



2019

# Richmond Fed Research Digest

Summaries of work by economists in the Bank's Research Department  
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Welcome to the eighth annual issue of the *Richmond Fed Research Digest*. The Federal Reserve Bank of Richmond produces several publications that feature the work of economists in its Research Department, but those economists also publish extensively in other venues. The *Richmond Fed Research Digest*, a midyear annual, brings this externally published research together in one place with brief summaries, full citations, and links to the original work. (Please note that access to articles may require registration or payment.) So bookmark this spot on the Richmond Fed website and mark your calendar for June 30, 2020, when the Bank will publish the next issue of the *Richmond Fed Research Digest*.

[Underlining indicates links to bios of Richmond Fed economists.](#)

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## The Persistence of Financial Distress

By [Kartik Athreya](#), [José Mustre-del-Río](#), and [Juan M. Sánchez](#)  
Review of Financial Studies, *forthcoming*

What are the empirics of household financial distress in the United States, and to what extent can we understand them as arising from the choices of optimizing consumers who face uninsurable risks? In an article forthcoming in the *Review of Financial Studies*, Kartik Athreya of the Richmond Fed, José Mustre-del-Río of the Kansas City Fed, and Juan M. Sánchez of the St. Louis Fed attempt to answer these two questions. They address the first question using account-level Federal Reserve Bank of New York Consumer Credit Panel/Equifax data. They address the second question by estimating a battery of state-of-the-art quantitative models of defaultable consumer debt over the life cycle.

The term “financial distress” can be defined in a variety of ways. Primarily, the authors consider people to be in financial distress in a given year if, during that year, at least one of their credit relationships (accounts) is at least 120 days past due — that is, severely delinquent. Because severe delinquency is an expensive way to repeatedly roll over debt, this definition plausibly captures financial distress.

The persistence of financial distress is important to measure and understand because it provides essential guidance to the appropriate interpretation of the risks facing households over a lifetime. For example, if financial distress is highly transitory, a given incidence for it over the life cycle would suggest that most or all households face similar risks over their lives, with each episode of financial distress not lasting very long. If, on the other hand, financial distress is highly persistent, the same incidence would be disproportionately accounted for by a much smaller number of borrowers who repeatedly, or in a sustained fashion, experience distress. The latter scenario is what the authors find in the data. They establish that 35 percent of U.S. consumers experience financial distress (severe delinquency) at some point during their lives. However, less than 10 percent of

U.S. borrowers—those who are in persistent trouble—account for most occurrences of financial distress. In particular, the incidence of financial distress is nearly double its unconditional rate six years after the initial distress. The authors also find that the persistence of financial distress is essentially invariant over the life cycle.

Athreya, Mustre-del-Río, and Sánchez show that these facts can be accounted for largely in a straightforward extension of a workhorse model of defaultable debt that accommodates informal default (severe delinquency) and a simple form of heterogeneity in time preference. The authors allow for informal default in their model (as opposed to Chapter 7 bankruptcy) because Chapter 7 bankruptcy, by construction, is very brief. It removes all unsecured debts and thus fails to capture the ongoing difficulties experienced by households.

**Less than 10 percent of U.S. borrowers—those who are in persistent trouble—account for most occurrences of financial distress.**

The data are strongly consistent with the presence of a subset of effectively impatient consumers. The authors stress, however, that the heterogeneity in effective discount factors that their estimation reveals is just that: effective. In other words, household behavior could be explained by a host of additional factors that their model does not include. This caveat implies that future work that allows for more detail on household-level economic dynamics is essential to more deeply understand the sources of this apparent heterogeneity. Certainly more research is necessary before reaching any conclusions that “implicate” individuals in their fates via the (unwarranted) interpretation of the authors’ results as solely representing literal differences in time preference.

<https://doi.org/10.1093/rfs/hhz009>

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## Interventions in Markets with Adverse Selection: Implications for Discount Window Stigma

By [Huberto M. Ennis](#)

*Journal of Money, Credit and Banking, forthcoming*

Discount window stigma refers to the reluctance of banks to borrow from a central bank for fear of appearing financially weak to depositors, creditors, and investors. Both policymakers and academic economists have expressed concern about this issue on a regular basis. Former Federal Reserve Chair Ben Bernanke, for example, often cited stigma as an important consideration when designing policies. He has warned that “the stigma problem is very real, with many historical illustrations.” Judging by such statements, one might conclude that policymakers and economists have a relatively good understanding of the theoretical underpinnings of discount window stigma. But only a few papers in the literature present models in which the observable outcomes often associated with stigma can arise endogenously.

In an article forthcoming in the *Journal of Money, Credit and Banking*, Huberto M. Ennis of the Richmond Fed analyzes a model of this type—a workhorse model of adverse selection in financial markets. It is the same basic framework that Philippon and Skreta (2012) used to study the optimal design of programs aimed at intervening in credit markets. Philippon and Skreta emphasize that within the model, “taking part in a government program carries stigma,” but they do not explicitly address the issues associated with discount window stigma. Ennis builds on their research by clarifying the (mainly “off-equilibrium”) implications for stigma in the model—exactly as laid out by Philippon and Skreta. Then he extends the model to take a more explicit, “on-equilibrium” approach to the issues associated with discount window stigma.

In the model, firms (banks) need to borrow to finance a productive project. There is limited liability and firms have private information about their ability to repay their debts, which gives rise to the

possibility of adverse selection. The central bank can ameliorate the impact of adverse selection by lending to these firms, but discount window borrowing is observable, and it may be taken as a signal of the firms' financial conditions. In equilibrium, the average "quality" of borrowers at the discount window can indeed be low, and in that sense, borrowing from the discount window could be considered a sign of financial weakness. Furthermore, after appropriate modifications, the model can produce the combination of observed interest rates (market rates and administered rates) that are often associated with the presence of stigma.

Beyond rationalizing the relevant outcomes, Ennis provides interesting insights that could broaden policymakers' and economists' perspectives when thinking about discount window activity and its implications. First, there is no clear sense in the model that stigma-like effects reduce the efficacy of the discount window. In fact, "negative" selection at the discount window is the means by which the government enhances economic efficiency as it promotes more overall lending and investment. In other words, within the context of the model, Ennis explains that stigma should perhaps be considered a *good* thing—as is the case, for example, in the recent contribution by Gorton and Ordoñez (2016). Second, the model highlights the subtle interactions between borrowing at the discount window and (complementary) borrowing done in the market. Repayment risk, market interest rates, and the resulting funding costs depend crucially on the ability of firms to tap the discount window. This is an issue that has not received much attention in the prior literature and for which the analysis by Ennis provides a valuable perspective.

<https://doi.org/10.1111/jmcb.12583>

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## Optimal Liquidity Policy with Shadow Banking

By [Borys Grochulski](#) and Yuzhe Zhang  
Economic Theory, *forthcoming*

Many economists and policymakers believe that the shadow banking sector was a key contributing factor to liquidity problems that emerged during the financial crisis of 2007–09. If they are correct, then optimal liquidity regulation of banks should recognize that the option to move assets from regulated banks to unregulated shadow banks can potentially render bank liquidity regulations ineffective.

In an article forthcoming in *Economic Theory*, Borys Grochulski of the Richmond Fed and Yuzhe Zhang of Texas A&M University study how the presence of shadow banking affects optimal liquidity regulation of banks. The authors use the pecuniary-externality-based theory of optimal liquidity regulation of Farhi et al. (2009) as their benchmark. They extend this theory by giving banks the option to move assets to a shadow banking sector, which they model as an arbitrage-seeking activity aimed at avoiding regulation. With the additional constraint introduced by shadow banks, the authors obtain a tractable mechanism design problem in which the possibility of free riding by shadow banks restricts the set of implementable asset prices.

In this model, Grochulski and Zhang derive two implications of shadow banking for optimal liquidity regulation policy. First, they show that optimal policy must implement a cap on the price of illiquid assets when the return on illiquid assets is high. This cap is necessary to prevent an exodus of bank assets to the shadow sector. A shadow bank's optimal strategy is to free ride on market liquidity by holding no liquid assets and dumping its illiquid assets on the market in the case of an idiosyncratic liquidity shock. If the market price of illiquid assets is high, this strategy yields attractive returns. The market price of illiquid assets, therefore, must be capped so banks have no incentive to pursue such a strategy.

Second, the authors show that optimal policy must implement a fire sale of illiquid assets when high demand for liquidity is anticipated. They model high liquidity demand as a high fraction

of banks that receive an idiosyncratic shock compelling them to sell their illiquid assets before maturity. High anticipated liquidity demand has a negative wealth effect in the economy due to the need to retain a lot of aggregate liquidity, which prompts little investment in high-yield, illiquid assets. Absent the possibility of shadow banking, or if the shadow banking constraint does not bind, high anticipated liquidity demand has no clear implication for the equilibrium price of illiquid assets, as their supply and demand both decrease. With the shadow banking constraint binding, however, the price of illiquid assets must drop in a fire-sale manner when high liquidity demand is anticipated because this is the only way to pass the negative wealth effect on to shadow banks.

Grochulski and Zhang show how these features can be implemented with a flat-rate tax on illiquid assets and a flat-rate subsidy for liquid assets similar to the payment of interest on reserves (IOR). In 2008, the need to support market liquidity was the justification given for accelerating Congress's authorization of the Federal Reserve to pay IOR to depository institutions. The authors' analysis provides a normative rationale for IOR consistent with this justification. Indeed, in their model, IOR is part of the policy that implements the optimal level of liquidity in equilibrium.

<https://doi.org/10.1007/s00199-018-1152-6>

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## What Caused the Great Recession in the Eurozone?

By [Robert L. Hetzel](#)

In *Innovative Federal Reserve Policies during the Great Financial Crisis*, edited by Douglas D. Evanoff, George Kaufman, and A.G. Malliaris, Boston: World Scientific Publishing, 2018

The Great Recession, which encompassed back-to-back recessions in the Eurozone, has reinvigorated debate over the causes of recessions. Given the major disruptions to financial markets, the Great Recession also has generated debate over inflation targeting, especially the question of whether central banks should add a measure of financial stability to their traditional objectives for output and inflation.

**Hetzel concludes that the ECB created a negative output gap to keep headline inflation at its 2 percent target when it should have concentrated on core inflation, which was significantly lower than headline inflation.**

In chapter nine of *Innovative Federal Reserve Policies during the Great Financial Crisis*, Robert L. Hetzel, who retired from the Richmond Fed last year, begins by making two methodological points. First, it is essential to distinguish monetary policy from credit policy. Monetary policy, defined as the central bank's reaction function for setting its policy rate, influences nominal expenditures by the public by influencing the term structure of the risk-free interest rate. The "stance" of monetary policy—the central bank's impact on stabilizing or changing growth in nominal expenditures—comes from the interaction of this risk-free term structure with the "natural" term structure. The latter is derived under the assumption of perfectly flexible prices and reflects the way in which the real rate of interest reconciles the desire of households to smooth consumption given unevenness in the

expected availability of the consumption good. Credit policy concerns how the central bank influences financial intermediation. Second, the narrative complements the model. While identifying the shocks that produce a recession requires a model, all models are incorrect in significant ways. Moreover, a multiplicity of models exists, capable of fitting any given time series. In practice, economists use a model in conjunction with an (often implicit) narrative. The narrative adds information from outside the model that renders plausible the association of a model's shocks, which are unobservable, with observable time series. In the case of the Eurozone recessions, the narrative suggests that the monetary policy of the European Central Bank (ECB) was contractionary at times, even though its credit policies were expansionary. However, both monetary disorder

and financial-market disruption work through financial markets and are therefore inherently difficult to separate.

Hetzel concludes that the ECB should have concentrated on core inflation (inflation in the sticky-price sector) instead of focusing on headline inflation. The ECB created a negative output gap to keep headline inflation at its 2 percent target when it should have concentrated on core inflation, which was significantly lower than headline inflation. If pessimism from the financial crises of 2008 and 2011 lowered the natural rate of interest, then the credit policies of the ECB would have been insufficient to stem recession without more aggressive reductions in the policy rate combined with forward guidance.

<https://www.nowpublishers.com/article/BookDetails/9789813236585>

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## The Evolution of U.S. Monetary Policy

By [\*Robert L. Hetzel\*](#)

*In Handbook of the History of Money and Currency, edited by Stefano Battilossi, Youssef Cassis, and Kazuhiko Yago, New York: Springer Publishing, forthcoming*

Beginning with the writings of British banker and economist Henry Thornton in 1802, central banks have been identified as the institutions that determine how nations control money creation. And with more than a century of experience with the Federal Reserve System, economic historians can make some general statements about how the Fed controls money creation and about the nature of the monetary regime.

Robert L. Hetzel, who retired from the Richmond Fed last year, does just that in a “living reference work” that will become a chapter in the forthcoming *Handbook of the History of Money and Currency*. “Since the creation of the Federal Reserve System, the goal of policymakers has been economic stability,” Hetzel writes. “Policymakers’ strategies for achieving that goal have evolved with their understanding of how the world works. An overview of that understanding and of its consequences for monetary policy provides an approximation to a laboratory for understanding what constitutes a stabilizing monetary policy. As an institution, when has the Fed been a major contributor to economic stability and when has it been a major source of instability?”

Hetzel argues that this laboratory provides a solid foundation for building a model that would allow for identification of the forces that drive prices and the business cycle. Such a model would allow monetary economists and policymakers to go beyond the correlations of monetary and macroeconomic variables to determine causation. The model also would explain how “exogenous” forces, that is, forces emanating from outside the workings of the price system, can move markets away from stable outcomes. The historical overview that Hetzel provides, however, suggests that economists and policymakers are still a long way from establishing a model and a rule for monetary policy that satisfactorily distill the lessons of the past.

Hetzel’s book chapter is organized into eight sections. “Defining the Monetary Regime” poses the questions, “What is a central bank and how does the systematic behavior of a central bank create the monetary regime?” The second section, “Pre-World War II Monetary Policy,” describes the monetary regime before 1941, while “Post-World War II Monetary Policy and Stop-Go” summarizes the era of “stop-go” monetary policy. A section called “The Great Moderation” reviews the post-disinflation Paul Volcker-Alan Greenspan era and the intellectual sea change that it entailed. The next section, “What Monetary Regime Did Volcker and Greenspan Create?” covers the regime that emerged during their tenures as FOMC chairmen. “The Great Recession” reviews monetary policy during the Great Recession, and “Why Was Raising Inflation So Hard after the Great Recession?” examines the reasons why the Fed regularly missed its inflation target on the downside in recent

years. The final section, "What Is the Monetary Regime?" concludes that the Federal Reserve has failed to benefit fully from its own history.

"The lack of consensus about how the monetary regime has evolved and what kind of rule will best provide for economic stability leaves the monetary regime fragile," Hetzel writes. The regime can vary based on the views of newly appointed policymakers, so it is extremely important to maintain an active dialogue between central bankers and economists centered on learning from history. "Much work remains in order to achieve consensus on the design of a rule that will make monetary policy into a consistently stabilizing influence."

[https://link.springer.com/referenceworkentry/10.1007/978-981-10-0622-7\\_32-1](https://link.springer.com/referenceworkentry/10.1007/978-981-10-0622-7_32-1)

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## Banking and Monetary Policy in American History from the Formation of the Federal Reserve

By [Robert L. Hetzel](#) and Gary Richardson

In *Oxford Handbook of American Economic History*, edited by Louis P. Cain, Price V. Fishback, and Paul W. Rhode, New York: Oxford University Press, 2018

In chapter thirty of the *Oxford Handbook of American Economic History*, Robert L. Hetzel, who retired from the Richmond Fed last year, and Gary Richardson of the University of California, Irvine trace the development of monetary policy in the United States from the founding of the Federal Reserve in 1913 through the Great Recession of 2007–09.

Initially, the Fed's founders attempted to use discount window lending to create an elastic currency that would expand and contract in response to business needs. Under the doctrine of "real bills," they relied on the market to regulate the supply of money and credit, subject to a discipline imposed by discount window lending that the extension of credit be for productive—not speculative—uses. The responsibility of the Fed was to prevent "inflation," defined at the time as unsustainable increases in asset prices, or bubbles. In 1929, the Fed burst a stock market bubble by increasing the cost of borrowing. As the nation plunged into recession, the Fed's twelve Reserve Banks failed to respond in a cohesive fashion. Differences of opinion among their leaders combined with their belief in the real bills doctrine resulted in highly contractionary monetary policy that only made matters worse.

During the Great Depression that ensued, the Roosevelt administration took control of monetary policy away from the Fed. This lack of independence continued throughout World War II as the Fed agreed to keep interest rates artificially low to help finance the war. But the dynamics of inflation, highlighted by the war and its aftermath, persuaded the leaders of the Fed to abandon the real bills doctrine. Instead of relying on market forces to curb inflation, the Federal Open Market Committee (FOMC) would manage inflation by influencing short-term interest rates. William McChesney Martin, a U.S. Treasury official who later chaired the Fed, negotiated a Fed-Treasury "accord" that separated monetary policy from the management of government debt, and the modern central bank was born.

By the early 1960s, the Fed had restored price stability, but inflation began to reemerge in 1965. It accelerated as the FOMC focused on achieving low, stable unemployment "with a politically acceptable amount of inflation." By the time Paul Volcker became chairman of the Fed in 1979, inflation was out of control, but Volcker demonstrated a strong commitment to reducing inflation, even in the face of rising unemployment, and the FOMC was able to lower inflation to 4 percent.

**William McChesney Martin was instrumental in establishing a Fed-Treasury "accord" that separated monetary policy from the management of government debt, and the modern central bank was born.**

After a quarter century without a severe recession, the Fed encountered another crisis in 2007. Hetzel and Richardson offer several different explanations of what caused the recession of 2007–09, including scenarios that place part of the blame on the Fed. “At present, policymakers are acting on the assumption that a disruption to financial intermediation, rather than contractionary monetary policy, caused the recent Great Recession,” they note. “Historical experience, however, shows that with scholarly research, contemporary understanding about the nature of recessions and the appropriate policy for preventing them changes considerably.”

Indeed, the authors find that Fed policymakers learned much from their experience during World War I, the Great Depression, World War II, and the Great Inflation. But then the Great Recession demonstrated that many unanswered questions remain.

<https://global.oup.com/academic/product/the-oxford-handbook-of-american-economic-history-9780199947973?cc=us&lang=en&#>

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## Aggregate Implications of Changing Sectoral Trends

By Andrew Foerster, [Andreas Hornstein](#), [Pierre-Daniel Sarte](#), and Mark W. Watson  
*National Bureau of Economic Research Working Paper No. 25867, May 2019*

The U.S. economy is approaching the longest expansion on record, but output has grown slowly in the wake of the Great Recession. In a National Bureau of Economic Research working paper, Andrew Foerster of the San Francisco Fed, Andreas Hornstein of the Richmond Fed, Pierre-Daniel Sarte of the Richmond Fed, and Mark W. Watson of Princeton University study the steady decline in trend GDP growth from 1950 through 2016. Building on Fernald et al. (2017), the authors explore the roles played by total factor productivity (TFP) and labor inputs in explaining this secular decline, but they do so at a disaggregated sectoral level.

The authors estimate an empirical model where TFP growth and labor growth in each industry have unobserved persistent and transitory components and where each component can itself stem from either aggregate or idiosyncratic forces. The estimates reveal that trends in TFP growth and labor growth have steadily decreased across a majority of U.S. sectors since 1950. More than two-thirds of the secular decline in aggregate TFP growth results from the combination of sector-specific disturbances, thus leaving only an ancillary role for aggregate factors. Similarly, sector-specific factors have dominated trend labor growth, especially in the durable goods sector.

Foerster, Hornstein, Sarte, and Watson define the process of structural change in different sectors as concurrently determined by the observed low-frequency behavior of TFP and labor growth in those sectors. They then embed those changes into a dynamic multisector framework in which materials and capital used by different sectors in the economy are produced by other sectors. The fact that changes in TFP growth or labor growth in a sector affect value-added growth in every other sector hinges critically on the presence of capital. This feature of the environment leads to quantitatively important multiplier effects from sectoral linkages to GDP growth. The size of this multiplier for each sector depends on its importance as a supplier of capital or materials to other sectors. The density of production linkages more generally determines the degree to which the sectoral network propagates structural changes in one sector to the rest of the economy.

Capital flow tables produced by the U.S. Bureau of Economic Analysis indicate that the construction and durable goods sectors produce roughly 80 percent of the capital used in almost every industry. The strength of these linkages results in GDP growth multipliers for those two sectors that are almost three times their share of the economy. Professional and business services as well as finance, insurance, and real estate, and wholesale trade are also associated with relatively large GDP growth multipliers because of their central roles as suppliers of materials. The authors find that changing sectoral trends in the past six decades, translated through the economy’s

production network, have on net lowered trend GDP growth by roughly 2.3 percentage points. Construction stands out more than any other sector, by a considerable margin, for contributing to the trend decline in GDP growth since 1950, accounting for 30 percent of this decrease. Structural changes in professional and business services and nondurable goods together account for another 25 percent.

Foerster, Hornstein, Sarte, and Watson note that the slow process of capital accumulation means that these structural changes have endogenously persistent effects. Therefore, they estimate that trend GDP growth will continue to fall during the next ten years unless there are persistent improvements to TFP growth and labor growth.

<https://doi.org/10.3386/w25867>

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## Real Rates and Consumption Smoothing in a Low Interest Rate Environment: The Case of Japan

By *Jonathon Leczna*r and *Thomas A. Lubik*

*Pacific Economic Review*, December 2018, vol. 23, no. 5, pp. 685–704

In an article in the *Pacific Economic Review*, Jonathon Leczna of Boston University and Thomas A. Lubik of the Richmond Fed study the dynamics of consumption, the real interest rate, and measures of labor input in Japan from 1985 through 2013. This period covers an asset price bubble followed by a financial crash and a prolonged period of economic stagnation and extraordinary monetary policy measures by the Bank of Japan, including the zero interest rate policy.

**The breaks in consumption growth and the real interest rate coincide with two major policy changes. The Bank of Japan began implementing a highly accommodative interest rate policy in 1995, and the government increased the consumption tax rate from 3 percent to 5 percent in 1997.**

The authors combine narrative and time-series analysis to identify and help explain a puzzle in Japanese macroeconomic dynamics. Evidence from comovement patterns, structural break tests, and more formal generalized method of moments estimation on structural Euler equations for consumption growth indicates that the behavior of aggregate consumption and its relationship with real interest rates changed considerably in early 1997. The authors also find evidence of a structural break in the behavior of employment and hours worked that started earlier in the decade. The picture that emerges of Japan's economy during the 1990s is one of considerable change in the structural parameters governing household consumption and labor-supply decisions. It is these structural changes that can explain the seemingly inconsistent behavior of consumption growth and real rates.

The timing of the breaks in consumption growth and the real interest rate coincide with two major policy changes. The Bank of Japan began implementing a highly accommodative interest rate policy in 1995, and the government increased the consumption tax rate from 3 percent to 5 percent in 1997. Leczna and Lubik find evidence to suggest that households formed stronger habit preferences toward their purchases and exhibited greater sensitivity to real interest rate movements following these policy changes. A rise in the serial correlation of consumption following the 1997 break suggests an increased role for habit formation in consumption. The authors find little evidence of habit formation from 1986 to 1997. However, starting in the second quarter of 1997, they find strong evidence in favor of habit formation. In addition, they find evidence of a greater responsiveness of consumption growth to real interest rate fluctuations beginning in the second quarter of 1997, arising largely from households becoming less risk averse, or equivalently from the elasticity of intertemporal substitution. The general nature of the authors' framework allows them to incorporate nonseparable consumption and leisure. Instability of the results and



dependence upon the use of either intensive or extensive measures of employment lead them to conclude that allowing for substitutability between consumption and leisure is unnecessary for capturing consumption dynamics in Japan.

In 2014, the government raised the consumption tax from 5 percent to 8 percent. And in 2017, the government raised the consumption tax again—this time to 10 percent. These new tax hikes, against the backdrop of Lecznar and Lubik’s results, argue for further study of the relationship between tax policy and aggregate consumption dynamics in Japan.

This research can be extended in several directions. First, there are concerns about the validity of results because of the generally low power of structural break tests and the presence of weak instruments. Second, the analysis should be broadened to consider alternative specifications of the Euler equation, especially regarding preferences. Third, assuming the results hold true, the analysis could be expanded to include other intertemporal relationships, such as asset pricing or investment equations. Finally, the analysis also could be used to inform models that explicitly model structural breaks as an equilibrium phenomenon.

<https://doi.org/10.1111/1468-0106.12284>

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## Distance and Decline: The Case of Petersburg, Virginia

By *Raymond E. Owens and Santiago M. Pinto*

*Virginia Economic Journal*, 2018, vol. 22, pp. 1–28

Following two centuries of general economic prosperity as a center of transportation, trade, and manufacturing, Petersburg, Virginia, has experienced a prolonged period of decline. Asymmetrically fixed boundaries combined with a shrinking population may have left the city particularly vulnerable to negative economic shocks as officials faced declining tax revenues and sticky municipal costs. After a large number of layoffs occurred in the 1980s, the city lost population, especially highly skilled workers, to the nearby suburbs of Richmond, Virginia, a much larger and more prosperous city. But other Virginia cities that experienced substantial layoffs during the 1980s did not decline to the same degree. Why did Petersburg suffer disproportionately?

In an article in the *Virginia Economic Journal*, Raymond E. Owens and Santiago M. Pinto of the Richmond Fed model two scenarios. The first scenario features two cities, one relatively vibrant and the other less so. These cities are close enough geographically that when economic activity declines in one city, workers and residents have reasonable options of commuting to or moving closer to jobs in the other city. In this scenario, the authors show that a negative productivity shock to one city leads to substantial migration of highly skilled workers to the other city. The authors also model a city that is far enough removed from other cities that a negative productivity shock does not cause as large of an outflow of highly skilled workers. In this second scenario, the more isolated city experiences a loss in aggregate utility for residents, but it remains in a better position to weather the shock and eventually return to a path of economic growth.

Evidence from several Virginia cities is consistent with the implications of these two models. After significant productivity shocks in the 1980s, home values and the number of higher-income residents decreased in Petersburg while they increased in the nearby Richmond suburbs. In contrast, more isolated Virginia cities—such as Lynchburg and Waynesboro—suffered less pronounced effects after they experienced shocks that were similar to those felt in Petersburg. The authors conclude that Petersburg was simply “too close” to Richmond, a city that prospered as Petersburg declined. In fact, Petersburg is in the same metropolitan statistical area as Richmond.

The authors also note that their model captures only a portion of the economic effects of a productivity shock. Other factors simultaneously may reinforce and amplify the initial effects. For

example, a decline in housing prices and a shift toward a lower-skilled workforce may adversely affect the public finances of a city. Lower tax revenues would lead to lower quality public goods, such as schools, parks, and other infrastructure. And this erosion of quality would make it increasingly difficult to attract and retain residents and employers. Presumably, the first workers to leave a struggling city would be the most highly skilled, an outcome that would further impede a city's ability to recover.

In the case of Petersburg, such obstacles may have been exacerbated by the city's asymmetrically fixed boundaries. In other words, Petersburg could grow, but it could not shrink as economic conditions deteriorated. Anticipating industrial expansion in the early 1970s, Petersburg annexed fourteen square miles from adjacent localities, but the anticipated growth never materialized, and the extra land saddled the city with higher municipal costs that were not fully supported by additional tax revenues.

<https://vaeconomics.wordpress.com/journal/>

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## Asset Pledgeability and Endogenously Leveraged Bubbles

By Julien Bengui and [Toan Phan](#)

*Journal of Economic Theory*, September 2018, vol. 177, pp. 280–314

After the U.S. housing bubble burst in 2007, economists renewed their efforts to understand leveraged asset bubbles. They have attempted to address such questions as: Under what conditions might bubbly assets and risky debts end up on the balance sheets of agents who are prone to default? Under what conditions do asset bubbles become leveraged—that is, financed by credit? And how do leveraged bubbly episodes differ from unleveraged ones?

Julien Bengui of the University of Montreal and Toan Phan of the Richmond Fed address these questions in an article in the *Journal of Economic Theory*. They develop a simple tractable general equilibrium model of endogenously leveraged asset bubbles. They incorporate two types of households: borrowers and lenders. Households can extend credit to each other, but borrowers cannot commit to future repayment and therefore need to pledge assets as collateral. To capture the main features of a securitized debt market, the authors assume that borrowing and lending is facilitated by a securitized credit pool. In other words, debt incurred by different borrowers is packaged together and sold as shares to lenders in a manner similar to the securitized mortgage market that expanded rapidly as the U.S. housing bubble emerged in the early 2000s.

**The authors' results imply that the combination of securitized credit pools and a high degree of bubbly asset pledgeability can facilitate the emergence of high-risk bubbly episodes.**

The authors find that when asset pledgeability is limited, any equilibrium bubble is unleveraged because households buy the bubbly assets using their own funds, so the bubbly episode is not associated with a credit boom. But when the bubbly assets are highly pledgeable, any equilibrium bubble must be leveraged because households can generate high returns by buying the bubbly assets using debt that is backed by the assets themselves. Also, high pledgeability tends to reduce down payments, and borrowers' option to default after the bubble bursts allows them to shift some of the risk of bubbly investment to the lenders. In a standard bilateral loan contract, the price of debt (the interest rate) would internalize this shifting of risk. However, when individual loans are packaged into a credit pool, individual default risks are also packaged together, facilitating the shifting of risk from borrowers to lenders. In fact, the authors show that when the pledgeability of bubbly assets is high, any bubbly episode in equilibrium must be associated with leveraged investment and an

expansion of the credit pool. Hence, a distinguishing characteristic of leveraged bubbly episodes is that they come with default risk because after the bubble bursts, it is optimal for borrowers to default when the value of their collateral falls below the value of their debt.

The authors' results imply that the combination of securitized credit pools and a high degree of bubbly asset pledgeability can facilitate the emergence of high-risk bubbly episodes. One interpretation of this implication is that low down payments combined with the packaging of risky loans into securitized credit pools not only facilitate asset bubbles and credit booms, but also can change the nature of asset bubbles from unleveraged to leveraged. Furthermore, in a leveraged bubbly episode, the risky assets end up in the hands of agents who are more prone to default after the bubble bursts. These predictions are consistent with the U.S. housing bubble, in which there was a boom in homeownership financed by collateralized debt that was facilitated by a securitized mortgage boom. When the bubble burst in 2007, the credit boom quickly turned into a bust with widespread default and foreclosure.

<https://doi.org/10.1016/j.jet.2018.06.005>

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## Temperature and Growth: A Panel Analysis of the United States

By *Riccardo Colacito, Bridget Hoffmann, and Toan Phan*

*Journal of Money, Credit and Banking, March-April 2019, vol. 51, nos. 2–3, pp. 313–368*

As average global temperatures are predicted to continue rising over this century, many scholars and policymakers have raised warnings of the potential for dramatic damages to the global economy. The economics literature has documented substantial negative effects of global warming on economic growth in developing economies, but for the United States, it has been challenging to provide systematic evidence that rising temperatures affect the growth rate of economic activities beyond sectors that are naturally exposed to outdoor weather conditions—such as agriculture.

In an article in the *Journal of Money, Credit and Banking*, Riccardo Colacito of the University of North Carolina at Chapel Hill, Bridget Hoffmann of the Inter-American Development Bank, and Toan Phan of the Richmond Fed analyze the effect of average seasonal temperatures on the growth rate of U.S. output. They find that seasonal temperatures, particularly summer temperatures, have significant and systematic effects on the U.S. economy, both at the aggregate level and across a wide cross-section of economic sectors. Specifically, they find that a 1°F increase in the average summer temperature is associated with a reduction in the annual growth rate of state-level output ranging from 0.15 percentage points to 0.25 percentage points.

The authors overcome challenges of measuring the economic impact in the United States by exploiting random fluctuations in seasonal temperatures across years and states. Using a panel regression framework with the growth rate of state gross domestic product (GDP), or gross state product (GSP), and average seasonal temperatures in each U.S. state, they find that summer and fall temperatures have opposite effects on economic growth. An increase in the average summer temperature negatively affects the growth rate of GSP, while an increase in the fall temperature positively affects this growth rate, although to a lesser extent. The different signs of the two effects suggest that previous studies' aggregation of temperature data into annual temperature averages may mask the heterogeneous effects of different seasons.

The summer effect dominates the fall effect in the authors' recent sample (post-1990), leading to a negative net economic effect of rising temperatures. This finding implies that the U.S. economy is still sensitive to temperature increases despite the progressive adoption of adaptive technologies such as air conditioning. The authors also document that the temperature effects

are particularly strong in states with higher summer temperatures. However, they do not find any evidence that the greater effect of temperature on GDP in the South is driven by lower levels of development. This lack of evidence implies that the channel through which temperature affects GDP in the South must be distinct from the one documented in the literature for developing economies.

To measure the long-term economic consequences of rising average global temperatures, Colacito, Hoffmann, and Phan combine their estimates of the effects of seasonal temperatures on the growth rate of U.S. output with several projections of U.S. temperature change over the next century. They perform their analysis under a “business-as-usual” benchmark, in which there is no additional mitigation and the estimated effects of temperature on economic growth remain unchanged. They document that the projected increases in summer and fall temperatures could reduce the annual growth rate of nominal GDP by up to 1.2 percentage points, which is roughly one-third of the historical average nominal growth rate of about 4 percent per year.

<https://doi.org/10.1111/jmcb.12574>

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## Asset Bubbles and Global Imbalances

By *Daisuke Ikeda* and [Toan Phan](#)

*American Economic Journal: Macroeconomics, forthcoming*

**B**ubbles are market values that far exceed assets’ fundamental values because buyers expect to resell the bubbly assets at even higher prices. Bubbles can boost capital investment and output, but their collapse can lead to sharp economic contractions. In a paper forthcoming in the *American Economic Journal: Macroeconomics*, Daisuke Ikeda of the Bank of Japan and Toan Phan of the Richmond Fed analyze the relationships between bubbles, capital flows, and boom-busts in economic activities.

**The boom and bust of housing prices in the United States in the early 2000s and the subsequent financial crisis have renewed interest among economists and policymakers in understanding these relationships.**

The boom and bust of housing prices in the United States in the early 2000s and the subsequent financial crisis have renewed interest among economists and policymakers in understanding these relationships. Three stylized features characterize the U.S. housing episode: global imbalances, a boom and bust in asset prices, and fluctuations in economic activities. First, over the past few decades, capital has flown in large quantities from emerging economies to developed ones, creating global imbalances. In particular, the United States has been a net capital importer since the 1980s, while emerging economies, especially China and other Asian nations, have experienced expanding current account surpluses. Second, the peak period of capital flows from emerging econo-

mies into the United States was associated with a spectacular boom and bust in asset prices, much of which is difficult to explain by changes in economic fundamentals. Several prominent economists and policymakers have argued that the glut of savings flowing from emerging economies into the United States after the East Asian crisis might have caused or at least facilitated the boom in housing prices prior to the financial crisis. Third, the boom-bust in asset prices was associated with significant fluctuations in economic activities, specifically credit expansion during the boom and contractions in aggregate economic activities during the bust.

Motivated by these observations, Ikeda and Phan develop a rational bubble model with two large open economies they refer to as North and South. The North represents the United States, while the South represents emerging economies such as China. The authors introduce heterogeneous productivity, credit friction, and asymmetry in financial development to the model before finally introducing bubbles.

Their results are twofold. First, financial integration facilitates the emergence of bubbles in the North by causing capital to flow from South to North due to the asymmetry in financial development. Capital inflows lower the interest rate in the North and hence facilitate the emergence of Northern bubbles. The authors also show that capital inflows increase the size of bubbles relative to the North's economy. They interpret this result as supportive of the earlier claim that inflows of savings from developing countries contributed to the housing bubble in the United States. Second, bubbles in the North, in turn, facilitate South-to-North capital flows. The emergence of a bubble in the North increases the returns from investing in the North and hence attracts even more capital from the South.

Together, these results predict a close and reinforcing relationship between capital flows and asset bubbles. Specifically, the financial integration of the South with the North leads capital to flow into the North. Capital inflows, in turn, facilitate the emergence of large bubbles in the North, which further exacerbate global imbalances. The authors' model also predicts a relationship between the boom and bust of a bubble episode and fluctuations in the aggregate economy. The North experiences expansions in aggregate economic activities during a boom phase but experiences contractions during a bust phase. These predictions are consistent with stylized features of recent boom-bust episodes.

<https://www.aeaweb.org/articles?id=10.1257/mac.20140286&&from=f>

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## Diverging Trends in National and Local Concentration

By *Esteban Rossi-Hansberg*, *Pierre-Daniel Sarte*, and *Nicholas Trachter*

*National Bureau of Economic Research Working Paper No. 25066, September 2018*

Much has been written recently about the increase in national market concentration observed over the past two decades and the role that large national firms have played in driving this trend. The evidence indicating a rise in national market concentration is uncontroversial; the market shares of the largest firms and the Herfindahl-Hirschman Index (HHI), among other measures of concentration, have increased consistently in most sectors since 1990. A narrative has emerged, however, in which this increase in national concentration is perceived as the cause of lower product-market competition. This fall in competition is then viewed as the cause of other apparent trends, such as rising markups and market power, the increasing profits of large firms, declining labor market dynamism and firm entry, and a declining labor share.

In a National Bureau of Economic Research working paper, Esteban Rossi-Hansberg of Princeton University and Pierre-Daniel Sarte and Nicholas Trachter of the Richmond Fed document four main facts regarding national and local product-market concentration in the U.S. economy between 1990 and 2014. These four facts indicate that the increase in market concentration observed at the national level over the past twenty-five years is being shaped by national enterprises expanding into new local markets. This expansion into new local markets is accompanied by a fall in local concentration as firms open more establishments. These observations are suggestive of more, rather than less, competitive markets.

The authors' first fact is that the positive trend in market concentration at the national level has been accompanied by a corresponding negative trend in market concentration at the local level. They observe an increase in concentration at the national level across the vast majority of sectors and industries, but they observe a fall in concentration when it is measured at various local levels.

Their second fact shows that local concentration is falling across industries that together account for 77 percent of employment and 70 percent of sales. Furthermore, conditioning on industries where national concentration is rising, industries where local concentration has declined account for the majority of overall employment across all major sectors.

The authors' third fact shows that among these industries, top firms have accelerated both trends. That is, excluding the top firm in each industry, the national increase in concentration naturally becomes less pronounced, and the decline in local concentration also becomes less pronounced.

Their fourth fact establishes that among industries with falling local concentration, the opening of a plant by a top firm is associated with a decline in local concentration that persists for at least seven years. This observation provides further evidence that in those industries, large enterprises do not enter and dominate a local market but instead lower its concentration.

The findings of Rossi-Hansberg, Sarte, and Trachter potentially help reconcile the observation of increasing concentration at the national level and the more mixed evidence on increasing markups and profits. Virtually no theory of product-market competition associates decreasing concentration with either increasing markups or increasing profits. The authors' facts also indicate that the rising trend in national concentration is not, in and of itself, necessarily a concern for antitrust policy. By decreasing local concentration, the expansion of top firms likely has increased local competition and, therefore, helped improve the quality and reduce the prices of many products.

<http://doi.org/10.3386/w25066>

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## The Benefits of Commitment to a Currency Peg: Aggregate Lessons from the Regional Effects of the 1896 U.S. Presidential Election

By Scott L. Fulford and [Felipe Schwartzman](#)

Review of Economics and Statistics, *forthcoming*

Exchange rate crises and banking crises are often intertwined, as observed during the Great Depression, in the second half of the twentieth century, and in the recent instability around the European Monetary Union. A substantial theoretical literature points out that causality can run in either direction.

**The authors' findings reinforce the notion that the best way to stabilize an exchange rate peg is to keep politics out of the management of the peg to the extent possible.**

In an article forthcoming in the *Review of Economics and Statistics*, Scott L. Fulford of the Consumer Financial Protection Bureau and Felipe Schwartzman of the Richmond Fed develop a methodology to use information from the cross-sectional impact of a one-time shock to the credibility of the gold standard in the United States—the 1896 presidential election—to shed light on this issue. The election provides unique insight because the central issue was whether the United States would stay on the gold standard, and the outcome remained uncertain until the end. Fulford and Schwartzman find evidence that this uncertainty had detrimental effects

on banking and finance and broader economic activity. The evidence also suggests that the prospect of devaluation can be costly—even when devaluation ultimately does not occur.

While the U.S. economy at the end of the nineteenth century differed substantially from current economies, the banking sector and international finance arguably played sufficiently prominent roles in the 1890s episode to make it informative for policymakers today. One key difference between modern economies and the one the authors analyze is the presence of a central bank with the ability to set interest rates that “defend” currency pegs, even when foreign exchange reserves become lacking. In contrast, before the Gold Standard Act of 1900, when the Treasury's gold reserves became depleted, exchange rate intervention required the Treasury to obtain authorization from Congress to issue bonds to replenish its reserves. This additional political step—and other political interventions—contributed to the lack of credibility, most notably during the panic of 1893.

So the authors' findings reinforce the notion that the best way to stabilize an exchange rate peg is to keep politics out of the management of the peg to the extent possible. They note that exchange rate crises are often self-fulfilling credibility crises: as concerns mount about exchange rate credibility, so do the costs of maintaining a peg, leading to greater concerns about credibility.

A major contribution of Fulford and Schwartzman's work is providing a method that cleanly distinguishes the costs of credibility in a single episode from the costs of the devaluation that often follows. They use the election to construct a time series for the driving process of interest through a comparison of cross-sectional data between periods. More formally, they use the change in cross-sectional variables around the date of the historical event to identify the loadings of a time-varying latent factor estimated using principal component methods. Then they use this time-series variation to identify the aggregate impact of the shock using standard methods.

In the case of the 1896 election, the authors find that bank leverage increased substantially following the election, particularly in states where gold was in greater use. Using the latent factor identified by the election, they conclude that full commitment to gold had the potential to reduce the volatility of real activity by a significant amount during the last two decades of the nineteenth century. Such commitment could have substantially mitigated the depression that began in 1893.

[https://doi.org/10.1162/rest\\_a\\_00833](https://doi.org/10.1162/rest_a_00833)

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## Financial Fragility and Over-the-Counter Markets

By [\*Bruno Sultanum\*](#)

*Journal of Economic Theory*, September 2018, vol. 177, pp. 616–658

In developed financial systems, investors participate in asset markets via financial institutions that trade assets (often over the counter) on their investors' behalf and provide liquidity (withdrawal options) to their investors. Two examples of such institutions are money market mutual funds and banks. An empirical literature suggests that large outflows from these types of institutions during the 2007–08 financial crisis were due to runs. However, the literature does not address whether the runs were connected to an over-the-counter (OTC) market structure. Establishing this connection would give policymakers a better understanding of which financial markets are fragile and which institutions are prone to runs.

In an article in the *Journal of Economic Theory*, Bruno Sultanum of the Richmond Fed embeds the main ideas of financial fragility discussed in the Diamond and Dybvig (1983) literature into a dynamic model of OTC markets. He models the financial sector as a large number of investors divided into different groups (financial institutions) that trade assets over the counter with a large number of dealers. Investors receive privately observed preference shocks, and financial institutions use the balanced team mechanism, proposed by Athey and Segal (2013), to implement an efficient risk-sharing arrangement among their investors. When the market is liquid, in the sense that search and bargaining frictions are small, it is likely to have a unique equilibrium and, therefore, not to be fragile. But when search and bargaining frictions are large, a run equilibrium exists—investors announce low valuations of assets because they believe everyone else in their financial institution is doing the same thing. Conditional on bank runs existing, the welfare impact of the search friction is ambiguous. During runs, trade is inefficient, and, as a result, a friction that reduces trade during runs has the potential to improve welfare. This result is in sharp contrast with the existing literature, which suggests that search friction has a negative impact on welfare.

Sultanum notes that during the 2007–08 financial crisis, institutions that suffered runs were trading large volumes of asset-backed securities—mostly over the counter. As a result, the financial sector featured a large number of institutions operating in a market with severe OTC frictions.

The most common prescription from regulators and scholars for enhancing financial stability is to regulate the contracts offered by financial institutions. But the need to tailor such regulations to different types of institutions produces a complex regulatory system with loopholes and regulatory arbitrage possibilities. Even if regulators are willing to write different regulations for each type of financial institution, it is not clear which regulations are optimal. Sultanum's results suggest a different way to enhance financial stability. Instead of regulating the contracts, policymakers could intervene in markets for the underlying assets. If regulators reduce trade frictions enough, they could enhance financial stability without regulating individual institutions. For example, during the 2007–08 crisis, the Federal Reserve implemented a number of programs designed to support the liquidity of financial institutions. One example is the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility, which helped money market mutual funds sell their asset-backed commercial paper.

Sultanum suggests that such policies have the potential to eliminate runs on financial institutions and stabilize the financial sector. But he also warns that such policies could increase asset misallocation during a crisis and ultimately decrease welfare.

<https://doi.org/10.1016/j.jet.2018.07.002>

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## Asset Issuance in Over-the-Counter Markets

By Zachary Bethune, [Bruno Sultanum](#), and [Nicholas Trachter](#)  
Review of Economic Dynamics, *forthcoming*

Many assets, both real and financial, are traded in secondary over-the-counter (OTC) markets. Many of these markets experienced severe volatility during the 2008 financial crisis, and several policies were enacted that aimed to directly support the issuance of new assets. For example, the Federal Reserve created the Term Asset-Backed Securities Loan Facility to support the issuance of asset-backed securities collateralized by different types of private loans. The Fed also created the Commercial Paper Funding Facility to support the issuance of commercial paper. While there is a large literature studying OTC markets, most studies in this literature assume a fixed supply of assets, an assumption that leaves the effects of policies designed to spur asset issuance outside the scope of that research.

**The authors study how the trading of seasoned assets in secondary OTC markets affects their primary issuance and, in turn, aggregate asset supply and welfare.**

In an article forthcoming in the *Review of Economic Dynamics*, Zachary Bethune of the University of Virginia, Bruno Sultanum of the Richmond Fed, and Nicholas Trachter of the Richmond Fed study how the trading of seasoned assets in secondary OTC markets affects their primary issuance and, in turn, aggregate asset supply and welfare.

In the authors' model of asset issuance in OTC markets, investors buy newly issued assets in a primary market and trade existing assets in a secondary market. But there is a double-sided hold-up problem involving both buyers and sellers in the secondary market. Sellers create surplus when they buy assets from issuers and resell them to high-valuation investors in the secondary market. (The surplus comes from asset intermediation.) But sellers only receive a share of that surplus, resulting in a hold-up problem. To fix this problem, all the trade surplus must accrue to the seller in the secondary market. In contrast, buyers in the secondary market prevent the surplus that would be created by intermediation when they buy assets from issuers instead of buying them from sellers in the secondary market. Since bargaining in the secondary market happens *ex post*, buyers only receive a share of the surplus, again resulting in a hold-up problem. Unlike more standard hold-up problems, the sunk cost underlying the inefficiency does not come from making an early investment—such as acquiring an asset from issuers—but from *not* making it. To fix this problem, all the trade surplus must accrue to the buyer in the secondary market.



Bethune, Sultanum, and Trachter show that the level of asset issuance and its efficiency depend on how investors split the surplus when trading in the secondary market. If buyers get most of the surplus, then sellers do not have incentives to participate in the primary market in order to intermediate assets, and the economy has a low level of assets. On the other hand, if sellers get most of the surplus, buyers have strong incentives to participate in the primary market, and the economy has a high level of assets. As previously noted, solving this double-sided hold-up problem would require both buyers and sellers to capture all of the trade surplus, which is clearly not feasible, so the authors propose a tax/subsidy scheme and show how it could restore efficiency.

They also extend their model in several dimensions and study the robustness of the inefficiency result. Finally, they explore the effects of the inefficiency using numerical examples. They study how bargaining power and trading speed in the secondary market affect the efficiency result, and they suggest some interesting implications for policy interventions aimed at restoring efficiency to OTC markets.

<https://doi.org/10.1016/j.red.2019.04.003>

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## Learning and Life Cycle Patterns of Occupational Transitions

By *Aspen Gorry, Devon Gorry, and [Nicholas Trachter](#)*  
*International Economic Review, May 2019, vol. 60, no. 2, pp. 905–937*

About 20 percent of workers from ages eighteen to twenty-eight switch between blue-collar and white-collar jobs each year. Although it has long been known that job mobility plays a crucial role in the wage growth of young workers, occupational choices are also important for explaining their human capital accumulation, patterns of job switching, and worker turnover. Most empirical studies of occupational mobility have focused on cross-sectional patterns of switching over time instead of following individuals over their life cycles. But the National Longitudinal Survey of Youth 1979 makes it possible to observe people switching occupational collars during the first ten years after they graduate from high school. About 36 percent of people in the survey do not switch, 18 percent switch once, 23 percent switch twice, and another 23 percent switch more than twice. The rates of transition between more specific occupational categories are even higher.

In an article in the *International Economic Review*, Aspen Gorry and Devon Gorry of Clemson University and Nicholas Trachter of the Richmond Fed develop a quantitative life cycle model of occupational choices with worker learning and occupation-specific productivity shocks to match life cycle patterns of occupational transitions and quantify the value of occupational mobility and learning. Their model builds on the classic job-shopping framework created by Johnson (1978), where worker learning drives occupational mobility.

Gorry, Gorry, and Trachter calibrate their model to match moments about workers' occupational mobility and wages. They find that a model with learning and productivity shocks is consistent with patterns of occupational mobility, wage growth, and a reduction in time to the second switch for individuals who have more than two occupational switches in the sample. An individual who just switched occupations will be relatively indifferent between the two occupations, although the distribution of workers' initial beliefs about their occupational type implies that workers entering the labor force are not as concentrated around the switching threshold. This result is consistent with mechanisms such as learning or productivity fluctuations across occupations where individuals switch occupations when they cross a threshold, but it is not consistent with other models of occupational transitions, such as job ladders, unless workers gain skills more rapidly as they age. Productivity shocks are included in the model to study the relative importance of learning and productivity fluctuations in generating this shifting behavior.

The authors use their calibrated model to measure how much workers value the ability to switch occupations and how much they would be willing to pay to learn their occupational type. These values change for workers as they age. For the average eighteen-year-old worker, the value of being able to switch occupations is about sixty-seven months of the maximum wage he or she could earn in the model (if the worker knew his or her type). And the value of learning his or her type is about thirty-two months of the maximum wage the worker could earn in the model. These values decline to nearly zero by the time workers are fifty years old, and much of that decline is due to learning in the model instead of mechanical horizon effects. Although both learning and productivity shocks are important to generate switches in the model, the authors find that the magnitude of the option values are robust to changes in risk aversion, the magnitude of the productivity shocks, and the inclusion of switching costs in the model.

<https://doi.org/10.1111/iere.12371>

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## Price Dynamics with Customer Markets

By Luigi Paciello, Andrea Pozzi, and [Nicholas Trachter](#)

*International Economic Review*, February 2019, vol. 60, no. 1, pp. 413–446

The customer base of a firm—the set of customers buying from it at a given point in time—is an important determinant of firm performance. Its effects are long-lasting because customer-supplier relationships are subject to a certain degree of stickiness. A large literature has stressed that price is an important instrument for attracting and retaining customers, and several authors have emphasized that accounting for the influence of customer markets on firm pricing has relevant implications for the propagation of aggregate shocks to prices and output. But these studies typically do not microfound customer reallocation across firms, or they rely on consumption habit formation abstracting from consumer flows. So the existing evidence on this mechanism consists mostly of anecdotes and surveys.

**The authors present what may be the first direct evidence linking firms' prices with customer-base evolution.**

In an article in the *International Economic Review*, Luigi Paciello and Andrea Pozzi of the Einaudi Institute for Economics and Finance and Nicholas Trachter of the Richmond Fed present what may be the first direct evidence linking firms' prices with customer-base evolution. They exploit scanner data documenting pricing and customer-base evolution for a major U.S. retailer. The data contain information on all the shopping trips each household makes to the retailer's stores. This information indicates

when customers leave the retailer by documenting prolonged spells with no purchases. Combining these data with detailed information on the retailer's prices, the authors can study the relationship between a customer's decision to shop elsewhere and the price of the goods he or she typically purchases. They show that an increase in the price significantly raises the probability that the customer leaves. Specifically, a 1 percent change in the price of the goods typically consumed by the firm's customers would raise the firm's yearly customer turnover rate from 14 percent to 21 percent.

Motivated by this finding, Paciello, Pozzi, and Trachter develop a rich model with endogenous customer dynamics and heterogeneous firm productivity. They show that the interaction of endogenous customer turnover and heterogeneous productivity delivers two main sets of results. The mechanism at the heart of the model allows them to match two important features of price and demand dynamics. To retain customers, firms have to absorb part of the productivity shocks, causing incomplete price pass-through; as firms with different productivity face endogenously different demand schedules, the price pass-through will be heterogeneous. Inertia in the customer base of a firm induces a greater persistence in firm demand than in firm productivity. Furthermore, the authors show that these predictions hold true in microdata from U.S. retailers. Finally, their study

offers a methodological contribution by building a framework to study the link between firm pricing and demand that features both customer turnover and price dispersion of identical products. Hence, their setup lends itself naturally to quantification of the key margins shaping the benefit and cost of searching by matching these observable statistics from the microdata.

The authors use their model as a laboratory to study the effect of a preference shock that shifts the utility from consumption. A positive preference shock raises customers' search intensity since it is more valuable for them to be matched with sellers offering a lower price. There are more consumers looking to switch, which incentivizes firms to lower their markups to retain them. Lower markups, in turn, magnify the effect of the demand shock on consumption. This result ties to a recent but very active area of research that emphasizes the importance of consumer shopping behavior for macroeconomic dynamics.

<https://doi.org/10.1111/iere.12358>

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## Should Platforms Be Allowed to Charge Ad Valorem Fees?

By [Zhu Wang](#) and Julian Wright

*Journal of Industrial Economics*, September 2018, vol. 66, no. 3, pp. 739–760

Many platforms that facilitate transactions between buyers and sellers charge ad valorem fees—in other words, fees that are proportionate to transaction prices. Well-known examples include online marketplaces (such as Amazon and eBay), payment card platforms (such as Visa, MasterCard, and American Express), and hotel-booking platforms (such as Booking.com and Expedia.com). In these cases, platforms typically charge sellers percentage fees, as well as sometimes small fixed per-transaction fees. Platform costs, which are largely fixed or dependent on the number (rather than the value) of transactions, cannot explain the levels of ad valorem fees set by these platforms. This has led to criticisms of the ad valorem fee structure, given it is not cost-reflective.

In an article in the *Journal of Industrial Economics*, Zhu Wang of the Richmond Fed and Julian Wright of the National University of Singapore explore whether ad valorem fees harm welfare and, if so, whether there may be a case for banning them. To address this issue, the authors use a model that they developed in Wang and Wright (2017), in which a profit-maximizing platform designs its fee structure to take into account heterogeneity in demand across the many products sold over its platform. The key idea captured by the model is that when a market involves many different goods that vary widely in their costs and values (characteristics may not be directly observable), then ad valorem fees, or ad valorem taxes, represent an efficient form of price discrimination because the value of a transaction is plausibly proportional to the cost of the good traded. The model implies that the profit-maximizing fee structure is affine (consisting of a percentage fee plus a fixed per-transaction component) if and only if the demand faced by sellers belongs to the generalized Pareto class that features constant curvature of inverse demand (which includes linear demand, constant-elasticity demand, and exponential demand as special cases). This feature of the model matches the fee structure used by many platforms. Moreover, the model implies that the fixed per-transaction component is present only because the platform incurs a marginal cost for processing each transaction; otherwise a simple percentage fee would be profit-maximizing.

Wang and Wright use their model to study what would happen if policymakers banned a platform's use of any ad valorem fee but left the level of the platform's fees unregulated. For policymakers who prefer that platform fees be determined by costs but are concerned about directly regulating fee levels, this scenario seems to be a natural approach to consider. However, the authors show that the welfare results are not obvious and are related to the long-standing debate on the welfare effects of third-degree price discrimination. They find that, in most cases, welfare would indeed be harmed if ad valorem fees were banned, including when the authors calibrate

the model to data from sales of DVDs on Amazon's marketplace and data from Visa signature debit card transactions. A similar result also would apply to a government that wanted to maximize tax revenue. Welfare would be higher when it does so using an ad valorem tax.

The key concept that drives the authors' results is that when a market involves many different goods that vary widely in their costs and values, ad valorem fees, or ad valorem taxes, represent an efficient form of price discrimination. In comparison, uniform fees (or uniform taxes) could adversely affect low-cost, low-value goods thereby reducing total welfare.

<https://doi.org/10.1111/joie.12180>

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## Review of *The Fed and Lehman Brothers: Setting the Record Straight on a Financial Disaster*, by Ball

By [John A. Weinberg](#)

*Business Economics*, January 2019, vol. 54, no. 1, pp. 97–99

The failure of Lehman Brothers on September 15, 2008, was a pivotal moment in the global financial crisis of 2007–09. It is widely believed that the financial turmoil in the wake of the Lehman bankruptcy contributed significantly to the deepening of the recession and perhaps even to the slow pace of recovery since 2009. So it stands to reason that careful study of public policy decisions in the Lehman episode has the potential to improve policymaking in the future.

In *The Fed and Lehman Brothers: Setting the Record Straight on a Financial Disaster*, Johns Hopkins economist Laurence Ball provides such a study. He first presents a narrative that includes a forensic accounting exercise to make the case that (1) Lehman was likely solvent in an economic sense and (2) it had sufficient collateral to pledge against emergency loans that could have led to an acquisition or orderly wind down without material risk to the Federal Reserve or taxpayers.

The remainder of the book questions the rationales given by former Fed Chairman Ben Bernanke and other Fed officials for the decision not to provide financial support to Lehman. Ball contends that the reasons provided immediately following Lehman's failure are inconsistent with the reasons given later.

Ball suggests that policy decisions made during this episode were political and that they were driven not by the Fed's judgment, but by Treasury Secretary Henry Paulson's distaste for further use of public money to assist troubled financial firms. Hence, the picture offered is one of the central bank surrendering its independent lender-of-last-resort authority to the political interests of the Treasury—a mistake that had predictable and avoidable consequences, according to Ball.

In a 2019 review of the book in *Business Economics*, John A. Weinberg of the Richmond Fed praises Ball's "thorough narrative, accounting exercises, and reporting on decision making." These elements, by themselves, will make the book "a valuable resource for students of the crisis." Weinberg calls Ball's strong conclusions about motivations and whether decisions were right or wrong "productively provocative." But, Weinberg hedges, "I think some of the conclusions are drawn with more certainty than may be warranted." Ball's evaluation of Lehman's assets, for example, relies on market valuations produced by the company, its regulators, and potential acquirers in the period before the firm's bankruptcy. This is the best information available, and it supports the conclusion that the company was at most slightly insolvent on a mark-to-market basis and probably solvent on an economic-value basis. But 2008 was a time of exceptionally high uncertainty about asset valuations.

**Weinberg calls Ball's strong conclusions about motivations and whether decisions were right or wrong "productively provocative." But, Weinberg hedges, "I think some of the conclusions are drawn with more certainty than may be warranted."**

"None of this is to say that allowing Lehman to go into an unassisted bankruptcy was clearly the correct decision in September of 2008," Weinberg concludes. "In the turmoil of that moment, it was an incredibly difficult decision, and I find it hard to second guess those who had to make it. That choice did provide a shock to the financial system, although I would argue that in large part the shock had to do with disappointing expectations that more assistance would be forthcoming. In this regard, an essential part of the story is how those expectations became entrenched, through the Fed's actions and statements about the need for central bank credit in the year leading up to the fateful Lehman weekend."

<https://doi.org/10.1057/s11369-018-00112-5>

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## Discretionary Monetary Policy in the Calvo Model

By *Willem Van Zandweghe* and *Alexander L. Wolman*

*Quantitative Economics*, January 2019, vol. 10, no. 1, pp. 387–418

Over the past two decades, New Keynesian models have become the dominant framework for applied monetary policy analysis. This framework is characterized by optimizing private sector behavior in the presence of nominal rigidities. The Calvo model of staggered price setting is the most common way of implementing nominal rigidities in New Keynesian models. In the Calvo model, a continuum of monopolistically competitive firms producing differentiated goods face a constant, exogenous probability of adjusting their prices. Its relatively tractable framework is undoubtedly the main reason why the Calvo model serves as the basis for so much applied work on monetary policy. However, infrequent price adjustment in this model leads to a time-consistency problem for monetary policy: the policy that the central bank would like to commit to today, for all future periods, is not the policy that it will choose in the future if it is able to choose its actions freely in the future—that is, with discretion.

In an article in *Quantitative Economics*, Willem Van Zandweghe of the Kansas City Fed and Alexander L. Wolman of the Richmond Fed examine this policy problem by studying discretionary equilibrium in the Calvo pricing model for a monetary authority that chooses the money supply. The authors contribute to the existing literature in three ways. First, in response to the identification of discretionary policy as a potential source of multiple equilibria, particularly in the Taylor model, they show that price-adjusting firms have a unique equilibrium price for a broad range of parameterizations in the Calvo model. Private agents make decisions, such as saving or price setting, based on expectations of future policy. Those decisions, in turn, are transmitted to the future through state variables, creating the potential for complementarity between actual and expected future policy when policy is chosen under discretion. While previous research shows that the Taylor model generates multiple equilibria under discretionary policy, the authors find no evidence of multiple equilibria in the Calvo model. They trace the contrasting behavior of the two models to differences in how current pricing decisions affect the overall price level and how the future policymaker responds to a measure of the dispersion in predetermined relative prices.

The second contribution flows from the first. Uniqueness of the equilibrium price set by adjusting firms allows the derivation of a generalized Euler equation, which had not previously been derived for the Calvo model. This equation represents the dynamic trade-off facing a discretionary policymaker in equilibrium, highlighting the various channels through which current policy can affect future welfare. The authors' third contribution is to provide global solutions, including welfare analysis, for the transitional dynamics that occur if the monetary authority gains or loses the ability to commit. In both cases, the authors find that the welfare gain or loss from the transition is quite close to the steady-state welfare difference between discretion and commitment. However, the transitions differ qualitatively: the transition from discretion to commitment involves a gradual decline in inflation, while the opposite transition involves an initial overshooting in inflation.

The authors conclude by noting that the properties of discretionary equilibrium are determined by the specifics of the model. The defining feature of the Calvo model is the assumption that a fraction of firms are prohibited from adjusting their prices. However, the details of the intertemporal nature of price setting differ across staggered pricing models, leading to different implications for the nature of equilibrium under discretionary monetary policy.

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## A Heterogeneous-Agent New-Monetarist Model with an Application to Unemployment

By *Guillaume Rocheteau, Pierre-Olivier Weill, and Tsz-Nga Wong*

*National Bureau of Economic Research Working Paper No. 25220, November 2018*

In a National Bureau of Economic Research working paper, Guillaume Rocheteau of the University of California, Irvine, Pierre-Olivier Weill of UCLA, and Tsz-Nga Wong of the Richmond Fed study equilibria of a new monetarist model with both expenditure and income risks and nondegenerate distributions of money holdings. While the literature following Lagos and Wright (2005) focuses almost exclusively on equilibria with degenerate distributions, the authors study equilibria with endogenous ex-post heterogeneity.

In the authors' model, workers can consume early in a decentralized market where money is essential or late in a centralized market where money can accumulate in the form of real balances. If income is not too large, it takes two or more periods, assuming the number of periods is endogenous, for a worker who begins with no money to reach his or her real-balance goal. (It takes one period in the Lagos-Wright model.) As a result, the distribution of money holdings is nondegenerate and value functions are strictly concave in money holdings. In contrast to the Lagos-Wright model, the value of money at a steady-state equilibrium increases with workers' income, which creates a channel through which the income distribution affects firms' profits, entry, and hence unemployment.

**The authors study equilibria of a new monetarist model with both expenditure and income risks and nondegenerate distributions of money holdings.**

Rocheteau, Weill, and Wong first illustrate the distributional effect in the context of a one-time helicopter drop of money to workers. If workers can reach their real-balance goals in a single period, as in Lagos-Wright, the helicopter drop has no real effect because the price level instantly adjusts to the money supply. In contrast, if it takes two or more periods for workers to reach their real-balance goals, the model exhibits nontrivial transitional dynamics. In other words, at two or more periods, a one-time increase in the money supply raises aggregate real balances because the price level does not increase as much as the money supply.

Next, the authors incorporate exogenous income risk by assuming that income follows a two-state Markov chain, where the low state is interpreted as unemployment. In Lagos-Wright, income risk is irrelevant because it does not affect workers' real-balance choices. In contrast, at two or more periods, income risk matters and the distribution of real balances becomes a function of the income distribution. It follows that the effectiveness of monetary policy depends on the state of the labor market. For instance, a one-time injection of money is more likely to have real effects when unemployment is high and the income of the unemployed is low. Anticipated inflation can raise welfare when unemployment is high.

Finally, the authors endogenize income risk in a frictional labor market. This creates an aggregate demand channel: when a shock redistributes liquidity toward those workers who face tighter liquidity constraints, total expenditures increase and firms post more vacancies, which ultimately

reduces unemployment. This environment leads to new predictions. First, an increase in unemployment benefits reduces unemployment. Second, there is a long-run Phillips curve if money growth is implemented by transfers to workers. The resulting trade-off between inflation and unemployment is exploitable and can raise welfare. Third, the aggregate demand channel amplifies productivity shocks. As productivity goes up, the fraction of employed workers increases. Since employed workers accumulate real balances faster than unemployed workers, aggregate real balances grow. Ultimately, the elasticity of unemployment to a productivity shock increases by about 30 percent relative to a model without an aggregate demand channel.

<https://doi.org/10.3386/w25220>

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## Relative Price Dispersion: Evidence and Theory

By *Greg Kaplan, Guido Menzio, Leena Rudanko, and [Nicholas Trachter](#)*  
*American Economic Journal: Microeconomics, forthcoming*

<https://www.aeaweb.org/articles?id=10.1257/mic.20170126>

**Editor's Note:** This article is substantially the same as the National Bureau of Economic Research working paper of the same title that was summarized in the *2016 Richmond Fed Research Digest*.

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## Editors' Introduction: The Renewal of the Canadian Inflation-Control Target

By *Francisco Ruge-Murcia and [Alexander L. Wolman](#)*  
*Canadian Journal of Economics, August 2018, vol. 51, no. 3, pp. 799–801*

<https://doi.org/10.1111/caje.12344>

**Editor's Note:** This article introduces a special section in the *Canadian Journal of Economics* that features some of the research produced at the Bank of Canada for the renewal of its inflation-control target in October 2016. At the time of this renewal, two key issues were the role of macroprudential policy and the importance of downward nominal wage rigidity.

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