THE EFFECT OF U.S. INFLATION ON THE PHILIPPINES

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ABSTRACT

The small open economy model predicts that inflation can be transmitted from a large economy to a small open economy in a fixed exchange regime but not in a flexible regime. Empirical studies, however, have shown contrasting results with some studies arguing that transmissions have even occurred in flexible regimes. This paper investigates how U.S. inflation affects inflation in the Philippines. The Philippines has operated under a flexible regime since the 1990s. I conduct unit root and cointegration tests between the U.S. and Philippine consumer price indices, in logarithm terms, and find that while the two series have unit roots, they are not cointegrated. The results suggest that U.S. and Philippine inflation do not follow the same stochastic trend and are, thus, not linked towards the long run. I set up a vector autoregression and impulse response function, and conduct a forecast error variance decomposition to show that U.S. price shocks have temporary effect on the Philippines in the short run. In summary, U.S. inflation has transitory but no permanent effect on the Philippines.

Key words: Foreign exchange regime, inflation transmission, unit root, cointegration test, structural break.

JEL classification: F31, F41, F42

Introduction

Domestic inflation can theoretically be isolated from monetary shocks and influences from and to the rest of the world. This is especially true in a flexible exchange rate regime. The argument rests on the adjustment mechanism of nominal macro-variables that respond to the initial monetary imbalances. An increase in the money supply of a country, for instance, leads to an increase in inflation and the nominal interest rate in that country. Under uncovered interest rate parity, the nominal exchange rate depreciates and inflationary pressure need not spill over to other countries. Inflation is, hence, over the long run, a domestic monetary phenomenon and the transmission of monetary disturbances is nonexistent (Lothian, 1992).

That inflation is a domestic monetary phenomenon is, to a great extent, conceptually sound and philosophically sensible. In the same way that only real variables can affect real events and monetary variables affect monetary events, international problems are solved with international resources while domestic problems are solved with domestic resources. Inflation is therefore a unique country experience and a local problem which can be solved with domestic monetary tools. Consequently, inflation in one country cannot be transmitted to another unless that other country permits the transmission.

This paper investigates the extent to which inflation in the U.S. affects inflation in the Philippines. At prima facie, there are many reasons to believe that U.S. inflation may be transmitted to the Philippines. First, the U.S., being the world's reserve currency country, has significant influence on the payment scheme of international trade and finances which the Philippines, a small open economy, is subject to. Second, the interlinkages between the two economies is substantial with the Philippines relying more on the U.S. in terms of the level of trade, capital flow and remittances. Third, the Bangko Sentral ng Pilipinas (BSP), the central bank of the Philippines, has normally kept a close watch on developments in the U.S. Federal Reserve monetary policies and has often adjusted its policy rates while considering these foreign developments, among many other variables. Hence, there are indications suggesting that Philippine inflation may follow developments in U.S. inflation.

The results of this study have important policy implications. The BSP operates with a flexible foreign exchange regime and has been targeting inflation since 2002. If inflation and price shocks from the U.S. are indeed transmitted to the Philippines, then the central bank needs to address these effects and re-asses the inflation targeting framework. Moreover, there may arise the need to revisit macroeconomic models that forecast domestic inflation.

The rest of the paper is organized as follows. In section 2, I review the relevant literature. In section 3, I discuss the exchange rate regimes and inflation rates in the Philippines during the past four decades. In section 4, I lay out the research methodology, identify the empirical tests used in this study, and interpret the results of the tests. Finally, in section 5, I conclude.

Review of Literature

The small open economy model predicts that the choice of the foreign exchange rate regime ultimately exposes or shields an economy from foreign inflation. On the one hand, under a fixed exchange rate regime, the monetary authority is committed to maintain a constant nominal exchange rate. Money supply endogenously adjust to maintain the fixed rate. Because of purchasing

power parity, the average domestic rate of inflation tracks the foreign inflation rate and consequently, foreign price shocks affect domestic prices. On the other hand, under a flexible exchange rate regime, the monetary authority allows the nominal exchange rate to adjust freely in response to foreign economic disturbances. The rate moves to maintain the domestic currency price of foreign goods that would have changed in the presence of foreign price shocks. Inflation is thus not transmitted from the large economy to the small open economy.

Yet, empirical evidences have shown conflicting results. Cheung and Yuen (2002) compare the effects of U.S. inflation on Hong Kong and Singapore and find that between the two, inflation in Hong Kong is more responsive to U.S. price movements. This result is consistent with standard theory considering that the foreign exchange regime in Hong Kong operated under a currency board. The result on Singapore, however, appears contradictory because even with a fully-flexible regime, its inflation is still affected by U.S. price shocks. Two arguments are raised to explain this result: first, flexible regimes do not necessarily insulate the economy from real shocks and second, the Monetary Authority of Singapore manages the currency to maintain competitiveness and curb imported inflation. The authors conclude that the exchange rate flexibility appears to absorb some of the impact of the foreign price shocks.

Feyzioglu and Willard (2006) conduct a study linking inflation in the U.S., China and Japan. They find limited evidence that inflation in China leads to price changes in the United States and Japan; however, inflation in the United States has an impact on Chinese inflation albeit short lived. Their finding is consistent with literature that suggests that under a relatively stable exchange rate regime, inflation is propagated from the reserve currency country to other economies. Shambaugh (2004), using a sample of 100 developing and industrial countries from 1973 through 2000, shows that a fixed exchange regime forces countries to follow the monetary policy of a base country more closely than a floating rate country.

Crowder (1996), however, observes that during the post-Bretton Woods floating rate period, there is strong evidence that inflation transmission among G-7 countries is at work; moreover, transmission does not originate solely from the U.S., the reserve currency country but from all seven countries. He listed several reasons to explain the transmission of inflation over the floating rate regime which include the central bank interventions in the foreign exchange market and the role of the U.S. dollar as the dominant reserve currency. Meanwhile, under circumstances where there exists currency substitution, Rogers (1990) has also showed that foreign inflation is positively transmitted to countries with flexible exchange rate system. He is able to establish that the transmission of foreign to domestic inflation during the transition to the new steady state is positively related to the elasticity of demand for foreign currency, and that the absolute magnitude of this transmission effect is positively related to the economy's initial stock of foreign real balances.

Finally, a number of studies argue that global factors are becoming more relevant for domestic inflation determination across a broad range of countries regardless of the type of exchange rate regime (see Borio and Filardo (2007); Fitoussi (2007); Kohn (2006)). Quirk (1994) argues that there is little relationship between the choice of exchange rate regime and inflation and concludes that the stability of the exchange rate has generally been a by-product of other policy choices.

Philippine Inflation and Exchange Rate Regime in the last Four Decades

During the last four decades, the Philippines has operated under two different exchange rate regimes. In 1973, the Philippine central bank formally adopted a managed float system, intervening in the foreign exchange market to maintain monetary stability and preserve the international value and convertibility of the peso. The operation of the central bank was not entirely independent as evidenced by government officials dominating the monetary board (Lamberte, 2002). For roughly two decades, the central bank had been officially targeting the exchange rate and this system was in place until 1992. Gochoco (1991) has shown that except in 1983 and 1984 when there were large discrete devaluations of the peso, the nominal exchange rate remained very stable while money supply growth, inflation and interest rates exhibited large variability.

The period of exchange rate targeting in the 80s coincided with external and internal shocks in the economy resulting in unpredictable monetary policies and very irregular inflation movement. External factors included the 1979 second oil price shock, the 1981-82 U.S. recession and the 1983 world interest rate increase. Internal factors included the Aquino assassination and a national balance of payment crisis leading to the 1983 debt moratorium (See Lindsey (1984) and Yap (1996)). Ultimately, it was the printing of money to finance public sector debt and intervene on the peso that resulted in the high inflation in the mid-80s, which reached 47 percent in 1984 (Gochoco-Bautista and Canlas, 2003).

In 1993, the new Central Bank Act was passed in Congress establishing the Bangko Sentral ng Pilipinas as an independent monetary policy making institution. The BSP's primary mandate was to maintain price stability conducive to a balanced and sustainable growth of the economy. It adopted a policy-shift away from exchange rate targeting to a new framework geared toward monetary aggregate targeting coupled with some form of inflation targeting. Still, the exchange rate was effectively fixed within a narrow band. In 1994, for example, the average exchange rate was Php. 26.40 to the dollar, in comparison to the 1996 rate of Php. 26.30 to the dollar. It was with this framework that the country went through the Asian Financial Crisis which led to the sharp depreciation of the peso from a rate of Php. 26.40 to the U.S. dollar in June 1997 to Php. 42.70 in January 1998.

The peso depreciation exacerbated the payments on maturing dollar-denominated debt obligations of the private sector which sent some businesses to bankruptcies and banks to hold greater amount of non-performing loans. Inflation also started to increase in 1998. The BSP then pursued monetary tightening so that by mid-1999, inflation was back to around 6 percent, the same level prior to the crisis. After recovering from the crisis, the central bank authorities allowed a more freely floating peso and officially announced adopting an inflation targeting framework in 2002. Between 2002 and 2007, the average actual inflation was 4.9

percent which is between the central banks lower and upper bound target of 4.3 percent and 5.3 percent (Gunigundo, 2009). These bounds were, however, broken at the height of the Great Recession when inflation hit double-digit level during the third quarter of 2008. It has since then greatly subsided and hovered between 2.6 percent to 4.0 percent in 2012.

Research Methodology and Empirical Results

This study uses monthly consumer price index data during the period, January 1990 to December 2014, the period generally associated with the BSP adoption of a flexible regime. Data are taken from the Bureau of Labor Statistics website for the US economy and the National Statistical Coordination Board websites for the Philippine economy.

I adjust the monthly CPI data using multiplicative seasonal adjustment with 12-month moving average and expressed the values in terms of logarithms. I then test each series for the presence of a unit root. If both series are found to be nonstationary, I perform a cointegration test. The motivation in conducting the cointegration test is to determine the existence of inflation transmission. The presence of cointegration shows that two variables follow the same stochastic trend and are thus linked towards the long run. In the presence of cointegration, a vector error correction model can be set up to understand the dynamics between the two inflation rates. In its absence, a vector autoregression model is more appropriate. Finally, I generate impulse response functions and factor-error variance decomposition to draw further insights from the series.

Test for the Order of Integration

To detect the presence of unit root with structural breaks, the Andrews and Zivot (1992) unit root test is applied individually to the U.S. and Philippine log CPI series. Determining the presence of a unit root is important because non-stationary series implies that a shock today will have persistence. Determining the presence of a unit root with structural break is equally important because failure to identify breaks leads to confusing them as evidence of non-stationarity. It is fair to believe that structural breaks in economies do occur whenever there are economic crises, technological shocks, policy or regime changes and organizational or institutional developments (Hatemi-J, 2008).

The null hypothesis is that the series has a unit root without exogenous structural break against the alternative hypothesis that the series is trend stationary with possible structural break. The testing procedure for the unit root takes into account three kinds of structural breaks: crash model which allows for a break in the level or intercept of the series (eq. 1); changing growth model which allows for break in the slope (eq. 2); and a combination of the two (eq. 3).

$$y_t = \mu^A + \alpha^A y_{t-1} + \beta^A t + \theta^A DU(\lambda) + \sum_{i=1}^{k} c_i^A \Delta y_{t-i} + \epsilon_t^A \quad (1)$$

$$y_t = \mu^B + \alpha^B y_{t-1} + \beta^B t + \gamma^B DT(\lambda) + \sum_{i=1}^{k} c_i^B \Delta y_{t-i} + \epsilon_t^B \quad (2)$$

$$y_t = \mu^C + \alpha^C y_{t-1} + \beta^C t + \theta^C DU(\lambda) + \gamma^C DT(\lambda) + \sum_{i=1}^{k} c_i^C \Delta y_{t-i} + \epsilon_t^C \quad (3)$$

where y_t is the data series, μ's are constant terms, α the coefficient of lagged y, λ is the breakpoint given by T_B/T , $DU(\lambda) = 1$ if $t > T\lambda$, 0 otherwise; $DT(\lambda) = tT\lambda$ if $t > T\lambda$, 0 otherwise. The results of the test are shown in Table 1.

Table 1: Zivot-Andrews Unit Root Test with Structural Break

Type of Structural Break	Breakpoint Date	Minimum t-statistic	5% Critical Value
U.S. CPI Series			
Break in Intercept	2008M10	-4.115	-4.80
Break in Slope	2008M5	-4.356	-4.42
Break in Intercept and Slope	2007M2	-4.857	-5.08
Philippine CPI Series			
Break in Intercept	1997M10	-4.200	-4.80
Break in Slope	2008M7	-4.002	-4.42
Break in Intercept and Slope	2008M8	-4.121	-5.08

The unit root tests for both the U.S. and Philippine CPI series show that the null hypothesis of the presence of unit root without exogenous structural break fails to be rejected. The results are the same for all three models: break in intercept, break in slope and breaks in both intercept and slope. Given the unanimity of the results, it is thus clear that the U.S. and Philippine CPI series each has a unit root. The presence of unit root opens the possibility that the two time series may be following the same stochastic trend and that inflation in the U.S. may affect inflation in the Philippines. To test this possibility, we employ the Gregory-Hansen cointegration test.

Test for Cointegration

Gregory and Hansen (1996) developed a test for cointegration with structural break following the residual-based test method. The test is basically of the ADF-, Z_α- and Z_t- type that test the null hypothesis of no cointegration against the alternative hypothesis of cointegration in the presence of structural break. The result of the test provides evidence for a long-run equilibrium relationship between two time series.

The standard model of cointegration without a structural break is given by:

$$y_{1t} = \mu + \alpha^T y_{2t} + \epsilon_t \tag{4}$$

where y_{2t} is I(1) and the error term is I(0). A structural change is introduced either as a shift in the intercept μ or a change in the slope α. To model the structural change, a dummy variable φ is defined as:

$$\varphi_{t\tau} = \begin{cases} 0 & if\ t \leq [n\tau] \\ 1 & if\ t > [n\tau] \end{cases} \tag{5}$$

where $\tau\ \epsilon\ (0,1)$ and represents the unknown timing of the shift. The timing of the shift is determined endogenously. Based on this formulation, the structural shift can be represented in three forms: a level shift (eq.6), a level shift with trend (eq.7) or a regime shift (eq.8).

$$y_{1t} = \mu_1 + \mu_2\varphi_{t\tau} + \alpha^T y_{2t} + \epsilon_t \tag{6}$$

$$y_{1t} = \mu_1 + \mu_2\varphi_{t\tau} + \beta t + \alpha^T y_{2t} + \epsilon_t \tag{7}$$

$$y_{1t} = \mu_1 + \mu_2\varphi_{t\tau} + \alpha_1^T y_{2t} + \alpha_2^T y_{2t}\varphi_{t\tau} + \epsilon_t \tag{8}$$

The cointegrating relation is estimated via ordinary least squares and then a unit root test is applied to the regression errors. The test statistics are computed using the Phillips method to obtain Z_α and Z_t and separately using the Augmented Dickey-Fuller test to obtain the ADF statistic. The result of the cointegration test of Philippine CPI on U.S. CPI, using the ADF statistic, is shown in Table 2.

The test results reveal that the null hypothesis of no cointegration fails to be rejected at the 1% significance level for all three models. These results mean that the Philippine CPI series is not cointegrated with the U.S. CPI series and hence, there is no long run link between the two series. Philippine inflation is not influenced by U.S. inflation over the long run. This finding supports the theory that the flexibility of the exchange rate regime shields the country from foreign price shocks.

Table 2: Gregory-Hansen Cointegration Test with Structural Break

Philippine CPI Series on U.S. CPI Series with Structural Break*
$lnPH_{cpi} = \mu + \alpha^T lnUS_{cpi} + \epsilon_t$

Structural Break	Breakpoint Date	Minimum t-statistic	Critical Value	
			1%	5%
Level shift	2005M3	-3.89	-5.13	-4.61
Level shift with trend	2005M3	-4.14	-5.45	-4.99
Regime shift	2000M12	-4.49	-5.47	-4.95

**AIC is used to determine the lag length.*

Vector Autoregression, Impulse Response Function and Forecast Error Variance Decomposition

Vector autoregression (VAR) is set up for the Philippine and U.S. inflation series to examine how inflation in the Philippines is affected by its own past realizations and past realizations of U.S. inflation. The first difference of the log CPI series, instead of the log CPI series, is used since the price levels are tested to be non-stationary. Unit root tests conducted on the first difference of the CPI series reveal that inflation in the U.S. and the Philippines are indeed stationary; hence, they can be used to properly estimate a VAR. The Akaike information criterion is used to determine the optimal lag-length for the VAR model.

After modelling the VAR, I derive an impulse response function (IRF) to describe how local inflation reacts over time to exogenous shocks. In the absence of a long run link, I expect to see that any temporary short run shocks should quickly die down over time. Moreover, the VAR and IRF can provide hints as to the direction of inflation transmission: whether U.S. inflation affects the Philippines or Philippine inflation affects the U.S. or even both. Finally, a Cholesky forecast error variance decomposition (FEVD) is set up to measure the magnitude of contribution of foreign shocks to local inflation.

The results of the VAR model is shown below. Graphical representations of the IRF and FEVD are shown in Figure 1 and Figure 2. In this analysis, I use a 5 percent alpha level to determine the significance of the variables. The p-values are in parentheses.

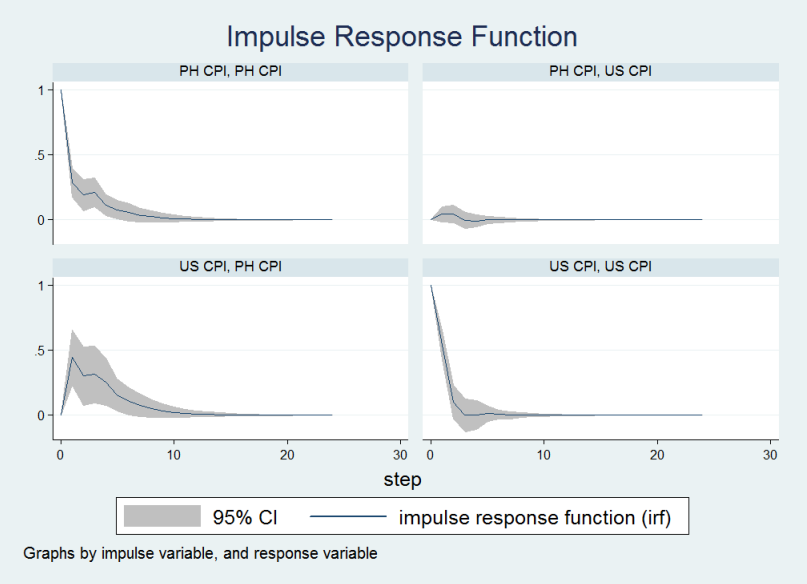
$$\Delta US_t = \underset{(0.000)}{0.001} + \underset{(0.000)}{0.54}\Delta US_{t-1} - \underset{(0.001)}{0.21}\Delta US_{t-2} + \underset{(0.510)}{0.04}\Delta US_{t-3} + \underset{(0.155)}{0.04}\Delta PH_{t-1} + \underset{(0.739)}{0.01}\Delta PH_{t-2} - \underset{(0.312)}{0.30}\Delta PH_{t-3}$$

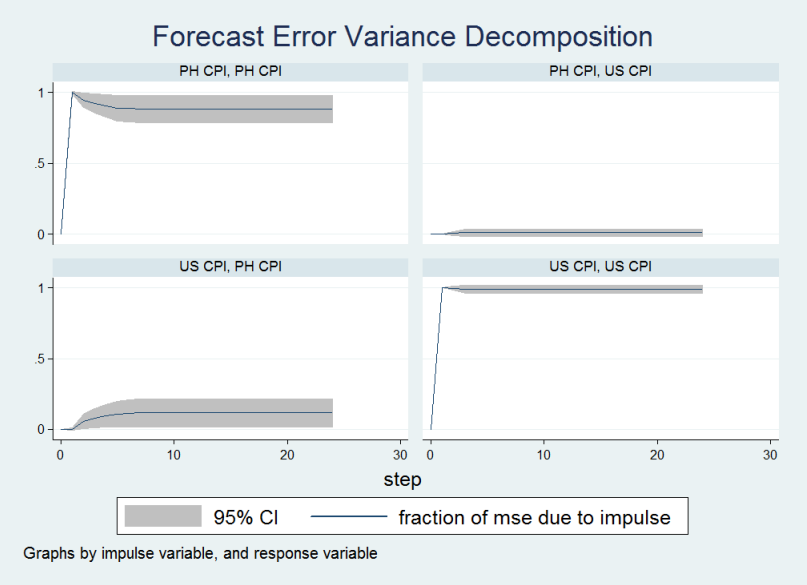
$$\Delta PH_t = \underset{(0.003)}{0.001} + \underset{(0.000)}{0.45}\Delta US_{t-1} - \underset{(0.595)}{0.07}\Delta US_{t-2} + \underset{(0.114)}{0.17}\Delta US_{t-3} + \underset{(0.000)}{0.29}\Delta PH_{t-1} + \underset{(0.129)}{0.09}\Delta PH_{t-2} + \underset{(0.040)}{0.11}\Delta PH_{t-3}$$

The optimal lag length for the VAR model is three lags. The VAR shows that in the short run, the direction of inflation transmission is from the U.S. to the Philippines and not the other way round. Inflation in the U.S. is only affected by its own lagged values. Based on the level of significance, U.S. inflation in the previous month has a positive contribution to its current level while inflation two months earlier has a negative contribution. A one percent increase in inflation the previous month results in a 0.54 percent increase in the current inflation. A one percent increase in inflation two months earlier results in a 0.21 percent decrease in the current inflation.

Meanwhile, inflation in the Philippines is affected by both its own lagged inflation and U.S. lagged inflation, indicative that the large economy is influencing inflation in the small open economy in the short run. There is persistence in Philippine inflation as levels one month and three months earlier also contribute to its current inflation level. Moreover, the effect of U.S. inflation on the Philippines comes with a one-month delay. The IRF results show that the immediate effect is considerable at 45 percent. But the effect is only short-lived, spiking on the first month before subsiding so that as early as the sixth month, the effect is already below 10 percent. A look at the variance decomposition reveals that the contribution of U.S. price shocks to Philippine inflation is at 11.8 percent.

Figure 1: U.S. and the Philippines: Impulse Response Function





Overall, these findings are consistent with the predictions of the small open economy model, indicating that towards the long run, foreign inflation from the large economy does not affect domestic inflation in a small open economy with a flexible exchange rate regime. Even with strong trade and financial linkages between the U.S. and the Philippines, inflation in the Philippines remains a domestic policy choice and concern for the central bank and policymakers. Indeed, while in the short run, there may still be a transmission, its effect is only temporary. The emerging stylized fact is that price shocks from the U.S. have transitory but no permanent effect on the Philippines. The results of this study have important implications to the central bank policy. As long as the BSP maintains a fully flexible exchange regime and allow the exchange rates to move freely in response to foreign shocks, it does not need to worry about spillovers from unwarranted developments in U.S. inflation. It suffices to say that the bank's framework that targets long run inflation may disregard the effect of foreign price shocks.

Conclusion

The small open economy model predicts that inflation can be transmitted from a large economy to a small open economy in a fixed exchange regime but not in a flexible regime. Empirical studies, however, have shown contrasting results with some studies arguing that transmissions have even occurred in flexible regimes. This paper investigates the extent to which U.S. inflation affects inflation in the Philippines. The Philippines has operated under a flexible exchange rate regime since the 1990s and adopted an inflation targeting framework in 2002. Understanding whether foreign inflation and price shocks are transmitted locally is therefore important so as to guide policymakers.

I use the small open economy model to serve as the theoretical framework for this study. I conduct unit root and cointegration tests between the U.S. and Philippine consumer price indices, in logarithm terms, and find that while the two series have unit roots, they are not cointegrated. These empirical results suggest that U.S. and Philippine inflation do not follow the same stochastic trend and are, thus, not linked towards the long run. Moreover, I set up a vector autoregression and impulse response function, and conduct a forecast error variance decomposition to show that U.S. price shocks have only temporary effect in the short run. In summary, U.S. inflation and price shocks have transitory but no permanent effect on the Philippines. The results of this study therefore support the theory.

The study has important policy implications. As long as the BSP maintains a fully flexible exchange regime and allow the exchange rates to move freely in response to foreign shocks, it does not need to worry about spillovers from unwarranted developments in U.S. inflation. It suffices to say that the bank's framework that targets long run inflation may disregard the effect of foreign price shocks.

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