

February 2018

## INSIDE THIS ISSUE

- Quantifying the Impact of ECB Policies during the Debt Crisis
- Informing College Students about Loan Options Increases Attainment
- Booming Home Prices Lead to Increased Spending on Public Education
- Eliminating ‘Food Deserts’ Won’t Cure Nutritional Inequality
- Evaluating the U.S. Dollar’s Outsized Role in World Trade

## Paying Down Credit Card Debt in Suboptimal Ways

Credit card borrowers typically do not repay their debts in the optimal way, if one assumes that their goal is to minimize their total interest costs. Instead of first tackling the loan with the highest interest rate, they split repayments to match the ratio of their card payments to the ratio of their card balances, according to **How Do Individuals Repay Their Debt? The Balance-Matching Heuristic** (NBER Working Paper No. 24161).

The cheapest way to pay down outstanding debt on multiple credit cards is to pay the minimum due on all cards and then to pay as much as possible on the card carrying the highest interest rate. If that card’s balance is fully paid, the borrower can then move on to the card with the next highest rate. Researchers [John Gathergood](#), [Neale Mahoney](#), [Neil Stewart](#), and [Joerg Weber](#) base their findings on credit card repayments of 1.4 million individuals over a two-year period—a dataset that allows them to link multiple cards to a single user. The researchers calculate that for two-card holders, the interest-minimizing strategy involves making 97.1 percent of “excess” payments—those above the required minimums—on the borrower’s highest-interest debt. But that’s not what most consumers do.

When studying borrowers with just two

Many consumers split their credit card payments across multiple cards in proportion to outstanding balances, ignoring interest rate differences and paying more than necessary.

only allocate 51.5 percent of their excess payments to the higher rate card, even though the average difference in the cards’ annual percentage rates (APRs) is 6.3 percentage points. That allocation is barely distinguish-

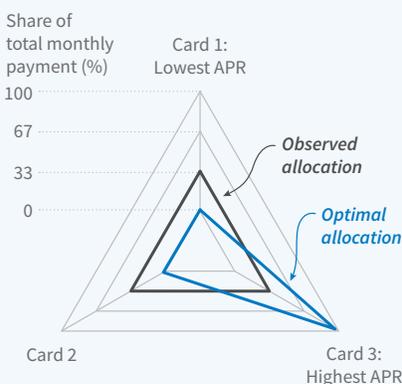
able from the 50-50 split that would occur if the borrowers ignored the respective interest rates on the two cards.

Why are borrowers apparently insensitive to the difference in interest rates? One explanation might be that the potential savings aren’t worth the time and effort needed to optimize their repayment. But the researchers find that the misallocation persists even if the APR difference is wide (in some cases, 15 percentage points) or if the payments are large—up to £800 (about \$1,100 at current exchange rates) per month. So the “optimizing is too costly” explanation doesn’t seem to fit.

Instead, individuals appear to follow a balance-matching heuristic, matching the ratio of their card payments to the ratio of their card balances. The researchers evaluate this heuristic against a set of other possibilities, including a “snowballing” rule where the lowest balance is paid down first. They find that balance-matching explains more of observed behavior than any other heuristic—more than half of the predictable variation in user repayments.

The researchers write that “[T]he credit card repayment decision is an ideal labora-

### Optimal vs. Observed Credit Card Payments



Payments in excess of minimum required payments  
Source: Researchers’ calculations using data from the Argus Information and Advisory Services’ Credit Card Payments Study

tory for studying borrowing because behavior that minimizes interest charges—what we refer to as optimal behavior—can be clearly defined.” Compared with choosing a

mortgage, where risk preferences could play a role in whether an individual picks a fixed- or adjustable-rate loan, or even credit card spending where rewards programs could

alter behavior, the decisions on how to repay credit card debt do not require explicit modeling of preferences.

—Laurent Belsie

## Quantifying the Impact of ECB Policies during the Debt Crisis

During the European debt crisis, several countries experienced large increases in government borrowing costs. The yields on government bonds for Ireland, Italy, Portugal, and Spain rose from around 2 percent in 2009 to between 7 and 20 percent in 2011, and Greek two-year bond yields rose to 200 percent in 2012. In response to this situation, the European Central Bank (ECB) enacted policies designed to reduce bond yields, including the Securities Markets Programme (SMP), Outright Monetary Transactions (OMT), and Long-Term Refinancing Operations (LTRO).

In **ECB Policies Involving Government Bond Purchases: Impact and Channels** (NBER Working Paper No. 23985), [Arvind Krishnamurthy](#), [Stefan Nagel](#), and [Annette Vissing-Jorgensen](#) examine the effects of these policies and quantify the effect of the SMP and OMT on bond yields. They also test for broader macroeconomic effects from these policies in the form of stock and corporate bond price increases both in distressed nations and in core eurozone countries.

The SMP, which started in May 2010, allowed the ECB to directly purchase government debt, with an initial focus on debt issued by Greece, Ireland, and Portugal. The program expanded to include Italy and Spain in 2011. In September 2012, the ECB initi-

ated the OMT, which also allowed for government bond purchases but required that countries apply for the program and agree to undergo fiscal adjustments. The ECB also

enacted three-year LTROs, an extension of a previous program that provided loans to banks. These loans were used, in part, to buy government debt.

The researchers find large decreases in sovereign bond yields following the introduction of the SMP and OMT. The yields on bonds with two-year maturities

policy had more modest impacts. The researchers find that the largest impact was a 50 basis point reduction in borrowing costs for Spain.

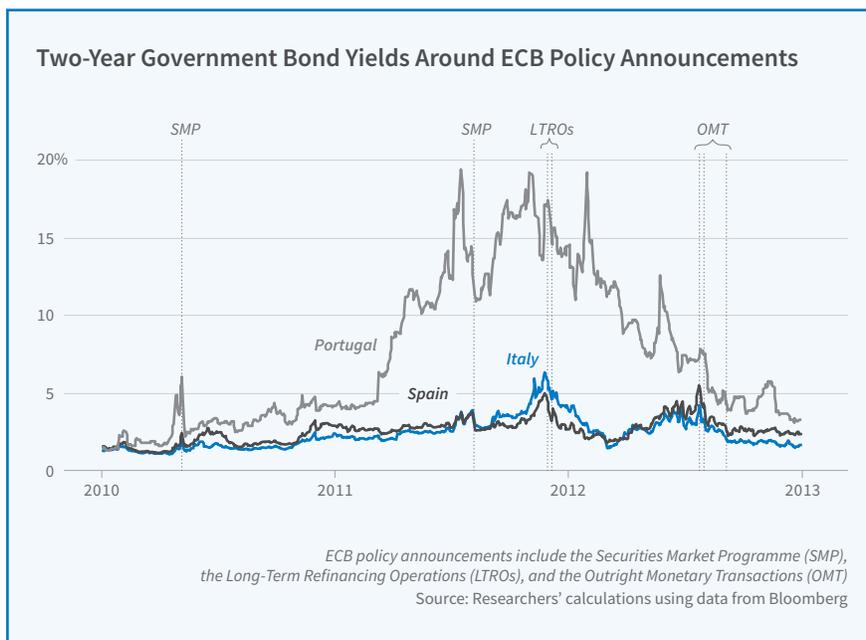
Two-year bond yields declined by 400 basis points for Italy and Spain, by 500 basis points for Ireland and Portugal, and by 1,000 basis points for Greece.

To analyze why yields declined, the researchers focus on Italy, Spain, and Portugal for reasons of data availability. The ECB publicly specified two goals for its programs. It sought to reduce the possibility that eurozone countries would split off and redenominate domestic debt in new currencies (“redenomination risk”) and it hoped to stabilize dysfunctional segments of the bond market, a problem called “market segmentation.” In addition to affecting redenomination risk and market segmentation, the ECB’s actions may also affect the default risk for sovereign bonds by changing market expectations of fiscal transfers and via lower redenomination risk and market segmentation lowering borrowing costs and thus default risk.

For both the SMP and OMT, the researchers find that the majority of the decline in yields

declined by 400 basis points for Italy and Spain (around 200 basis points each from the SMP and the OMT), by 500 basis points for Ireland and Portugal, and by 1,000 basis points for Greece. The LTRO

can be explained by a drop in default risk and a fall in the degree of market segmentation. In Italy, default risk accounted for 30 percent of the fall in yields, while a decline in market segmentation was responsible for



the other 70 percent. In Spain, default risk accounted for 42 percent, market segmentation for 43 percent, and redenomination risk for 15 percent. For Portugal, falling default risk explained 40 percent of the decline, a reduction in market segmentation explained

36 percent, and a decline in redenomination risk explained 24 percent.

The SMP and the OMT also had substantial impacts on the stock markets of the distressed countries and core euro-zone countries. The SMP led to a 4 percent

increase in stock values, and the OMT led to a 13 percent rise. Stock market returns following the LTRO were mixed—some countries saw positive returns; others experienced negative returns.

—Morgan Foy

## Informing College Students about Loan Options Increases Attainment

Since 2000, undergraduate enrollment in the United States has risen by more than 30 percent, largely in two-year institutions such as community colleges. Student loan debt has also increased, reaching \$1.4 trillion in 2017. In **Student Loan Nudges: Experimental Evidence on Borrowing and Educational Attainment** (NBER Working Paper No. 24060), Benjamin M. Marx and Lesley J. Turner conduct a field experiment at a community college to examine how nonbinding student loan “offers,” which potentially provide information about a student’s federal loan eligibility, impact loan take-up and academic attainment. They find that average credits earned and grade point averages (GPAs) both increase by 30 percent among students who borrowed as a result of the information.

Colleges are required to make federal loans available to all eligible students but can decide whether to include information about federal loan availability in students’ financial aid packages. These nonbinding offers may affect loan take-up if students are unaware of federal lending options or if the offers anchor students’ perceptions about how much to borrow.

The researchers ran a field experiment at a large community college to estimate the effects of such offers and subsequent student borrowing. Students were randomized into two groups: a treatment group, where students received a \$3,500 to \$4,500 loan “offer” in their financial aid award letter, and a control group, where the financial aid letters listed \$0 in offered loans. The offers did not affect students’

federal eligibility or borrowing requirements but potentially provided information about loan eligibility and available loan amounts.

tional attainment and find that students who were induced to borrow by a nonzero loan offer earned 3.7 more credits in an academic year, on average. Furthermore,

Students who were induced to borrow after receiving information on loan availability earned 3.7 more credits in an academic year and raised their grade point averages by 0.6 points.

In the treatment group, 32 percent of students took out a loan—a 39 percent increase over the control group figure of 23 percent. The treatment group also borrowed \$348 more on average, 32 percent more than the control group.

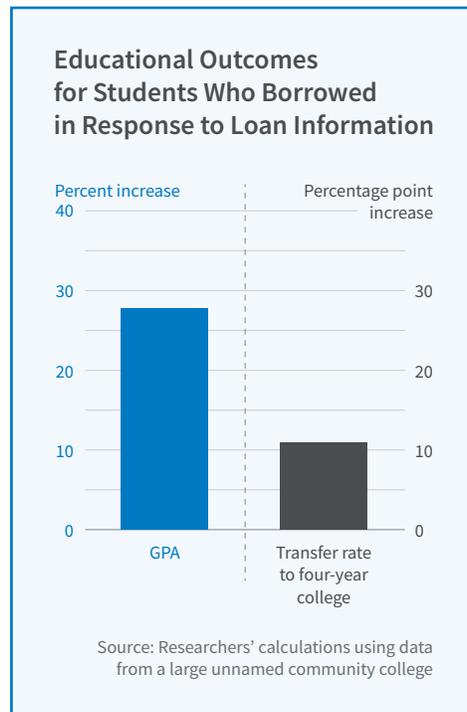
The researchers examine the impact of the informational program on educa-

borrowers earned higher GPAs, by about 0.6 points. The researchers also find that the loan offer led to a 23 percent (12 percentage point) drop in reenrollment at the community college in the year following the experiment and an 11 percentage point increase in transfers to four-year public institutions, representing a 178 percent increase relative to the control group.

The increase in credits earned, at an average loan of \$4,000, equates to 0.9 more credits per \$1,000 lent. If students default on their loans at the community college’s average rate, the researchers estimate a federal cost of \$444 per \$4,000 loan. Thus, each \$1,000 spent results in 8.1 additional credits earned.

For the average student, the researchers estimate a \$169 increase in annual earnings due to the attainment gains within the community college. They estimate that the increased enrollment at four-year schools further raises annual earnings by \$198, for a total annual earnings increase of \$370 as a result of the informational loan offer.

The researchers argue that the nonbinding loan offer works to counter misperceptions of loan availability and inattention to alternatives. Students in the treatment group are more likely to borrow across the



spectrum of loan amounts, which suggests previous unawareness of federal loan availability. The researchers estimate that learning about loan availability explains at least 78 percent of the effect of this interven-

tion. They find significant bunching of loan take-up at the offered amount, suggesting inattention to alternative amounts.

Across U.S. colleges, five million students attend schools that do not include

loan offers in their financial aid packages. The researchers note that this indicates potential for attainment gains on a broad scale.

—Morgan Foy

## Booming Home Prices Lead to Increased Spending on Public Education

House prices and local spending on public education are intertwined. Higher spending on local schools may increase the demand for homes in a community, thereby boosting house prices. But rising house prices may also expand the property tax base in a jurisdiction, thereby supporting higher spending on public schools. The latter linkage implies that when house prices rise, for example as a result of declining economy-wide interest rates, school spending may also increase.

Matthew Davis and Fernando V. Ferreira test the hypothesis that surging home prices result in more spending on education. In **Housing Booms and Public School Finances** (NBER Working Paper No. 24140), they find that housing booms accounted for half of the rise in public school spending during the 1990s and 2000s. This was a period when median public school spending rose by 41 percent in real terms, from \$9,131 per student in 1990 to \$12,907 in fiscal year 2008–09.

Housing markets are cyclical and the magnitude of those cycles, measured by changes in house prices from peak to trough, have increased over time. Moreover, the last housing cycle was characterized by changes in prices that were not linked to fundamental factors, such as broad increases in wages. When such booms

affect a labor market area—much larger than an individual school district—and are unrelated to other local factors that may influence prices, it is possible for researchers to examine how fluctuations in home prices impact school finances.

finance data from the National Center for Education Statistics and home price data from CoreLogic to estimate that house-price-to-school spending linkage. They focus on the period between the mid-1990s and the mid-2000s, when housing

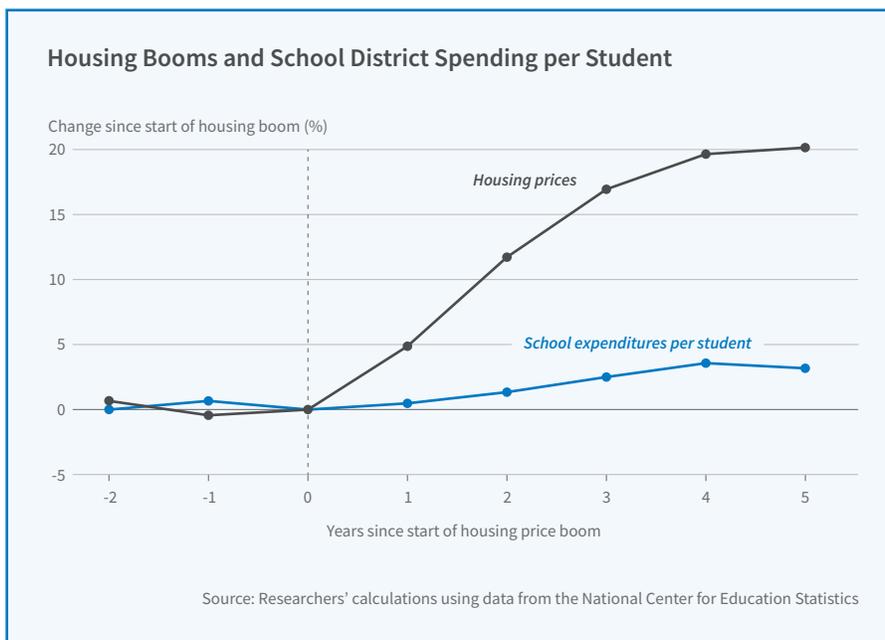
From 1995 to 2007, average real house prices in the United States rose 95 percent. Because property tax revenues are often linked to home values, expenditure per pupil in public schools also rose, by about 17 percent.

Rising home prices during a boom raise local property tax revenue unless the local government cuts tax rates to offset the higher home prices. If the jurisdiction spends part of this revenue on its schools,

markets were beginning to boom at different times around the country.

For the typical school district in the data sample, home prices are 20.1 percent higher five years after the onset of a housing boom. School expenditures also increase, but only with a one- or two-year lag compared to housing prices. By the fourth year of the boom, school expenditures are 3.3 percent higher. Using these figures, the researchers estimate that a 1 percent rise in home prices increases school expenditures by about 0.18 percent. Overall, from 1995 to 2007, average real house prices in the dataset analyzed by the researchers rose 95 percent. This was associated with an increase in expenditure per pupil of about 17 percent, roughly half of the rise in school spending per student in that period.

markets were beginning to boom at different times around the country. For the typical school district in the data sample, home prices are 20.1 percent higher five years after the onset of a housing boom. School expenditures also increase, but only with a one- or two-year lag compared to housing prices. By the fourth year of the boom, school expenditures are 3.3 percent higher. Using these figures, the researchers estimate that a 1 percent rise in home prices increases school expenditures by about 0.18 percent. Overall, from 1995 to 2007, average real house prices in the dataset analyzed by the researchers rose 95 percent. This was associated with an increase in expenditure per pupil of about 17 percent, roughly half of the rise in school spending per student in that period.



the house price run-up will translate into higher school spending. This represents an important spillover from housing markets to local government finances.

The researchers use school district

ated with an increase in expenditure per pupil of about 17 percent, roughly half of the rise in school spending per student in that period.

The researchers also investigate how

those additional resources were used by school districts. Four years after a housing boom, school capital expenditures

increased by 17 percent, teacher salaries by 2.9 percent, and teacher benefits by 3.7 percent. Interestingly, bureaucratic costs, such

as administrator salaries, did not increase following housing booms.

—Morgan Foy

## Eliminating ‘Food Deserts’ Won’t Cure Nutritional Inequality

Low-income households consume less nutritious diets than their high-income counterparts. Of the many potential explanations, one that has attracted recent attention among policy advocates argues that a substantial fraction of the poor live in “food deserts,” neighborhoods lacking full-service supermarkets stocking a wide variety of healthy foods.

In **Geography of Poverty and Nutrition: Food Deserts and Food Choices Across the United States** (NBER Working Paper No. 24094), [Hunt Allcott](#), [Rebecca Diamond](#), and [Jean-Pierre Dubé](#) find that nutritional inequality has less to do with the supply of supermarkets in a neighborhood than with the demand for healthier foods by its residents. Their findings suggest that education, nutritional knowledge, and regional food preferences play a far larger role in nutritional inequality than access issues.

This study analyzes what people of varying incomes eat and drink, measures the nutritional value of their consumption, and assesses the role that food deserts play in nutritional inequality. The researchers rely on data from a wide variety of sources which provide them with a rich array of demographic and geographic information about who buys what, where stores are located, where purchasers live and shop, and even when new food stores open in neighborhoods.

They find differences in the availability

of supermarkets in higher-income and lower-income neighborhoods, with higher-income districts having larger food stores clearly capable of stocking a wider variety of produce, breads, meats, dairy products, and other

wider variety of healthy foods. They find that the entry of new supermarkets has only a limited effect on shoppers’ purchasing patterns, and that variation in access to supermarkets accounts for only about 5 percent

Exposing low-income households to the same food-buying opportunities available to higher-income households would reduce nutritional inequality by only 9 percent.

goods than the more limited offerings of smaller corner grocery and drug stores common in lower-income areas. The researchers also confirm that those in higher-income areas buy more healthy and nutritious foods in general. So there is a correlation between food deserts and poor nutritional outcomes.

But the researchers also examine what happens after the opening of new supermar-

kets in low-income neighborhoods that were previously identified as food deserts, and what happens when individuals move from low-income areas to higher-income areas where there are more supermarkets with a

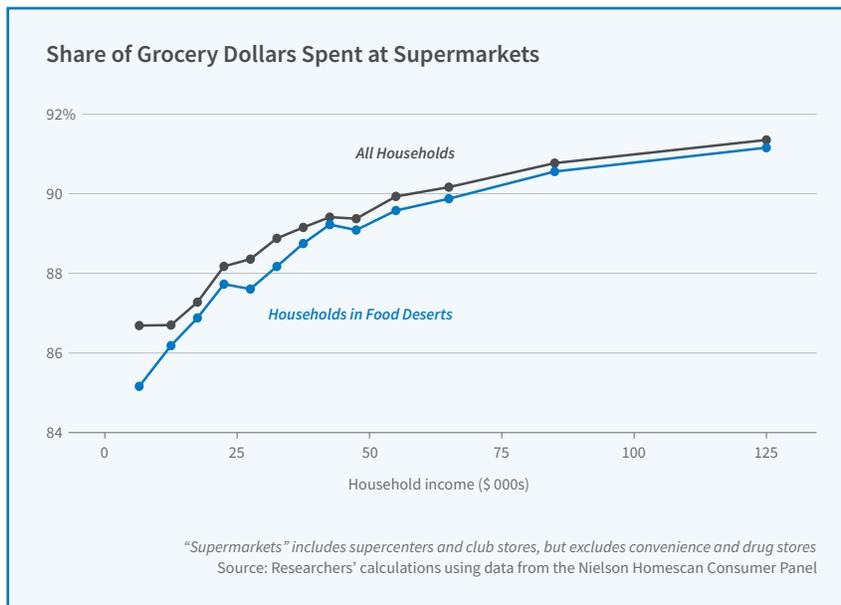
of the difference in healthy eating between high-income and low-income households. Purchasing and geographic data help to explain this finding. Those who live in food deserts drive longer distances to get food at supermarkets, so when new supermarkets open in their own neighborhoods, they merely transfer their old purchasing habits to the new stores. They benefit when

new stores open in their neighborhoods, but those benefits are mostly tied to a reduction in their travel time and transportation costs of buying food.

The research finds that those who move to areas where others generally eat more healthy foods do not change their own eating patterns, at least over the several-year time horizon studied. The researchers conclude that exposing low-income households to the same food-buying opportunities and prices that are

available to higher-income households would reduce nutritional inequality by only 9 percent; the remaining 91 percent is due to differences in demand.

—Jay Fitzgerald



# Evaluating the U.S. Dollar's Outsized Role in World Trade

Fluctuations in the dollar reverberate through global trade, and even affect transactions that do not involve the United States.

Because of the prevalence of invoice pricing in dollars, changes in the value of the dollar can have a larger impact on the trade flows between two non-U.S. nations involved in bilateral trade than changes in their own currencies.

In *Global Trade and the Dollar* (NBER Working Paper No. 23988), [Emine Boz](#), [Gita Gopinath](#), and [Mikkel Plagborg-Møller](#) analyze annual trade price and volume data for 55 countries from 1989–2015. As of 2015, the sample studied accounted for 91 percent of the world's total exports and imports of goods.

The researchers focus on estimates of the degree of price pass-through and the elasticity of trade with respect to the exchange rate.

When they do not control for fluctuations in the value of the dollar, they find that a 10 percent depreciation in the currency of an importing nation relative to that of its exporting counterpart raises the importer's prices by 8 percent, suggesting an almost complete pass-through. Adding the exchange rate of the importing country relative to the dollar dramatically reduces the pass-through estimate, to 3.2 percent. The dollar, by comparison, becomes the

dominant factor with a pass-through estimate of 6.6 percent into import prices. The researchers also calculate that a 10 percentage point rise in the

it affects the total volume of global trade, even among trading partners that do not include the United States. A 1 percent appreciation of the dollar

Recognizing that many goods are priced in dollars affects estimates of exchange rate pass-through and the elasticity of trade with respect to the exchange rate.

share of imports invoiced in dollars would increase the dollar pass-through by 2 to 3.5 percentage points.

When the dollar's value changes,

against all other currencies is associated with a 0.6 to 0.8 percent decline in total trade among countries in the rest of the world.

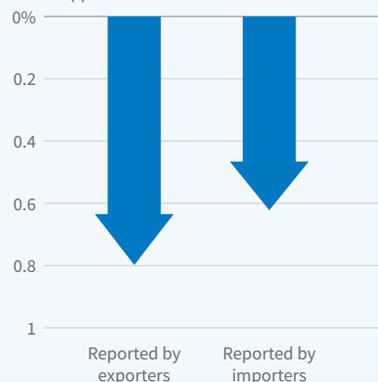
The researchers further find that the greater the share of a nation's imports invoiced in dollars, the greater the spillover effect on its inflation rate from shifts in the dollar's value. The share of imports invoiced in dollars varies widely among countries—for example, from 13 percent for Switzerland to 59 percent for Turkey and 88 percent for Argentina. Countries with less import volume invoiced in dollars are more insulated from fluctuations in the dollar.

The researchers explore whether the euro has effects similar to those of the dollar and find that it does not. "Euro pass-through into prices is negligible on average, while the dollar pass-through remains high when we control for the euro," the researchers conclude.

— Steve Maas

## Movements in U.S. Dollar and Global Trade Volume

Effect on rest-of-world trade volume when the U.S. dollar appreciates 1% relative to all currencies



Source: Researchers' calculations using data from U.N. Comtrade, the World Bank, the Federal Reserve Bank of St. Louis, and Gopinath (2015)

## NBER

The National Bureau of Economic Research is a private nonprofit research organization founded in 1920 and devoted to objective quantitative analysis of the American economy. Its officers are:

James M. Poterba—President & Chief Executive Officer  
Karen N. Horn—Chair  
John Lipsky—Vice Chair

The *NBER Digest* summarizes selected Working Papers recently produced as part of the Bureau's program of research. Working Papers are intended to make preliminary research results available to economists in the hope of encouraging discussion and suggestions for revision. The *Digest* is issued for similar informational purposes and to stimulate discussion of Working Papers before their final publication. Neither the Working Papers nor the *Digest* has been reviewed by the Board of Directors of the NBER.

The *Digest* is not copyrighted and may be reproduced freely with appropriate attribution of source. Please provide the NBER's Public Information Department with copies of anything reproduced.

Individual copies of the NBER Working Papers summarized here (and others) are available online free of charge to affiliates of subscribing organizations, such as universities and colleges, and to employees of NBER corporate associates. For others, there is a charge of \$5 per downloaded paper or \$10 per hard copy paper. Outside of the United States, add \$10 per hard copy order for postage and handling. To order, email the NBER Subscriptions Department at [subs@nber.org](mailto:subs@nber.org) or call (617) 588-1405; please have the Working Paper number(s) ready.

A full subscription to the NBER Working Papers entitles the subscriber to all new papers, recently more than 1,100 per

year. The online standard rate for a full digital subscription is \$2,400; the online academic rate is \$1,115. Subscriptions are free for corporate associates. The standard rate for hard-copy subscribers is \$10,000 per year and the academic rate is \$8,000. Higher rates apply for international hard-copy orders.

**Partial Working Paper subscriptions**, delineated by program, are also available. For further information, see our website, or write: National Bureau of Economic Research, 1050 Massachusetts Avenue, Cambridge, MA 02138-5398.

Requests for *Digest* subscriptions, changes of address, and cancellations may be sent to *Digest*, NBER, 1050 Massachusetts Avenue, Cambridge, MA 02138-5398 (please include the current mailing label), or emailed to [subs@nber.org](mailto:subs@nber.org). Print copies of the *Digest* are only mailed to subscribers in the U.S. and Canada; those in other nations may request electronic subscriptions at [www.nber.org/drsunsubscribe/](http://www.nber.org/drsunsubscribe/).