



# RESEARCH UPDATE

These working papers present preliminary findings of research conducted by Philadelphia Fed economists, analysts, and visiting scholars. Visit our website for more **abstracts** and **papers**.

## **Valuing “Free” Media in GDP: An Experimental Approach**

“Free” consumer entertainment and information from the Internet, largely supported by advertising revenues, has had a major impact on consumer behavior. Some economists believe that measured gross domestic product (GDP) growth is badly underestimated because GDP excludes online entertainment (Brynjolfsson and Oh 2012; Ito 2013; Aeppel 2015). This paper introduces an experimental GDP methodology that includes advertising-supported media in both final output and business inputs. For example, Google Maps would be counted as final output when it is used by a consumer to plan vacation driving routes. On the other hand, the same website would be counted as a business input when it is used by a pizza restaurant to plan delivery routes.

Contrary to critics of the U.S. Bureau of Economic Analysis (BEA), the process of including “free” media in the input-output accounts has little impact on either GDP or total factor productivity (TFP). Between 1998 and 2012, measured nominal GDP growth falls 0.005% per year, real GDP growth rises 0.009% per year and TFP growth rises 0.016% per year. Between 1929 and 1998, measured nominal GDP growth rises 0.002% per year, real GDP growth falls 0.002% per year, and TFP growth rises 0.004% per year. These changes are not nearly enough to reverse the recent slowdown in growth.

The authors’ method for accounting for free media is production oriented in the sense that it is a measure of the resource input into the entertainment (or other content) of the medium rather than a measure of the consumer surplus arising from the content. The BEA uses a similar production-oriented approach when measuring GDP. In contrast, other researchers use broader approaches to measure value. Brynjolfsson and Oh (2012) attempt to capture some consumer surplus by measuring the time expended on the Internet. Varian (2009) argues that much of the value of the Internet is in time saving, an additional metric for capturing consumer surplus. The McKinsey Institute (Bughin et al. 2011) attempts to measure the productivity gain from search

directly. In particular, this production-oriented accounting has no method to account for instances in which the good or service precedes the revenue that it eventually generates. Over the past two decades, many Silicon Valley firms have followed the disruptive business model described as URL: ubiquity now, revenue later. Some firms have been creating proprietary software or research, which is already captured in the national accounts as investment. Other firms have been creating intangible investments in open source software, customer networks and other organizational capital. Despite their long-run value, none of these intangible assets are currently captured in the national accounts as investment. If we treat these asset categories as capital, then the productivity boom from 1995 to 2000 becomes even stronger and the weak productivity growth of the past decade may be ameliorated somewhat.

*Working Paper 16–24. Leonard Nakamura, Federal Reserve Bank of Philadelphia Research Department; Jon Samuels, Bureau of Economic Analysis; Rachel Soloveichik, Bureau of Economic Analysis.*

## **Localized Knowledge Spillovers: Evidence from the Agglomeration of American R&D Labs and Patent Data**

The authors employ a unique data set to examine the spatial clustering of private R&D labs. Instead of using fixed spatial boundaries, they develop a new procedure for identifying the location and size of specific R&D clusters. Thus, they are better able to identify the spatial locations of clusters at various scales, such as a half mile, 1 mile, 5 miles, and more. Assigning patents and citations to these clusters, they capture the geographic extent of knowledge spillovers within them. Their tests show that the localization of knowledge spillovers, as measured via patent citations, is strongest at small spatial scales and diminishes rapidly with distance.

*Working Paper 16–25. Kristy Buzard, Syracuse University; Gerald A. Carlino, Federal Reserve Bank of Philadelphia Research Department; Robert M. Hunt, Federal Reserve Bank*

of Philadelphia Payment Cards Center; Jake K. Carr, Ohio State University; Tony E. Smith, University of Pennsylvania. Supersedes Working Paper 15–03.

### **Borrower Credit Access and Credit Performance After Loan Modifications**

While the preventive effect of loan modifications on mortgage default has been well-documented, evidence on the broad consequences of modifications has been fairly limited. Based on two unique loan-level data sets with borrower credit profiles, this study reports novel empirical evidence on how homeowners manage their credit before and after receiving modifications. The paper has several main findings. First, loan modifications improve borrowers' overall credit standing and access to credit. Modifications that provide principal reduction, rate reduction, or greater payment relief, as well as those received by borrowers not in financial catastrophe, lead to a larger improvement in borrowers' credit rating than others. Second, loan modifications lead to a slight increase in borrowers' debts, primarily on home equity line of credit (HELOC) accounts and auto loans. Third, borrowers' performance on nonmortgage accounts, however, has not been negatively impacted by modifications. This study demonstrates that interventions designed to improve household balance sheets could have a direct and sizable impact on borrower financial outcomes.

*Working Paper 16–26. Lei Ding, Federal Reserve Bank of Philadelphia Community Development Studies & Education.*

### **Identity Theft as a Teachable Moment**

This paper examines how a negative shock to the security of personal finances due to severe identity theft changes consumer credit behavior. Using a unique data set of linked consumer credit data and alerts indicating identity theft, the authors show that the immediate effects of fraud on consumers are typically negative, small, and transitory. After those immediate effects fade, identity theft victims experience persistent, positive changes in credit characteristics, including improved risk scores (indicating lower default risk). The authors argue that these changes are consistent with increased salience of credit file information to the consumer at the time of severe identity theft.

*Working Paper 16–27. Nathan Blascak, Federal Reserve Bank of Philadelphia Payment Cards Center; Julia Cheney, Federal Reserve Bank of Philadelphia Payment Cards Center; Robert M. Hunt, Federal Reserve Bank of Philadelphia Payment Cards Center; Vyacheslav Mikhed, Federal Reserve*

*Bank of Philadelphia Payment Cards Center; Dubravka Ritter, Federal Reserve Bank of Philadelphia Payment Cards Center; Michael Vogan, Moody's Analytics. Supersedes Working Paper 14–28.*

### **Information Spillovers, Gains from Trade, and Interventions in Frozen Markets**

The authors study government interventions in markets suffering from adverse selection. Importantly, asymmetric information prevents both the realization of gains from trade and the production of information that is valuable to other market participants. They find a fundamental tension in maximizing welfare: While some intervention is required to restore trading, too much intervention depletes trade of its informational content. The authors characterize the optimal policy that balances these two considerations and explore how it depends on features of the environment. Their model can be used to study a program introduced in 2009 to restore information production in the market for legacy assets.

*Working Paper 16–28. Braz Camargo, Sao Paulo School of Economics–FGV; Kyungmin Kim, University of Iowa; Benjamin Lester, Federal Reserve Bank of Philadelphia Research Department.*

*Supersedes Working Paper 13–20.*

### **Declining Trends in the Real Interest Rate and Inflation: The Role of Aging**

The authors explore a causal link between aging of the labor force and declining trends in the real interest rate and inflation in Japan. They develop a New Keynesian search/matching model that features heterogeneities in age and firm-specific skills. Using the model, they examine the long-run implications of the sharp drop in labor force entry in the 1970s. They show that the changes in the demographic structure induce significant low-frequency movements in per-capita consumption growth and the real interest rate. These changes also lead to similar movements in the inflation rate when the monetary policy follows the standard Taylor rule, failing to recognize the time-varying nature of the natural rate of interest. The model suggests that aging of the labor force accounts for roughly 40% of the declines in the real interest rate observed between the 1980s and 2000s in Japan.

*Working Paper 16–29. Shigeru Fujita, Federal Reserve Bank of Philadelphia Research Department; Ippei Fujiwara, Keio University, Australian National University.*