

# Inflation Dynamics and Monetary Policy: An Introduction to the 2015 Economic Policy Symposium

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Following the global financial crisis and Great Recession, inflation in many countries has behaved unexpectedly. Inflation rates in advanced economies have run below targets despite aggressive monetary actions, and the international dimensions of inflation are of increasing importance. These observations make policymakers question the extent of change in the relationship between inflation and monetary policy. Investigating this issue requires dissecting both micro-level and macro-level data using novel frameworks.

To address these issues as central banks contemplate monetary policy implications for inflation dynamics, the Federal Reserve Bank of Kansas City sponsored a symposium titled “Inflation Dynamics and Monetary Policy,” Aug. 28-30, 2015, in Jackson Hole, Wyo. Participants included central bankers, academic economists and individuals from around the world who are engaged in the analysis of inflation dynamics.

A number of themes emerged during the proceedings. First, to ensure price stability over time, central banks should accept responsibility for price stability and acknowledge that controlling inflation is an imperfect process. Second, a key challenge in setting the proper course for monetary policy is disentangling normal business cycle dynamics from longer-run trends in the data. Third, the conduct of policy when interest rates are constrained at the zero lower bound presents unique challenges for achieving price stability. Fourth, the

currency in which imports are priced plays a key role in the degree to which fluctuations in exchange rates affect inflation dynamics in a given country. For countries in which imports are priced in the domestic currency, inflation dynamics largely will be insulated from exchange rate shocks. And fifth, the way firms adjust prices in response to changing conditions, particularly when financially constrained, can result in inflation dynamics that differ greatly from those predicted by standard macroeconomic models.

### **The Role of Financial Frictions in Inflation Dynamics**

Professor Simon Gilchrist of Boston University and Federal Reserve Board economist Egon Zakrajšek presented a paper that addressed why prices failed to decline in the face of significant and long-lasting slack following the Great Recession. They presented empirical evidence from the past four decades showing that the response of industry-specific inflation to changes in aggregate financial conditions depends upon differences in the ease of access to credit. For industries in which firms faced a high likelihood of financial constraints, inflation is insensitive to changes in financial conditions. On the other hand, industries in which firms have ready access to credit see a significant decline in inflation in response to tighter credit conditions.

These empirical findings support their hypothesis that changes in financial conditions affect the dynamics of producer prices over the business cycle. Gilchrist and Zakrajšek use a model to illustrate how firms' access to external finance alters the response of output and inflation. In tight credit conditions, liquid firms take advantage of the opportunity to steal market share from illiquid firms by cutting prices. Illiquid firms will set higher prices to generate more cash flow today and avoid expensive external finance. Through this mechanism, output falls but overall inflation can increase following a financial crisis, a dynamic very different from standard macroeconomic models. Thus, the role of financial frictions may help explain the unorthodox behavior of inflation in the Great Recession and the subsequent recovery.

Their discussant, Professor Peter Klenow of Stanford University, discussed additional evidence on the role of customer markets and

firms' pricing responses over the business cycle. Recent studies have found increasing evidence that supports the idea that firms grow by acquiring customers, not just by lowering prices or improving product quality. Such studies support the authors' finding that liquid firms will sharply reduce prices when credit is tight to increase their future market share. Klenow also discussed the behavior of average prices relative to costs following the Great Recession. While Gilchrist and Zakrajšek showed that some firms increased prices while others cut prices following the financial crisis, the overall effect on aggregate prices relative to costs is not clear. Klenow discussed related research that provides evidence in support of the authors' view that the actions of financially constrained firms that increased their markup of prices over costs contributed to the depth of the Great Recession and the relatively modest disinflation.

### **The International Price System**

Professor Gita Gopinath of Harvard University provided empirical evidence on international prices and global trade dynamics across 35 developed and developing countries. Changes in the prices of a country's currency are important factors in determining international spillovers of monetary policy as well as international trade competitiveness. International prices are characterized by two key features. First, the vast majority of world trade is invoiced in a few currencies, predominantly in U.S. dollars. Second, international prices are not very sensitive to exchange rates at horizons of up to two years.

Based on these characteristics, the behavior of prices for trade goods largely is determined by the currency in which the price is invoiced. In that sense, a country's inflation sensitivity to exchange rate fluctuations is related to the fraction of its imports that are invoiced in a foreign currency. For the United States, inflation is insulated from exchange rate shocks because 93 percent of imports are invoiced in U.S. dollars. On the other hand, inflation in other countries can be highly sensitive to exchange rate fluctuations because the fraction of imports invoiced in each home currency typically is less than 25 percent. As a result, exchange rate depreciations (appreciations) make U.S. exports less (more) expensive, while for other countries they mainly raise (lower) prices relative to costs, hence affecting profits.

Professor Charles Engel of the University of Wisconsin discussed Gopinath's paper, focusing on the invoicing currency decision and monetary policy implications. He highlighted Gopinath's suggestion that a firm may choose to keep its prices similar to those of its competitors by setting prices in an agreed upon currency, such as the U.S. dollar. As long as all firms set their prices in this common currency, their prices will remain relative to each other and will be insensitive to exchange rate movements. An interesting follow-up question related to how firms settle on a common currency for pricing relative to the more traditional practice of pricing in the local currency where the good is being sold. Engel also discussed the link between import price behavior and the prices of consumer goods. Since nearly all consumer goods are priced in the local currency, more investigation is needed to understand the link between import prices and consumer goods prices and to better understand the interactions of exporters, distributors and consumers. Finally, Engel discussed implications of the international price system for the independence of monetary policy within a country as well as global repercussions of monetary policy through demand and exchange rate channels.

### **Central Bank Perspectives on Inflation Dynamics**

To complement the discussion of inflation dynamics, a panel of central bankers and academics from several countries shared views on inflation experiences. Thomas Jordan, chairman of the Swiss National Bank, discussed the effect of international spillovers on inflation dynamics in Switzerland. A key question is whether a central bank, particularly in a small open economy, can independently control inflation given the increases of globalization and interconnectedness of financial markets. In Switzerland, the Swiss currency is far more important in the international financial system than the size of the country would suggest. Spillover effects through the exchange rate, thus, play an outsized role for Switzerland with respect to inflation dynamics. Prior to the financial crisis, the Swiss experience confirmed it never is appropriate to use monetary policy to fine-tune the inflation rate. Following the financial crisis, the Swiss experience also suggested that sometimes it may be difficult for small open economies to control inflation. Unconventional monetary policy may mitigate

adverse effects of spillovers to inflation, but such policy should be aimed toward medium-term price stability and not toward fine-tuning inflation.

Professor Athanasios Orphanides of the Massachusetts Institute of Technology discussed the principles and guides that can help a central bank ensure price stability over time. A first principle is that a central bank must accept responsibility for price stability. A second complementary principle is that a central bank should acknowledge that controlling inflation is an imperfect process. Since monetary policy is a blunt instrument, it is not realistic to expect a central bank to be able to use policy to fine-tune inflation. To help guide policy, central bankers employ macroeconomic models. But given the imperfections of such models, proper risk management should focus on assessing the risks that lie outside of these models and identifying a robust framework for monetary policy decisionmaking that best achieves and maintains price stability.

Rodrigo Vergara, governor of the Bank of Chile, discussed the recent inflationary experience of Latin America. While most advanced economies have experienced low inflation following the Great Recession, inflation in many Latin American countries has increased sharply in the past two years. This surge has coincided with a slowdown in activity, resulting in part from a combination of external shocks and structural factors that make these countries susceptible to such shocks to inflation dynamics. The primary external shock was the end of the commodity boom, which led to large spillover effects because commodities account for a relatively large share of exports in many Latin American countries. The effect of the shock then was magnified by the relatively high degree of exchange rate pass-through, which tends to amplify the inflationary effect of external shocks in Latin American countries.

## **The Outlook for China**

Professor David Li of Tsinghua University gave the luncheon address and discussed recent developments in the Chinese economy. Three main factors have contributed to recent volatility in the Chinese economy and financial markets: slowdowns in 1) export growth, 2) residential construction and 3) non-residential investment.

These shifts are occurring as China is transitioning toward a consumption-driven economy fueled by rising wage rates and increases in disposable income. As this transition continues, three conditions are very critical to supporting sustainable growth in China. First, institutions and government policies should be reasonably pro-market. Second, investment in education is essential for human capital development. And third, China needs to have good working relationships with advanced economies.

To achieve this growth, China will need to overcome several challenges. Regarding the financial sector, the current high level of financing costs is constraining economic activity. China should establish new institutions or structures to provide lower-cost access to credit, particularly for needed long-term infrastructure projects. Local governments should be given mandates to finish scheduled investments in infrastructure to avoid delays in needed upgrades. Finally, announced reforms should be implemented, including the reform of state-owned enterprises and planned cuts in taxes.

### **The Bumpy Story of Inflation and Monetary Policy**

Professor Jon Faust of Johns Hopkins University and Professor Eric Leeper of Indiana University presented a paper that addressed the complicated relationship between monetary policy behavior and inflation dynamics. They challenged the conventional perspective that monetary policy appropriately responds to normal business cycle dynamics. In that conventional view, central banks promote inflation stability by behaving in a simple and systematic manner, as roughly described by some type of Taylor rule. They offered instead an alternative view of the world with one major difference: aggregate inflation and real-side dynamics reflect disparate and persistent movements in countless variables. As a result, the policy implications of such movements cannot be captured well by a few conventional summary statistics, such as rates of inflation and unemployment.

In support of this alternative view, they provide evidence that undermines the conventional view of a systematic relationship between inflation dynamics and monetary policy behavior. First, they show that historical models of standard business cycle dynamics essentially

have been of no value in predicting inflation dynamics. Second, they highlight the ever-present challenge of trying to measure the economy, where one must attempt to separate longer-run trends from short-run business cycle dynamics. With limited ability to distinguish trend and cycle in real time, one is severely hampered in trying to apply conventional business cycle dynamics to discern appropriate policy responses. Third, they highlight additional issues that arise if business cycle dynamics and other dynamics interact in a way that cannot be disentangled. They conclude by advising that economists and policymakers should stop looking for simple and straightforward solutions to the challenges that monetary policy poses.

Their discussant, Professor Takatoshi Ito of Columbia University, examined the debate between the conventional and alternative view of inflation dynamics and offered an assessment based on the experience of the Japanese economy. While the authors are correct in pointing out the challenges of separating long-run trends from short-run business cycle dynamics, economists long have been aware of these challenges and have created a wide set of techniques and models to deal with such concerns. However, a challenge remains for assessing what “normal” looks like and how and when the economy will return to “normal”: what is normal in one period is abnormal in another. As an example, Ito discussed Japan’s experience and the effect of demographic change. One certain outcome of an aging population is that it lowers the potential growth rate of the economy, primarily through a reduction in the number of workers. A debatable outcome is the effect of demographics on inflation. Most economists believe there is no link between aging and inflation, but a few suggest that an aging population has contributed to disinflationary pressure in Japan. The ultimate answer may be somewhere in between: Japanese policy actions have shown the inflation rate can be controlled, if not precisely, even when aging is under way.

### **Inflation During and After the Zero Lower Bound**

Professor S. Borağan Arouba of the University of Maryland and Professor Frank Schorfheide of the University of Pennsylvania presented a paper that examines inflation dynamics during and following periods in which the nominal interest rate is constrained at the

zero lower bound. They considered the experience of three countries/ areas that have experienced periods with interest rates at the zero lower bound: Japan, the United States and the euro area. For the United States, the zero lower bound episode has been associated with positive inflation, while GDP deflator inflation has been negative in Japan with the exception of two short periods of positive inflation. For the euro area, inflation rates have been falling toward the end of the sample as the policy rate has approached zero.

The authors presented a model to examine whether these historical episodes can be characterized as two distinct outcomes: an “inflation target” equilibrium with positive inflation and a deflationary equilibrium. This approach attempts to capture three stylized facts that are hard to match with standard models: 1) inflation is persistent, 2) a key part of inflation dynamics is driven by a slowly changing trend and 3) inflation is hard to predict. Using the model to explain the experiences in the United States and Japan, the results suggest the deflationary equilibrium fits the data poorly for both countries. The model has difficulty determining whether Japan has remained within the “inflation target” regime or a sudden change of expectations has shifted Japan to the deflationary equilibrium. There is little evidence to support a shift in the United States toward a deflationary equilibrium.

Their discussant, Lucrezia Reichlin of the London Business School, examined the implications of the model for the conduct of monetary policy. To avoid a deflationary equilibrium, the model prescribes increasing the interest rate when inflation falls below a certain threshold. However, putting this policy into practice would carry a substantial risk of a short-term contractionary effect on output. The empirical evidence for Japan in the late 1990s suggests this scenario played out. An open question is whether the modeling approach of Arouba and Schorfheide is appropriate to analyze the facts at the zero lower bound and policy to avoid deflation. Models are simplistic by design and important factors, such as the role of expectations in the conduct of monetary policy, also should be considered on this topic.

### **Global Inflation Dynamics and Monetary Policy**

In the closing panel of central bankers, Mark Carney, governor of the Bank of England, examined the relationship between the global

financial cycle and global inflation dynamics and what that means for policymakers. While global linkages, including commodity markets, goods and services trades and financial channels, provide an ever-present influence on economic activity across countries, domestic economic conditions still matter very much. The importance of domestic conditions is apparent in the divergence in monetary policy, particularly when adjusting for unconventional policy actions. As policymakers seek to determine the appropriate path for their respective policy rates, they will continue to monitor a wide range of domestic economic indicators while also weighing global factors and risks that have the potential to spill over to domestic conditions.

Vítor Constâncio, vice-president of the European Central Bank, discussed euro area inflation dynamics and implications for monetary policy. One key challenge in recent years is that inflation dynamics have shown signs of instability, resulting in a sequence of erroneous inflation forecasts. From 2009 to 2011, inflation did not fall as much as past experiences would have predicted, and after 2012, inflation failed to return to target as expected. Many economists have questioned whether the relationship between inflation and real activity, summarized by the Phillips curve, weakened during this period. An approach that accounts for uncertainty in measuring slack and inflation expectations finds that the Phillips curve remains a useful tool for analysis in the euro area, suggesting that a sustained recovery of inflation is conditional upon economic growth and stable inflation expectations.

Stanley Fischer, vice chairman of the Board of Governors of the Federal Reserve System, shared comments on domestic and international factors that have held inflation persistently below 2 percent in the United States. While the sharp decline in oil prices clearly has held down headline inflation, measures of core inflation, which are intended to help us look through transitory price fluctuations, also have been relatively low. Economic slack and appreciation of the dollar appear to have been two contributors to downward pressure on inflation. Another key element is the role of inflation expectations. Stable inflation expectations over the past three decades likely have contributed to the long period of low and stable inflation. But he said we should question whether inflation expectations are remaining stable because various measures of inflation expectations have given

different signals over the past year. The Federal Open Market Committee has committed to fostering the movement of inflation toward its 2 percent objective, and through such actions will enhance the credibility of monetary policy and support the continued stability of inflation expectations.

Governor Raghuram Rajan of the Reserve Bank of India concluded with a discussion of the political economy of monetary policy. While much of the work of central bankers is based on a technical framework, the reality of central banking is that historical experience and the current political environment do influence the importance placed on various pieces of the economic framework. For example, the move toward inflation targeting likely was triggered by public dissatisfaction following the stagflation period of the 1970s. While many central banks have achieved low and stable inflation since then, India is engaged in a prolonged effort to reduce a high level of inflation. Despite a broad consensus that inflation should be lowered, it has not happened. Why? Likely because different parties are favored in the disinflationary process while others are hurt. Thus, the job of a central banker cannot be immune from political economy considerations, and such factors should be taken into account in discussions of the economy and monetary policy.