Is Globalization Changing Monetary Policy: An exploration of recent evidence

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Abstract

Globalization has been rigorously studied amongst academics who examine portions of the economy that are not directly linked to monetary policy, including analyzing its impact on wealth and income, the environment, and specific industry sectors. However, globalization's effect is more far-reaching than analysis on subsections of the economy reveal. In fact, evidence from recent years suggests that increased financial and economic interconnectivity has impacted key metrics, potentially altering the mechanisms by which central banks approach monetary policy. This study seeks to unpack the complex interplay between trade, international financial markets, and the various means by which their integration could change macroeconomic orthodoxy.

1. Introduction

One of the most transformative developments in recent human history has been the advent of globalization. Its rapid expansion began in the early 1990s and, for the most part, has continued without interruption. During this period, large advances have been made in the quality of human life. This is shown in part through the world’s Human Development Index rating (accounting for a long and healthy life, knowledge level, and a decent standard of living), which has experienced an average annual growth rate of 73 percent, as well as through the 64 percent decrease in the amount of people living in extreme poverty since 1990 (United Nations Human Development Reports, 2016; World Bank, 2016).

Immense cross-discipline interest in the study of globalization has been generated as well, as sociologists, psychologists, and political scientists have examined it for its impact on society’s social fabric. Economic inquiries, on the other hand, have been focused mostly on non-monetary
areas, analyzing globalizations influence on wealth and income, the environment, labor, and specific industry classifications (Wagner, 2005). However, as this study will examine, globalization’s impact is more far-reaching than restrained analysis on portions of the economy reveal. In addition to, and partially resulting from, features such as outsourced labor and production, recent evidence suggests key metrics used by central banks to evaluate the macroeconomy and set monetary policy are being increasingly impacted by globalization, and that these trends may require adaptations in the structure of the empirical models used to evaluate macroeconomic parameters.

In this study, we have reviewed existing analysis of globalization’s impact on macroeconomic indicators, and have determined there are two significant channels by which globalization is changing monetary policymaking: the Phillips Curve and financial markets. The remainder of the paper is as follows. In Section 2, a brief overview of monetary policy and its importance is discussed, followed by a review of the recent trend toward unconventional monetary policy in Section 3. Section 4 describes the specific relevance of the identified key metrics (the Phillips Curve and financial markets) to central bank action. Section 5 is a discussion of key terms and perspectives needed to be deconstructed for conceptualizing globalization in the context of monetary policy. Section 6 and 7 are technical reviews of globalization’s impact on theoretical models for the Phillips Curve and financial markets respectively. Each of these sections also includes relevant case studies that display the theoretical impacts in a real-world setting. Section 8 examines potential monetary policy implications, highlighting key areas of note for central banks, and the last section concludes the study and outlines a direction for future research.
2. Monetary Policy Overview

Monetary policy has a significant impact on a nation’s overall economy, but is often not fully understood as a method for influencing the macro-economy. The two most important channels through which macroeconomic policy is exercised are fiscal and monetary. Fiscal policy originates mostly through government action, and is comprised of actions such as taxation and government spending. Monetary policy, on the hand, deals solely with the amount of money circulating in the economy, otherwise known as the monetary base.

Whereas fiscal policy is often administered through legislative bodies of government, monetary policy originates from the actions of central banks, many of which, de factor or otherwise, have been assigned a “dual mandate” by legislative bodies to:

1. Maintain stable and low inflation
2. Keep the economy at or near full employment

Unlike fiscal policymakers, monetary authorities are limited in their instruments to influence the macro-economy. The primary channel by which they do so is through controlling short-term interest rates (Ragan, 2005, p. 4). Otherwise known as the overnight interest rate or federal funds rate, the value of the short-term interest rate controls the level at which commercial banks can lend and borrow from other financial institutions.

Central banks alter the value of the short-term interest rate, which in turn has an impact on interest rates and bond yields across the economy. These include, but are not limited to, short and long-term treasury and government securities, as well as mortgage rates (Ragan, 2005, p. 4). Monetary policy actions also influence the investment decisions made by firms, as an increase (decrease) in the targeted rate causes a decrease (increase) in credit demanded by households.
and firms. Financing a mortgage, capital expenditure, and other forms of investment becomes costlier when the federal funds rate increases, and conversely the opposite is true when the rate decreases (p. 4).

When firms and households have a bullish outlook on growth in the economy, they will be more likely to utilize credit backed investment at higher short-term interest rates. A problem associated with this relationship that has become relevant in recent years is known as a “liquidity trap.” This occurs when central bank interest rates are set nearly as low as possible (in an attempt to influence increased borrowing and investment by firms) without decreasing the rate into negative territory, but simultaneously the investment outlook by firms and households is so bleak that even the relatively cheap availability of credit is not enough to incentivize economic activity. In the liquidity trap scenario, firms and households believe it is more beneficial to keep their wealth in the form of money (rather than assets), and therefore savings increases and the money circulating through the economy declines. These developments have led to a rise in unconventional monetary policy since the Global Economic and Financial Crisis (GEFC), described in the next section.

3. Unconventional Monetary Policy

As observed by Mario Draghi, President of the European Central Bank (ECB), in a 2016 speech in Frankfurt, “across advanced economies inflation is low, and has been low for some time... Long-term inflation expectations, based on market prices, remain below our numerical definitions of price stability” (Draghi, 2016, p. 2). For both the ECB and the U.S. Federal Reserve, the definition of price stability has been placed at 2% annual inflation (European Central Bank, 2017; Kocherlakota, 2014, p. 4). In industrialized economies, meeting inflation targets has been
particularly difficult since the GEFC in 2008-09 (see Graph 1). In addition to the inability for central banks to meet their 2% targets, Gamber et al. (2015) conclude that, in the case if the Federal Reserve, the push for monetary policy transparency since 1993 has coincided with Fed forecasting credibility diminishing in relative terms, as the Survey of Professional Forecasters and even random chance has been proven to more accurately predict inflation (p. 48).

**Graph 1 - Consumer Price Index (CPI) Inflation 2008-2015**

In his speech, Draghi recognizes globalization as a potential contributing factor for the inability to meet inflation targets, as he goes on to say that globalization “may increase the importance of global prices relative to domestic prices, making it harder for advanced economies to avoid importing disinflation from abroad” (Draghi, 2016, p. 4). These comments echo those of Carney (2015), Governor of the Bank of England, and Fischer (2015), Vice Chairman for the Board of Governors of the Federal Reserve System, who in similar speeches recognized that prolonged disinflation may be connected to increased economic interconnectivity.
Carney (2015) and Fischer (2015) attribute the relationship between disinflation and globalization as a factor contributing to increased policy divergence amongst nations and the rise of unorthodox monetary policy behavior. As stated by Carney, in response to major economic shocks there “has been an unprecedented broadening of monetary policy instruments and increased policy divergence” (p. 2). Dreger and Wolters (2015) attribute the unconventional monetary policy actions to the need to avoid eclipsing the zero-lower-bound, which, as discussed earlier, occurs when the nominal interest rate is at or below zero (p. 40). Lowering interest rates below the zero-lower-bound has traditionally been considered dangerous by monetary authorities, as doing so limits the options available to central banks to influence the economy.

In Sung and Kim’s (2015) analysis, the authors observe unconventional monetary policy trends amongst central banks in large developed economies, including Japan, U.K., U.S., and the Eurozone after the GEFC. Initially, there was a divergence of monetary policy between the Federal Reserve and ECB, as the Fed chose to increase liquidity through asset purchases of debt and mortgage-backed-securities (see Table 1) and the ECB increased liquidity by expanding available credit (Dreger & Wolters, 2015, p. 41).

Unconventional decisions by the Federal Reserve are well documented in available literature (Chen et al., 2016), and are characterized by large scale asset purchases, maturity extension programs, and attempts to control expectations of low policy rates (see Table 1). Although massive liquidity injections of this nature have been supplemented by near-zero interest rates, they have been unable to prevent some monetary authorities in Europe from setting rates in negative territory (Draghi, 2016). Comprehensively, the aims of these monetary policy initiatives have proven relatively ineffective. Sung and Kim (2016) determine through
regression analysis that the expansion of the monetary base has had little impact on the inflation rate, which has even decreased in some cases (p. 24). These trends are a contributing motivation for the composition of this study. Is it possible that globalization could be the cause of central bank inability to meet stated policy goals, and if so, will understanding globalization’s impact on the macro-economy allow monetary authorities to return to conventional policy action? These questions are examined further moving forward.

### Table 1 - Large scale asset purchase programs by the Federal Reserve

<table>
<thead>
<tr>
<th>Program Type</th>
<th>Announcement</th>
<th>Termination</th>
<th>Assets Purchased</th>
<th>Amount¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSAP1</td>
<td>November 2008</td>
<td>March 2009</td>
<td>Agency mortgage-backed securities (MBS) and agency debt Agency securities</td>
<td>$600 billion</td>
</tr>
<tr>
<td></td>
<td>March 2009</td>
<td>March 2010</td>
<td>Long-term US Treasury securities</td>
<td>$850 billion</td>
</tr>
<tr>
<td>LSAP2</td>
<td>November 2010</td>
<td>June 2011</td>
<td>Long-term US Treasury securities</td>
<td>$600 billion</td>
</tr>
<tr>
<td></td>
<td>September 2011</td>
<td>June 2012</td>
<td>US Treasury securities with remaining maturities of six to 30 years</td>
<td>$400 billion</td>
</tr>
<tr>
<td></td>
<td>June 2012</td>
<td>December 2012</td>
<td>US Treasury securities with remaining maturities of six to 30 years</td>
<td></td>
</tr>
<tr>
<td>LSAP3</td>
<td>September 2012</td>
<td>October 2014</td>
<td>Agency MBS</td>
<td>$40 billion per month²</td>
</tr>
<tr>
<td></td>
<td>December 2012</td>
<td>October 2014</td>
<td>Longer-term US Treasury securities</td>
<td>$45 billion per month²</td>
</tr>
</tbody>
</table>

¹Initially announced amount of asset purchases for each programme or programme expansion. ²The purchases were open-ended when they were announced. The Federal Reserve started to taper the asset purchases in January 2014, and eventually halted the purchases altogether in October 2014. Source: US Federal Reserve.

Source: Chen et al. (2016)

### 4. Key Metrics

The two components most frequently discussed when analyzing how increased globalization is impacting variables used to set monetary policy are the Phillips Curve and financial market conditions. Therefore, before diving deeper it is helpful to understand why these features of the macro-economy are so important to central banks.

#### 4.1 The Phillips Curve

The Phillips Curve, which models an inverse relationship between the inflation rate and level of unemployment, was first established by Phillips in his threshold 1958 paper *The Relation*
between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957 (Gordon, 2008, p. 4). Before the development of the Phillips Curve, models predicting U.S. inflation assumed that when the economy was below levels of full employment, price levels would remain stable and inflation would rest near zero (Gordon, 2008, p. 3). Although this theory held mostly true up through the first half of the 20th century, questions regarding its viability arose when inflation strayed from its theoretically chartered path during the 1953-54 recession.

As described by Gordon (2008), Phillips’ (1958) study inserted itself into a “fractured intellectual atmosphere... [and] replaced discontinuous and qualitative descriptions by a solid quantitative hypothesis based on an extraordinarily long history of evidence” (p. 3-4). The original model specification put forth by Phillips (1958) has undergone alterations and taken on various forms over the last 60 years, but the Phillips Curve and its relevance to monetary policy has not wavered. Today, central banks still employ the Phillips Curve to as a means of measuring the impact of monetary policy on the domestic output gap, which is essential in forecasting inflation (Çiçek, 2011, p. 1655). One of the derivative models based on Phillips’ original model has even been labeled as “unambiguously the right econometric framework to understand the evolution of post-war US inflation” (Gordan, 2008, p. 37).

4.2 Financial Markets

In their deconstruction of the complex and layered process that is monetary policy, Herrmann and Schroeder (2008) emphasize the importance of financial markets to the effectiveness of central bank action. Monetary authorities have little direct control over the long-term interest rate, but rather attempt to influence the long-term rate through short-term rate

---

1 An output gap is the difference between real and potential output.
adjustments. However, as the authors explain, central banks do not even directly control all short-term interest rates (p. 1). Rather, they do so through various operational money market tools. In this respect, the interplay between monetary policy setting and private-sector reactions is much more indirect, with the financial sector acting as an essential transmitter (p. 1). This relationship is mostly found through central banks’ ability to adjust expectations and influence the behavior of financial intermediaries (mainly banks) and financial markets more generally (p.1).

The importance of financial intermediaries in transferring monetary policy relates predominantly to their role in lending, as there is no perfect substitute available for a bank loan (Kashyap & Stein, 1997, p. 3). This is because financial intermediaries, and especially banks, have the unique capability to assess credit-worthiness. Information about borrowers who seek to access funds through a third party is rarely comprehensive, making it difficult for these actors to obtain funds through any other channel. Because banks establish longer-term relationships with borrowers looking to access third party funds, they can collect information on them and construct a clearer view on their ability to pay, therefore leading to informed assessments of credit-worthiness. However, as these borrowers do not have adequate substitutes for bank loans, they are impacted by willingness on the part of financial intermediaries to supply credit. In this aspect, monetary policy has an essential role in the willingness for banks to supply credit, as empirical analysis has proven that contractionary monetary policy results in a drop in the availability of bank loans (Hoshi, Scharfstein, and Singleton, 1993).

Due to the recent rise in unconventional monetary policy driven by central bank action in the foreign exchange markets, as discussed in the previous section, the relationship between
central banks and international financial institutions has grown in significance. In the structure of a model used by Céspedes et al. (2017), this relationship is accounted for most notably through financial intermediaries, as the authors highlight the need by firms to fund investment into capital goods through borrowing from banks (p. 2).

5. Key Terms & Perspectives

5.1 Terms

To frame the discussion from this point forward, it is helpful to establish an understanding of terms and arguments that are key to examining global influences on macroeconomic variables. Borio and Filardo (2007) provide a strong basis from which to build off in this respect. First, in the context of this study, globalization is defined as the integration of the global economy (Borio and Filardo, 2007, p. 1). In recent years, this process of integration has been accelerated. Whereas in 1990 trade accounted for only 39.605 percent of global GDP and $3.496 trillion of merchandise exports, in 2015 it accounted for 57.68 percent of global GDP and totaled $16.576 trillion of merchandise exports (World Development Indicators, 2017). Borio and Filardo (2007) note that the escalation in globalization has led to, in their estimation, a necessity to shift macroeconomic perspectives from the traditional “country-centric” modeling approach, to one which is “globe-centric.” This shift is spurred by global economic slack, which is defined in the present paper as the underutilization of resources in the global economy (Borio and Filardo, 2007, p. 12).

Borio and Filardo categorize the country-centric approach as presently being the “prevailing model of inflation” (p. 1). Under this model, inflation is determined exclusively by domestic factors, and any international influence on the domestic economy is captured through
exchange rates and import prices (p. 3). The authors propose that this model is no longer well suited due to the increasing interconnectedness of economies. To pursue a more appropriate approach to economic modeling of inflation, the authors propose a globe-centric approach. This model assumes demand and supply can be supplemented across countries, input markets are globally integrated, and goods produced in foreign markets can act as close substitutes (p. 4). The globalization of inflation hypothesis, which claims that factors influencing domestic inflation have become increasingly global in origin, is directly linked to the application of the globe-centric approach and has a direct impact on the Phillips Curve (Milani & Park, 2015; Ahmad & Civelli, 2016; Auer, Raphael, Borio, & Filardo, 2017). In association with the globe-centric view, the meaning and impact of global value chains (GVCs) becomes relevant, and is defined as “cross-border trade in intermediate goods and services” (Auer, Raphael, Borio, & Filardo, 2017). As trade agreements and the volume of trade have proliferated, GVCs have lengthened. Therefore, it is possible that the individual inputs, assembly, packaging, and final consumption of product in the international goods market each took place in different regions of the world.

5.2 Perspectives

There are those that dispute the globalization of inflation hypothesis. Ball (2006) addresses the question of globalization’s significance to inflation in the context of the United States. In Ball’s opinion, trade had not transformed significantly enough to cause a noteworthy change in the relationship between globalization and inflation. As noted by Daniels et al. (2015), the most recent observations utilized in many of the studies that conclude none or even negative relationships between increased interconnectivity and changes in inflation are typically from the 1980’s. Therefore, these data sets are observing periods prior to the rapid increase in trade that
occurred beginning in 1990, and are therefore outdated. Daniels et al. (2015) finds that relative to these older studies, such as Ball (2006), the average share of economic openness in recent analysis has grown and is therefore likely the cause of the discrepancy between studies conducted in the early and mid 2000's and those which are more recent (Watson, 2016, p. 158).

Bianchi and Civelli (2015) and Ahmad and Civelli (2016), however, give reason to believe Ball’s (2006) isolation of changes in trade volume was perceptive. The authors find that for most countries sampled, the statistically significant threshold variable in determining the impact of global economic slack on inflation is the level of trade openness (Ahmad & Civelli, p. 285). The authors define an economy’s trade openness by the combined share of exports and imports relative to GDP \( \left( \frac{\text{Exports} + \text{Imports}}{\text{GDP}} \right) \), and conclude that there is a level of openness beyond which domestic inflation becomes more responsive to external influences captured in foreign economic slack, although the authors do not provide a value for that claim (p. 285). Ahmad and Civelli (2016), as well as Milani and Park (2015), determine that a lack of trade openness in countries such as Japan and the U.S. is the central reason why closed economies do not exhibit non-linearity in the relationship between inflation and globalization. The current study draws from more recent literature, mostly published in the years preceding the GEFC. Therefore, the studies used to evaluate the current relationship between globalization and monetary policy metrics is supported by observations that account for the expansion of economic interconnectivity since 1990. The next section consists of a review of structural changes to the Phillips Curve caused by globalization, supplemented by case studies to demonstrate theoretical modeling in real-world scenarios.
6. Phillips Curve

The flattening of the Phillips Curve is the most commonly referenced impact of globalization on this key metric (Marzinotto, 2009). When this paper refers to the flattening of the Phillips Curve, it means to relay that inflation is becoming less responsive to changes in output and unemployment. Kuttner and Robinson (2008) describe that the presence of this phenomena could have conflicting effects. On the one hand, a flatter Phillips Curve means lower inflation would be sustainable during periods where the output gap was large and unemployment levels were low. Conversely, this development would mean that established levels of inflation would become harder to bring down (p. 110).

Graph 2 – Growth of GVCs over time (%)

Source: Auer, Raphael, Borio, & Filardo (2017)

Recent literature has found evidence that Phillips Curve modelling should include factors outside of the domestic economy, for instance by considering import prices (Auer, Raphael, Borio, & Filardo, 2017; Albuquerque & Baumann, 2017). Auer, Raphael, Borio, and Filardo (2017) explore this relationship regarding global value chains (GVCs) and intermediate goods trading, which have grown in prevalence since 1990 (see Graph 2). Lower barriers to trade and increased economic openness have fundamentally changed firm production processes. As firms rarely own
the means of production, they have increased substitutability across their supply chain (p. 3). Furthermore, their ability to move stages of production between countries presents a new opportunity to account for economic slack that exists in the macro-economy (p. 4). Ultimately, the authors conclude through empirical analysis that the heightened connection between trade openness and the global slack’s influence on inflation is driven by growth in trading intermediate goods and services (p. 9).

6.1 Threshold Study

To provide insight into the impact of changes in the makeup of goods markets, Watson (2016) utilizes a New-Keynesian dynamic stochastic general equilibrium (DSGE) model to study the factors which influence real and nominal price rigidity, as well as to determine the impact of trade openness on the modern Phillips Curve (p. 138). By employing the New-Keynesian DSGE model, the author accounts for the lagged adjustment of prices in reaction to economic shocks (price stickiness) and limit the actions of economic actors to utility maximization and rational expectations (De Grauwe, 2010). In addition to these benefits, Watson’s (2016) modelling approach mirrors the central bank procedure, as DSGE models have become a constant component of macroeconomic forecasting by monetary authorities (De Grauwe, 2010, p. 413-414).

The adopted DSGE framework put forth by the author includes many parameters meant to reflect real activity. The model operates based off the assumption that firms fall under two categories: exporters, which sell goods domestically and internationally, and non-exporters, which only sell goods in their home country (p. 141). The consumers, or households, which firms
are appealing to do not discriminate against goods in the domestic market, and in fact have a constantly changing price elasticity of demand.

Within these parameters, the exporting and non-exporting firms base their price setting decisions on slightly different models (p. 142):

\[
(1) \sum_{k=0}^{\infty} E_t \left( \alpha^k Q_{t,t+k} C_{H,i,t+k} (P_{H,i,t} - M C_{i,t+k}) \right)
\]

\[
(2) \sum_{k=0}^{\infty} E_t \left( \alpha^k Q_{t,t+k} [C_{H,i,t+k} (P_{H,i,t} - M C_{i,t+k})] + C_{F,i,t+k}^* \left( S_{t+k} P_{F,i,t}^* - M C_{i,t+k} \right) \right)
\]

Equation 1 outlines the theoretical framework for which non-exporting firms set their prices \((P_{H,i,t})\), to meet domestic demand \((C_{H,i,t+k})\) for the good produced by firm \(i\) at time \(t\), all in relation to marginal cost \((M C_{i,t+k})\). Equation 2 outlines the same process by which exporting firms in the domestic economy meet demand, with a few important changes that are highlighted in red. Exporting firms seek to meet demand in the domestic and foreign markets simultaneously, and therefore set two prices on goods. One price is based on the value of the domestic currency \((P_{H,i,t})\) relative to domestic demand \((C_{H,i,t+k})\), and the other is determined by the foreign currency \((P_{F,i,t+k}^*)\) and foreign demand \((C_{F,i,t+k}^*)\).

Accounting for the degree of trade openness, Watson (2016) models a situation in which price changes are not constant from firm to firm. Rather, in conjunction with prices being positively dependent on firm \(i\)'s price relative to competitors (p. 138), Watson's (2016) model also dictates that the optimal mark-up for each firm is determined individually based on market share (p. 144). The outcome of this framework creates an environment where an influx of firms selling a variety of products in the market creates substitutability. Therefore, there is an increase in the opportunity cost of choosing not to respond to price changes dictated by the market (p. 144).
In determining the impact of trade openness on the Phillips Curve, Watson (2016) utilizes the following theoretical Phillips Curve model in her analysis (p. 148):

\[
\pi_{H,t} = \beta E_t \pi_{H,t+1} + \lambda \frac{(1-\alpha)(1-\sigma)}{\alpha} \left[ m \bar{c}r_t - \frac{d}{\sigma} \varpi (\hat{p}_{H,t} - \hat{p}_{F,t}) \right]
\]

The most relevant elements of this model for the current study are the variables $\varpi$ and $m \bar{c}r_t$. $\varpi$ represents the ratio of imported goods in a home country's overall economy, and in concurrence with $m \bar{c}r_t$ (the log deviation of real domestic marginal cost at time $t$), these variables express that complementarity amongst strategic price setting decisions by firms makes inflation more reliant on the mark-up of domestic goods relative to that of imported goods (p. 148).

Watson (2016) provides the following example to illustrate this point:

Following a decrease in the price of imports which leads to an increase in the relative price of domestic goods, domestic producers face higher price elasticity of demand which prompts them to lower their mark-ups. As a result, domestic prices decline even if marginal cost remains unchanged (p. 148).

Watson's (2016) findings indicate that, due to increased competitiveness, structurally open-economies face more pronounced effects on domestic inflation in response to foreign variables (p. 149). The author also examines the degree to which prices change due to economic openness and increased competition, finding a strong correlation between initial trade openness and the frequency of price changes (consistent with empirical and survey evidence) (p. 154). Watson determines that these changes are heavily reliant on the initial level of a country's economic openness, as increased initial openness, and therefore higher levels of competition, result in the increase of elasticity of inflation relative to marginal cost. Graph 3 exemplifies this relationship, as the value of $1+N^*$ on the horizontal axis demonstrates the level of competition in the domestic
economy, where higher values of $1+N^*$ indicate greater competition.

**Graph 3 – Impact of openness on the factors of the Phillips Curve**

![Graph 3](image)

*Source: Watson (2016)*

*Note: $1+N^*$ is a numerical representation of the level of competition in the domestic economy.*

### 6.2 Exchange Rate Pass-Through and the Phillips Curve

An additional factor contributing to the flattening of the Phillips Curve is an increase in exchange rate pass-through, which is the responsiveness of international prices to changes in the domestic exchange rate. Daniels and VanHoose (2013) identify this relationship specifically regarding levels of output and employment.

The authors conclude that the direct impact of exchange rate pass-through on an environment consisting of integrated goods markets becomes more significant when increases in consumer price index inflation are induced by higher priced imported goods (p. 136). This is because changes in the domestic real exchange rate under these conditions expand the degree of exchange rate pass-through, which Daniels and VanHoose (2013) explain through the following models (p. 136):
Equation 4 theoretically determines the output ($y_t^{mc}$) produced by a given firm in sector $i$ with market clearing wages\(^2\). An important variable of note in this equation is $\gamma$, which is a measurement for the extent of exchange rate pass-through valued between zero and one, where when $\gamma=0$ there is no presence of exchange rate pass-through, and when $\gamma=1$ there is complete exchange rate pass-through (p. 135). The authors conclude that Equation 4 demonstrates that when increases in $\gamma$ occur due to surges in inflation resulting from imports, there is a corresponding decline in labor supply (see Equation 5), as well as a reduction of the impact on employment and output in these sectors (p. 137). In effect, this analysis displays that when exchange rate pass-through increases, the Phillips Curve relationship changes as well, because the reaction of output and employment to changes in inflation is modified.

### 6.3 The Case of Korea

Milani and Park (2015) employ a theoretical DSGE model like that found in Watson (2016), and apply the model to the small open economy of Korea. Recognizing the difficulties posed by examining the globalization of inflation hypothesis only in relation to the United States, the authors choose to study Korea due to its position as a small and open economy (see Graph 4). To replicate the macroeconomic environment taking place during each of the time-varying observations, Milani and Park (2015) select data from Korea’s top 24 trading partners of each period, and weight their impacts based on the

\(^2\) Market clearing wages represent the value at which labor demand and supply are equilibrated.
share of trade each country accounted for relative to Korea’s total imports and exports within the group (p. 297).

Graph 4 – Korean openness

The estimation results strongly support many arguments associated with the globalization of inflation hypothesis. The results indicate that firms producing domestic goods face substantial price stickiness, whereas in the import sector firms retained much more flexibility. These results indicate the presence of a non-trivial level of exchange rate pass-through (p. 298). In addition, Milani and Park (2015) find significant evidence that Korean output has shifted from dependency on domestic demand to that of foreign demand (p. 299). The same result is found for Korean inflation. These developments are exemplified in Graph 5.

Source: World Development Indicators (2017)
Graph 5 – Changes to the Korean inflation in response to output shocks

![Graph 5](image_url)


6.4 The Case of Turkey

The ongoing debate and evidence in support of the globalization of inflation hypothesis spurred Çiçek (2012) to apply similar analysis to Turkey. The author predicted that hypothesis would hold true for Turkey based on numerous changes in the countries macroeconomic indicators, including a decline in inflation rate volatility and a rapidly increasing level of trade openness (See Graph 6) (p. 1656). To test his hypothesis, Çiçek (2012) runs a variety of forward looking extended Philips Curve OLS regressions, placing specific emphasis on the coefficient of the output gap, because if it declines, then the Phillips Curve for Turkey is flattening.

Rather than solely focus on the de-trended inflation rate as the dependent variable, the author deconstructs the consumer price index \( \pi_{t}^{PPI} \) into a weighted some of tradeable goods \( \pi_{t}^{T} \) and non-tradeable goods \( \pi_{t}^{NT} \), with the expectation that global factors effect non-tradeable goods at a higher rate (p. 1658). Çiçek (2012) tests this hypothesis with the following model (p. 1659):
(6) \[ \Delta \pi_t = c + \rho \pi_t^{(RE)} + (1 - \rho) \pi_{t-1} + \alpha_1 y_t^d + \alpha_2 y_{t-2}^\text{diff} + \gamma e_1 + \varphi d\text{um} + \epsilon_1 \]

The two variables of emphasis for our purposes are the global output gap \((y_{t-2}^\text{diff})\) and the domestic output, featured in a separate model in the study. The global output gap, which is statistically significant at the 5% confidence level, measures at 0.31%, which exceeds the 0.21% estimate of the domestic output gap (p. 1659). These results suggest the global output gap has indeed eclipsed the domestic output gap in its impact on Turkish inflation. In addition, the study tests this conclusion through a time-varying process model, and proceeds to estimate that coefficients of the domestic output gap have gradually fallen, indicating a flattening of the Phillips Curve (p. 1660).

**Graph 6 – Turkish openness & inflation since 1990**

![Graph showing inflation and trade (%GDP) over time]

*Source: OECD & World Bank (2017)*

Moreover, the author concludes in their analysis that exchange rate pass-through in Turkey has indeed increased. These findings are consistent with conclusions reached by Daniels and VanHoose (2013) in Section 6.2.

Section 7 examines the impact of financial globalization on important monetary
policy metrics. Although separated from one another in this study for the purpose of analysis, it is important to note that interconnectivity among global financial markets largely increased accordingly with the integration of goods markets and the expansion of international trade. This connection is due to the demand for multinational financial institutions by growing corporations (Goldberg, 2013, p. 4) (Graph 7).

**Graph 7 – Ratio of international trade and bank international claims to global GDP**

Source: Golberg (2013)

### 7. Financial Markets

Financial markets and intermediaries are known to be an essential component in the framework of central bank effectiveness, largely because monetary policy target variables (i.e. interest rates, inflation, and exchange rates) are inherently financial (Ma & Lin, 2016, p. 1). Therefore, financial markets are often the bridge that transmits monetary policy into the real economy.
Hoffman and Tillmann (2012) employ the following nuanced panel OLS regression to estimate a country's national price level (NPL) in a financially globalized environment (p. 1508):

\[ \text{logNPL}_{it} = c + \beta_0 \times \text{FIN}_{it} + \beta_1 \{ \text{FLO}_{it} \times \text{FIN}_{it} \} + \beta_2 \text{FLO}_{it} + I^t X_{it} + \varepsilon_{it} \]

In this model, \( \text{FLO}_{it} \) is a dummy variable representing the presence of a floating exchange rate, and \( \text{FIN}_{it} \) is a measurement of international financial integration, equal to the sum of foreign assets and liabilities over GDP \( \left( \text{FIN}_{it} = \frac{\text{FA}_{it} + \text{FL}_{it}}{\text{GDP}_{it}} \right) \) (p. 1506). In addition, within the NPL model, \( X_{it} \) is comprised of a set of control variables, such that (p. 1508):

\[ X_{it} = (\text{logGDP}_{it}, \text{OPEN}_{it}, \text{logSIZE}_{it}, \text{OPEN}_{it} \times \text{logGDP}_{it}, \text{DUR}_{it}, \text{CREDIT}_{it}) \]

Amongst other factors, \( X_{it} \) accounts for economic openness \( \left( \text{OPEN}_{it} = \frac{\text{Exports}_{it} + \text{Imports}_{it}}{\text{GDP}_{it}} \right) \) and the duration of a given exchange rate regime \( (\text{DUR}_{it}) \). The authors examine this regression model relative to fixed, intermediate, and floating exchange rate regimes\(^3\). The authors determine that when floating exchange rate regimes experience financial openness, downward pressure is placed on the price level, and the opposite is the case for fixed and intermediate regimes (p. 1511). The monetary policy implications put forth by the authors are described in Section 8.

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\(^3\) Fixed, sometimes referred to as hard peg, exchange rate frameworks occur when a domestic currency is directly tied to that of another single or group of currencies. Free floating exchange rates are determined through the supply and demand process, and as such are subject to volatility. Lastly, intermediate, sometimes referred to as a soft peg, exchange rate regime balance between fixed and floating systems (Wagner, p. 618-619).
In addition, there is an unequal distribution of the impacts that stem from increased economic interconnectivity amongst nations, the basis of which is trade openness. The inequity in this dispersion is caused by a variety factors, some of which are starkly apparent in emerging Asia (Devereux & Yetman, 2014). In the decades leading up to the 1990s, the level of goods market integration in Asian countries was low while the domestic financial infrastructure was underdeveloped and could not sustain global market exposure. In recent decades, however, Devereux and Yetman’s (2014) analysis shows that each of these structural components in Asia have evolved, and indeed reversed, having a significant role on the exchange rate.

As portrayed in Graph 8, the level of goods market integration in Asia has increased dramatically since 1990. Present levels of integration cause a few changes worth noting for their impact on exchange rates. First is the harmonization of consumer preferences, which creates uniformity in consumption demand across economies (Devereux & Yetman, 2014, p. 108). The
resulting impact of this trend is mitigated exchange rate pass-through\textsuperscript{4}, which in turn causes prices in emerging Asian economies to be less likely to change and inflation to be less volatile (p. 107).

The impact of goods market integration on exchange rate pass-through is further amplified by financial internationalization. In recent decades, emerging Asian financial markets have developed in complexity and lowered barriers to international capital flows, trends which are exemplified though international investment positions (a nation’s total of foreign assets minus foreign liabilities) as a share of GDP (p. 105). Devereux and Yetman (2014) employ a risk-sharing regression model to estimate the degree to which financial market openness has exposed Asian economies, the results of which are depicted in Graph 9. The $\beta$ variable is the coefficient which measures risk-sharing, where $\beta=0$ implies full risk-sharing. As is seen in the graph, levels of risk-sharing have increased as emerging Asia has become more integrated into global financial markets (p. 109). Due to these trends, the impact of exchange rate fluctuations has gained in importance to determining relative wealth.

Lowered barriers to international capital flows have impacted emerging and developed market economies as well through their financial transactions with one another. When analyzing long-term bond yield trends in developed economies, Kamin (2010) determined that inflows of capital originating from emerging economies had a role in suppressing long-term trends (p. 15). The same conclusion was reached by Warnock and Warnock (2006). The authors determined through their analysis that foreign purchases of U.S. Treasury bonds lessened yields significantly.

\textsuperscript{4} Exchange rate pass-through is the responsiveness of international prices to changes in the domestic exchange rate.
On the other hand, emerging and transition economies often face difficulties due to capital flow volatility, as investors are much more likely to remove capital from the countries at the smallest sign of macroeconomic disequilibrium or political instability. This sentiment is echoed by Caruana (2012), who emphasized that the expansion of foreign exchange reserves in central bank balance sheets increases exposure to developments in foreign markets (p. 5). Especially for open economies, the expansion of central bank balance sheets and the functioning of financial markets has become more susceptible to changes in the exchange rate (Céspedes et al., 2017, p. 1). This is the case because changes in foreign asset values or foreign bond holdings influence long-term interest rates, impacting the value of both assets and liabilities (Caruana, 2012, p. 5).

**Graph 9 – Risk Sharing in Asian Economies**

Furthermore, volatile international capital flows have a large impact on GDP within many economies, and have been associated with predicting oncoming financial crises (Carp, 2014, p. 355). The same conclusion was reached by Wagner (2005), who discussed the importance of interconnected financial markets (defined in Wagner’s study as the increase in cross-border capital flows) during the 1990’s East Asia economic crisis (p. 624). In his analysis, Wagner (2005)
concluded that the crisis was in large part spurred after initial surges in the quantity of international capital flows into Asian countries was quickly reversed by a greater retreat of capital outflows (p. 617). In the following subsection, a comprehensive analysis of financial globalization’s impact on an economy is discussed in the context of Switzerland.

7.1 The Case of Switzerland

A nation which exemplifies the impact of globalization on a country’s domestic exchange rate is Switzerland. Switzerland, classified as a small-open economy given its GDP and level of openness (see Graph 10), is highly susceptible to external influences on the performance of the domestic economy. According to Jordan (2016), about twenty-five percent of Swiss inflation originates abroad. The author explains that the Swiss Franc exchange rate is important to the country’s overall economy for two fundamental and interconnected reasons: the Swiss Franc is well-known for being a “safe-haven” currency (a holding with low risk and high liquidity) and is frequently used in trading activities in global financial markets (McCauley, 2009; Jordan, 2016).

Graph 10 – Swiss openness as a small economy

Source: World Development Indicators (2017)

In 1996, $96 billion USD flooded into Indonesia, Korea, Malaysia, Thailand, and the Philippines. In 1998, these same countries experience an outmigration of $105 billion USD.
In the past, these features of the Swiss Franc's exchange rate worked in the favor of stabilizing the Swiss economy relative to global developments. The epochs labeled “High Inflation Period” and “Low Inflation Period” in Graph 11 are examples of such times, as the changes in the Swiss Franc's nominal exchange rate offset changes in global inflation (p. 264). However, what is unique about the third period during the global economic and financial crisis (GEFC), the Swiss Franc's desirability as a “safe-haven” currency created serious obstacles for the Swiss National Bank (SNB). Due to the currency's valuation reliability, demand for keeping wealth in the form of Swiss Franc's increased dramatically, causing the currency's value to experience an unprecedented rise in value (p. 3). The overvaluation of the Swiss Franc meant that the cost of imported goods was driven down in relative terms, further deflating CPI to zero percent.

In reaction to these headwinds, the SNB deployed unprecedented and unconventional monetary policy actions, introducing in 2011 a minimum Swiss Franc exchange rate with the euro to control the currencies overvaluation (p. 3). The evolution of the euro crisis and its resulting spillovers on the Swiss economy pushed monetary authorities into further unchartered territory in 2015, lowering interest rates below the zero-lower-bound to -0.75% (p.4).

**Graph 11 - Inflation Measures and the Swiss Franc Nominal Effective Exchange Rate**

![Graph 11 - Inflation Measures and the Swiss Franc Nominal Effective Exchange Rate](image)

*Source: Jordan (2016), OECD, SNB*
The following section discusses the monetary policy implications central banks should be aware of based on the developments discussed in Sections 6 and 7.

8. Implications for Monetary Policy

Recognizing that changes spurred by globalization are taking place and interfering with traditional occurrences in the domestic macro-economy is an important step. However, as many of the studies reviewed recognized, there is a need on behalf of monetary authorities to determine appropriate adjustments to adequately correct for these developments in real time.

Devereux and Yetman’s (2014) study provided substantial insight for monetary authorities as they determine the best course of action when accounting for the impact of globalization. Most notably, the authors made the case for unsterilized intervention, rather than sterilized intervention. Defined as the purchase or sale of foreign currency by a central bank to influence the exchange value of the domestic currency without changing the monetary base, sterilized intervention is a policy choice which the authors conclude becomes ineffective beyond a certain level of financial openness (p. 109). This is because as global financial markets become increasingly interconnected, attempts to manipulate the exchange reserve markets will be counteracted by other active agents (p. 111).

However, in an attempt to manage the exchange rate between 2002 and 2012, Asian central banks participated in massive foreign exchange reserve expansion, most of which came through debt expansion (p. 110). The continuation of these actions, however, proves to be unsustainable, as the large external balance sheets held by Asian central banks are costly to the entire region. Known as sterilization costs, these occur when interest rates exceed those of derived from foreign exchange reserves (p. 111). For some economies in Asia, it is estimated that
sterilization costs amount to as much as 1.2% of annual GDP. It is for these reasons that Devereux and Yetman (2014) advocate for the institution of unsterilized intervention (p. 120).

Sometimes referred to as passive action on behalf of central banks, unsterilized intervention is an attempt to influence exchange rates and the money in circulation by not participating in domestic or foreign currency and asset markets. Unsterilized intervention essentially reduces the instruments available to monetary authorities to interest rates, and is seen by the authors as maintaining a small role to improving welfare (p. 105). However, Devereux and Yetman (2014) note that attempts to correct the economy through exchange rates may be losing effectiveness overall due to the decrease in exchange rate pass-through (p. 108).

Cetorelli and Golderberg (2012) conclude that the rise of global banks bolsters, and in fact amplifies, the effectiveness of monetary policy induced liquidity shocks (p. 1812). Although this point is still disputed, consensus around the authors’ conclusion would mean that action by central banks to induce liquidity shocks can be scaled back in future monetary policy efforts without reducing the actions intended impact. Cetorelli and Golderberg’s (2012) assessment also warrants attentiveness moving forward, as the enhanced role of induced liquidity shocks could lead to unintended consequences if central banks act as they would have during periods of less financial integration.

Conversely, Ma and Lin (2016) conclude that financial development is strongly negatively related with central bank impacts on output and inflation (p. 10). Kamin (2010) similarly determines that there are aspects of financial globalization that diminish the effectiveness of

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6 Global banks are institutions that expand operations internationally through the establishment of physical bank branches (Cetorelli & Golderberg, 2012, p. 1811).
actions taken by monetary policymakers. The channels Kamin (2010) highlights to substantiate this claim are bonds and currencies (p. 17, 34). Like the goods market described in the previous section, as financial markets continue to merge, government bonds from different countries become more substitutable (p. 17). This substitutability hinders a central banks ability to influence risk premiums\(^7\) through traditional instruments. In addition, outside of the European Central Bank and the US Federal Reserve, Kamin (2010) concludes that rise of the dollar and euro as vehicle currencies, or forms of money used in international transactions, further diminishes the ability of central banks to influence the economy through changes to the monetary base, as printing domestic currency to combat liquidity crises becomes less impactful when financial assets are not held in the domestic currency (p. 34).

Albuquerque and Baumann (2017) argue that regardless of globalization’s impact on changing exchange rates, the Phillips Curve remains an essential tool for monetary authorities when projecting inflation and determining monetary policy action (p. 2). The authors claim that the appropriate response to the changing global dynamics, which is resulting in the flattened Phillips Curve, is a deeper consideration of global developments in domestic forecasting models (p. 2).

The literature also points for a need by central banks to reassess their interpretation of the sacrifice ratio because of the flattening Phillips Curve (Daniels et al., 2005; Calza, 2009; Çiçek, 2012; Ahmad & Civelli, 2016). The sacrifice ratio is the consequence that occurs when monetary authorities seek to slow growing inflation by influencing output and economic growth

\(^7\) A risk premium is an excess return on a relatively more uncertain investment (Arnott & Bernstein, 2002).
\[
(Sacrifice \ Ratio = \frac{Cost \ of \ Production \ Loss}{\% \ of \ inflation})
\] (Çiçek, p. 1655-56). Daniels and VanHoose (2006) conclude that increased openness and the diminished relationship between inflation and output means that central bank policy now has a reduced effect (p. 1345). This indicates that the cost of production and growth loss will be relatively larger compared to changes in inflation which were experienced in the past, making central bank tightening to control inflation less desirable. In a later publication, Daniels and VanHoose (2013) conclude that increases in the sacrifice ratio are enlarged due to greater degrees of exchange rate pass-through as well (p. 148).

Some authors argue that a method for counteracting (dis)inflationary forces could be achieved through coordination amongst central banks (Zhang et al. (2015); Chatterjee (2016); Georgiadis & Mehl, 2016). Frameworks exist that suggest this would be optimal, as their models demonstrate a sub-optimal Nash equilibrium when monetary authorities act independently across nations (Cœuré, 2016, p. 9). However, the theoretical implications of central bank co-movement prove much more difficult in practice than in theory, because central banks have different mandates and structural frameworks which they operate within.

In the aggregate, macroeconomic scholars agree that globalization has changed the transmission of monetary policy (Georgiadis & Mehl, 2016). The biggest effect of which has been the importance of interest rates relative to exchange rates in influencing macroeconomic developments. Increased financial globalization means that the wealth of domestic financial actors (who are increasingly more likely to hold foreign assets) are more directly impacted by changes in the exchange rate (p. 201). Therefore, both their investment and consumption decisions will be more reliant on exchange rate movements than changes in the interest rate.
9. Conclusion

Through a review of literature, empirical research, and nuanced theoretical modeling, this study has identified changes taking place to the Phillips Curve and international financial market structures that are of importance for monetary authorities to monitor moving forward. Consistently, researchers concluded that international developments are increasingly influencing trends in domestic macroeconomic metrics, and greater trade and financial openness were mentioned frequently in these studies as being the statistically relevant factors to include for more accurate modeling moving forward (Borio & Filardo, 2007; Bianchi & Civelli, 2016; Auer, Raphael, Borio & Filardo, 2017).

To review, Section 6 demonstrated theoretically and through case study analysis that changes to firm price setting factors and exchange rate pass-through are causing a flattening of the Phillips, triggering the relationship of inflation to output and unemployment to be less prominent. Furthermore, Section 7 demonstrated that degrees of financial openness also have an important role on exchange rate pass-through and national price levels, as exemplified through Switzerland. Additionally, this section highlighted the growing correlation between international capital flows and the ability for monetary authorities to impact long-term bond yields, reporting mixed results but an overall increase in international risk sharing. Based on these conclusions, Section 8 addressed the implications on monetary policy which seem most urgent, specifically highlighting changes to sterilized interventions, the sacrifice ratio, and monetary policy transmission.

Moving forward, central banks should consider the degree to which their country's economy fits the characteristics to be susceptible to a flattening Phillips Curve and international
financial market integration. The two variables which are most important to determining an economies exposure to these shifts are economic size and openness. Studies have often found countries such as the United States, which are large in GDP and have a relatively low level of economic openness, are less susceptible to foreign influences on their domestic economy relative to countries with smaller gross domestic product and greater degrees of openness (Ball, 2006; Marzinotto, 2009; Bianchi & Civelli, 2015; Milani & Park, 2015; Ahmad & Civelli, 2016).

To address the questions posed at the end of Section 3, although unconventional monetary policy has become relevant at the same time as rapidly expanding globalization, the literature does not seem to support a correlation between the two. In fact, in most cases the researchers conclude that both a flattening Phillips Curve and integrated global financial markets would increase the effectiveness of monetary policy relative to effectiveness pre-globalization. Therefore, it does not seem that unconventional monetary policy measures are warranted as a motivation for similar research in the future.

Although many of the authors and research covered in this study put forth recommendations for further monetary policy adjustments and predicted changes to monetary policy effectiveness, it is important to emphasize that this area of analysis is quite new and inconclusive. Therefore, future research should continue applying the theoretical models discussed in this study to real world activity to measure its accuracy. Furthermore, we recommend that future research takes a more in depth look at the relationship between globalized central bank balance sheets and monetary policy, as this area of study was the least examined impact to be featured in this study.
References


