms that do foreign direct investment must set up an affiliate and sell in the local

market first, and can only export after selling in the local market. Second, the decision to open an affiliate and the decision to export from it are independent across markets. A conference participant questioned whether an MNE would care about sales of each affiliate or rather the sum of sales across all affiliates. The profits of the affiliate in each country are independent of the number of affiliates the firm has.

They calibrate the model to match static and dynamic moments for U.S. MNE affiliates in the top ten host countries over the last thirty years. The calibrations reveal that opening affiliates is costlier than exporting from them and that export sales to the United States are generally associated with lower barriers than sales to alternative export locations. The model also reveals that there is heterogeneity in barriers to MNE expansion, explained by type of sales, host country, and type of friction. Using the calibrated model, the authors investigate the importance of frictions to multinational expansion, using Brexit as an example. Increasing friction between the U.K. and other European countries makes both exporting from the U.K. to other European countries and exporting from other European countries to the U.K. more costly. As a result, export platform sales from the U.K. would decline, with lowered incentives to open affiliates in other European countries. Standard models of trade and horizontal foreign direct investment cannot capture these effects.

This research presents a new theory to model the expansion of multinational enterprises that is not captured in standard trade models. The authors show that MNEs grow within a market at the extensive margin, not the intensive margin, and grow less and less predictably than exporters. This model shows that the compound option structure is important for understanding the actions of MNEs following a shock and for understanding affiliate location choices.

Protectionism and the Business Cycle

Alessandro Barattieri, **Matteo Cacciatore**, and Fabio Ghironi

Recent popularity of protectionist measures around the world has revived debates on the potential costs and benefits of using protectionist trade policies to boost aggregate economic performance, rebalance external accounts, and address complaints about the distributional effects of trade. The goal of this paper is to contribute to this debate by analyzing the effects of protectionism on macroeconomic fluctuations. The authors pursue this goal by presenting empirical evidence and by building a small open economy model that allows them to investigate the dynamics that result from protectionist policies.

The authors employ structural vector autoregressions to reveal the short-term effects of trade policy on macroeconomic outcomes. The first part of the empirical analysis uses quarterly data on initiation of antidumping investigations in order to identify exogenous trade policy shocks. The focus is on two emerging countries (Turkey and India) and a small developed economy (Canada) that are the most active users of these trade measures. The second part of the analysis considers the import-weighted average of applied tariff rates for a larger set of small developed economies. Both pieces of evidence suggest that protectionism is recessionary, inflationary and has, at best, a small positive effect on the trade-balance-to-GDP ratio. The investigation of the dynamics reveals that protectionist policies affect small open economies in a manner similar to a negative supply shock that contracts output, increases prices and has mixed effects on the trade balance.

A structural model is used to study scenarios in which temporary protectionist policies may arguably be beneficial. The first scenario is a liquidity trap or a country being stuck at the zero lower bound on interest rates. The authors describe the hypothesis that a country may indeed benefit from protectionist policies in such a scenario, given the inflationary nature of protectionism. However, when they hit the model economy with an exogenous recessionary shock that pushes the economy to the zero lower bound, it is revealed that any beneficial inflationary effects of protectionism are counteracted by the unfavorable macroeconomic effects of reduced real income. The second scenario investigates a model economy with a pegged nominal exchange rate. Even here, the model shows protectionism to be contractionary, a result that challenges conclusions in some textbook models.

A participant asked how far one could go with a new Keynesian model addressing these questions. It was pointed out that the presenter

had indicated the model required reallocation of firms within exporters and importers and physical capital to explain these results. It was also asked whether the VAR evidence would be obtained if the authors were to assume physical capital but no entry or exit of the firms. The presenter responded that a model that has nominal rigidities but no capital accumulation would lead nowhere because it would suggest that a tariff led to an expansion. He added that a model requires endogenous capital accumulation and investment prices in order to be affected by tariffs and reflect the structural effects. He concluded by saying that although one would achieve qualitatively similar results with just endogenous capital accumulation, a third of the quantitative effect would be missed.

Trade Policy is Real News: A quantitative analysis of current and future changes in U.S. trade barriers

George Alessandria and Carter Mix

In the 20 years leading to the Great Recession, the real-trade-to-GDP ratio in the United States doubled from 13.5 to 27 percent, and then held steady around 29 percent from 2012 to 2017. Slowing in trade growth was observed around the world in the same period. This paper tries to identify the sources of these slowdowns and quantify the impact of changes in current and future trade policies on the U.S. and global economy.

The authors try to quantify the relative importance of three explanations for the trade slowdowns: The first explanation is that the transitions from past trade deals and reforms may have run their course.

Second, trade barriers may have arisen as protectionist policies tend to be countercyclical. Third, weakness in economic growth.

The two-country dynamic stochastic general equilibrium model of trade integration and business cycles developed by the authors has three fundamental features. The model features exogenous changes in current and future trade policy, an endogenous gradual response of trade to aggregate shocks, and shocks that generate business cycles and changes in trend growth consistent with the cyclicality of trade. The model also allows examination of the effect of changes in trade policy on growth.

The model presents two key findings: First, the usual shocks leading to recessions depress trade even as output recovers, as firms gradually exit and re-enter the export market. Second, while current trade liberalizations are expansionary, future trade liberalizations are contractionary. This contractionary effect of future liberalization arises from the wealth effect on labor supply, along with a substitution effect from future investment and falling production costs. The authors state that because of the anticipatory effects, eliminating or delaying future changes in trade barriers can have expansionary short-term effects, at the expense of medium-term growth.

An audience member asked if the model had implications for asset prices. The presenter responded that he was investigating a variant of the framework focusing on how asset prices of exporting and non-exporting firms differ relative to how their sales are changing.

Endogenous Trade Protection and the Exchange Rate Adjustment

Stéphane Auray, Michael B. Devereux, and Aurélien Eyquem

Exchange rates play a role in cushioning the impact of negative demand shocks, increasing the trade balance at home but reducing the trade balance of partner countries. If partner countries react to the appreciation of their currency by imposing trade barriers, one would expect an endogenous relationship between exchange rates and protectionism. This paper analyzes this relationship using an open economy New Keynesian model and presents empirical evidence in line with its theoretical results. In this model, shocks affect terms-of-trade manipulation incentives through exchange rate changes. Contrary to conventional wisdom, the authors argue that these incentives are stronger in flexible exchange rate regimes.

The authors propose a repeated game in which governments choose tariffs subject to time-varying incentive constraints. In models with flexible prices, permanent productivity shocks have no effects on the equilibrium tariff policy. Thus, trade policy's cyclicality is a price rigidity phenomena. In sticky-price models, equilibrium tariffs respond differently to demand or supply shocks. Under high elasticity of intertemporal substitution (EIS), they show that monetary policy (demand) innovations will lead to an increase in trade restrictions. Persistent technological (supply) shocks will generate a less binding incentive constraint that further reduces trade restrictions in equilibrium.

The authors present evidence that protectionist tensions are conditionally more prevalent under flexible exchange rates using a yearly panel of countries from the World Trade Organization's Global Anti-Dumping dataset. Their specifications include Poisson and negative binomial regressions of the number of trade disputes per country on the GDP level, the GDP growth rate, net exports to GDP, a measure of trade openness, a measure of exchange rate flexibility, and a trade-weighted measure of the real exchange rate. They conclude that their exchange-rate flexibility measure increases the probability of trade disputes.

In a second set of empirical exercises, they estimate country-specific structural vector autoregressive models (SVAR), using sign restriction identification. They use a long series of flexible exchange rates for Australia, Canada and the U.S. In an impulse-response function analysis, they show evidence that a positive supply shock raises GDP growth and competitiveness, which makes the use of trade disputes and tariffs less attractive for policy makers. They suggest that this effect might have to do with the higher output costs of a potential tariff war.

A participant mentioned that a tighter link between evidence and theory would help the reader. In the current version, the theory does not aim to reproduce patterns in the data, which reduces the empirical evidence's use. In the panel specifications, the participant suggested using country fixed effects, as some countries might be more prone to use trade policies. In the SVAR analysis, he observed the absence of the real exchange rate within the sign restriction framework, which should be central to the analysis.

He also commented that some choices about relevant margins, distortions and model assumptions would enjoy more motivation or robust discussion. Particularly, dynamic distortions and the exchange rate are key for the question asked in the paper, but not featured in the model. In contrast to previous trade literature, the current version assumes a Cobb-Douglas aggregator and focuses only on the EIS, instead of the product of the EIS and the trade elasticity.

Trade and Currency Weapons

Agnes Benassy-Quere, **Matthieu Bussiere**, and Pauline Wibaux

When combined with an export subsidy, a tax on imports theoretically has the same impact as currency devaluation. In both cases, it increases the relative price of foreign suppliers in the short term. Depending on pass-through effects and on trade elasticities, the volume of imports fall, while the volume of exports increases. In the longer run, the upward change of domestic prices progressively offsets these effects.

However, there are significant differences between tariffs and currency changes. In particular, tariffs are a policy variable. Exchange rates are generally determined on financial markets, even though they react to policy decisions from fiscal and monetary authorities. As a result, we may consider changes in tariffs more persistent than exchange-rate fluctuations, affecting the decision by the exporter to offset the induced change in relative prices by adjusting the mark-up, and of the importer to switch to another supplier. Import tariffs may be sector specific, whereas currency devaluation affects all sectors simultaneously, with a larger effect on the cost of imported inputs. Furthermore, tariffs and exchange rates differ in their welfare implications.

The authors consider monetary policy as an instrument a government may use to stabilize the output gap and the trade balance after a shock. They first estimate elasticities of trade to tariffs and to exchange-rate fluctuations within the same empirical specification, based on product-level bilateral trade flows for 110 countries from 1989 to 2013. The results show that the effect of tariffs is much larger than exchange-rate movements: one percent depreciation of the exporter's currency is associated with a rise in exports by 0.5 percent, whereas a one percentage point tariff cut in the destination country leads to a rise in exports by 1.4 percent. Hence, one percent currency devaluation is equivalent to a 0.34 percentage point tariff cut.

Based on the estimation, the authors investigate the policy implications within a simple macroeconomic model. They find that the two instruments are partly substitutes. However, if both instruments are available, they are used as complements. In particular, they may use one instrument in a pro-competitive way, while using the other to stabilize the purchasing power of domestic households.

They show that over the range of the estimated equivalence ratio between both instruments, the monetary response to a negative demand shock is always to cut the domestic interest rate. If both instruments are available, they suggest accompanying a monetary expansion with a trade policy that depends on the nature of the shock. It is optimal to cut the tariff to limit the negative impact of currency depreciation on household purchasing power.

One audience member asked whether the regression results only showed contemporaneous effects. The author noted that they also included lags in other specifications but that the results were not very different. He also acknowledged a point raised by another audience member that if the tariffs were anticipated then the estimate would be biased upwards.

Trade Finance and International Currency

Tao Liu, Dong Lu, and Wing Thye Woo
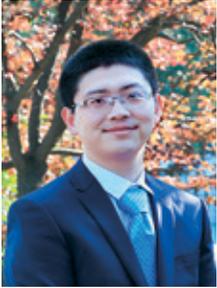
Currency internationalization and its implications are one of the central issues in open-economy macroeconomics. Conventional wisdom holds that the emergence of international currency depends on the issuing country's size and openness, but historical experience shows the importance of financial factors. The authors study trade finance as a distinct channel for financial factors to affect currency usage in international trade. Bank-intermediated trade finance directly supported more than 40% of global trade, with a much higher share for developing countries, according to the ICC Banking Commission. Although the influence of trade finance on many dimensions of international trade have been examined, we know little about how it relates to the currency acceptance decision. The paper aims to bridge this gap by developing a general equilibrium framework to study the linkages among trade, finance and international currency.

They first use a novel and comprehensive dataset from SWIFT (Society for Worldwide Interbank Financial Telecommunication) to document some empirical patterns of the currency choice in international trade. With private credit to GDP as a main measure of domestic financial market development, they find financial factors are statistically and economically significant in promoting the international use of a currency, on par with or greater than the impact of other well-known determinants such as inflation and exchange rate volatility. These empirical patterns suggest both the importance of financial markets and the relevance of the trade finance channel in determining the status of international currency.

The authors then build a two-country model with endogenous currency choices. The model features timing mismatch between payment and shipment and lack of commitment among agents. Exporters receive liquidity from banks at a discount, so they choose currency to maximize their profit, which relates to the financial factor of a country's financial development, the macroeconomic factor of inflation level, and the microeconomic factor in terms of trade. They do not use a currency in international trade if the issuing country does not have a liquid and efficient financial market.

The authors closely relate the effect of monetary policy on international trade with the specific currency regime. It is not always possible to boost net exports through nominal depreciation of home currency. The model suggests that the incumbency advantage of international currency is not as strong as once thought. The trade finance channel propagates and amplifies monetary policy effect, so that an inflationary monetary policy severely deteriorates the exporter's net profit and endangers the status of an international currency, potentially leading to a rapid transformation of an international monetary system.

One audience member asked about the fraction of trade flow covered by the SWIFT dataset and stated that the paper was interesting and ambitious. He suggested that the model used in the paper might not be particularly well designed for the topic. Specifically, other models of network externality have similar features and implications. He also suggested that it would be nice if the paper could better describe the data and he was unsure about what the regression implied.

An Unhealthy Trade Surplus?

Jungho Lee, **Shang-Jin Wei**, and Jianhuan Xu

The authors explore the implications of trade imbalance on the composition of a country's imports and exports. For example, China is the largest importer of waste products in the world, with 45 million tons of scrap metal, waste paper, and used plastic, worth over $18 billion in 2016. The United States is one of the largest exporters of such solid industrial waste. The authors study whether they can connect trade patterns to the fact that China consistently runs a large trade surplus and the United States a large trade deficit.

The authors aim to develop a theory and provide empirical tests on whether and how a trade imbalance can distort the comparative advantage of a country. A key insight is that a trade surplus from Country A to Country B makes it more likely for ships returning to A to be under their full carrying capacity. This imbalance reduces the unit shipping cost for Country A imports, making it relatively cost effective for the surplus countries to import goods that are heavy relative to their value. It follows that deficit countries have a comparative advantage in exporting relatively heavy goods.

There is also a possible connection between trade imbalance and imported health hazards. Waste products often involve more pollution and more consequences for health than other imports. If the negative externality associated with industrial waste is not properly addressed by a pollution tax and meaningful enforcement, both of which are often lacking in developing countries, a trade surplus could represent an additional source of pollution externality.

The authors estimate an augmented gravity equation that incorporates trade imbalance and weight-to-value ratio of goods. Under the assumption that the weight-to-value ratio is an exogenous physical characteristic consistent across countries, they estimate that a one percent increase in the trade surplus is associated with an increase in the value of heavy good imports by about 0.03 to 0.04 percent.

To explore the welfare effects of the waste good imports, the authors estimate the impact of city waste good imports on the health condition. They find a significant correlation between city cancer rate and waste goods imports. They then use the city's closest port trade surplus as an instrument of the waste good imports, finding that a trade surplus increase of 10 percent corresponds to 0.08 percent increase in the cancer rate.

One audience member asked whether China is paying or is paid to import the waste. The author replied that China is paying. He also noted that China imports waste for recycling. Another audience member asked whether the shipping cost includes margin from the shipping company. The author responded that cost probably includes some margin. A participant asked how we knew that China would not import more waste, even if there were less surplus. The author noted that the cross-sectional data suggests countries with more surplus import more waste, but that the question is impossible to completely address using data.

Global Value Chain Participation and Exchange Rate Pass-Through

Georgios Georgiadis, Johannes Grab, and **Makram Khalil**

A salient feature of past decades has been a decline in pass-through of exchange rate changes to local-currency prices of imported goods. Understanding the drivers of this decline is important, as exchange rate pass-through (ERPT) is a key determinant of the international propagation of shocks, with implications for the movements of relative prices, the change of external imbalances, and business cycle co-movements of the effectiveness of monetary policy. The degree of ERPT is relevant for central banks with an explicit inflation target.

The authors consider a new explanation for the secular decline in ERPT to import prices: the rise of global value chains. Spurred by a decline in transportation costs, adoption of trade-liberalizing policies, and advances in information and communication technologies, firms increasingly distribute stages of production across countries. By fragmenting production chains internationally, the share of intermediate goods in total trade has risen continuously relative to that of final goods. A larger share of imported intermediates in total intermediates used in the production of exports implies a larger ERPT to local-currency export prices. The larger sensitivity of local-currency export prices to exchange rate changes implies a smaller sensitivity of foreign-currency import prices abroad.

The authors illustrate the mechanism described above in a structural two-country model with trade in intermediate goods. The model predicts that ERPT to export prices rises as the economy's global value chain participation increases. The model predicts that because of the increase in ERPT to local-currency export prices in the home economy, which stems from greater global value chain participation, pass-through to local-currency import prices fall in the foreign economy.

The authors investigate empirically the role of Global Value Chain Participation (GVCP) for the decline in ERPT to import prices. In particular, they obtain estimates of the ERPT to export prices for 33 advanced and emerging economies from 1995 to 2014, and analyze the role of GVCP for variation within these estimates. The results suggest that GVCP raises economies' ERPT to export prices. In a second step, they get estimates of the ERPT to import prices analogously to that of export prices and investigate how the former varies with the GVCP of economies' trading partners. Consistent with the implications of the structural model, they find that ERPT to import prices is smaller for economies whose trading partners exhibit larger ERPT to export prices due to higher GVCP.

A participant praised the paper for combining two facts: first, that exports are increasingly produced using imports, and second, the decline in exchange rate pass-through. He suggested that it would be interesting to see how the proposed mechanism performed in multiple rounds and with multiple trade partners.

Exchange Rates and Prices: Evidence From the 2015 Swiss Franc Appreciation

Raphael Auer, **Ariel Burstein**, and Sarah M. Lein

The authors study how prices and consumer expenditures respond to exchange rate movements based on the large and sudden appreciation of the Swiss franc (CHF) on January 15, 2015. Using home scan data on non-durable consumer goods purchases by Swiss households and data on import prices at the border, they document the response of border and consumer prices, the extent of consumer expenditure switching between domestic and imported goods, and the role of the invoicing currency of border prices in these responses. They use this case study to shed some light on the sources of incomplete exchange rate pass-though the alternative implications of invoicing currency in international trade, the role of nominal rigidities and pricing complementarities in price change, and the extent of expenditure switching by households to changes in exchange rates.

Specifically, the authors analyze the impact of the appreciation on prices and expenditures using detailed border and retail transaction-level data. In the first six months after January 15, 2015, retail prices fell on average by only 1.3% in response to the 14.7% appreciation of the EUR/CHF. They perform simple accounting exercises to quantify the sources of incomplete exchange rate pass-through to retail prices. Border prices of imported goods fell by roughly 7% in the first two quarters of 2015, while import prices at the retail level fell by only 3%. Had all border prices been invoiced in EUR, the reduction in retail prices including imports and Swiss-produced goods would have been only 0.3 percentage points larger given the relatively small share of imports in expenditures. Had all retail goods been imported and not subject to non-traded distribution costs, the decline in retail prices would have been 5.4% rather than 1.3%.

The authors also look beyond the average response of prices and present a range of facts on how changes in retail prices vary across products regarding the invoicing currency and border price change of imports in the respective product categories. They first provide evidence that variation in border price changes and in invoicing currency across imported products have a sizable impact on retail prices faced by consumers. According to the estimates, in the first six months after the CHF appreciation, a 1 percentage point larger reduction in import prices at the border resulted in a 0.3-0.4 percentage point larger price reduction for imported products at the retail level. The estimates imply that retail import prices in product categories that are fully invoiced in foreign currency fell by roughly 4 percentage points more than in product categories fully invoiced in CHF. While they base previous evidence on the role of invoicing currency on import and export price changes at the border, their results establish that differences in border price changes associated with the currency of invoicing carry over to consumer prices.

The authors examine the response of the intensive and extensive margins of price change in the months following the appreciation. They document a large increase in the frequency of price reductions and a small decline in the frequency of price increases. However, import prices on average did not fall substantially despite the large increase in the fraction of firms reducing prices because there was a marked decline in the absolute size of price reductions. Besides this aggregate evidence, they show that the increase in the frequency of price reductions and the decline in the size of price reductions were larger for products with larger border price reductions.

One audience member asked whether the data includes online transactions. The author replied that it only includes offline physical purchases. Another audience member asked whether the price shown in the data is unit value prices. The author noted that the prices are actual survey prices. The author also noted that there is a lot of variation across products in invoicing methods, and such variation does not correlate with the quantity that it imports the product

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