

Inflation Dynamics in a Post-Crisis Globalized Economy

By Mark Wynne



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he Great Recession that accompanied the global financial crisis—from which many advanced economies are still struggling to recover—

prompted extraordinary policy responses from central banks around the world. Some of these responses were coordinated, but all were directed at fulfilling purely domestic mandates for price stability and, in some cases, maximum employment. Fears that the dramatic expansion of central bank balance sheets would lead to higher inflation at the consumer level have so far proven unfounded, whether due to still-abundant slack in many countries or well-anchored inflation expectations.

But some have argued that an extended period of ultra-easy monetary policy is manifesting itself in excessive risk taking, bubbles in certain asset classes and price pressures in countries that are recipients of capital flows in search of yield, which will ultimately lead to higher inflation globally. At the same time, the debate has increasingly focused on the rapidly growing emerging and developing economies as their share of global output keeps rising. The disinflationary impact of the integration of these (generally) low-wage economies into the global trading system has challenged our understanding of the price-setting process at the national and international level and our understanding of exchange rate pass-through.

This forum discussing these and other aspects of inflation and price-setting follows two other joint Dallas Fed–Swiss National Bank conferences, “Microeconomic Aspects of The Globalization of Inflation” in 2011 and, more recently, “The Effect of Globalization on Market Structure, Industry Evolution and Pricing” (*see page 24*).

Globalization and Inflation Dynamics

The first two papers considered how globalization has affected inflation dynamics. This sub-

ject has been at the core of the institute’s research since the program was launched in 2007.¹ A key question is whether the greater integration of the global economy now means that measures of global, rather than domestic, resource utilization matter when assessing inflation pressures. Chart 1 shows measures of output gaps, one for the U.S., the other for the rest of the world excluding the U.S.

In “What Helps Forecast U.S. Inflation? Mind the Gap!” Enrique Martínez-García of the Dallas Fed and Ayşe Kabukçuoğlu of Koç University address this question from a forecasting perspective. A widely cited study by Andrew Atkeson and Lee Ohanian (2001) raised doubts about the ability of measures of resource utilization, or slack, to improve simple time-series-based forecasts of inflation.² Other studies have since documented a decline in the relationship between measures of domestic resource utilization and subsequent inflation. This decline coincides with the integration of large, emerging-market economies into the global trading system. So on the surface, it is plausible that global rather than domestic slack is the relevant driving force for inflation.

Martínez-García and Kabukçuoğlu find that measures of global slack have limited predictive power for U.S. inflation. However, they also find that the terms of trade (or rather, the deviation of the terms of trade from trend) help forecast inflation in the U.S. Moreover, this seems to be a relatively robust result because the terms of trade work well for different measures of inflation and over different time periods. In some sense, this result is not too surprising. In an earlier paper, Martínez-García and Mark Wynne (2010) had shown that the open-economy Phillips curve can be written either as a relationship between inflation and domestic and foreign slack, or as a

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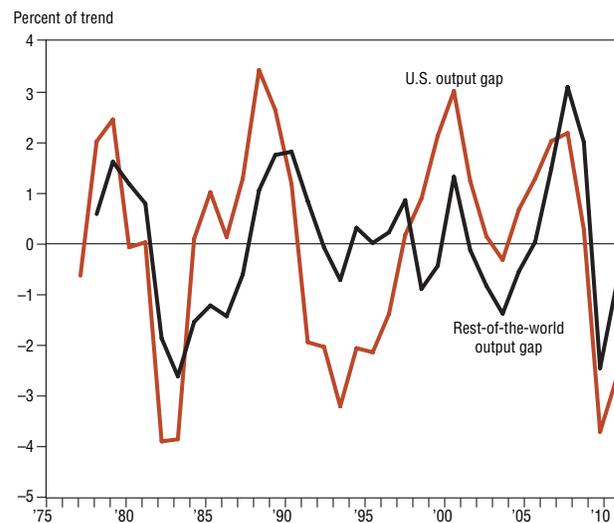
When: Aug. 22–23

Where: Swiss National Bank, Zurich

Sponsors: Federal Reserve Bank of Dallas

Globalization and Monetary Policy Institute, Swiss National Bank, Bank for International Settlements, Center for Economic Policy Research

Chart 1
U.S. and Foreign Output Gaps



SOURCE: Author's calculations.

relationship between inflation, domestic slack and the terms-of-trade gap.³

Measuring resource utilization is challenging in the best of times; measuring resource utilization in rapidly growing emerging-market economies undergoing structural change is even more challenging. But measuring the terms of trade—the relative price of imports in terms of exports—is a lot easier because data on the prices of imports and exports are more readily available. Martínez-García and Kabukçuoglu go a step further in their paper and try to understand the reasons for their forecast results by simulating a workhorse New Keynesian open-economy model and investigating what factors might account for their findings. They conclude that a run of good luck (in the period prior to the financial crisis) in conjunction with better monetary policy can best account for their findings, with globalization playing an important complementary role.

In “Globalization and Inflation: Structural Evidence from a Time Varying VAR Approach,” Francesco Bianchi of Duke University and An-

drea Civelli of the University of Arkansas evaluate the global slack hypothesis using data from 18 countries. Instead of focusing on whether measures of global slack can help forecast domestic inflation in the group of Organization for Economic Cooperation and Development (OECD) countries they include in their study, they ask whether there is any evidence that globalization has altered inflation dynamics in these countries in a manner consistent with the global slack hypothesis. Importantly, they use a methodology (time-varying coefficient vector autoregressions) that allows the impact of global factors to change over the sample period (1971 to 2006; they end their study before the onset of the recent global financial crisis).

They find that—consistent with the global slack hypothesis—global slack affects the dynamics of inflation in many countries, but, contrary to the global slack hypothesis, the effects of global slack do not get stronger over time as these countries become more integrated into the global economy. This puzzling finding is similar to the

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results reported by Martínez-García and Wynne (2012) for the U.S.⁴

In discussing the paper, conference participants noted that the global slack hypothesis matters more for movements of inflation around trend because movements in trend inflation are largely determined by the actions of central banks. Others questioned the inclusion of measures of foreign slack and terms of trade in the specifications of the open-economy Phillips curve given that both variables capture the same thing. (This point is also made in some detail in Martínez-García and Wynne 2012.)

Small open economies provide a natural laboratory in which to study the role of global forces in inflation dynamics. Such economies are more exposed to external shocks, and inflation may be more responsive to global resource utilization. Poland is a classic example of a small open economy. In the third paper in the session, “Does Domestic Output Gap Matter for Inflation in a Small Open Economy?” Aleksandra Halka and

Jacek Kotłowski of the National Bank of Poland examine the drivers of inflation in Poland.

The authors’ empirical strategy is to estimate a series of Phillips curves at the sectoral level. They use data from the Polish consumer price index at the four-digit COICOP (classification of individual consumption by purpose) level, which gives them 110 price series. Their sample period runs from 1999 through second quarter 2012.

Halka and Kotłowski find that more than half of the components of the Polish consumer price index (CPI) are sensitive to changes in domestic activity in Poland as measured by the Polish output gap. This is somewhat surprising given the highly open nature of Poland’s economy. They also report that the category of goods whose prices are most sensitive to changes in the exchange rate is durable goods.

Finally, Halka and Kotłowski construct a new Index of the Demand for Sensitive Goods (IDSG); that is, an index of the prices of those goods that seem to be most sensitive to the domestic business cycle in Poland. They find that while the new series tends to track the headline CPI reasonably well, the two series diverge significantly in 2007 to 2009. Specifically, headline CPI inflation was significantly lower than IDSG inflation during these years, possibly because the global financial crisis was associated with an increase in global slack that restrained the headline number. Poland came through the recent financial crisis in better shape than most other European countries. It experienced only one quarter of negative growth, fourth quarter 2008.

During the discussion, a question was posed: Why isn’t there more deflation in the euro area given the paper’s findings? If domestic inflation is as sensitive to domestic economic activity as the paper claims, we might expect to see a lot more deflation in some euro-area countries where there is clearly a large negative output gap (for example, Spain and Greece). It may be that the measures of the output gap used in this (and the previous papers in this session) are poor proxies for the pri-

Participants (from left) Andreas Fischer and Raphael Auer of the Swiss National Bank and Mark Wynne of the Dallas Fed.



mary driver of inflation in New Keynesian models, namely marginal costs. Conference participants also asked about the degree to which the domestic output gap in Poland can be differentiated from the output gap in, say, Germany given the high degree of integration between the two economies.

Price Setting

A key element in modern international macroeconomic models is how firms set prices in foreign and domestic markets. Selling internationally means that a firm has to decide whether to set its prices in the currency of the country where a good is produced (producer currency pricing) or in the currency of the country where the good is sold (local currency pricing). The option chosen will determine how much of a change in the exchange rate between the two currencies shows up in the prices of the final good.

Under local currency pricing, exchange rate pass-through should be zero; under producer currency pricing, the pass-through should be 1. A 10 percent depreciation of the dollar against the euro, for example, should be reflected in a 10 percent increase in the price of U.S. imports from the euro area. However, in practice, estimates of the degree of exchange rate pass-through fall outside the theoretical range of zero to 1, or, in the case of export prices, zero to minus 1. Empirical estimates range from -2.26 to 2.55.

In “Exchange Rate Pass-Through and Market Structure in a Multi-Country World,” Kanda Naknoi of the University of Connecticut proposes a simple solution to this puzzle. Naknoi argues that the key to understanding the discrepancy is that exporting firms typically do not compete against firms from just one country (or, more specifically, against firms pricing in just one other currency) but rather against firms from many countries. Thus, when the dollar appreciates against, say, the euro, U.S. exporters also need to factor into their pricing decisions what is happening to the value of the dollar against the yen, the pound sterling and so on. She presents a simple static partial-equilibrium model

of a firm’s pricing problem in a multicountry world that can generate estimates of exchange rate pass-through greater than zero. That is, in response to a depreciation of the euro against the dollar, a U.S. exporter might raise rather than lower the dollar price of exports.

Naknoi’s model is related to earlier work by Paul Bergin and Robert Feenstra (2009) that examines pricing decisions in a simple three-country environment.⁵ Whereas Naknoi works from a quadratic specification of preferences over differentiated goods (to generate variable elasticities of demand), Bergin and Feenstra start with a translog specification of the consumer expenditure function. Bergin and Feenstra use their model to account for changes in measured exchange rate pass-through to U.S. import prices. Naknoi reports simulations showing that her model can in principle account for the variation in estimates of exchange rate pass-through to export prices reported in the existing literature. An important open question is how her framework would perform in a general-equilibrium setting.

The second paper in this session addressed an important puzzle in international economics: Why are prices of tradable consumption goods higher in rich countries than in poor countries? It has been long known that there are large differences in the prices of nontradable goods across countries, with nontradables a lot cheaper in poor than in rich countries. Often this is attributed to differences in productivity between the traded and nontraded sectors in these countries, but recent research has shown that differences in productivity levels between traded and nontraded sectors is not large enough to account for the observed price differences. Tradable price differences are even more puzzling because they imply significant deviations from the law of one price (goods have one price in various locations after giving effect for exchange rate differences).

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demand for such goods, which arises from the fact that consumers in these countries typically import a wider variety of goods.⁶ In his presentation, “Why are Goods and Services More Expensive in Rich Countries? Demand Complementarities and Cross-Country Price Differences,” Daniel Murphy from the University of Virginia proposes an alternative explanation.

Murphy centers on the existence of complementary catalyst goods in rich countries. For example, consumers in rich countries are willing to pay more for cars because of the existence of good roads in these countries. Likewise, consumers in these countries are willing to pay more for electrical goods because of the presence of a reliable supply of electricity. Murphy tests his theory using data on Chinese and U.S. export prices and finds support for the core idea in the data. For example, a percentage-point increase in the fraction of roads that are paved is associated with a (statistically significant) 0.6 percent increase in the price of new cars. Likewise, a megawatt-hour increase in per capita electricity consumption (a proxy for access to electricity) is associated with an increase in the prices of electrical goods of between 2 and 6 percent (depending on whether we look at the prices of U.S. or Chinese exports of electrical goods). An important open consideration for future research is quantifying the role of demand complementarities in a more precise manner.

Monetary Policy Impact

Ultimately, of course, we are interested in how economic integration might impact the conduct of monetary policy. The benchmark for monetary policy in most countries is a variant of the rule first proposed by John Taylor (1993), which states that the policy rate should respond to deviations of inflation from target and deviations of output from potential.⁷ There is no role for external factors (such as the terms of trade or foreign slack) in such a rule. The final three papers address this question from different angles.

Raphael Schoenle of Brandeis University pre-

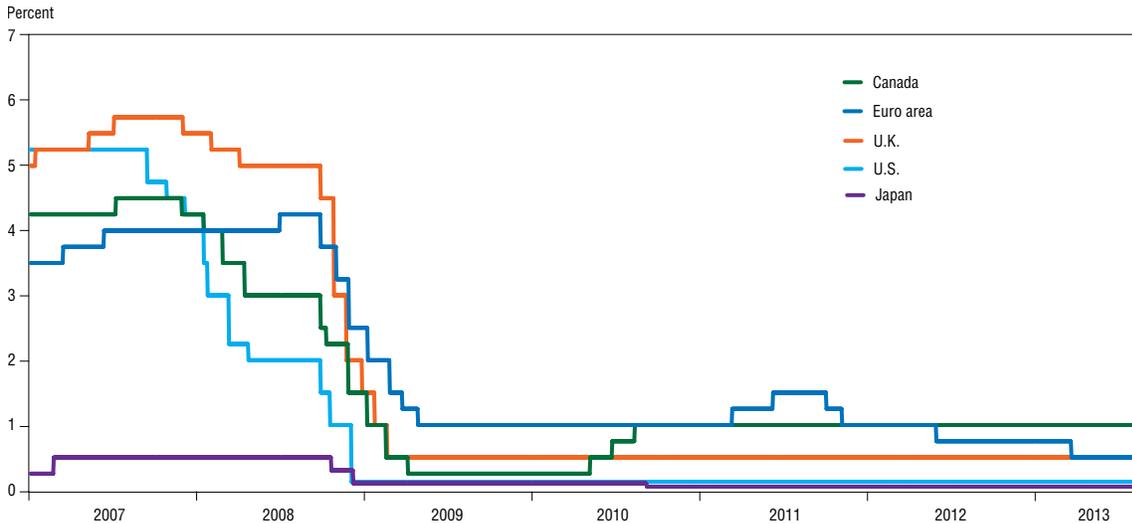
sented his joint paper with Simon Gilchrist of Boston University and Jae Sim and Egon Zakrajsek of the Federal Reserve Board on “Inflation Dynamics During the Financial Crisis.” The recent financial crisis was the most severe since the Great Depression, and Schoenle et al. ask whether firms’ pricing decisions during the crisis depended on the strength of their balance sheets. A major contribution of the paper is to match data on firms’ pricing from the Bureau of Labor Statistics’ producer price program with data on firms’ financial conditions from Compustat.

They find that at the peak of the crisis, firms with weaker balance sheets tended to increase prices, while those with stronger balance sheets lowered their prices. Specifically, in fourth quarter 2008, firms with relatively weak balance sheets (as measured by the ratio of a firm’s cash and other liquid assets to total assets) set prices in such a way as to produce a 20 percentage-point differential in factory gate inflation relative to firms with stronger balance sheets. Having documented these facts, the authors propose a theory of price setting that incorporates a financial constraint (in the form of a need to raise external finance to cover production costs through equity issuance). Their model is capable of generating widely differing inflation responses to various shocks depending on whether the financial friction is assumed binding or not.

The zero lower bound on policy rates—the inability to set interest rates below zero due to the existence of cash as an alternative store of value—was once thought to be a pathology of interest only to scholars of the Great Depression or of Japan following the bursting of its twin real estate and stock market bubbles in the late 1980s and early 1990s. However the policy response to the global financial crisis pushed interest rates to historic lows by early 2009, where they have remained (*Chart 2*).

Analyses of how economies respond to shocks now routinely take explicit account of the existence of the zero lower bound (see, for example,

Chart 2

Policy Rates in the Advanced Economies

SOURCES: National central banks; Haver Analytics.

the paper by Schoenle et al.). A paper by Gregor Bäurle and Daniel Kaufmann of the Swiss National Bank, “Exchange Rate and Price Dynamics at the Zero Lower Bound,” examines Switzerland’s experience with policy rates at the zero bound to see how the response of the economy differs in such circumstances. (Switzerland experienced two such episodes: the first from March 2003 to June 2004, and the second from January 2009 through May 2012.)⁸ A key determinant of the response to shocks in such an environment is how the central bank sets policy. If the central bank is engaged in inflation targeting, and long-run inflation expectations are anchored, a temporary shock may have permanent effects on the exchange rate and the price level (the idea of letting bygones be bygones). By contrast, if the central bank targets the price level rather than the inflation rate, these permanent effects of temporary shocks at the zero lower bound can be avoided.

How trade integration might impact the conduct of monetary policy is addressed explicitly in Matteo Cacciatore and Fabio Ghironi’s paper, “Trade, Unemployment and Monetary Policy.”

Cacciatore of HEC Montreal and Ghironi of Boston College examine how the optimal conduct of policy changes as trade linkages grow, developing a rich two-country model with multiple distortions (due to sticky prices and wages, firm monopoly power, labor market search and incomplete financial markets) that can potentially be offset by monetary policy. They report three major findings. First, when trade linkages between countries are weak, optimal monetary policy is inward-looking and gives little weight to foreign developments. Optimal monetary policy in this situation calls for a low but positive rate of inflation to offset some of the distortions in the economy. Second, as international trade increases and more productive firms gain market share, there is less need to use inflation to offset these distortions. And third, as trade becomes more integrated, business cycles become more synchronized across countries and there is less to be gained from conducting monetary policy in a cooperative versus noncooperative manner.

At a minimum, globalization changes the sources of the shocks to which monetary policy makers must respond in fulfilling their mandate for price stability.

Conclusions and Future Directions

As with most research conferences, this conference raised as many questions as it answered. The key question driving the research agenda of the globalization institute is how the increased integration of the global economy through trade and financial channels affects the conduct of monetary policy in the U.S. At a minimum, globalization changes the sources of the shocks to which monetary policy makers must respond in fulfilling their mandate for price stability (and, as in the case of the U.S., maximum sustainable employment). But it could potentially alter the nature of optimal monetary policy and the design of policy rules.

An ongoing challenge is accurate measurement of the output gap. The basic New Keynesian Phillips curve is usually written as a relationship between inflation, expected inflation and real marginal costs. The relationship can also be written in terms of the output gap if one is willing to make certain assumptions about the structure of the labor market. However, the concept of the output gap that is consistent with New Keynesian theory is very different from the concept commonly employed in empirical exercises such as those reported in the Martínez-García and Kabukçuoglu, Bianchi and Civelli, and Halka and Kotłowski papers presented at the conference.

This point has been known for some time (see, for example, Neiss and Nelson 2003).⁹ Indeed, Martínez-García and Kabukçuoglu mention it in their paper and report some figures showing that, depending on how a model is parameterized, there may be a positive, a negative or no relationship between the theory-consistent measure of the output gap and a measure constructed using a Hodrick–Prescott filter. Of course, one option would be to rely on measures of real marginal costs instead as the driving variable, but finding the data necessary to construct such measures for emerging-market economies that play such an important role in global inflation dynamics is an enormous challenge.

A second theme that emerged in conference

discussions dealt with the behavior of inflation during the recent financial crisis. Given the enormous amount of slack that emerged during the crisis, it is perhaps surprising that inflation did not fall by more than it did, or that more countries did not experience outright deflation. Some have attributed this to strong anchoring of inflation expectations.

However, as the discussion of the Halka and Kotłowski paper showed, if domestic factors truly are as important in driving price developments at the sectoral level, we should have seen more deflation. One possible resolution to this puzzle is suggested by the Schoenle et al. paper that draws attention to the importance of firms' financial conditions in setting prices. Of course, Schoenle et al. are only able to study price developments at the producer level. Central banks are more interested in price developments as measured by consumer price indexes, but the pricing decisions of retailers and the factors influencing them involve many more margins that are only imperfectly understood. Bäurle and Kaufmann's paper also provided evidence based on the Swiss experience that the transmission of shocks may differ when a central bank sets its policy rate at the zero lower bound, suggesting that the response to the financial recession may have also played a role in changing the transmission mechanism for monetary policy.

And, finally, there is the question of how monetary policy ought to be conducted in a highly integrated global economy. The paper by Cacciatore and Ghironi seems to suggest that inward-looking policies continue to deliver good outcomes even as the world becomes more integrated. But such findings tend to be sensitive to the details of the model environment used to study monetary policy and, in particular, to the degree of business-cycle synchronization that the economies attain under a given policy framework. Robust policy rules and guidelines for monetary policy are still some way off.

Cacciatore and Ghironi model trade integration as coming about through trade in final goods.

However, trade in intermediate goods is a defining feature of the modern era of globalization, and it would be useful to know how robust the Cacciatore and Ghironi results are to such an extension.

In light of the Naknoi results—how going from a two-country to a multicountry setting can help explain certain results in the exchange rate pass-through literature—it might also be useful to see an extension of the Cacciatore and Ghironi framework that allows for foreign trade partners that adopt different exchange regimes vis-à-vis the home country, specifically fixed and floating.

Notes

¹ See, for example: “Openness and Inflation,” by Mark A. Wynne and Erasmus Kersting, Federal Reserve Bank of Dallas *Staff Papers*, no. 2, April 2007; “Obstacles to Measuring Global Output Gaps,” by Wynne and Genevieve R. Solomon, Federal Reserve Bank of Dallas *Economic Letter*, vol. 2, no. 3, 2007; “The Global Slack Hypothesis,” by Enrique Martínez-García and Wynne, Federal Reserve Bank of Dallas *Staff Papers*, no. 10, September 2010; and “Global Slack as a Determinant of U.S. Inflation,” by Martínez-García and Wynne, Federal Reserve Bank of Dallas, Globalization and Monetary Policy Institute Working Paper no. 105, August 2012.

Also see: “Global Slack and Domestic Inflation Rates: A Structural Investigation for G-7 Countries,” by Fabio Milani, *Journal of Macroeconomics*, vol. 32, 2010, pp. 968–81; “Has Globalization Transformed U.S. Macroeconomic Dynamics?” by Milani, *Macroeconomic Dynamics*, vol. 16, no. 2, 2012, pp. 204–29; “Globalization, Domestic Inflation and Global Output Gaps: Evidence from the Euro Area,” by Alessandro Calza, Federal Reserve Bank of Dallas, Globalization and Monetary Policy Institute Working Paper no. 13, May 2008; and “Some Preliminary Evidence on the Globalization–Inflation Nexus,” by Sophie Guilloux and Enisse Kharoubi, Federal Reserve Bank of Dallas, Globalization and Monetary Policy Institute Working Paper no. 18, July 2008.

² “Are Phillips Curves Useful for Forecasting Inflation?” by Andrew Atkeson and Lee Ohanian, Federal Reserve Bank of Minneapolis *Quarterly Review*, Winter 2001, pp. 2–11.

³ See note 1, Martínez-García and Wynne (2010).

⁴ See note 1, Martínez-García and Wynne (2012).

⁵ See “Pass-Through of Exchange Rates and Competition Between Floaters and Fixers,” by Paul R. Bergin and Robert C. Feenstra, *Journal of Money, Credit and Banking*, vol. 41, no. s1, 2009, pp. 35–70.

⁶ See “Income Differences and Prices of Tradables,” by Ina



Conference participants considered how the increased integration of the global economy through trade and financial channels affects monetary policy.

Simonovska, Federal Reserve Bank of Dallas, Globalization and Monetary Policy Institute Working Paper no. 55, July 2010.

⁷ See “Discretion Versus Policy Rules in Practice,” by John B. Taylor, *Carnegie Rochester Conference Series on Public Policy*, vol. 39, no. 1, 1993, pp. 195–214.

⁸ Switzerland also experienced episodes of zero interest rates (as measured by the call money rate) in the 1970s, from 1977 through 1979.

⁹ See “The Real-Interest-Rate Gap as an Inflation Indicator,” by Katharine Neiss and Edward S. Nelson, *Macroeconomic Dynamics*, vol. 7, no. 2, 2003, pp. 239–62.