



# Globalization and Monetary Policy Institute

2016 ANNUAL REPORT



Federal Reserve  
Bank of Dallas



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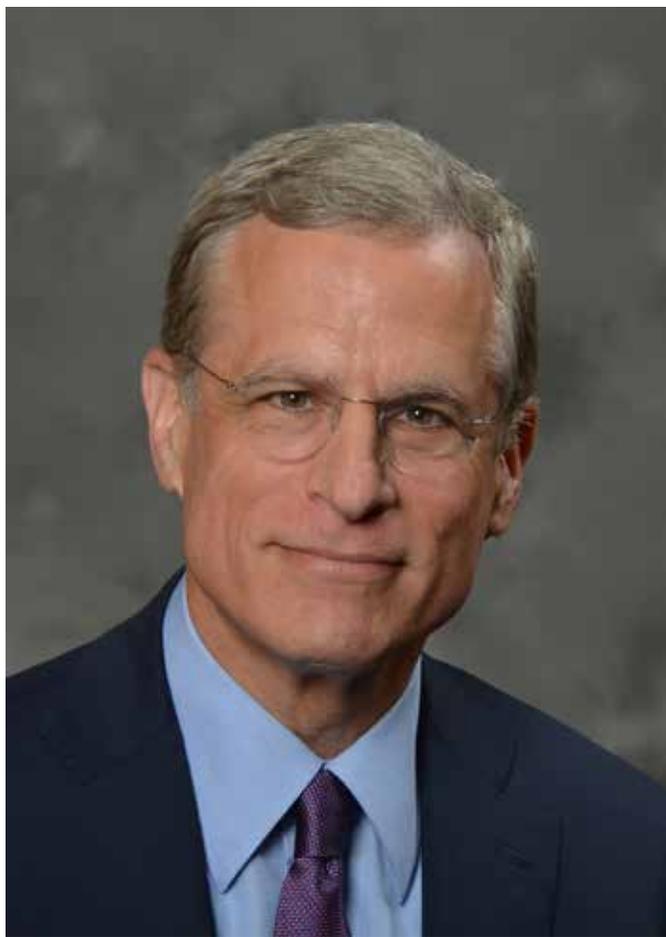
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# Letter from the President



**Due to the underlying strength of the U.S. consumer, U.S. gross domestic product (GDP) growth rebounded in the second half of 2016.**

**i**n last year's letter, I wrote about the complexities of being a central banker at this point in our history. Developments over the course of 2016 reinforced that this is, indeed, a complex time.

At the beginning of last year, Federal Open Market Committee (FOMC) participants (including me), on average, expected that we would raise interest rates four times during 2016. However, unexpected financial turmoil in China in the first quarter led to a rapid tightening in financial conditions globally that threatened to materially slow the U.S. economy. First- and second-quarter GDP readings were weak due to the financial turmoil as well as a deceleration in inventory builds by U.S. companies. The surprising June U.K. referendum result on Brexit also had an impact on the Fed's risk-management stance. As a result, FOMC participants revised down their outlook for rate increases, and the Fed ultimately raised rates once in 2016.

Due to the underlying strength of the U.S. consumer, U.S. gross domestic product (GDP) growth rebounded in the second half of 2016. Our economists at the Dallas Fed are currently forecasting in excess of 2 percent GDP growth in 2017. This is sluggish growth by historical standards, but it should be sufficient to allow for further removal of labor market slack and steady progress in achieving the Fed's 2 percent inflation goal.

## **International Focus**

In 2016, I made a number of foreign trips to better understand some of the key issues confronting the global economy. I visited London in April and met with business and government leaders to get a better read on the Brexit debate. In August, I spent a week in China meeting with officials and business leaders to deepen my understanding of the transition that is underway there and the

challenges that Chinese policymakers are facing.

China is the world's second-largest economy and has, in recent years, accounted for about a third of global growth. The country is challenged by high levels of overcapacity in state-owned enterprises, high and rising levels of debt, and a growing issue of capital outflows despite very strong capital controls. As a result, our team at the Dallas Fed continues to closely monitor Chinese conditions. It is our view that the world will have to become accustomed to lower levels of Chinese GDP growth in the years ahead and that China's challenges will create increased vulnerability to financial turmoil, which could, in turn, have an impact on global financial conditions.

We had several visits during the year with senior officials of the Banco de México as well as other senior government officials and business leaders. There has long existed a very strong relationship between the Banco de México and the Federal Reserve Bank of Dallas. The Eleventh District—Texas, northern Louisiana and southern New Mexico—has deep cultural and economic ties with Mexico.

Mexico is Texas' top trading partner. In 2016, Texas exports to Mexico were \$92.7 billion, and it is estimated that these exports supported approximately 1 million jobs in Texas. Dallas Fed economists believe that the trading relationship with Mexico has helped various industries in Texas and the U.S. gain global competitiveness, and this relationship has helped create jobs in the U.S. In addition, Texas border cities have benefited tremendously from the increasing U.S.-Mexico economic integration—leading to job gains, primarily in service sectors, that have resulted in higher wages and improved standards of living for many Texans. The Dallas Fed's Globalization Institute will continue

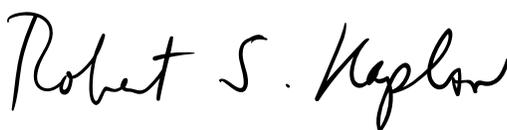
to do research that deepens our understanding of the linkages between the U.S., Texas and Mexico.

### **The Globalization Institute**

The Globalization Institute plays a key role in advancing our understanding of international economies and global economic relationships. The core business product of the institute is its working paper series. These papers are intended for eventual publication in peer-reviewed journals, which is a key metric of research success.

The institute also has an important public outreach mission. Through our Global Perspectives speaker series, the Dallas Fed hosted a Trilateral Conference in February that featured Governor Agustín Carstens of Banco de México and Governor Stephen Poloz of the Bank of Canada. We also hosted former U.S. Treasury secretaries Hank Paulson, Robert Rubin and Larry Summers, Harvard Business School Dean Nitin Nohria and former Bank of England Governor Lord Mervyn King. The Global Perspectives series will be a key part of our outreach initiative at the Dallas Fed in the coming years.

The world's economies and financial markets are more interconnected than ever before. The Federal Reserve Bank of Dallas' Globalization Institute will continue to do comprehensive research that explores these linkages. Our thought leadership and public outreach efforts are intended to provide valuable insight for policymakers and business and community leaders as well as the general public.



Robert S. Kaplan  
President and CEO  
Federal Reserve Bank of Dallas

**Dallas Fed  
economists believe  
that the trading  
relationship with  
Mexico has helped  
various industries  
in Texas and the  
U.S. gain global  
competitiveness, and  
this relationship has  
helped create jobs in  
the U.S.**

# Oil-Rich Venezuela Tips Toward Hyperinflation

By Janet Koech



Venezuela, once the wealthiest nation in Latin America, is suffering a dramatic reversal of fortunes and the worst economic crisis in its history. Though the nation has crude oil reserves of close to 300 billion barrels—the world’s largest such holdings—many Venezuelans go without the most basic goods in an economy plagued by chronic shortages.<sup>1</sup>

The economic collapse—the product of falling oil prices, currency and capital controls, and mismanagement that includes printing money to finance government operations—has brought Venezuela to the brink of hyperinflation.

Oil accounts for more than 90 percent of export income in Venezuela and is the largest source of government revenue, according to

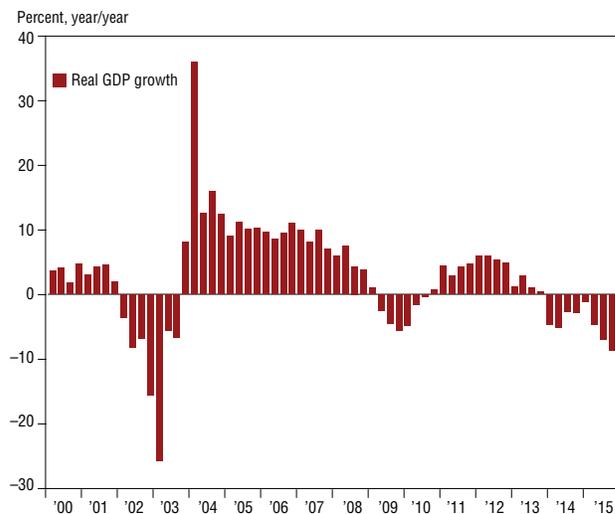
the Organization of the Petroleum Exporting Countries (OPEC).<sup>2</sup> These foreign exchange earnings are, in turn, used to finance imports. Venezuela imports more than 70 percent of its food, and dwindling foreign exchange earnings are creating severe shortages. Economic output declined on a year-over-year basis for eight consecutive quarters through the end of 2015, the latest year for which data are available (*Chart 1*). Growth and inflation outlooks continue deteriorating as the economic crisis deepens.

Venezuela’s inflation is the highest in the world. The International Monetary Fund (IMF) anticipated a 476 percent annual price increase in 2016 and forecasts inflation of 1,660 percent in 2017. Official government data show a 12-month inflation rate of 180 percent in December 2015 (*Chart 2*).<sup>3</sup>

The country’s economic and monetary developments evoke memories of Zimbabwe at the start of its hyperinflation and subsequent collapse in 2007–09 as well as periods of persistently high inflation in Latin America in the 1990s. This persistently high inflation morphed into hyperinflation—defined as inflation exceeding 50 percent per month—in Argentina, Bolivia, Brazil, Nicaragua and Peru. Other countries—Mexico and Chile—managed to avoid hyperinflation.<sup>4</sup>

Venezuela’s central bank published economic statistics in January 2016 for the first time in a year, confirming that annual inflation had reached triple-digit levels, with anecdotal evidence suggesting that prices have substantially increased since then. The government has increasingly relied on its central bank to print money to finance its spending and fill the fiscal gap created by

Chart 1  
Venezuela's Economy on the Decline Since 2014



SOURCES: Banco Central de Venezuela; Haver Analytics.

diminished oil revenues. Rates in the black market, through which much of the economy operates, indicate much steeper currency devaluation.

### Lifeblood of Oil

Venezuela's 352,144 square miles on South America's northern coast—wedged between Colombia, Brazil and Guyana—is roughly twice the size of California. The country has a population of 30 million and is rich in natural resources, including gold, minerals and crude oil.

The discovery of oil in 1914 transformed Venezuela's agriculture-dependent economy. By the mid-1920s, oil revenue supplied two-thirds of the state's income and was responsible for more than 90 percent of exports. Oil wealth made it possible for the government to build a network of roads and infrastructure and expand its agricultural and manufacturing sectors. As the world struggled with the Great Depression in the 1930s, the Venezuelan bolivar appreciated nearly 70 percent against the U.S. dollar as oil revenue flowed in.<sup>5</sup>

The strong bolivar made coffee and cocoa exports more expensive and less competitive, impacting the nation's agricultural sector. At the same time, it was a boon for Venezuelan consumers, who could suddenly afford to import just about everything from food to clothes and electronics. Imported goods became commonplace. The strong currency was politically popular, setting off a national spending spree.

Good times didn't last. World War II disrupted global trade, bringing product shortages and economic disarray. Venezuela's economy has since largely mirrored oil-price volatility; robust postwar growth boosted global demand for oil, lifting prices higher. Geopolitical conflicts in the Middle East in the early 1950s further supported oil prices, diverting more funds to Venezuela. By the late 1950s, however, oil prices had drifted lower as Middle East production surged. To combat production and price swings, the world's main oil-exporting countries, includ-

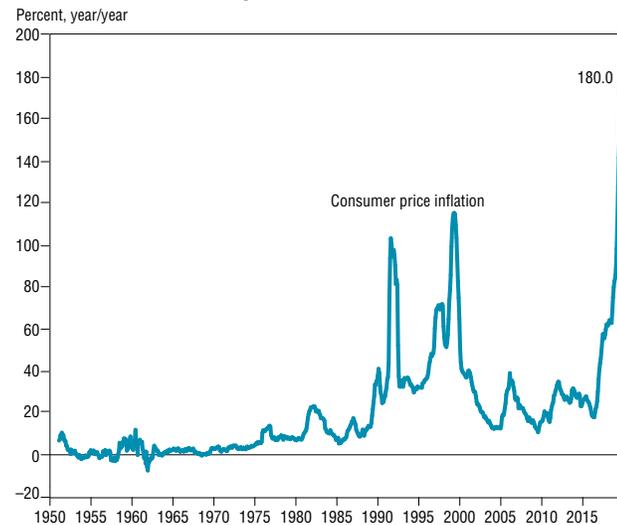
ing Venezuela, formed OPEC in 1960.

The oil embargo of 1973 drove up world energy prices again. Venezuelan government revenue quadrupled from 1972 to 1974, spawning a splurge of public and private consumption.<sup>6</sup> The government increased spending and nationalized the oil and steel industries. When oil prices began to slip after 1977, Venezuela's growth slowed as interest rates soared, ballooning the nation's external debt to 61 percent of GDP in 1985 from 13 percent in 1976. Oil revenue could no longer sustain a range of government subsidies, price controls and public institutions. Moreover, widespread corruption and political patronage flourished at the expense of economic development. These problems intensified when oil prices declined further in the mid-1980s, leading to slow growth, high inflation and a diminished standard of living.<sup>7</sup>

Expanding energy demand from emerging economies, particularly China, drove an oil-price recovery in the early 2000s. Venezuela's oil revenue rose to levels not seen in two decades. The government channeled the proceeds to expand social-spending programs, often at the expense of reinvestment in exploration and production by the

Chart 2

### Venezuela's Inflation Skyrockets



SOURCES: Banco Central de Venezuela; International Monetary Fund World Economic Outlook; Haver Analytics.

**As the world struggled with the Great Depression in the 1930s, the Venezuelan bolivar appreciated nearly 70 percent against the U.S. dollar as oil revenue flowed in.**

## Venezuela's economic crisis is marked by a chronic lack of currency, food and other basics, exacerbated by long-standing price and foreign-exchange controls.

state-owned oil and gas company, *Petróleos de Venezuela*.

### Volatile Political History

Venezuela's political history has a recurring pattern: government overspending when oil prices are high with little saving for lean times. During the 1950s, dictator Marcos Pérez Jiménez promised to modernize the country. His government instead became so corrupt and wasteful that one of his infrastructure projects—a nine-mile road linking the capital, Caracas, to the coast—cost \$5.6 million per mile (or \$53 million per mile in 2015 dollars) and was referred to as the “costliest freeway in the world.”<sup>8</sup>

In the 1970s, President Carlos Andrés Pérez also promised to transform Venezuela into a developed nation. However, at the height of the oil boom, in 1974, he ordered the hiring of attendants and operators for every bathroom and elevator in government buildings. The country ended up broke and indebted when oil prices fell a decade later.<sup>9</sup>

Hugo Chávez, the nation's 64th president and leader of Venezuela's socialist movement, the Bolivarian Revolution, prom-

ised to make 21st century socialism possible through government spending. From 1999 to 2014, the government earned more than \$1.36 trillion from oil—more than 13 times the amount of the (inflation-adjusted) infusion of aid under the Marshall Plan, which allowed Europe to recover from World War II. Venezuela's expenditures briefly aided the poor until the economy collapsed yet again when oil prices fell in mid-2014.<sup>10</sup>

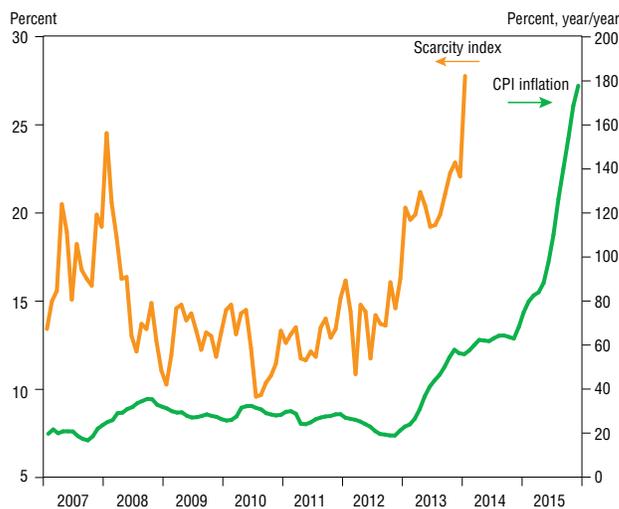
Current President Nicolás Maduro took over following Chávez's death in 2013. Maduro has struggled to maintain his mentor's charisma and popular support amid mounting frustration over widespread shortages.

### Price Controls and Shortages

Venezuela's economic crisis is marked by a chronic lack of currency, food and other basics, exacerbated by long-standing price and foreign-exchange controls. These restrictions and the lack of investment in basic infrastructure have eroded Venezuela's productive capacity, making the country overly dependent on imports for its consumption. Yet, foreign currency controls have hindered the ability to pay for imports. Making matters worse, U.S. dollars have been in short supply, the result of an oil-price collapse, which saw prices fall from \$100 per barrel in mid-2014 to as low as \$30 in early 2016 before moving toward \$50 at year-end.

Nearly 1 in 3 goods was missing from supermarket shelves in January 2014, according to the “scarcity index,” a since-discontinued central bank measure of the share of absent food and household items (*Chart 3*). Shoppers' daily struggle is evident in the long lines to purchase limited quantities of hard-to-find necessities. Government-imposed price controls make it difficult to produce and earn a profit, so while supermarket shelves are empty, a thriving black market has developed. In March 2016, goods were more than 17 times costlier on the black market than on the conventional market.<sup>11</sup> By August 2016, some goods, including staples, cost 100 times the official price. Milk sold for 7,000 bolivars—more than \$700 at the official exchange

Chart 3  
Scarcity Index Shows Venezuela Running Low on Store Supplies



NOTE: The scarcity index measures the percentage of food and household items missing from store shelves. Venezuela's central bank stopped reporting scarcity index data in January 2014 and inflation data in December 2015. CPI stands for consumer price index, a measure of the weighted average prices of a basket of goods and services. SOURCES: Banco Central de Venezuela; Haver Analytics.

rate—or about \$7 if one had U.S. dollars, then worth a bit more than 1,000 bolivars to the dollar on the black market. However, many residents have neither the bolivars to afford black-market prices nor the U.S. dollars to exchange at the favorable rates.<sup>12</sup>

Government-imposed controls restrict imports by limiting dollars available to private-sector companies. The value of imported goods fell 27 percent in third quarter 2015 from the prior-year level—and has declined 47 percent since oil prices peaked in 2012 (*Chart 4*). Price controls and subsidies ensured that many products were much cheaper in Venezuela than in neighboring Colombia, making smuggling to Colombia a profitable business and further exacerbating shortages. More recently, however, the lack of basic goods combined with rising prices has driven Venezuelans to illegally smuggle these products from Colombia.

### Capital and Currency Controls

The Venezuelan government has maintained a system of currency controls and a fixed (but adjustable) official exchange rate since 2003.<sup>13</sup> The government makes dollars available at multiple exchange rates, allowing some companies and individuals to access dollars at preferential rates.

There have been two official exchange rates since March 2016, when the government announced its dual foreign-exchange-rate system. The first rate, known as DIPRO, replaced the CENCOEX rate and is set at 10 bolivars per \$1. This fixed-but-adjustable rate is used for imports of government-authorized priority goods, including food, medicine and raw materials for production. The second rate, DICOM, governs transactions not covered by the DIPRO rate and is allowed to “fluctuate according to the country’s economic dynamics.” The rate had an initial opening of 206.5 bolivars per \$1 on March 7, 2016, and was priced at 686.6 bolivars per \$1 on Jan. 26, 2017. Venezuela previously had a three-tiered official currency-control system.

This multiple-exchange-rate arrangement creates numerous opportunities for

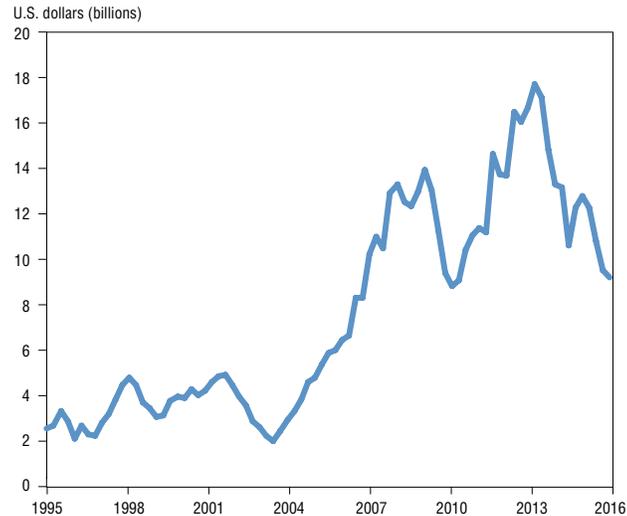
arbitrage. For instance, at the beginning of 2017, a cup of coffee at a bakery cost 1,100 bolivars—equivalent to \$110 or \$1.63, depending on which of the two exchange rates was applied. The dollar-denominated price is much cheaper if the black-market rate is applied.<sup>14</sup>

Venezuela has experienced a series of currency devaluations associated with its surging inflation. In 2007, the government introduced a new currency, the bolivar fuerte (the strong bolivar)—the old bolivar with three trailing zeroes removed. Although the devaluation made everyday transactions easier, it failed to address the country’s underlying lack of economic discipline and policies that undermined sustainable economic growth.

The government devalued the currency in January 2010, from 2.15 bolivars to 2.6 bolivars per \$1 for an assortment of food and health care imports and to 4.3 bolivars for other imports such as cars, petrochemicals and electronics. Two years later, the currency was devalued again, to 4.3 bolivars for both classes of goods. Once more, in February 2013, the bolivar was devalued to 6.3 bolivars amid rising budget deficits. Most recently, in February 2016, President Maduro cut the

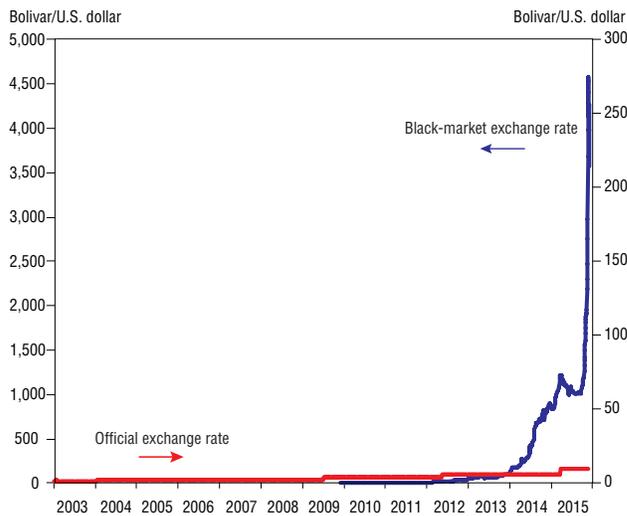
Chart 4

### Imports to Venezuela Decline in Recent Years



SOURCES: Banco Central de Venezuela; Haver Analytics.

Chart 5

**Venezuela Currency Depreciates Sharply on Black Market**

SOURCES: Federal Reserve Board; DolarToday; Haver Analytics.

**Venezuela's economic situation is increasingly reminiscent of the beginning of high-inflation episodes elsewhere in Latin America and in Zimbabwe.**

official exchange rate to 10 bolivars per \$1.

Chronic shortages have inflated the black-market value of the bolivar, which traded upward of 3,600 per \$1 in January 2017—far above official exchange rates (*Chart 5*).<sup>15</sup> The largest bill in circulation in November 2016—the 100 bolivar note—was worth \$10 at the official exchange rate and pennies at the black-market rate. The bolivar, its purchasing power evaporating, has left Venezuelans carrying increasingly large wads of cash to purchase everyday items.

A large cup of coffee, costing 1,100 bolivars, required 550 of the lowest, 2-bolivar-denomination currency and 11 of the 100-bolivar notes at the beginning of the year. Newly denominated currency—including 20,000-bolivar notes—was rolled out in mid-January.<sup>16</sup> With the IMF forecasting that inflation will reach 1,660 percent in 2017 and 2,880 percent in 2018, purchasing power will quickly erode further.

### **Inflation, Price Stabilization**

Venezuela's economic situation is increasingly reminiscent of the beginning of high-inflation episodes elsewhere in Latin America and in Zimbabwe (*Chart 6*). Periods of economic and financial crisis in the latter

half of the 20th century accompanied the Latin American bouts of rapid currency depreciation. A measure of price changes in nine of the most populous countries in the region shows that inflation averaged nearly 160 percent per year in the 1980s and 235 percent per year in the first half of the 1990s.<sup>17</sup> Some countries experienced hyperinflation. Since the mid-1990s, however, inflation rates have universally declined, mostly to the single digits.

Large budget deficits financed by money creation are characteristic of high-inflation episodes. Underlying causes include declining export earnings due to falling commodity prices, government overspending on programs not financed through taxes or borrowing, and a lack of central bank independence resulting in monetization of debt. Overexpansive fiscal and monetary policies are generally followed by wage and price controls that create bottlenecks and shortages, resulting in currency overvaluation, capital flight, declining tax revenues, increasing external debt and accelerating inflation.

In Argentina, Brazil and Bolivia, hyperinflation culminated in a lengthy deterioration in the countries' fiscal accounts and increased fragility in the financial system due to a regional debt crisis and a tendency to accept high inflation. Argentina experienced repeated cycles of hyperinflation followed by attempts at stabilization. Its stabilization program and emergence from debt default included the elimination of the budget deficit, privatization and monetary reform that included a new currency whose value was rigidly fixed against the U.S. dollar.<sup>18</sup> The government, however, defaulted on its debt during this high-inflation period.

In 1994, Brazil implemented its "real plan" that successfully ended more than a decade of chronic inflation. The plan included the introduction of a new currency, the *real*, combined with fiscal and monetary policies that restricted government expenses and raised interest rates.

Bolivia set on the path to hyperinflation because of an overvalued currency, a large

fiscal deficit and external debt, and an abrupt reversal of foreign capital inflows. Mexico and Chile endured periods of high inflation before successfully reducing price increases that could have led to hyperinflation.

Mexico maintained a regulated floating-rate regime from 1985 to 1991, followed by an exchange rate band until late 1994. That year, the band became unsustainable amid market instability and a speculative attack on the Mexican central bank's international reserves. Additionally, a leading presidential candidate was assassinated, a rebel uprising in southern Mexico was renewed and U.S. interest rates rose.

In response, Mexico's foreign exchange commission adopted a floating currency—which remains in place—prompting a sharp peso devaluation and financial crisis. Under

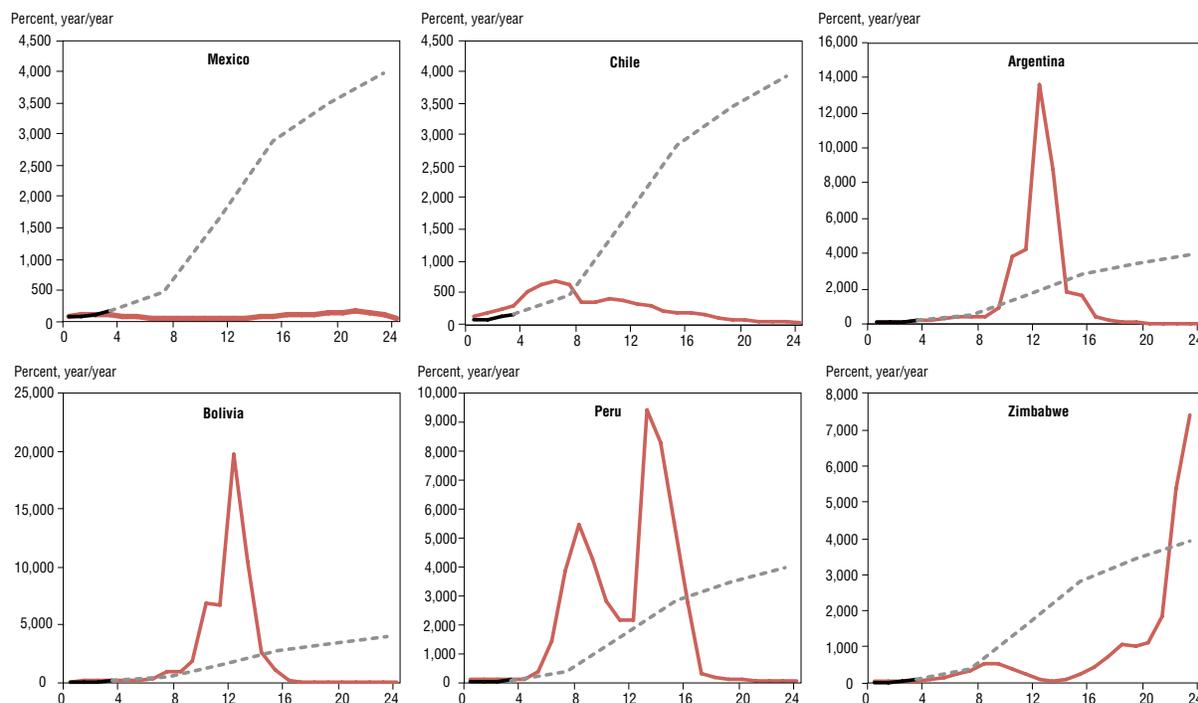
a 1994 constitutional amendment, Banco de México was granted autonomy under which it has set annual inflation targets since 1996. Average annual inflation fell to the single digits in 2000, where it has remained. Similarly, Chile adopted an inflation target in 1990, which contributed to gradually declining price increases.

In Venezuela, the government has printed more currency to finance its spending. These factors have produced the highest inflation in the world.

### Dealing with the Economic Crisis

Venezuela's economic crisis is most directly linked to the mismanagement of its oil wealth—a combination of corruption, ambitious social spending and a lack of savings or investment in the oil industry. The govern-

Chart 6  
How Venezuela's Inflation Compares with Other High-Inflation Countries



NOTES: The charts plot the evolution of consumer price index (CPI) inflation over six years (24 quarters) for a sample of high-inflation countries from the time year-over-year inflation first exceeded 80 percent. The black solid line is the evolution of Venezuela's inflation in 2015, and the dashed lines are estimates of Venezuela's annual CPI inflation for 2016–20 from the International Monetary Fund.

SOURCES: National statistical offices; International Monetary Fund; Haver Analytics; author's calculations.

**To compound the currency crunch, the Venezuelan government announced on Dec. 12, 2016, that it would withdraw all 100-bolivar bank notes from circulation, giving Venezuelans 10 days to exchange the old bills for new ones at the central bank.**

ment has been repeatedly caught unprepared when oil prices have collapsed. The quantity theory of money indicates that sustained high growth rates of a nation's money stock in excess of its production of goods and services eventually produces high and rising inflation rates. This is what economist Milton Friedman referred to when he said, "Inflation is always and everywhere a monetary phenomenon."

Venezuela responded with price controls. Such controls inevitably lead to shortages because they encourage demand at a price lower than what goods would otherwise cost. Profit margins get squeezed and shortages worsen when foreign exchange earnings, used to pay for imports, decline. Government-imposed currency and capital controls also limit access to foreign currency for imports of intermediate goods used in production, triggering additional shortages. A thriving black market emerges for the trade of goods and currency, though at much higher than officially set rates.

Consumer prices increased at an average annual rate of 40 percent in 2013, climbing to 62 percent in 2014. The pace of increase accelerated through 2015, reaching 122 percent. By December 2015, year-over-year inflation was at 180 percent. Although the government stopped publishing inflation data more than a year ago, evidence is mounting that inflation has worsened.

In the absence of official statistics, some analysts now track the prices of specific items to get a sense of price increases. For instance, Bloomberg News' Bloomberg Café Con Leche Inflation Index tracks the price of a cup of coffee at a bakery in Caracas. The price soared from 450 bolivars a cup to 1,100 bolivars over a span of 22 weeks ended Jan. 18, 2017—an annual inflation rate of 768 percent.<sup>19</sup>

One U.S. dollar brought 3,684 bolivars on the black market on Jan. 25, 2017, up from 960 bolivars 12 months earlier and from 185 bolivars two years before. This steep devaluation reflects a loss of confidence in the government. Venezuelans resorted to

weighing stacks of bills to pay for basic items instead of counting them individually before the government introduced new, higher-denominated currency in January 2017.

The larger bills offer only temporal relief, not a solution to the inflationary distortions. Indeed, other countries encountering a similar situation have found that larger-denominated currency often leads to episodes of even higher inflation or hyperinflation, as was the case in Austria, Germany and Hungary after World War I and Zimbabwe in 2008. The Zimbabwe government issued the world's greatest denomination, the 100 trillion-dollar bill, shortly before the currency was abandoned in favor of the U.S. dollar in 2009.<sup>20</sup>

To compound the currency crunch, the Venezuelan government announced on Dec. 12, 2016, that it would withdraw all 100-bolivar bank notes from circulation, giving Venezuelans 10 days to exchange the old bills for new ones at the central bank. President Maduro called the 100-bolivar bills instruments of an "economic coup" to destabilize his government and said that the move would strike a blow at "international mafias" that hoarded cash. Colombian shoppers and organized criminals were buying up the 100-bolivar bills to go shopping in Venezuela, he said, worsening the shortages of basic goods. He ordered the closing of the border with Colombia to counter "bolivar smuggling."

The withdrawal of the nation's largest-denomination note came well before replacement bills were available. Maduro backtracked on his decision after a lack of fresh banknotes sparked unrest. The government rolled out new replacement banknotes ranging from 500 to 20,000 bolivars in January.

### **Cautionary Tale**

Typically, adoption of an independent central bank has stabilized chronic inflation episodes. It is part of a strategy that often includes an alteration in the fiscal regime and the institution of a credible exchange-

rate stabilization mechanism. The adoption of the U.S. dollar to replace the local currency immediately ended Zimbabwe's hyperinflation, while Latin American countries used a combination of stabilization programs to rein in inflation.

So far, Venezuela's measures to deal with its economic crisis have been lacking. Apart from a rise in the price of heavily subsidized gasoline and a devaluation of the essential-goods exchange rate (from 6.3 to 10 bolivars per U.S. dollar in February 2016), the administration continues to print money while maintaining currency and price controls.<sup>21</sup> The country's money supply increased 458 percent from the beginning of 2015 to January 2017, sending prices sharply higher (Chart 7). To keep up with the rising prices and erosion of the currency's value, Maduro raised the minimum wage 50 percent in January 2017, the fifth increase in a year. He also appointed a political supporter to run the central bank.

Through the mounting crisis, Venezuela confronts the difficult task of shoring up its economy at a time when the conditions that previously buoyed growth—stronger global growth and higher commodity prices—are less supportive. A recent oil-price uptick has provided little relief. The larger-denominated currency will ease the difficulty of simple transactions, but it doesn't solve the underlying causes of inflation. As the citizens struggle to make ends meet, they are left to wonder how much worse economic conditions can get and what kind of future their resource-rich country faces.

Resolution of Venezuela's situation remains elusive, though the crisis is a manifestation of how corruption, mismanagement and an addiction to oil can quickly erode the fortunes of a country.

## Notes

<sup>1</sup>Venezuela is the country with the world's most proven crude oil reserves, according to the 2015 *Annual Statistical Bulletin* by the Organization of the Petroleum Exporting Countries (OPEC).

<sup>2</sup>Venezuela's oil revenues accounted for about 95 percent of export earnings in 2015. See note 1.

<sup>3</sup>Prior to the January 2016 data release, no data were issued for more than a year.

<sup>4</sup>"The Monetary Dynamics of Hyperinflation," by Phillip Cagan, in *Studies in the Quantity Theory of Money*, Milton Friedman, ed., Chicago: University of Chicago Press, 1956, pp. 25–117.

<sup>5</sup>See *Crude Nation: How Oil Riches Ruined Venezuela*, by Raúl Gallegos, Lincoln, Neb.: Potomac Books, University of Nebraska Press, 2016, p. 60.

<sup>6</sup>"Inflation Dynamics in Latin America," by Carlos Capistrán and Manuel Ramos-Francia, *Contemporary Economic Policy*, vol. 27, no. 3, pp. 349–62.

<sup>7</sup>Venezuela's annual consumer price inflation reached 100 percent in 1996, and its standard of living declined to 1960 levels—21 percent below its 1977 peak.

<sup>8</sup>See note 5, p. 67.

<sup>9</sup>See note 5, p. 73.

<sup>10</sup>See note 5, p. 15.

<sup>11</sup>"A Day Out at the (Black) Market in Venezuela," by Scott Tong, American Public Media, March 23, 2016, [www.marketplace.org/2016/03/23/world/resource-curse/day-out-black-market-venezuela](http://www.marketplace.org/2016/03/23/world/resource-curse/day-out-black-market-venezuela).

<sup>12</sup>"Venezuela: Where Flour, Pasta and Milk Can Cost a Month's Pay," by Flora Charner and Rachel Clarke, CNN, Aug. 2, 2016, [www.cnn.com/2016/08/02/americas/venezuela-food-prices](http://www.cnn.com/2016/08/02/americas/venezuela-food-prices).

<sup>13</sup>In 2003, President Hugo Chávez imposed currency controls to stem capital flight after an oil workers' strike. At the time, \$1 could fetch 1.6 Venezuelan bolivars. Today, that same dollar can buy 172 bolivars at the official government exchange rate, a devaluation of more than 99 percent.

<sup>14</sup>As of Jan. 6, 2017, \$1 was worth 10 bolivars at the DIPRO rate, 675.4 bolivars at the DICOM rate and 3,241 bolivars on the black market.

<sup>15</sup>Data are from DolarToday, [dolartoday.com](http://dolartoday.com).

<sup>16</sup>"2.75 Million New Banknotes Enter into Circulation in Venezuela," by Jeanette Charles, *Venezuelanalysis.com*, Jan. 18, 2017, <https://venezuelanalysis.com/news/12888>. Since Jan. 16, 2016, Venezuela has issued banknotes in denominations of 500, 5,000, and 20,000. In all, six new banknotes will be issued, with 1,000, 2,000 and 10,000 denominations expected at an as-yet-undisclosed time.

<sup>17</sup>"Inflation in Latin America: A New Era?" speech by Ben S. Bernanke, Federal Reserve Board of Governors, Feb. 11, 2005. The nine countries are Mexico, Colombia, Venezuela, Brazil, Bolivia, Uruguay, Peru, Argentina and Chile. Inflation is weighted by each country's gross domestic product.

<sup>18</sup>"Stopping Three Big Inflation: Argentina, Brazil, and Peru," by Miguel A. Kiguel and Nissan Liviatan in *Reform, Recovery, and Growth: Latin America and the Middle East*, Rudiger Dornbusch and Sebastian Edwards, eds., Chicago: University of Chicago Press, 1995, pp. 369–414.

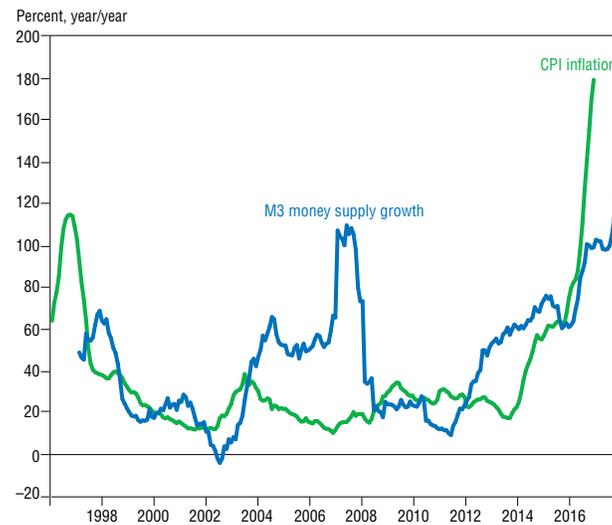
<sup>19</sup>See the Venezuelan Café Con Leche Index, Bloomberg, [www.bloomberg.com/features/2016-venezuela-cafe-con-leche-index](http://www.bloomberg.com/features/2016-venezuela-cafe-con-leche-index).

<sup>20</sup>"Hyperinflation in Zimbabwe," by Janet Koech, Globalization and Monetary Policy Institute 2011 Annual Report, Federal Reserve Bank of Dallas, 2012, pp. 2–12.

<sup>21</sup>The government increased the price of gasoline to 6 bolivars a liter from 9.7 centavos in February 2016. This is a 60-fold increase and equivalent to about 11 U.S. cents per gallon, but prices remain one of the cheapest in the world.

Chart 7

### Money Supply, Inflation Substantially Increase in Tandem



NOTES: M3 is the broadest definition of monetary assets available in an economy. CPI stands for consumer price index, a measure of the weighted average prices of a basket of goods and services.

SOURCES: Banco Central de Venezuela; Haver Analytics.

# Q&A with Robert Kaplan and Lord Mervyn King



**I was about to leave again when the Bank of England was made independent by the incoming Labour government in 1997.**

**Robert Kaplan:**

Lord King thank you for being here. We really appreciate it. I will start with this, why did you become a central banker?

**Lord Mervyn King:**

By accident. I was an academic and I had taught in the states. I went back to London to the London School of Economics and I was asked to be a nonexecutive director of the Bank of England, which is a part-time position and I took that on.

And after six months, the then-chief economist decided to leave and move on to something else. So, the governor at the time, Robin Leigh-Pemberton, had to appoint a successor and he said, "Oh, do I really have to have an economist?" He wasn't very enthusiastic about it, and in light of subsequent events, you can see why.

But he was told he had to have one. So, he then thought very hard about it. At the Bank, there was a family sports day once a year and as a nonexecutive director, I had been invited to play in the governor's tennis match. And it was the best performance I had ever put on court to that date and indeed I regret to say, subsequently.

I hit the ball really hard and the ground shots went in. So, he was so impressed and he knew I could play cricket as well, so he told me if he had to have an economist, he wanted one who could play cricket and tennis. So, that's how I was offered the job. I had no intention of staying. I took it for two to three years with every intention of going back to academic life, but each time I tried to go back, something happened.

The first time we were forced out of the

exchange rate mechanism and I came up with the idea of inflation targeting, which we introduced at the beginning of 1993. And then I was about to leave again when the Bank of England was made independent by the incoming Labour government in 1997. So, I had to stay on to make that work.

**Robert Kaplan:**

*Independence in that context meant what?*

**Lord Mervyn King:**

It meant deciding interest rates. Up until that point, the level of interest rates had been decided by the Chancellor of the Exchequer and, in fact, we didn't even have regular meetings. You could sit in your office in the morning and get a telephone call saying that the Chancellor would like to discuss interest rates after lunch.

And so the financial markets had no idea when interest rates could change. They could change at any moment on any day, except of course when there was an election or there was some political event where it would be inconvenient to change interest rates.

That was completely altered in 1997, so much so that when Tony Blair stood down as the prime minister, it so happened that his announcement that he was standing down as the prime minister coincided to the very minute with an announcement that we were raising interest rates. That could never have happened under the previous regime.

Then I was asked to be governor so I had to stay on for that. Then I was going to leave after my first term, but we were bang in the middle of the financial crisis. But come 2013,

it would have needed an act of parliament to change the maximum length of a term, and that was too much for anyone. So, I was able to, at last, leave.

**Robert Kaplan:**

*What's the importance of a central bank being independent? We are having a lot of conversations in this country about central bank independence. Why is it important?*

**Lord Mervyn King:**

When we were made independent, it was not so long after the two decades of very high and volatile inflation of the '70s and '80s. Even here in the states, inflation reached 13.5 percent. In the U.K., it reached 27 percent, but it was all over the place and that led to volatility, not just of inflation, but of output and employment, too.

So, we were very keen to get away from that. And the way to achieve it was a combination of taking the decision on interest rates away from political influence, giving it to a central bank that genuinely had independence, and secondly, introducing an inflation target, either overtly or implicitly, in which the central bank would bring inflation gradually back to the target. And everyone knew that, so expectations of what would happen in the future were anchored to confidence in how the central bank would behave and I think that was very important.

What is fascinating today of course is that at the very moment when central banks are keeping interest rates very low, the politicians around the world are complaining that they are too low. This is the reverse of what

we had assumed would be the case. We now face the risk that if we abandon independence of central banks, we will throw out the baby with the bath water, and another decade on, we will find ourselves with high inflation again and then wonder how can we get it back.

And of course one thing we learned about inflation was that once you let inflation rise to a higher level, it's very costly to bring it back. You need a deep recession to bring expectations of inflation right down again.

**Robert Kaplan:**

*You were the governor during the lead-up to the crisis and during the crisis. What are the key lessons you learned in the aftermath of the crisis?*

**Lord Mervyn King:**

There are many of them I think. The first and biggest, and the one I talk about in my book, is that I think having created this remarkable period of stability of inflation and output, we rather got carried away and forgot the basic rule, which is you can never forecast the future. The future is inherently very uncertain and, therefore, you needed a system that can be resilient.

There is no point blaming anyone for this, but I think that what happened around the world was that the evolution of China as a growing and dominant economy injecting a lot of savings into the world economy—the phrase that Ben Bernanke used was the savings glut—started to bring interest rates down, especially long-term real interest rates, and we should have realized that this was creating something that was wholly unsus-

**It was a real genuine loss of confidence, and international trade started to fall even faster than it had in the 1930s. There was the prospect of another Great Depression.**

tainable. In a healthy economy, expected long-term real interest rates on 10-year inflation-protected securities ought to be somewhere in the, I don't know, 3–5 percent-a-year range.

You can't find any historical period where that really was not the case. Over 25 years, 10-year real interest rates started around 4 percent, and they came down to zero. That cannot be an equilibrium. I think economists allow themselves to be so obsessed with the models that they have created but instead of sitting back and saying there is something wrong here, they just carried on with the traditional view that if you don't see enough growth, you cut interest rates.

Central banks in the West were cutting interest rates to boost domestic spending, and we were generating current account deficits, trade deficits, which meant that we were borrowing from abroad on a scale that could not go on forever. And in the end, it didn't. Much of that borrowing was mediated through the banking system. So, it was the banking system that collapsed first. That's one lesson.

I think the other big lessons are that we took our eye off the ball of leverage in the banking system that grew very rapidly in a period of five years. Nothing went wrong in that period of five years, but we should have been more alert to the fact that it was creating serious problems.

I don't think we had thought through how we would operate the regime of lender of last resort. We assumed that what we had all read about in the textbooks was, if we had a crisis, the central bank would act as a lender of last resort, lending through the banking system. But it turned out the banking system was completely different from the banking system that was described in the textbooks. We can come back to that later.

I suppose the other lesson I learned is that when there is a crisis, politicians will do everything they can to avoid blame. And, therefore, central banks were in an exposed position, and that's when it's very important for a central bank to keep its nerve and not

get pushed into doing things, which a central bank shouldn't do, like take big credit risk with its balance sheet. Those are decisions which ought to be taken by elected officials.

If the central bank says, "Well, no one else is going to do it, so I will," the difficulty is that after the crisis has gone away, the politicians will say, "What was your authority for doing that?" And then they use this as an attack for cutting back the authority of the central bank. And you have seen some of that in the debate about Dodd-Frank.

**Robert Kaplan:**

*In the aftermath of the crisis, there really wasn't much in the way of fiscal policy in the Western world and so central banks in the United States, the ECB and the Bank of England took extraordinary measures to support growth. Do you think that central banks went too far, did too much?*

**Lord Mervyn King:**

No. I think that in late 2008/early 2009, what we saw was a collapse of confidence around the world, not just in the industrialized world where we had experienced the banking crisis. My opposite number in Brazil would telephone me and say, "Car sales collapsed in Brazil but we haven't got a banking crisis." In India, steel sales collapsed; they didn't have a banking crisis either. And it was a real genuine loss of confidence, and international trade started to fall even faster than it had in the 1930s. There was the prospect of another Great Depression.

So, I think central banks had to act pretty dramatically to head that off. The problem was pretty much over by late 2009. The banking crisis in my view ended in May 2009, when the Federal Reserve and the U.S. Treasury announced the stress test of the banks and said, "Well, either the banks themselves have to raise capital or we will put it in and take shares in return."

That ended the banking crisis. But I think after that, central banks probably made a mistake in thinking that the cause of weak

demand continued to be a Keynesian downturn. In my judgment, demand has been weak because people came to realize during the crisis that the level of domestic spending in our economies beforehand had been too high.

Before the crisis, central banks saw that our economies were facing a structural trade deficit. Well, that's a drag on total demand, and if you want to maintain stable inflation and stable employment, you have got to get total demand to run in line with supply.

If net trade is being a drag on demand, you have to boost domestic demand so that when you subtract the contribution from the trade deficit, total demand is equal to supply. And central banks were very successful in doing it. But of course, what they did was to achieve stability but in an unsustainable way because domestic demand can't run forever above the level of productive potential.

What the crisis did was to bring home to everyone that we all had been spending more than we could afford to in the long run. So people cut spending, and that gap had to be filled by something; export demand is the

obvious thing.

What the source of demand weakness wasn't, was a temporary headwind, which of course is the language that central banks have come to use to describe the difficulty of generating a recovery.

I think the big mistake that's been made is if you misdiagnose the problem and say that the weakness in demand is just a temporary headwind, whereas in fact, it's a permanent fall in demand, what you will end up doing is not just cutting rates and wait until you see a recovery and then getting back to normal again; you cut rates, that generates a little bit of a recovery, but that peters out because the fall in demand is permanent.

So, you have to cut again, and you end up keeping cutting rates until you get to zero. Once you are up to zero, then only an economist can really believe that negative interest rates are the way to generate the recovery.

I feel that's where we are. There are some very good economists who think that if only interest rates could be -5 percent then we would get a recovery. But of course, if you ask people if Janet Yellen were to announce that



interest rates—far from rising—would be at -5 percent for the next year, most people will say, “What the hell are these people in the Fed doing?” Nevertheless, the economics professionals would cheer and say “Fantastic, you have done the right thing, now we are bound to get a recovery.”

**Robert Kaplan:**

*Changing gears somewhat, what’s going to happen now, in first the U.K. and then in Europe, in the aftermath of the Brexit vote? What do you think the impact of this will be, and you think more countries in Europe will follow?*

**Lord Mervyn King:**

No, I think not. Let’s start with the European Union. The European Union, I think, faces two existential problems, and they are serious. One is the monetary union, where I don’t think it’s working. I think it has been a disaster, and I don’t think there is any real prospect of having rapid economic growth in the European Union while monetary union persists. And they have no answer to this at all.

The other is immigration, where the principle of the free movement of people within Europe was a fine principle when you were just thinking of people moving amongst a small number of Western European countries to other countries. But it came under pressure when the Eastern European members joined the European Union, and it has come under intolerable pressure when a million or more people want to come from outside the EU into the EU each year.

De facto the Schengen Area, where there is a passport-free travel zone within the European Union, has been abandoned. Those countries have been forced to put up controls and barriers to prevent illegal immigrants being shipped on from the first country they arrive at to somewhere else in the EU. I think they have no answer to these questions at all.

But what is not an existential problem for the EU is British membership. If you look at what happens in Italy or France in their upcoming elections, the people who vote for Five Star in Italy or Marine Le Pen in France, they don’t go home in the evening and say, “You know darling, I was very impressed by the vote in Britain, and I do wonder whether



we shouldn't sort of vote in a similar way here"; they vote according to domestic conditions in their own countries.

So, I don't think that Britain leaving the EU will actually have much impact on what happens in the rest of the EU. The EU, I think, has serious problems, but I don't think they are affected one way or another by the U.K. staying in it, which was precisely why the U.K. was actually not having a lot of influence on the rest of Europe.

Now, in terms of the U.K., I think the situation in some ways is relatively straightforward. The prime minister said, and this was a fairly obvious thing to do, that there will be a bill to repeal the European Communities Act of 1972, which is the act under which we joined the EU. And then immediately pass a short bill to translate all existing legislation that we adopted as a member of the EU directly into U.K. law so that parliament can take its time to decide which of the legislation we have adopted in recent years we want to keep, or to get rid of, or to have another domestic debate about. But it will be the U.K. parliament that decides that.

When it comes to trade, I think, it's a lot simpler than some people would suggest. I think there are three groups of countries that matter. The first are countries outside the EU, but with which the EU has a trade agreement. And we go to those countries and say, "Look, when we leave, why don't we just roll over the treaty we have got with you already by virtue of our membership with the EU and just carry it on?"

The second group of countries are countries again outside the EU, but with which the EU itself does not have a trade agreement, we go to them and say, "We would like to have a trade agreement; either we get one, in which case fine, we are better off, or we don't, in which case we have got the status quo again."

And the third is obviously the rest of the EU, where we will have to negotiate with them. But there is a good cop and bad cop routine here; the bad cop will be all the European institutions, people in Brussels; the good cop will be politicians around the rest

of Europe, including in Germany, once their elections next autumn are out of the way, and they will be very much influenced by the fact that the U.K. has a very large trade deficit.

Now, there are not many circumstances in which having a big trade deficit is a good idea, but it just so happens that negotiating a trade agreement is one of them.

**Robert Kaplan:**

There has been a lot of discussion in this country of late about Dodd-Frank bank regulation. We have been advocating here that small- and mid-sized banks should get substantial relief because they are not systemically risky.

But there has been even discussion or suggestion that maybe even on big banks there would be a change. What's your view on what's an appropriate way for us to think about bank regulation here, in the U.K. and in Europe?

**Lord Mervyn King:**

During and just after the crisis, it seemed to me pretty clear that what we had to do was to move to a point where the leverage of the banks was a lot lower than it had been before the crisis. And of course banks themselves were trying to reduce their leverage.

Going forward, I would like to see a relatively tough simple leverage ratio. But I think that what we have actually done in practice is try to ensure that if the same thing that happened in 2007-08 happened again, that every single detail of that is now closed off.

So, what we have done is to create a massively detailed set of regulations that would almost certainly be irrelevant for the next crisis, which inevitably will be rather different. I think the only way sensibly to regulate the banking system is not to burden it with such detail. In the U.K. and London, I am amazed now that when you talk to people in banks, they feel they can't do anything without taking the advice of their compliance officer. That is not the definition of healthy regulation. That's excessive detail.

One simple example: Several central

**I don't think that Britain leaving the EU will actually have much impact on what happens in the rest of the EU. The EU, I think, has serious problems, but I don't think they are affected one way or another by the U.K.**

I am also very worried about the impact of the current level of interest rates on the viability of pension funds and insurance companies and just as worried about young people deciding whether it's worth bothering to put aside money for pension provision.

banks now have to approve the chief executive and the chairman of a bank. That's fair enough. But then they also insist on approving a whole raft of people below that level before they can be appointed.

Well, if you have approved someone to be a chief executive of a bank, why don't you trust him or her to make the right decisions about the people they want to employ?

**Robert Kaplan:**

We've been calling for broader economic policy actions to support economic activity going forward. What types of policy options would you encourage other policymakers to be considering?

**Lord Mervyn King:**

I think there are three sorts of things that are important. First, greater flexibility in exchange rates to prevent the buildup of unsustainable trade surpluses and deficits. The weakness of the euro area is a problem not just for Europe but for the world economy. Second, on the supply side, maybe people will think more imaginatively about the kind of changes that will be made. They have got to be sensible ones. But tax reform is one, particularly in the area of savings and investments.

Education is another if we are going to deal with the concerns of people who feel they have been left behind by globalization. The jobs that they were brought up to do simply don't exist anymore—that's always going to be the case. But education and retraining is a fundamental part of dealing with this problem.

I am also very worried about the impact of the current level of interest rates on the viability of pension funds and insurance companies, and just as worried about young people deciding whether it's worth bothering to put aside money for pension provision. So, I think there is a whole range of things that can be done in this area.

And the third is, international cooperation, and this is going to be the hardest of all. I think the problem at present is that most

countries in the world could genuinely say today, "If only the rest of the world was growing normally, we would be fine, but since it isn't, we aren't," and so countries are tempted to say, "So, what can we do on our own to get out of this trap, push down the exchange rate?"

Well, that's clearly a zero-sum game. So, we've got to find some way of creating a positive-sum game at the level of the world. The IMF ought to be able to do it, but I worry that it's become so political because of its relationship with Europe that they would find it very hard to do.

**Robert Kaplan:**

What about infrastructure spending?

**Lord Mervyn King:**

Infrastructure spending is a good idea subject to some caveats. The first one is that some proposals amount to a sort of Keynesian injection of demand. The trouble is, we don't face Keynesian unemployment anymore. The unemployment rate is down to 5 percent. So, if you have infrastructure spending, it is going to crowd out some other form of spending.

What is the other form of spending we think is less deserving? That's not obvious by any means, and the second thing is that it really ought to be something which is financed by government because infrastructure spending such as turning JFK Airport into DFW is not going to be cheap, and is going to be quite difficult to finance privately, I think. These are projects we need to pursue and plan, but you can't just switch it on like that.

**Robert Kaplan:**

But if we could do private financing, would you welcome private-sector involvement? For example, a lot of these airports have been turned into shopping malls in effect. If we could find a way to use less government money—more private money—would you say that was good or bad?

**Lord Mervyn King:**

Well, there is still a problem. If the answer is, let's do lots of investment in infrastructure, it doesn't matter who is financing it, some other spending gets crowded out, and I only favor private-sector providers for genuinely private-sector projects.

What I am very unhappy about, is what's being done in the U.K. and elsewhere, called the Private Finance Initiative, in which the private sector finances a project and the public sector then runs it. What's bizarre about this, is that it's completely the wrong way around. The public sector can borrow money much more cheaply than the private sector and the private sector can run things better than the government. So, why don't we do it the right way around?

**Robert Kaplan:**

[One last question to wrap this up. What advice would you be giving to the Fed from here as we watch the next phase of the recovery unfold?](#)

**Lord Mervyn King:**

I think if I were to give advice, I think I would say, central banks should now make it very clear that they can't really provide any more support. We have to be on a path of gradually trying to remove the stimulus that we have given in recent years.

The hopes for recovery have to rely on other policymakers. There are a range of different policies but they need to be thought through very carefully. It's easy to say infrastructure is a good thing, and indeed, there is obviously bipartisan support for infrastructure spending, but as both Martin Feldstein and Larry Summers have pointed out in recent weeks, infrastructure spending should not be carried out simply in order to reduce unemployment even further below what may well be a natural rate of unemployment.

And it doesn't make sense to create artificial ways of financing infrastructure investment merely in order to keep debt off the public-sector balance sheet. If there is a good argument for infrastructure, then issue

government bonds to finance it.

The problem facing the public finances in the United States is not a short-term problem, it's a long-term problem. One thing I think can be explained to people and be understood and accepted, is that all our pension schemes need to be modified to acknowledge that we are living longer. As life expectancy goes up, we must share the benefits of that between working life and retirement.

So, the age at which we qualify for pension has to keep rising, and this should be built into our pension schemes, both private and social security.

That would be one way to make a big dent in the prospective future deficits that we face.

# The Potential Impact of Decentralized Virtual Currency on Monetary Policy

By G.C. Pieters



**Electronic money is a broad term for any money, currency or asset not held in physical form—it can include representations of a sovereign currency or claims on a real-world good.**

One of the most unexpected global monetary developments in the past decade has been the emergence of decentralized virtual currencies. Bitcoin, the largest and best known of the decentralized virtual currencies, has well-documented market properties—including its use as an international vehicle currency. Decentralized virtual currencies are of particular interest to central bankers because eventually they could change administration of monetary policy globally by allowing users to circumvent capital controls and managed exchange rates.

## Digital Currency? Virtual Currency? Cryptocurrency?

The terminology used when discussing currencies such as bitcoin is rapidly evolving. Chart 1 is a visualization of the relationship between the various terminologies, created by merging definitions suggested by the European Central Bank, Bank of International Settlements and *Bitcoin Magazine*.

*Electronic money* is a broad term for any money, currency or asset not held in physical form—it can include representations of a sovereign currency or claims on a real-world good. The online payment system PayPal digitally represents many sovereign currencies, such as the U.S. dollar, and therefore trades in electronic money. *Digital currency* is a subset of electronic money that has no broadly accepted physical counterpart. Finally, *virtual currency* is a subset of digital currency that is intentionally created, or predominately used, for purchasing both digital and nondigital (“real-world,” or tangible) goods.

Digital and virtual currencies can either

be *centralized* or *decentralized*. A centralized currency is any currency that is issued and maintained by a central group or organization, while decentralized currencies are not.<sup>1</sup> Simulated currencies (also called *game currencies*) are examples of centralized digital currencies. These currencies are created to purchase items within a simulated system, primarily video games, belonging to a nongovernment company or group. For example, the online game Second Life (created by Linden Labs) uses an in-game currency referred to as Linden dollars. World of Warcraft (WoW) (created by Blizzard Entertainment) primarily relies on a currency referred to as WoW gold. Eve Online (created by CCP Games) has a currency called ISK. All are designed to be earned through in-game tasks and spent on in-game items within the respective simulated system, ranging from armor and clothes to flying pigs and spaceships.

Some players may choose to buy Linden dollars, WoW gold or Eve ISK using government-issued currencies on third-party exchanges instead of spending time on in-game tasks. These exchanges tend to be very limited—usually involving only the U.S. dollar, the euro and the British pound—and may be deemed illegal by some companies. An example of a centralized virtual currency is E-gold, founded in 1996. E-gold was a digitally traded currency backed by gold that could be traded for sovereign currencies, with the issuance and trading system managed by the company Gold & Silver Reserve.

*Cryptocurrency* refers to any electronic money created using cryptographic technology to regulate its creation and ensure the legitimacy of transactions conducted using

that money. Formally, bitcoin can be described as a decentralized virtual cryptocurrency. However, because all cryptocurrencies are decentralized virtual currencies, the two terms are used interchangeably.

Cryptocurrency technology is essential for decentralized digital currencies, which face a severe double-spending problem—someone could “copy and paste” the digital monetary unit and spend it over and over again because there is no central authority to validate the authenticity of a transaction. Bitcoin’s founder(s) solved this problem with the invention of blockchain technology—an accounting system in which a complete history of transactions of any bitcoin user is both unalterable and publicly viewable to ensure that no user can spend more bitcoins than they have acquired. This also means that no central entity or organization clears transactions, which is why decentralized currencies are difficult to regulate.<sup>2</sup>

Table 1 lists the names, U.S. dollar value of the stock of the currency (market capitalization) on Dec. 27, 2016, and founding date of the five most highly capitalized cryptocurrencies. As the oldest and largest of them, bitcoin is frequently studied and is the best understood. Alternatives to bitcoin are collectively referred to as *altcoins*.

### Bitcoin Markets

Why do people purchase bitcoins? The reasons are evolving as bitcoin becomes more established and integrated into the world economy. Wilson and Yelowitz (2015) find a correlation between interest in criminal activity and interest in bitcoin. Brière, Oosterlinck and Szafarz (2015) show that

Chart 1  
Definitions Based on Issuer and Intended Scope of Use, Transaction Verification and Technology

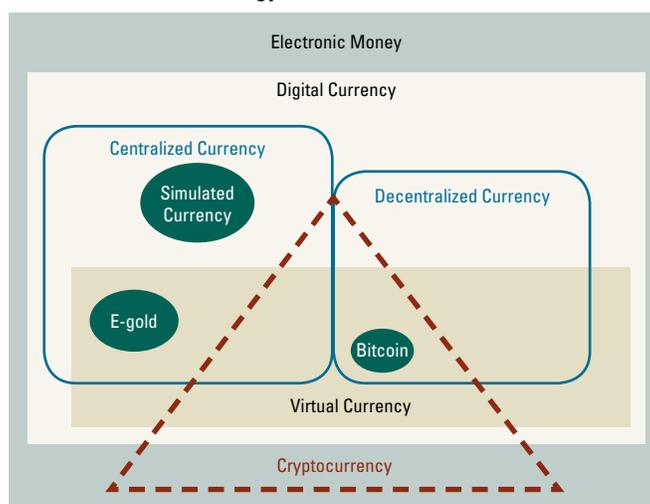


Table 1  
Largest Cryptocurrencies by Market Capitalization, Founding Date

Cryptocurrency name	Market capitalization (U.S.\$)	Founding date
Bitcoin	\$13,872,012,671	2009
Ethereum	\$670,845,473	2014/2016
Ripple	\$228,099,345	2012
Litecoin	\$182,040,688	2011
Monero	\$123,119,681	2014

SOURCE: CoinMarketCap, <https://coinmarketcap.com>, accessed December 2016.

**Bitcoin is globally traded, yet there is no global regulatory framework for it. Some countries, such as Ecuador, have attempted to ban bitcoin.**

bitcoin can be a useful diversification asset in a financial portfolio. Bitcoin can also be used to buy tangible goods on an increasing number of websites such as Amazon and Overstock or in some physical stores as an alternative to sovereign currencies.<sup>3</sup>

There are multiple ways to acquire a bitcoin, but one of the most common is through a bitcoin exchange. It is like any other online marketplace: Anyone wishing to purchase (or sell) a bitcoin indicates the amount of bitcoin and pays (or receives) the price in the monetary unit they select from those accepted by the exchange. The available electronic money ranges from sovereign currencies such as U.S. dollars, Chinese yuan, or New Zealand dollars, to other cryptocurrencies such as ethereum or litecoin. Exchanges differ in the range of electronic monies they accept, their fees, regulatory requirements and other properties. The impact of these on the price of a bitcoin in an exchange is examined in Pieters and Vivanco (2016).

Bitcoin is globally traded, yet there is no global regulatory framework for it. Some countries, such as Ecuador, have attempted to ban bitcoin. Others, such as Cyprus, encourage its use. Within the U.S., virtual currency exchanges are regulated by the Financial Crimes Enforcement Network (FinCEN). It requires that all bitcoin exchanges collect the identification of purchasers. Pieters and Vivanco (2016) test the enforceability of this ruling by attempting to purchase bitcoins using U.S. dollars from a location within the U.S. While all bitcoin exchanges within the U.S. collected information, very few outside of the U.S. did, circumventing FinCEN regulations.<sup>4</sup>

### Bitcoin-Based Exchange Rates

Chart 2 shows how \$1,000 can be directly exchanged for euros using official exchange rate markets, at a hypothetical exchange rate of \$1 for €0.97. Alternatively, one bitcoin (BTC) can be purchased for \$1,000, and the bitcoin can then be sold to obtain euros at a price of 1 BTC for €970. In this second scenario, bitcoin is used as a vehicle currency to move from one currency to another. This process is simple to implement on any exchange that allows the sale and purchase in at least two currencies. In Chart 2, both the official exchange rate and the bitcoin-based exchange rate are the same. However, it is possible that the bitcoin market is too small, or that bitcoin users ignore and are ignored by international markets, so that bitcoin-based exchange rates are actually uninformative and bear little similarity to the official exchange rate markets.

Pieters (2016) examines exchange rates derived from bitcoin trades and finds that in the absence of a policy of exchange-rate management, bitcoin-based exchange rates reflect official exchange rates. Additionally, they also provide information on black market exchange rates and capital controls. Chart 3 shows both the official and bitcoin exchange rate between the U.S. dollar and the British pound, normalized to begin at the same exchange rate value. These two currencies are highly traded with minimal restrictions, and movements in bitcoins and official exchange rates are essentially identical.

Argentina, in contrast, had a period of financial market restrictions to support a desired exchange rate, during which a substantial and well-developed black market for trades between the U.S. dollar and Argentine peso arose. This black market was so well established that newspapers quoted both the official (government supported) exchange rate and the unofficial (black market) rate, called the dólar blue.

Chart 4 shows the three exchange rates—the official, bitcoin and unofficial dólar blue rates—both during and after the end of the Argentinian exchange rate program in

Chart 2  
Two Methods of Converting U.S. Dollars into Euros

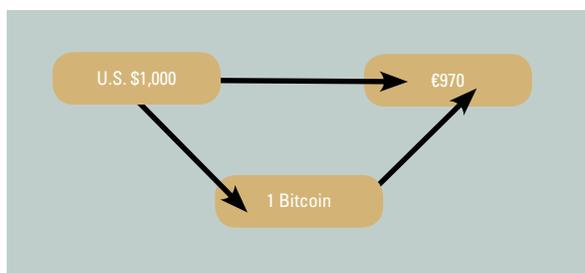
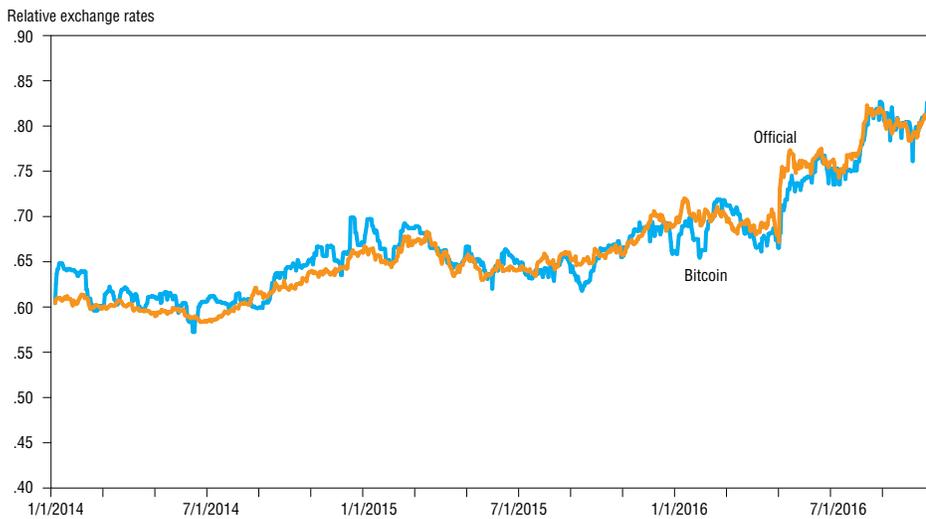
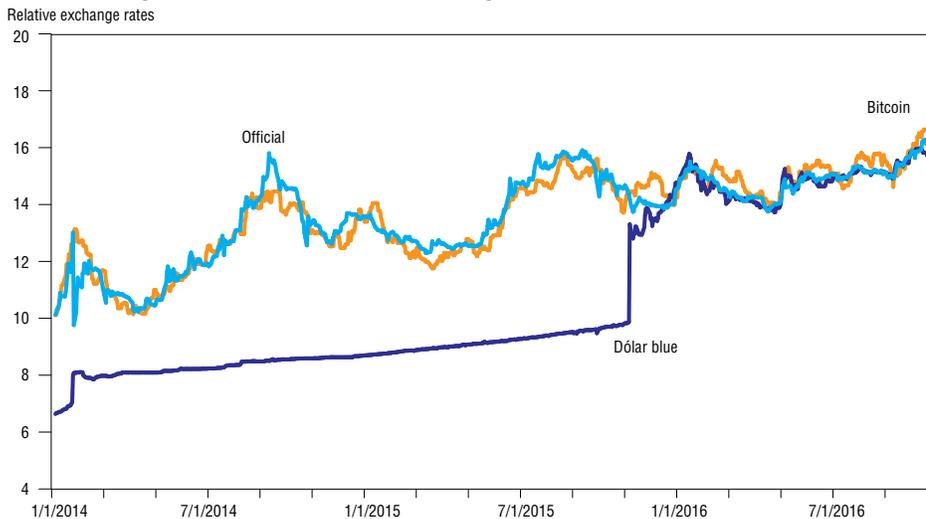


Chart 3

**Official and Bitcoin-Based U.S. Dollar–British Pound Exchange Rate**

SOURCES: Bitcoincharts.com (bitcoin prices); investing.com (official exchange rates); Pieters (2016); author's calculations.

Chart 4

**U.S. Dollar–Argentine Peso Bitcoin-Aided Exchange Rates**

SOURCES: LocalBitcoins exchange, bitcoincharts.com (bitcoin prices); investing.com (official exchange rates); Àmbito Financiero (unofficial exchange rates); Pieters (2016); author's calculations.

December 2015. The bitcoin exchange rate does not reflect the official exchange rate during the period of financial market restrictions. It, however, mirrors the movement of the unofficial exchange rate. This suggests that the bitcoin market was used as a channel to circumvent restrictions on currency trades. After capital controls ended, bitcoin and official exchange rates became similar. These two examples provide evidence that

bitcoin use is not limited to purchases within a domestic market; it also facilitates transactions across currencies on a global scale.

**Trilemma of International Finance**

The relative value of any two currencies—the exchange rate—is determined through their sale and purchase on the global foreign exchange market. If government policy interferes with this market by changing

the relative supply or demand of currencies, the exchange rate is managed.

The trilemma of international finance, illustrated in Chart 5, is a restriction on government policy that follows immediately from the interaction of exchange rates, monetary policy and international capital flows. The trilemma states that any country can have only two of the following: (1) unrestricted international capital markets, (2)

a managed exchange rate or (3) an independent monetary policy.

If the government wants a managed exchange rate but does not want to interfere with international capital flows, it must use monetary policy to accommodate changes in the demand for its currency in order to stabilize the exchange rate. In the extreme, this would take the form of a currency board arrangement, where the domestic currency

is fully backed by a foreign currency (as in the case of Hong Kong). In such a situation, monetary policy can no longer be used for domestic purposes (it is no longer independent). If a country wishes to maintain control over monetary policy—to reduce domestic unemployment or inflation, for example—it must limit trades of its currency in the international capital market (it no longer has free international capital markets). A country that chooses to have both unrestricted international capital flows and an independent monetary policy can no longer influence its exchange rate and, therefore, cannot have a managed exchange rate.

The U.S. has chosen (1) and (3): It allows unrestricted international movement of capital and has an independent monetary policy and, as a result, must accept a market-determined exchange rate. Hong Kong maintains a (2) fixed exchange rate and allows (1) unrestricted capital flows, with its monetary policy dedicated solely to maintaining its exchange rate. Prior to 2016, Argentina had a (2) managed exchange rate and (3) independent monetary policy and imposed restrictions on international capital flows.

Bitcoin creates a problem for Argentina and similar countries; it makes circumventing capital controls easier. As demonstrated

Chart 5  
Depiction of the Trilemma of International Finance

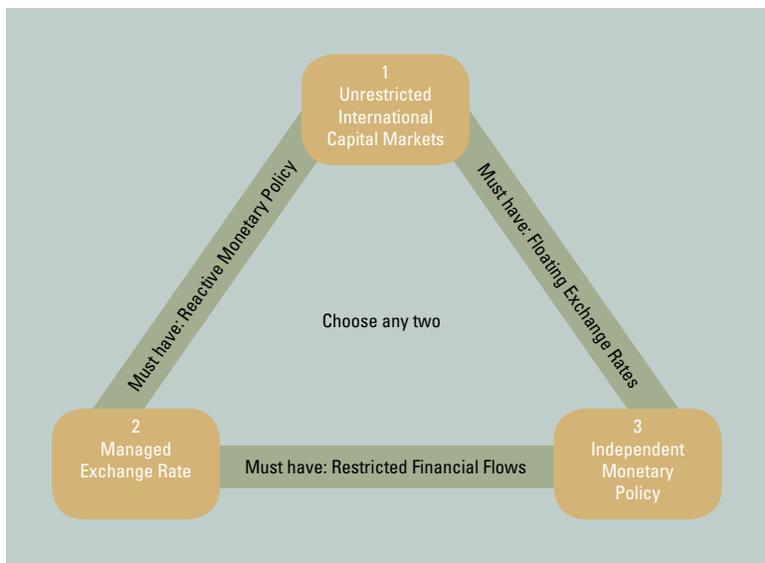
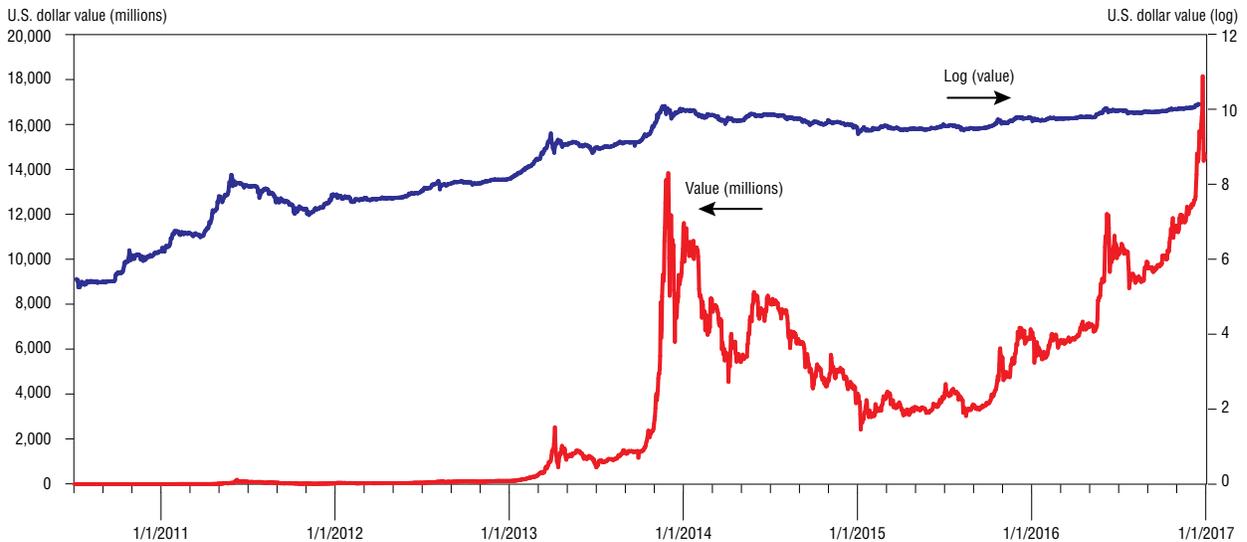


Chart 6  
Bitcoin Market Capitalization from July 1, 2010, to Dec. 28, 2016



SOURCES: Coindesk.com; author's calculations.

in Pieters and Vivanco (2016), government attempts to regulate the globally accessible bitcoin markets are generally unsuccessful, and, as shown in Pieters (2016) and Chart 4, bitcoin exchange rates tend to reflect the market, not official exchange rates. Should the flows allowed by bitcoin become big enough, all countries will have, by default, unrestricted international capital markets.

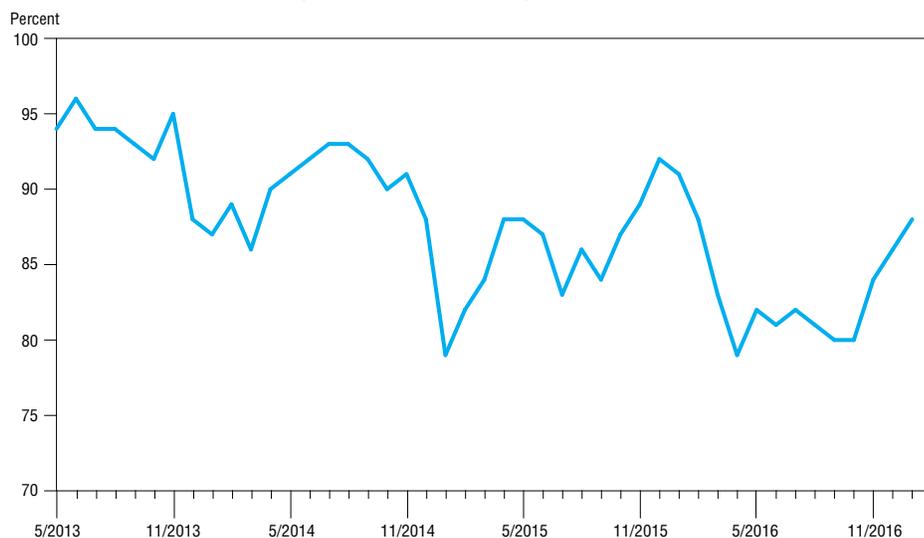
Thus, with bitcoin, (1) unrestricted international capital markets is chosen by default. Therefore, the only remaining policy choice is between (2) managed exchange rates or (3) independent monetary policy. If the country chooses (1) and (2), it must use reactive monetary policy to achieve the managed exchange rate. If the country chooses (1) and (3), it must have a floating exchange rate because it has no remaining tools with which to maintain a managed exchange rate.

Ali et al. (2014), the European Central Bank (2015) and the Bank for International Settlements (2015) all concur that cryptocurrencies may eventually undermine monetary policy, but at the time of their writing, all found that the small size of cryptocurrency markets did not represent any tangible restrictions. However, the market capitalization of bitcoin is growing rapidly, doubling from \$7 billion on Jan. 2, 2016, to nearly \$14 billion by Dec. 28, 2016 (Chart 6).

Additionally, despite bitcoin's rapid growth, data show that bitcoin's share of the cryptocurrency market has fallen from a dominating 95 percent to as low as 80 percent (Chart 7). While Table 1 shows that no individual altcoin has a market size comparable to bitcoin, the altcoins are collectively becoming more important. They achieved a combined \$2 billion market capitalization on Dec. 28, 2016, for a collective cryptocurrency market capitalization of \$17 billion—and unlike the much larger foreign exchange market, there is high liquidity between currencies.

If adoption of cryptocurrencies continues growing, the size of cryptocurrency flows relative to international financial markets will increase and central banks in economies of all sizes will have to make monetary policy

Chart 7

**Bitcoin's Monthly Share of Cryptocurrency Market Capitalization Declines**

SOURCE: CoinMarketCap, <https://coinmarketcap.com>.

decisions in an environment in which consumers can opt to use a globally traded and unregulated alternative currency.

**Notes**

<sup>1</sup>While not represented on Chart 1, any electronic money that is not a digital currency is centralized. This is because it must, by definition, have a physical representation, which in turn requires implied approval (or disapproval) by an agency (such as a central bank).

<sup>2</sup>For an explainer on blockchain technology, see Koch and Pieters (forthcoming).

<sup>3</sup>Websites such as coinmap (<http://coinmap.org>) or usebitcoins (<http://usebitcoins.info>) maintain lists of businesses that accept bitcoins.

<sup>4</sup>Pieters and Vivanco also show that persistent price deviations arise based on the extent of information gathering by a given exchange. Exchanges that require users to provide identification to open an account had prices that did not significantly deviate from the prices of the largest exchange. Those that required ID to transfer a sovereign currency posted slight price deviations over short intervals, while those that required no identification could post large and persistent deviations.

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# Interactions Between Exchange Rates and Import Prices: **What Have We Learned?**

By Mina Kim



**G**lobalization has deepened economic interdependence among countries as firms seek to take advantage of international trade to source production where it is cheapest, and investors look to global financial markets to diversify their portfolios. One need only look at the global financial crisis of 2007–08 and the associated global recession to grasp the extent of globalization.

During the Great Recession, almost all advanced economies and some developing economies experienced a drop in gross domestic product (GDP) growth. Chart 1 shows the synchronous decline in GDP growth rates for selected Organization for Economic Cooperation and Development (OECD) countries that trade frequently with each other. Simultaneously, the world experienced a trade collapse that was worse than the drop

in GDP growth, reflected in export growth rates of the same OECD countries (*Chart 2*).<sup>1</sup>

As the global financial crisis illustrates, this interdependence has serious implications for the international transmission of shocks and the ability of monetary policy to stabilize national economies. Consequently, policymakers are being forced to take greater account of the global economic landscape when formulating policy.

Exchange rates are at the center of the international transmission of shocks via trade linkages. Given the United States' growing reliance on imports, the potential impact of exchange rate movements has become more important (*Chart 3*). These movements directly affect the competitiveness of U.S. firms in the global market and at home and, therefore, affect firms' production, employment and earnings, and, in turn, consumer prices. Indirectly, exchange rate movements also induce expenditure switching toward countries with cheaper goods, affecting consumer prices. This essay focuses on these interactions between exchange rates and prices.

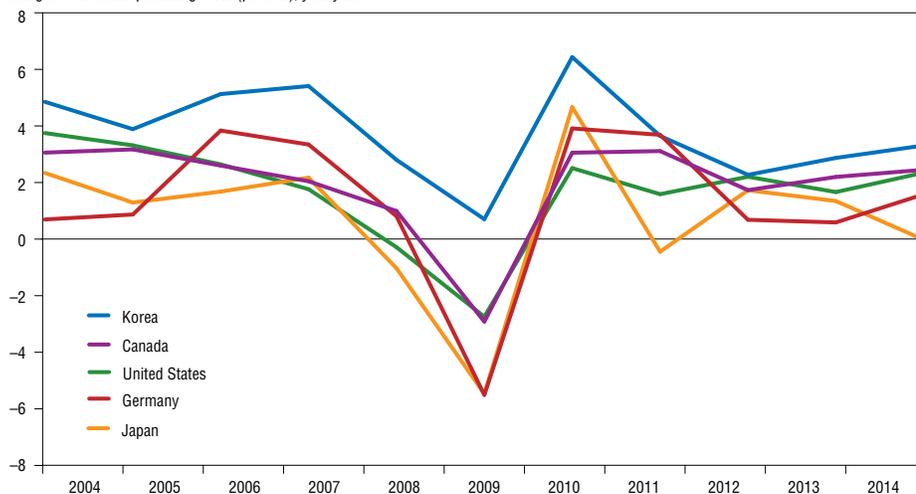
## Exchange Rates, Trade Prices

There is evidence that firms are sensitive to exchange rate changes when setting export prices. Given the U.S.' increasing reliance on imports, the extent to which exchange rate changes are passed through to import prices (also known as exchange rate pass-through) has critical implications for domestic inflation and the appropriate response of monetary policy.

More specifically, exchange rate pass-through is most commonly defined as “the

Chart 1  
**GDP Growth Rates for Selected OECD Countries Synchronously Fall**

Real gross domestic product growth (percent), year/year



NOTE: OECD stands for Organization for Economic Cooperation and Development.  
SOURCE: International Monetary Fund World Economic Outlook.

percent change in import (or export) prices for a percent change in the exchange rate” (Chinn, 2006). For example, suppose that an exchange rate (defined as the number of units of the domestic currency needed to purchase a unit of foreign currency) increases 10 percent. If the exchange rate pass-through is 1, then the price of imports will increase by 10 percent. If exchange rate pass-through is 0.5, then the price of imported goods will increase by only 5 percent. If pass-through is 0, then the price of imported goods will be unchanged.

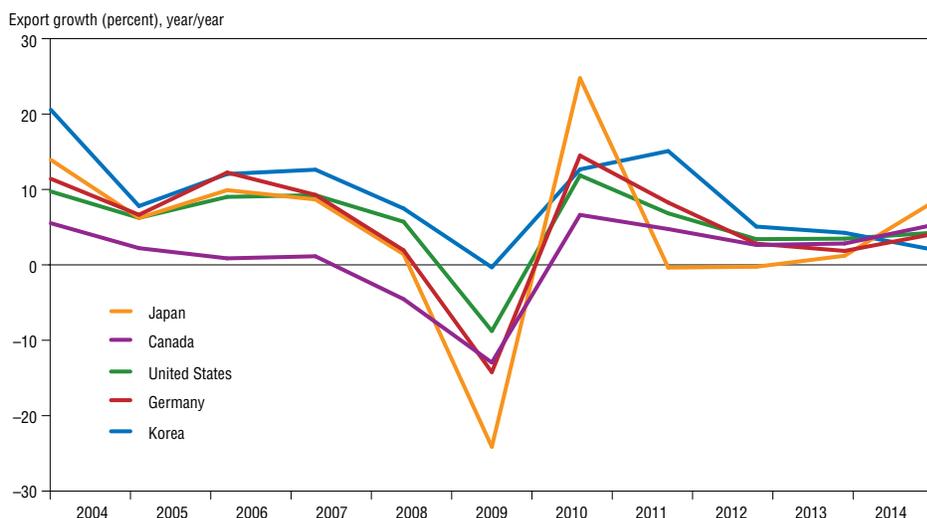
The academic literature on exchange rate pass-through is expansive, and there is wide variation in the empirical estimates of exchange rate pass-through across countries, goods and time periods.<sup>2</sup> The empirical evidence for the U.S. shows that pass-through is incomplete and low. In the aggregate data, the long-run pass-through estimate is around 0.4 (Campa and Goldberg, 2005); in product-level data, the estimate is similar (Gopinath and Itskhoki, 2010). The empirical evidence also shows that exchange rate pass-through in the U.S. has been declining since at least the 1980s.<sup>3</sup> These empirical regularities can be explained by understanding the price setting behavior of firms.

**Exporter Response to Exchange Rate Fluctuations**

The literature outlines many factors affecting how exporters respond to exchange rate changes, of which four are highlighted:

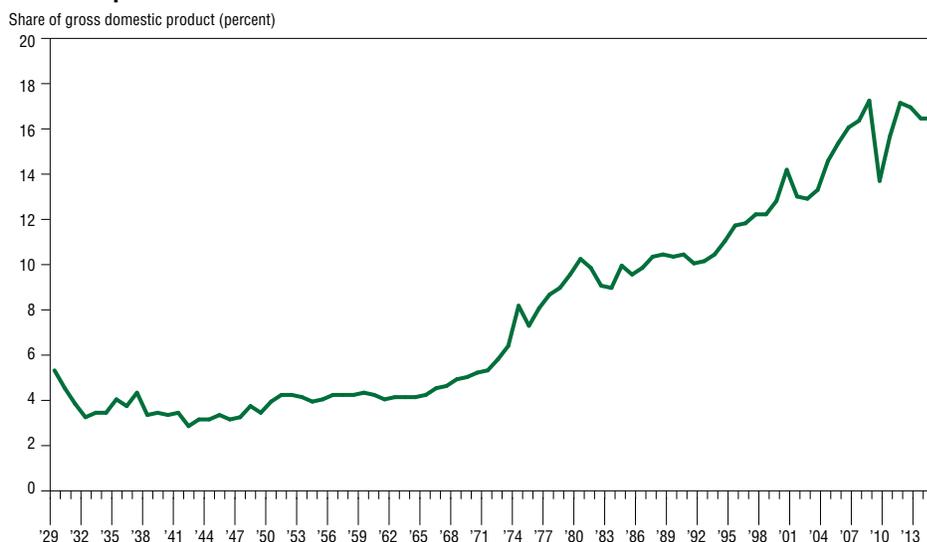
- Menu costs
- Desired pass-through
- Market structure
- Policy environment

**Chart 2**  
**Export Growth Rates Simultaneously Drop for Selected OECD Countries**



NOTE: OECD stands for Organization for Economic Cooperation and Development.  
SOURCE: International Monetary Fund World Economic Outlook.

**Chart 3**  
**Share of Imports in U.S. GDP Rises**



SOURCE: Bureau of Economic Analysis.

**When prices are sticky and cannot be adjusted instantaneously, the currency of invoicing determines the amount of exchange rate fluctuation that can be passed through.**

First, the cost of adjusting prices, or menu costs, matters (Blinder et al., 1998; Schoenle, forthcoming; Fabiani et al., 2006). Small exchange rate movements may not warrant incurring the cost of adjusting prices. Instead, the exchange rate change is absorbed in firms' margins. However, firms may be unable to keep prices fixed when movements are large. Menu costs result in prices that exhibit infrequent change, what economists commonly refer to as "sticky" prices.

When prices are sticky and cannot be adjusted instantaneously, the currency of invoicing determines the amount of exchange rate fluctuation that can be passed through. Exporters desiring low exchange rate pass-through in the short run will choose to invoice in the local currency, or the currency of the destination country (Gopinath, 2015). However, exporters desiring high exchange rate pass-through in the short run will choose to invoice in their own (or the producer's) currency, the currency of the origin country. One explanation is that exporters facing more competition in the destination market may desire to keep prices stable relative to their competitors. Exporters can better maintain stable prices by pricing in the local currency.<sup>4</sup>

Third, market structure can affect how firms set prices (Campa and Goldberg, 2005). In competitive sectors, firms are less able to absorb any losses from exchange rate changes and must thus adjust prices quickly. This is not the case for firms in differentiated goods sectors. Relatedly, firms with market power are better able to absorb exchange rate shocks and are less likely to adjust prices (Atkeson and Burstein, 2008).

Lastly, the policy environment can be important for exporters' pricing decisions. For example, in countries that have credible inflation-targeting monetary policy, there is less inclination for firms to change prices when exchange rates change since they have confidence that the shocks are temporary (Taylor, 2000, and Gagnon and Ihrig, 2004).

Kim et al. (2013) argue that the pricing behavior of firms also depends on a country's exchange rate policy. The abandonment of

China's hard peg to the U.S. dollar in 2005 can be used to study how firms change import and export prices in response to changed exchange rate policy. The switch in exchange rate policy from a hard peg to a managed float resulted in gradual appreciation of the Chinese yuan against the dollar (*Chart 4*).

The degree of price stickiness in U.S.–China trade prices is examined using goods-level data on trade prices from the Bureau of Labor Statistics (BLS). The duration of U.S.–China trade prices, based on the frequency of price changes in each month (the frequency-implied duration), appears to have declined almost 30 percent since China abandoned its hard peg to the U.S. dollar.

We extend a menu-cost model to reflect this stylized fact and find that the change in exchange rate policy can explain about 60 percent of the decline in price stickiness. In our model, exchange rate fluctuations influence price-setting behavior through aggregate demand. The appreciation of the Chinese yuan leads to an increase in aggregate demand for U.S. exports to China, inducing U.S. exporters to raise their prices.

Our results are complementary to those found in Floden and Wilander (2006). They present a menu-cost model in which firms adjust prices in response to exogenous exchange rate fluctuations. In their model, large exchange rate changes raise the opportunity cost of holding prices fixed, so firms change prices more frequently, and exchange rate pass-through is dependent on the size of the exchange rate change. Furthermore, the Floden and Wilander model generates asymmetric responses to exchange rate changes based on the direction of the change. They find that appreciation of the exporter's currency leads to higher exchange rate pass-through than depreciations, especially during periods of inflation.

### **Asymmetric and Nonlinear Responses**

Evidence of asymmetric and nonlinear responses to exchange rate fluctuations has important consequences for monetary policy and suggests that policymakers and forecast-

ers at least reconsider the effectiveness of the “rule of thumb” used to estimate how currency movements will affect inflation.<sup>5</sup> The appropriate policy response to dollar appreciation may be different than that for depreciation if the price responses are different. Likewise, the appropriate policy response to a large change in exchange rates may not be the same as the one for a small change if nonlinearities are present.

The asymmetries and nonlinearities described in Floden and Wilander (2006) primarily point to menu costs and strategic choice of invoicing currency as the mechanisms generating those price responses. Aside from Floden and Wilander (2006), there are several other theories as to why asymmetries in exchange rate pass-through might exist. These mechanisms include:

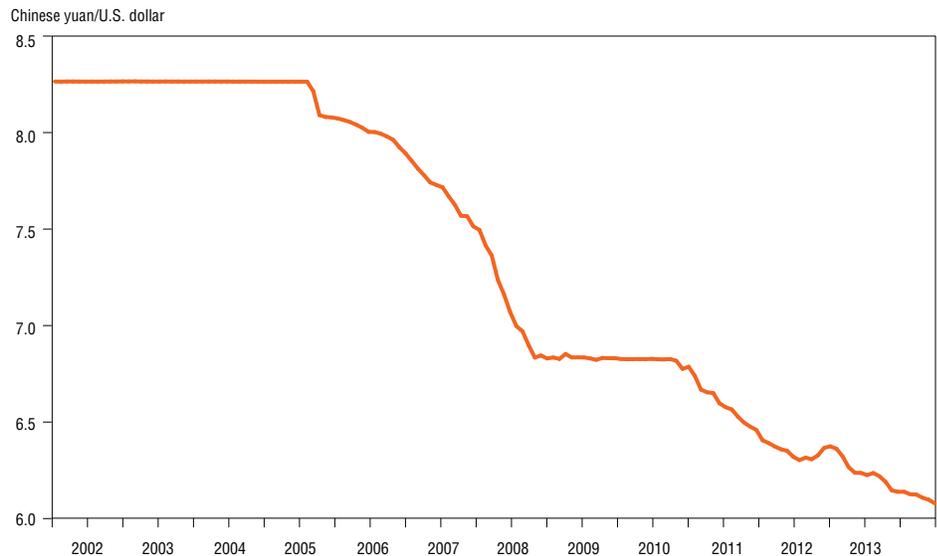
- Competition for market share
- Production switching
- Binding quantity constraints

When exporters are concerned about market share, they adjust markups to increase their future profits. When the importer’s currency appreciates, the exporter updates prices, but only to increase market share. When the importer’s currency depreciates, the exporter will instead absorb some of the exchange rate change in order to hold market share. Under this strategy, exchange rate pass-through is greater when the importer’s currency appreciates than when it depreciates.

Alternatively, the mechanism through which asymmetries can arise is through production switching (Ware and Winter, 1988). Exporters may switch between domestic inputs and foreign inputs in response to exchange rate changes as a means of reducing cost. Assuming the extreme case in which a firm can use either the domestic or foreign input, the firm switches to the cheaper domestic input when the importer’s currency appreciates. Since the marginal cost is unaffected, the price of the final good drops as output increases with the marginal revenue increase. On the other hand, when the

Chart 4

#### Monthly Chinese Yuan/U.S. Dollar Exchange Rate Falls After Unpegging



SOURCE: Board of Governors of the Federal Reserve System.

importer’s currency depreciates, marginal revenue and marginal cost both decrease, and the firm does not change output or price, resulting in zero pass-through.

In both of these cases, appreciation of the importer’s currency results in greater pass-through than during depreciation. That direction of asymmetry will not hold when exporters face binding quantity constraints. These binding quantity constraints occur when firms have limited ability to increase production when the importer’s currency appreciates. Instead, the exporter will raise markups to hold prices fixed and increase profits. On the other hand, when the importer’s currency decreases, the exporter may reduce markups, but will still increase prices somewhat to offset increased costs. Thus, appreciation of the importer’s currency will instead produce lower pass-through than depreciation.

Recent empirical evidence on nonlinearities or asymmetries in exchange rate pass-through is limited, especially involving the U.S. Older studies focused on how price responses differed between appreciations

**Unfortunately, economists have little understanding as to why exchange rate pass-through varies along these different dimensions.**

and depreciations. The results have been mixed, with no clear evidence whether appreciation or depreciation is associated with higher pass-through. Mann (1986) used aggregate U.S. data and found that exchange rate pass-through was higher in periods of appreciation than depreciation. However, the difference was not statistically significant. Kadiyali (1997) and Goldberg (1995) focused on a single industry and found the opposite outcome. Other industry studies found that the direction of asymmetry depended on the industry (for example, Mahdavi, 2002, and Olivei, 2002).

Pollard and Coughlin (2004) consider both asymmetries and nonlinearities in exchange rate pass-through to U.S. import prices. They use industry-level exchange rate changes and find no clear direction of asymmetry across industries, as in the previous literature. They find nonlinearities such that larger exchange rate fluctuations are generally associated with higher exchange rate pass-through, even when accounting for asymmetries.

Kim et al. (2017) incorporate more recent time periods in their examination of

asymmetries and nonlinearities in exchange rate pass-through to U.S. import prices. Unlike Pollard and Coughlin (2004), the authors use goods-level transaction price data from the BLS and match it with country-level data on exchange rates and consumer price indexes to better understand the importance of asymmetries and nonlinearities to U.S. inflation.

Throughout the period considered, the U.S. experienced episodes of appreciation and depreciation of varying degrees. Chart 5 shows a histogram of the average monthly exchange rate change seen in the data, where exchange rate is defined as foreign currency per dollar. The distribution is bell-shaped and roughly centered around zero, suggesting that asymmetries and nonlinearities might be masked in aggregate data.

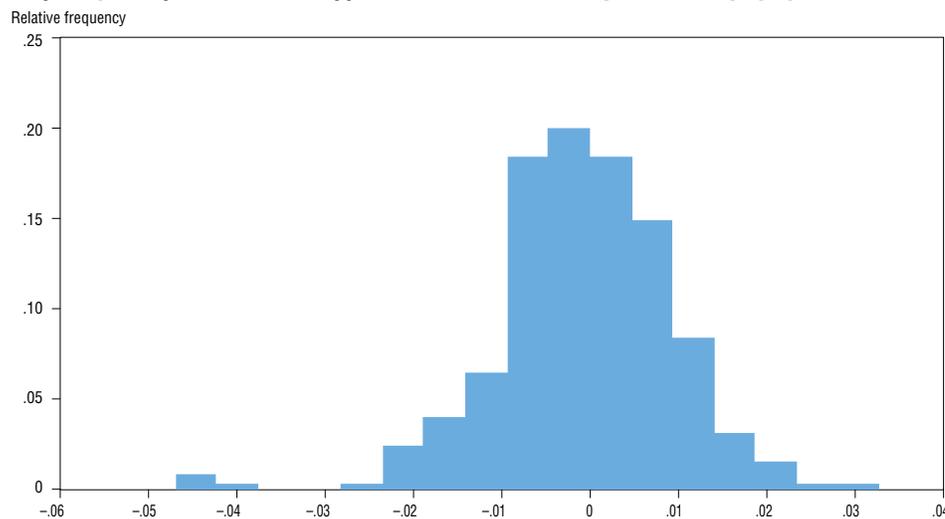
Unlike Pollard and Coughlin (2004), we find no economically significant evidence of nonlinearities, even when the data is disaggregated by sector. However, we find that asymmetries in exchange rate pass-through exist to varying degrees across different aggregations of the data, with depreciations tending to pass through faster than appreciations. Stickiness in nominal prices does not seem to drive our results, as these asymmetries persist even when we restrict our analysis to goods that experience at least one price change. On the other hand, nominal price stickiness can explain why we see significant asymmetries disappear in the long run.

It may be that the asymmetries found are a result of firms exiting because of currency depreciation. No asymmetries were found when examining the probability of a good exiting the dataset because of exchange rate fluctuation.

These preliminary findings suggest that the nature of competition and price setting is important when determining the extent of pass-through. Menu costs may reconcile the short-run and long-run results on exchange rate pass-through, but that mechanism alone cannot explain the strong asymmetries found.

Chart 5

**Frequency of Depreciations and Appreciations in U.S. Exchange Rates Roughly Symmetric**



NOTE: Exchange rate is quoted as U.S. dollar/foreign currency.

SOURCES: International Monetary Fund International Financial Statistics; Bureau of Labor Statistics; author's calculations.

## Extent of Pass-Through

The academic literature has made great strides in understanding how exchange rate movements affect inflation. There is little disagreement that exchange rate pass-through is incomplete, and economists have some understanding of why that might be occurring.

There is less agreement on the extent of pass-through. It seems to vary across time and across industries. It also seems to vary depending on the direction of the exchange rate shock and sometimes the magnitude of the exchange rate shock. Unfortunately, economists have little understanding as to why exchange rate pass-through varies along these different dimensions. As a result, there has been little success predicting how exchange rate changes will affect inflation.

More recent studies, such as Forbes et al. (2015), Bussiere et al. (2015) and this author's work, suggest that the mechanisms behind the exchange rate change could matter. The degree of exchange rate pass-through could depend on whether a supply, demand or nominal shock drives the exchange rate fluctuation, for example. Further investigation can help policymakers effectively respond to exchange rate movements.

## Notes

<sup>1</sup>See Eichengreen and O'Rourke (2010) for more details about the global financial crisis and a comparison to the Great Depression.

<sup>2</sup>See Burstein and Gopinath (2014) for a more extensive review of the academic literature on exchange rate pass-through.

<sup>3</sup>See, for example, the figures in Marazzi et al. (2005) for an illustration of the decline in exchange rate pass-through into U.S. import prices.

<sup>4</sup>Other possible mechanisms are described in Gopinath (2015).

<sup>5</sup>According to Forbes et al. (2015), the "rule of thumb" commonly used for the U.S. is a pass-through rate of 5 percent into domestic prices.

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# Conference on International Economics

By Michael Sposi



Globalization has led to increased integration across countries in goods markets and financial markets and has changed the environment in which policy operates. As a result, researchers in the various subfields have developed new methods to study and measure the consequences of globalization.

To better understand these developments, the Federal Reserve Bank of Dallas' Globalization Institute and the University of Houston brought together researchers from academic institutions and the Federal Reserve System for a conference focusing on international trade and prices and on international finance and sovereign debt.

The goal was to foster a cross-pollination of ideas across these subfields of international economics.

## International Trade, Prices

Understanding the welfare implications of globalization—or of policy, for that matter—is of the utmost importance to economists. From a practitioner's perspective, the measurement of welfare is challenging. A central difficulty involves constructing indexes that accurately quantify changes in price levels and the cost of living across both time and space. Any reasonable price index must be consistent with some notion of consumer preferences, or consumer utility, and must be constructed to use real-world data. Stephen Redding of Princeton University presented the paper "A Unified Approach to Estimating Demand and Welfare" (co-authored with David Weinstein of Columbia University), which explores a new approach to bridging price-index theory and data at the most

fundamental level.

Current methods of constructing price indexes and measures of welfare rely on three distinct approaches: 1) macroeconomic price indexes based on time-invariant preferences,<sup>1</sup> 2) microeconomic demand-system estimation with time-varying demand curves and 3) actual price data constructed using formulas that differ from those implied by macro and micro approaches but that embed intuitive properties researchers want to exploit.

The micro and macro approaches are mutually inconsistent with each other, and neither is consistent with the approaches used by statistical agencies, the authors point out.

The authors develop a unified estimation approach to reconcile the discrepancies between micro prices, macro prices and practice. In particular, they provide conditions under which the aggregate utility function can be characterized by a constant aggregate demand parameter, in spite of demand for each good changing over time. Additionally, the estimation approach incorporates the properties of the approaches statistical agencies use most.

The authors demonstrate a new source of estimation bias that arises when one ignores changes in demand over time. They show empirically that this bias implicitly overstates cost-of-living changes by an average of 2.8 percentage points per year between 2000 and 2014. This bias is roughly as large as the bias that would arise if one failed to account for changes in the varieties of goods and services over time.

## 2016 Conference Summary

**When:** Oct. 7–8

**Where:** Federal Reserve Bank of Dallas

**Sponsors:** Globalization Institute,  
Federal Reserve Bank of Dallas;  
University of Houston



Existing theories of export decisions involve firms balancing a fixed cost of accessing foreign markets with future profits that can be earned from selling into those markets.

### Expectations and Export Decisions

Not only is accounting for changes in varieties important for measuring economic well-being, it is also important for understanding fluctuations in trade volumes. That is, much of the variation in trade volume is due to an extensive margin, reflecting firms entering and exiting export markets. Eduardo Morales of Princeton University presented “What Do Exporters Know” (co-authored with Michael Dickstein of New York University), which examines firms’ export decisions.

Existing theories of export decisions involve firms balancing a fixed cost of accessing foreign markets with future profits that can be earned from selling into those markets. Uncertainty surrounding profits includes the firms’ relative competitiveness, local demand conditions and the local policy environment in the foreign market. As such, if a researcher observes that a particular firm did not export to a market, it is inferred that either the fixed cost is too large or the expected profits are too small.

However, the researcher has very little

information about what the firm’s expectations actually were when making the decision. So if a researcher incorrectly specifies the expectations on which firms are acting, the estimated fixed costs of exporting will be biased. This is an important empirical issue given that many questions involve quantifying the response of exports to trade cost shocks.

To mitigate this bias, the authors introduce a new econometric technique that allows the researcher to measure firms’ expectations using a few pieces of available data, such as lagged aggregate exports, lagged domestic sales and distance. The authors apply their methodology to Chilean exporters and find that, after accounting for the information available to firms at the time of the export decision, the estimated parameters for the fixed cost of exporting are at least 70 percent lower. One key implication is that, relative to a model in which firms have complete information, firms increase their exports substantially more in response

**Trade costs are clearly an important determinant of the magnitude and direction of trade flows.**

to otherwise equal reductions in trade costs.

In addition to the decision of whether to export, firms are faced with the challenge of managing complex global supply chains, from initial design to sourcing of inputs, assembly and final distribution. That is, international trade involves vertical linkages and trade in intermediate goods. To understand how spillovers occur across countries, one must first develop a framework that accounts for the specific types of linkages. Chart 1 depicts a typical supply chain for an arbitrary electronic device.

Previously, researchers incorporated trade in intermediate goods, but there were very few attempts to explicitly incorporate the sequential nature of the global value chain, in which various stages of production specifically make use of output from previous stages.

**Challenges to Supply Chain Modeling**

From a modeling perspective, many complications arise, making modeling an optimal supply chain technically challenging.

Pol Antràs of Harvard University presented “On the Geography of Global Value Chains” (co-authored with Alonso de Gortari of Harvard), which develops a model to characterize the best location for each stage of production in a global value chain. Key trade-offs include: 1) minimizing the transport costs between each stage, and 2) assigning each stage of production to the location that has a comparative advantage at that stage (i.e., labor-intensive activities to countries with low wages and high productivity at that stage) in order to minimize the final consumer cost.

Between each stage of production, trade costs are incurred, including transportation, storage and potentially tariff costs. After each stage of production, trade costs accumulate and further raise the value of the good. Trade costs tend to be roughly proportional to the value of the good—for example, a tax rate incurring high trade costs at the end of the supply chain carries a greater impact than at the beginning of the chain. Therefore, it is generally more efficient to incur proportionately smaller trade costs at the end of the supply chain by, for instance, being closer to

Chart 1  
Global Value Chain for Electronics Industry



SOURCE: IDC Manufacturing Insights (courtesy ventureoutsources.com).

a large market.

This feature guides the main finding of the model: More upstream or basic activities should generally be performed at locations that are less central in the global economy, such as Singapore and Indonesia, while more downstream activities should be performed at more central locations, such as China. Between the beginning and final stages, each step of production should occur at locations that are geographically close to the previous stage, such as Thailand. These predictions are broadly consistent with the data.

Trade costs are clearly an important determinant of the magnitude and direction of trade flows. Additionally, trade costs are important for determining the balance of trade. That is, in order for a country to run a trade deficit, it must borrow resources from the rest of the world. Ricardo Reyes-Heroles of the Federal Reserve Board presented his paper “The Role of Trade Costs in the Surge of Trade Imbalances,” in which he argues that the decline in trade costs since 1970 accounts for 69 percent of the rise in global imbalances during the period.

He identifies two channels through which trade costs affect imbalances. First, trade costs drive a wedge between the real “effective” interest rate (i.e., the real interest rate converted into units of consumption) paid by the borrower and the real effective rate received by the lender on capital flows used to finance the imbalances. During the times when the borrowing country borrows, its consumption basket will be loaded with high-cost imported goods, but when that country subsequently repays the loans, its consumption basket will contain relatively low-cost domestic goods. This composition effect means that the overall gains to borrowing are diminished and, hence, there is less incentive to borrow in the first place. As trade costs decline over time, the gap between real effective borrowing and lending rates narrows and it becomes less costly to run trade imbalances.

The second channel involves expectations of declining trade costs. Such expecta-

tions create additional current demand for international borrowing, driving up the real interest rate. In turn, current imbalances are smaller than they otherwise would have been, and future imbalances are larger than they otherwise would have been. That is, trade imbalances are postponed to a future time when they are less costly to finance. As a result, the expectation of future trade-cost declines generates an upward “tilt” in the magnitude of global imbalances over time.

International trade in goods is not independent of financial considerations. For one, a country’s balance of trade must be reconciled with the balance of payments so that a trade deficit is accompanied by net foreign borrowing, or a trade surplus is accompanied by net foreign lending. For another, the exchange rate, which is intimately linked to the current account and capital flows, has important implications for firms that buy and sell goods across the world. The next set of papers explores international capital markets more closely.

### **International Finance and Sovereign Debt**

Distortions that generate suboptimal investment rates come with costly implications for economic performance. Liliana Varela of the University of Houston presented “Reallocation, Competition and Productivity: Evidence from a Financial Liberalization Episode.” The paper shows that distortions in international capital markets do, in fact, have consequences for the allocation of resources and aggregate productivity within a country. She develops a model with heterogeneous firms that use capital for production and for research and development, which affects future productivity and competitiveness. She uses the model as a framework to examine the consequences of a financial liberalization episode in Hungary.

Before 2001, foreign firms in Hungary were allowed access to international credit markets, but domestic firms were not. Growth rates for domestic firms were quite similar to those of international firms. After

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2001, capital controls were removed for all firms.

Following the financial liberalization, domestic firms grew much faster than international firms did. The paper shows that domestic firms experienced higher growth in labor productivity, and especially greater R&D and capital intensity. The higher degree of capital intensity was a direct consequence of access to foreign capital. The paper also shows that, following the liberalization, all firms became more competitive as the foreign firms' markups decreased relative to domestic firms', particularly in sectors that rely more on external finance.

International credit and financial markets improve the allocation of resources and generate higher efficiency and productivity, but some features of these markets are not well understood. For instance, the foreign exchange market (one of the largest in the world) seems to admit systematic arbitrage opportunities. Consider a U.S. investor exchanging one U.S. dollar for euros on the spot market, investing those euros in a risk-free German government bond and then converting the proceeds from that bond back into dollars at a predetermined forward rate. Such a transaction should yield the same return as investing that same U.S. dollar in a U.S. risk-free asset, such as a short-term Treasury. This equality, known as "covered interest parity" (CIP), has failed to hold following the Great Recession yet remains deeply rooted in the way practitioners and researchers think about financial markets. In fact, the assumption that CIP holds can be found in almost any textbook on international finance.

Wenxin Du of the Federal Reserve Board presented "Deviations from Covered Interest Parity" (co-authored with Alexander Tepper of Columbia University and Adrien Verdelhan of the Massachusetts Institute of Technology's Sloan School of Management and the National Bureau of Economic Research). The authors show that while CIP was a robust feature of the data prior to the financial crisis, it has since broken down among the G-10 currencies—the Australian dollar, Canadian

dollar, Swiss franc, Danish krone, euro, British pound, Japanese yen, Norwegian krone, New Zealand dollar and Swedish krona—vis-à-vis the U.S. dollar.

While this deviation between textbook theory and reality, known as the cross-currency basis, has been documented and studied previously, the authors present evidence pointing to a new combination of factors driving it: 1) the increased cost of financial intermediation following the crisis, and 2) the persistent imbalances in investment demand and funding supply across countries. With regard to the first factor, the authors argue that because of regulations, financial intermediaries cannot fully hedge their foreign currency positions. They find that the magnitude of the cross-currency basis is larger at quarter-ends, when quarterly regulatory reports are due, a feature absent prior to the crisis. Concerning the second factor, they show that the cross-currency basis is higher for countries with higher nominal interest rates, reflecting greater demand for investment relative to saving. Moreover, the basis tends to increase with monetary policy announcements.

Whether CIP holds is crucial for central banks, whose monetary policy is aimed at targeting the exchange rate of, for instance, small open economies. Manuel Amador of the Federal Reserve Bank of Minneapolis and the University of Minnesota presented "Exchange Rate Policies at the Zero Lower Bound" (co-authored with Javier Bianchi and Fabrizio Perri of the Minneapolis Fed and Luigi Bocola of Northwestern University and the National Bureau of Economic Research). The authors argue that if the nominal interest rate consistent with CIP happens to be negative, pursuing an exchange rate objective necessarily implies deviations from CIP given that the nominal interest rate is constrained to be non-negative. This provides an arbitrage opportunity resulting in capital inflows into the small open economy that is costly for the central bank because it has to take the negative side of the arbitrage trades by accumulating foreign reserves in order to manage an

exchange rate target.

The authors also argue that there are welfare losses to the small open economy that would not exist away from the zero lower bound (ZLB). In particular, deeper financial integration with the outside world, which is typically beneficial when the economy is above the ZLB, becomes a curse when at the ZLB following foreign interest rate increases. The reasoning is that, at the ZLB, the size of the required reserve accumulation increases.

International financial markets play an equally important role in the conduct of fiscal policy as it pertains to debt issuance and repayment. Governments across the world regularly tap international credit markets for the financing of infrastructure projects as well as for regular spending on payroll and social programs. In many cases, much financing is sourced from foreign investors. When a country's fiscal authority runs into trouble, or when the debt is denominated in foreign currency and the local currency depreciates, the government must decide whether to default. Benjamin Hébert from Stanford University presented "The Costs of Sovereign Default: Evidence from Argentina" (co-authored with Jesse Schreger of Princeton University and Harvard Business School). The paper sheds light on the magnitude of default costs. A key issue that any study confronts is the chicken-and-egg problem: Does the economy deteriorate because of the sovereign default, or does the government default because the economy deteriorates? To examine this, the authors explore legal rulings in the case of Argentina and examine how equity returns and exchange rates responded to changes in the probability of default.

By assuming that Argentine firms in the economy are not directly impacted by the legal rulings, they use prices of credit default swaps to measure changes in the probability of Argentine government default. The authors compile and isolate 15 rulings that potentially changed the probability of default. They find that, on average, increases in the likelihood of default reduced the U.S.-dollar value of Argentine assets. Specifically, on

July 30, 2014, when Argentina defaulted, the risk-neutral five-year default probability increased from 40 percent to 100 percent, and the estimates imply that this change alone was responsible for a 28 percent decline in the value of Argentine firms.

The authors translate the changes in the value of the equities into changes in real economic activity, and find that the present discounted value of gross domestic product growth declined between 3.6 percent and 6.6 percent as a result of the default.

Given that the economic consequences of sovereign default are large, it is crucial to have a theoretical foundation to understand the inner workings of the market for sovereign debt. Whether warranted or not, on occasion investors may place a high probability on the government defaulting or may believe that there is a high degree of uncertainty in terms of default. This makes it more difficult for the government to auction bonds and, thus, increases the incentive for the government to default. In this sense, default can potentially be self-fulfilling in that investors' expectations are the very reason for default. In the previous literature, such situations tend to result in failed auctions, in which the government cannot issue debt at a positive price, and default results.

Empirically, it is rare that governments fully default, though they may pay extremely high spreads to borrow from investors. Satyajit Chatterjee of the Federal Reserve Bank of Philadelphia presented "Self-Fulfilling Debt Crises, Revisited: The Art of the Desperate Deal" (co-authored with Mark Aguiar of Princeton University, Harold Cole of the University of Pennsylvania and Zachary Stangebye of the University of Notre Dame). The paper presents a model that attempts to capture these more realistic features.

Their model includes "fire-sale auctions," in which the government can issue debt at a positive, albeit low, price when investors place a high probability on default. That is, the government knows that its fundamentals are relatively strong enough and is therefore willing to make such deals. The

authors refer to these as "desperate deals" because the government will have to pay a high spread (over "safe" asset prices) for the credit.

Under these circumstances, the sovereign country can circumvent some consequences of coordination failure that result in a self-fulfilling debt crisis. The model, therefore, produces debt dynamics and volatile spreads more in line with the data than what other theories predict. Specifically, the model indicates that: 1) actual default is rare, 2) spreads are volatile in emerging economies and 3) large spikes in spreads are only weakly correlated with declines in output (e.g., recently in Portugal, Ireland, Italy, Spain and Greece).

### Pushing the Research Frontier

The papers presented at the conference pushed the research frontier for various subfields within international economics, including international trade, international finance and sovereign debt. Moreover, the presentations and discussions made evident that there are important overlaps between each subfield. The interdependence between international trade, trade imbalances and capital flows is one such overlap. Another is the close relationship between international capital markets and sovereign debt and default.

Each paper prompted excellent participant discussions, including those by "Exchange Rate Policies at the Zero Lower Bound" co-author Luigi Bocola, Laura Alfaro of Harvard University, Michael Devereux of the University of British Columbia, Jonathan Eaton of Penn State University, Robert Johnson of Dartmouth College, Hanno Lustig of Stanford University, Benjamin Malin of the Federal Reserve Bank of Minneapolis, Vivian Yue of Emory University and Jing Zhang of the Federal Reserve Bank of Chicago.

### Note

<sup>1</sup>The Törnqvist index is one of the more commonly used indexes.

# Summary of Activities 2016

**Institute staff published research in top peer-reviewed journals and added 35 new papers to its working paper series to go with 38 in 2015, bringing the series total to 294.**



In 2016, the Globalization Institute continued its tradition of research excellence by publishing a number of notable academic papers and convening leading minds in the field of economics to discuss topics vital to the U.S. and world economies.

Institute staff published research in top peer-reviewed journals and added 35 new papers to its working paper series to go with 38 in 2015, bringing the series total to 294. Of the 35 new papers, permanent staff in Dallas contributed 15 and institute research associates provided the rest. As in years past, a wide range of topics was covered, including insight from markets for bitcoin, international linkages at the level of individual U.S. states, technical contributions dealing with econometric theory, and the solution of rational expectations models (a full list of new working papers is provided elsewhere in this report).

In addition, the institute hosted a major research conference with the University of Houston and revived its public lecture series, renaming it Global Perspectives.

## Academic Research

The year 2015 was the institute's best to date in terms of journal acceptances, with permanent staff contributing 13 papers. While the acceptance rate was notably lower in 2016, staff had papers accepted for publication in several peer-reviewed journals, including:

- *Journal of Monetary Economics* (Carnegie-Rochester Conference Series)—“Capital Controls and Monetary Policy Autonomy in a Small Open Economy,” by J. Scott Davis and Ignacio Presno
- *Journal of International Economics*—“Distribution Capital and the Short- and Long-Run Import Demand Elasticity,” also by Davis with Mario J. Crucini

- *Open Economies Review*—“A Quantitative Assessment of the Role of Incomplete Asset Markets on the Dynamics of the Real Exchange Rate,” by Enrique Martínez-García
- *Review of Regional Studies*—“Diversification and Specialization of U.S. States,” by Janet Koech and Mark A. Wynne, forthcoming

In addition, Cambridge University Press in spring 2016 published the proceedings of the institute's 2014 centennial conference as *The Federal Reserve's Role in the Global Economy: A Historical Perspective* (Michael D. Bordo and Wynne, editors).

At year-end, the staff had papers under review at *Econometrica*, the *Journal of Monetary Economics* and the *Review of Financial Studies*.

## Conferences

The institute organized one major research conference in 2016, a collaboration with the University of Houston that is expected to become an annual event alternating between Dallas and Houston. The conference featured presentations from researchers at the University of Houston as well as the Federal Reserve Board of Governors and Federal Reserve Bank of Minneapolis and Harvard, Pennsylvania State, Princeton and Stanford universities. A full summary of the conference by Michael Sposi is presented elsewhere in this report.

Staff presented their work at high-profile conferences and in university seminars throughout 2016. These included the Carnegie-Rochester-New York University Conference Series on Public Policy, Fall Midwest Trade meeting, International Association for Applied Econometrics conference, Midwest Macroeconomics meeting and RIDGE Workshop on Trade and Firm Dynamics, plus meetings of the Allied Social Sciences Association, Econometric Society, Midwest Economics Association, Society for Economic Dynamics, Southern Economic Association,

Spanish Economic Association, System Committee on International Economic Analysis and Western Economic Association. Staff also gave seminar presentations abroad at the Bank for International Settlements–Hong Kong, Reserve Bank of New Zealand, Shanghai University of Finance and Economics and University of Exeter (UK) and at home at Arizona State University, Marquette University, Purdue University and University of Texas.

### Bank Publications

Institute staff contributed seven articles to the Bank's *Economic Letter* publication: "Emerging-Market Debtor Nations Likely to Follow Fed Rate Boosts," by Davis; "Consequences of the Euro: Monetary Union, Economic Disunion?" by Martínez-García and Valerie Grossman; "Stock Market Provides Imperfect View of Real U.S. Economy," by Julieta Yung; "Impact of Chinese Slowdown on U.S. No Longer Negligible," by Alexander Chudik and Arthur Hinojosa; "Global Demographic Trends Shape Policy Environment," by Wynne; "Risk, Uncertainty Separately Cloud Global Growth Forecasting," by Chudik, Martínez-García and Grossman; and "U.S. Productivity Growth Flowing Downstream," by Sposi and Kelvinder Viridi. *Economic Letter* is designed to disseminate research to a broad nontechnical audience.

### Institute Public Lecture Becomes Global Perspectives

The institute extended its public lecture series, which resumed toward the end of 2015. The series was rebranded as Global Perspectives and featured several high-profile speakers. February's Trilateral Conference was highlighted by a panel discussion between Dallas Fed President Robert S. Kaplan, Bank of Canada Governor Stephen S. Poloz and Banco de México Governor Agustín Carstens. The series continued with

former U.S. Treasury Secretary Henry Paulson in March, followed by Harvard Business School Dean Nitin Nohria in June, former U.S. Treasury Secretary Larry Summers in September, former U.S. Treasury Secretary Robert Rubin in October and, finally, former Bank of England Governor Lord Mervyn King in November. An edited version of the conversation between Kaplan and Lord King appears elsewhere in this report.

### People

There were no new hires to the permanent staff in 2016. Agustín Bénétrix (Trinity College Dublin), Daniel Riera-Crichton (Bates College), Jae Won Lee (Seoul National University), Gina Pieters (Trinity University) and Nam Vu (Miami University) joined the institute's network of research associates. Mina Kim (Bureau of Labor Statistics) and Pieters visited the institute for the fall semester. Eric van Wincoop (University of Virginia) also visited for a week in the fall. Ariel Weinberger (University of Oklahoma) and Alejandro Rivera (University of Texas at Dallas) were also regular visitors during 2016.

**The institute extended its public lecture series, which resumed toward the end of 2015. The series was rebranded as Global Perspectives and featured several high-profile speakers.**



# Institute Working Papers Issued in 2016

Working papers can be found online at  
[www.dallasfed.org/institute/wpapers](http://www.dallasfed.org/institute/wpapers)

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**Optimal Monetary and Fiscal Policy at the Zero Lower Bound in a Small Open Economy**

*Saroj Bhattacharai, Konstantin Egorov*

No. 261

**Inflation as a Global Phenomenon—Some Implications for Policy Analysis and Forecasting**

*Ayse Kabukcuoglu, Enrique Martínez-García*

No. 262

**Quantitative Assessment of the Role of Incomplete Asset Markets on the Dynamics of the Real Exchange Rate**

*Enrique Martínez-García*

No. 263

**The U.S. Oil Supply Revolution and the Global Economy**

*Kamilar Mohaddes, Mehdi Raissi*

No. 264

**The Implications of Liquidity Expansion in China for the U.S. Dollar**

*Wensheng Kang, Ronald A. Ratti, Joaquin L. Vespignani*

No. 265

**Endogenous Firm Competition and the Cyclicalities of Markups**

*Hassan Afrouzi*

No. 266

**Wages and Human Capital in Finance: International Evidence, 1970-2005**

*Hamid Boustanifar, Everett Grant, Ariell Reshef*

No. 267

**Economic Fundamentals and Monetary Policy Autonomy**

*Scott Davis*

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**Big Data Analytics: A New Perspective**

*Alexander Chudik, George Kapetanios, M. Hashem Pesaran*

No. 269

**The Post-Crisis Slump in the Euro Area and the U.S.: Evidence from an Estimated Three-Region DSGE Model**

*Robert Kollmann, Beatrice Pataracchia, Rafal Raciborski, Marco Ratto, Werner Roeger, Lukas Vogel*

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**China's Slowdown and Global Financial Market Volatility: Is World Growth Losing Out?**

*Paul Cashin, Kamilar Mohaddes, Mehdi Raissi*

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**The Deep Historical Roots of Macroeconomic Volatility**

*Sam Hak Kan Tang, Charles Ka Yui Leung*

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**Optimal Monetary Policy in Open Economies Revisited**

*Ippei Fujiwara, Jiao Wang*

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**Banking Crises, External Crises and Gross Capital Flows**

*Thorsten Janus, Daniel Riera-Crichton*

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**The Market Resources Method for Solving Dynamic Optimization Problems**

*Ayse Kabukcuoglu, Enrique Martínez-García*

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**Breaking Down World Trade Elasticities: A Panel ECM Approach**

*Jaime Martínez-Martin*

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**Is the Renminbi a Safe Haven?**

*Rasmus Fatum, Yohei Yamamoto, Guozhong Zhu*

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**Oil Prices and the Global Economy: Is It Different This Time Around?**

*Kamilar Mohaddes, M. Hashem Pesaran*

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**On What States Do Prices Depend? Answers From Ecuador**

*Craig Benedict, Mario J. Crucini, Anthony Landry*

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**Trends and Cycles in Small Open Economies: Making the Case for a General Equilibrium Approach**

*Kan Chen, Mario Crucini*

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**Exposure to International Crises: Trade vs. Financial Contagion**

*Everett Grant*

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**Half-Panel Jackknife Fixed Effects Estimation of Panels with Weakly Exogenous Regressors**

*Alexander Chudik, M. Hashem Pesaran, Jui-Chung Yang*

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**The Speed of Exchange Rate Pass-Through**

*Barthélémy Bonadio, Andreas M. Fischer, Philip Sauré*

No. 283

**Central Bank Communications: A Case Study**

*Scott Davis, Mark A. Wynne*

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**Diversification and Specialization of U.S. States**

*Janet Koech, Mark A. Wynne*

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**System Reduction and Finite-Order VAR Solution Methods for Linear Rational Expectations Models**

*Enrique Martínez-García*

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**FDI and the Task Content of Domestic Employment for U.S. Multinationals**

*Alexis Grimm, Mina Kim*

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**Macroeconomic News and Asset Prices Before and After the Zero Lower Bound**

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**Financial Performance and Macroeconomic Fundamentals in Emerging Market Economies over the Global Financial Cycle**

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**Globalization, Market Structure and Inflation Dynamics**

*Sophie Guilloux-Nefussi*

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**A One-Covariate at a Time, Multiple Testing Approach to Variable Selection in High-Dimensional Linear Regression Models**

*Alexander Chudik, George Kapetanios, M. Hashem Pesaran*

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**Do Oil Endowment and Productivity Matter for Accumulation of International Reserves?**

*Rasmus Fatum, Guozhong Zhu, Wenjie Hui*

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**Does Bitcoin Reveal New Information About Exchange Rates and Financial Integration?**

*Gina Pieters*

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**Financial Regulations and Price Inconsistencies across Bitcoin Markets**

*Gina Pieters, Sofia Vivanco*

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**Capital Goods Trade, Relative Prices, and Economic Development**

*Piyusha Mutreja, B. Ravikumar, Michael Sposi*

# Institute Staff and Senior Fellows

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