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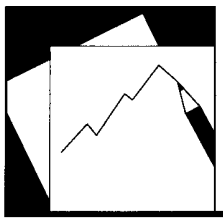

IMF Working Paper

An Assessment of Malaysian Monetary Policy during the Global Financial Crisis of 2008–09

Harun Alp, Selim Elekdag, and Subir Lall

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Asia and Pacific Department

An Assessment of Malaysian Monetary Policy during the Global Financial Crisis of 2008–09?

Prepared by Harun Alp, Selim Elekdag, and Subir Lall[1]

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Abstract

Malaysia was hit hard by the global financial crisis of 2008–09. Anticipating the downturn that would follow the episode of extreme financial turbulence, Bank Negara Malaysia (BNM) let the exchange rate depreciate as capital flowed out, and preemptively cut the policy rate by 150 basis points. Against this backdrop, this paper tries to quantify how much deeper the recession would have been without the BNM's monetary policy response. Taking the most intense year of the crisis as our baseline (2008:Q4–2009:Q3), counterfactual simulations indicate that rather the actual outcome of a –2.9 percent contraction, growth would have been –3.4 percent if the BNM had not implemented countercyclical and discretionary interest rate cuts. Furthermore, had a fixed exchange rate regime been in place, simulations indicate that output would have contracted by –5.5 percent over the same four-quarter period. In other words, exchange rate flexibility and the interest rate cuts implemented by the BNM helped substantially soften the impact of the global financial crisis on the Malaysian economy. These counterfactual experiments are based on a structural model estimated using Malaysian data.

JEL Classification Numbers:E5, F3, F4, C11

Keywords: financial accelerator, Bayesian estimation, DSGE model, financial crises, sudden stops, monetary policy, Malaysia, emerging markets.

Authors' E-Mail Addresses: harun.alp@tcmb.gov.tr, selekdag@imf.org, slall@imf.org

[1] Harun Alp is with the Central Bank of the Republic of Turkey. The views expressed in this working paper are those of the authors and do not necessarily represent those of any institution the authors are or have been affiliated with.

EXECUTIVE SUMMARY

This paper argues that proactive monetary policy by the Bank Negara Malaysia (BNM) helped soften the impact of the global financial crisis of 2008–09. Specifically, the findings suggest that without the countercyclical and discretionary interest rate cuts and exchange rate flexibility, the global financial crisis would have been associated with a much deeper economic contraction in Malaysia.

To mitigate the severity of the downturn that would very likely follow the financial stress episode which intensified in the fall of 2008, the BNM let the exchange rate depreciate and cut policy rates by 150 basis points. But did it help?

The most intuitive way to communicate our quantitative results is by taking the growth rate during the most intense year of the global financial crisis as our baseline, namely the four quarters spanning 2008:Q4–2009:Q3. Model-based counterfactual simulations indicate that without the countercyclical and discretionary interest rates cuts implemented by the BNM, output would have contracted by 3.4 percent rather than the actual 2.9 percent during these four quarters. Moreover, if a fixed exchange rate regime would have been in place of the current monetary policy framework (which allows exchange rate flexibility), the results indicate that growth would have been –5.5 percent. In other words, these simulations underscore the favorable output stabilization properties owing to the combination of countercyclical monetary policy and exchange rate flexibility.

These finding are based on counterfactual simulations derived from an estimated dynamic stochastic general equilibrium (DSGE) model which, along with standard nominal and real rigidities, includes a financial accelerator mechanism in an open-economy framework.

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I. INTRODUCTION

The global financial crisis which intensified in September 2008 was characterized by an episode of acute international financial stress and a sharp global economic contraction.[2] In this context, taking the most intense year of the crisis as our baseline, namely the four quarters spanning the 2008:Q4–2009:Q3 period, Malaysian real GDP contracted by about three percent (**Figure 1**). While such a downturn is quite moderate relative to many other economies' experiences, Malaysia was one of the most adversely affected Asian economies. To mitigate the severity of the recession, Bank Negara Malaysia (BNM) let the exchange rate depreciate and cut policy rates by 150 basis points—did this help?

The focus of this paper is to assess the role of countercyclical interest rate cuts and exchange rate flexibility in mitigating the fallout from the global financial crisis of 2008-09. Specifically we seek to address to following question: If the countercyclical and discretionary interest rate cuts along with exchange rate flexibility had not been allowed, how much deeper would the downturn in Malaysia have been? This paper finds that the downturn would have been substantially more severe.

To provide a quantitative answer to this question, we develop and estimate a small open economy dynamic stochastic general equilibrium (DSGE) model designed to capture salient features of the Malaysian economy. The model contains a number of nominal and real frictions such as sticky prices, sticky wages, variable capital utilization, investment adjustment costs, and habit persistence, and also incorporates a financial accelerator mechanism à la Bernanke and others (1999) in an open-economy setup to better fit the Malaysian data.

The model is used to generate counterfactual simulations. To more intuitively convey our quantitative results, we consider the growth rate during the most intense year of the global financial crisis as our baseline, namely the four quarters covering the 2008:Q4–2009:Q3 period. In this context, our counterfactual simulations indicate that without the countercyclical and discretionary interest rate cuts possible under the BNM's current monetary policy framework, growth over the four quarters under consideration would have been –3.4 percent instead of the actual outcome of –2.9 percent. This difference in outcomes is in line with Christiano and others (2008), which finds growth contributions of 75 basis points and 127 basis points for the United States and the Euro area, respectively, which is further discussed below. Other counterfactual experiments are also insightful. For example, if a fixed exchange rate regime would have been in place instead of the current monetary policy regime which allows exchange rate flexibility, the results indicate that growth over the 2008:Q4–2009:Q3 period have been –5.5 percent.

In sum, without a flexible exchange rate regime and active countercyclical monetary policy, the impact of the recent global financial crisis would have been substantially more severe. The BNM's current monetary policy framework underpinned by a flexible exchange rate seems to have increased the robustness of the Malaysian economy to shocks. In particular, along with the countercyclical and discretionary interest rate cuts, exchange rate flexibility served as a shock absorber, both of which increased the resilience of the economy. The latter result

[2] Cardarelli, Elekdag, and Lall (2011) could serve as a useful reference.

echoes the favorable output stabilization properties of exchange rate flexibility which can be traced back to at least the seminal contributions of Mundell and Fleming.

This paper builds on a tradition of small open economy DSGE models. Over time, these real models such as Mendoza (1991) were augmented with nominal rigidities to motivate and then explore the implications of monetary policy (for example, Gali and Monacelli, 2002, among others). To capture financial frictions more appropriately, building on Bernanke and others (1999), a financial accelerator mechanism was also added on to these models (see for example, Cespedes and others, 2004; Devereux, and others, 2006; Gertler, and others, 2007; as well as Elekdag and Tchakarov, 2007).

With the growing feasibility and popularity of Bayesian methods, building upon the closed economy studies of Smets and Wouters (2003, 2007), small open economy models were estimated (Lubik and Schorfheide, 2007). Then, Elekdag, Justiniano, and Tchakarov (2006) estimated a small open economy model with a financial accelerator for an emerging market, which later motivated others to use richer modeling structures (see, for example, Garcia-Cicco, 2010). Against this backdrop, as in Alp and Elekdag (2011) and Alp, Elekdag, and Lall (2011), this paper takes Elekdag, Justiniano, and Tchakarov (2006) as a starting point, and augments their model with some of the features in Gertler and others (2007), Smets and Wouters (2007) to improve model fit and to facilitate the counterfactual simulations discussed below.

This paper is structured as follows. The next section begins by briefly providing the background to the nature of the shock that hit Malaysia in the immediate aftermath of the collapse of Lehman Brothers in September 2008. The paper then goes on to describe the model used in this paper, followed by a description of the estimation results for the case of Malaysia. This is followed by an assessment of the result and its implications for the channels of transmission of monetary policy. The final section concludes with some policy implications.

II. Background to the 2008–09 Crisis and its Impact

With the collapse of Lehman Brothers in September 2008, the accompanying global liquidity squeeze also affected Malaysia. U.S dollar funding pressures resulted in sharply wider cross-currency basis swap spreads and sporadic evidence of difficulty in accessing credit. The benchmark equity index declined some 30 percent between mid-2008 and March 2009. Portfolio outflows amounted to around $27 billion in 2008, and bank outflows surged in the second half of 2008, though on a smaller scale than in some other economies that were more dependent on wholesale cross border financing.

The downturn in global trade adversely affected Malaysian exports, given Malaysia's high degree of integration with the global economy. The 15 percent (year-on-year) decline in exports in the first quarter of 2009 also dampened domestic demand, particularly fixed investment.

In response to the real and financial spillovers, the authorities acted swiftly and decisively to maintain financial stability as well as cushion the downturn that was in prospect, given the financial stress and sharp markdown of global growth prospects. Bank Negara Malaysia (BNM) safeguarded short-term funding in the banking system by announcing in October 2008 its willingness to back interbank lending. It also used a combination of foreign exchange

intervention and some depreciation of the exchange rate, as a response to capital outflow pressures. BNM cut policy interest rates by 150 basis points to 2 percent, and reduced reserve requirements to ease financial intermediation costs. In addition to other financial policy measures, two fiscal stimulus packages were implemented to cushion the economy.

The swift and comprehensive policy response, against the backdrop of robust financial and corporate sector balance sheets, helped cushion the downturn. Despite the very severe shock to the economy, output contracted relatively modestly before rebounding rapidly in 2010.

III. A Model for Malaysia's Monetary Policy

This section presents an overview of the structural model underpinning our quantitative results on the role of monetary policy during the downturn. As mentioned above, readers primarily interested in the main policy implications of the paper could directly proceed to Section V. The goal here is to present the general intuition of the model. For further details, please see Alp, Elekdag, and Lall (2012).

The structural framework builds upon a core (New) Keynesian model. The model used is an open-economy variant of what the literature refers to as a New Keynesian dynamic stochastic general equilibrium (DSGE) model. However, to better fit the data, the model is augmented with a number of features including real and nominal rigidities (including, for example, investment adjustment costs and sticky wages), as well as a financial accelerator mechanism (to capture financial market imperfections) among several others. The model consists of several agents including households, producers, and the government. There are three types of producers: entrepreneurs, capital producers, and retailers. The government is responsible for implement monetary and fiscal policy. In what follows, this section will focus on the transmission of certain shocks and the role of monetary (and exchange rate) policy.

A. The Transmission of Shocks

Recall that this paper seeks to investigate the role of monetary policy in softening the impact of the global financial crisis on the Malaysian economy. To help foster model intuition, it would be useful to focus on three shocks associated with the crisis and explore how they were transmitted to Malaysia. These shocks are: a collapse in foreign demand, distress across international capital markets, and heightened uncertainty. An overview of how these shocks are propagated within our model is discussed below in turn.

The export demand shock

The export demand shock, or perhaps equivalently, the foreign demand shock, propagates through the model via the market clearing condition below:

$$Y_t^H = C_t^H + C_t^{eH} + I_t^H + C_t^{H*} + G_t$$

Leaving aside differences in notation, this is basically the standard aggregate demand identity for home (domestically produced) goods, which posits that domestic output is equal to the sum of consumption of domestically produced goods (which is the sum of both household and entrepreneurial consumption, $C_t^H + C_t^{eH}$), domestic investment good, I_t^H, government expenditures, G_t, and exports, C_t^{H*}. Therefore, a collapse in export (foreign) demand is simply represented by a decline in C_t^{H*}.

The sudden stop shock

Malaysia's experience during the global financial crisis was also associated with a reversal of capital inflows (a "sudden stop" in the parlance of Calvo and others, 2004), as well as a sharp depreciation of the exchange rate. To capture these interrelated disruptions, we (as do many other papers) augment the uncovered interest parity (UIP) condition with an exogenous shock:

$$i_t = i_t^* E_t \left[\frac{S_{t+1}}{S_t}\right] \Phi_t$$

where, i_t and i_t^*, represent the domestic and international (gross) interest rates, respectively, S_t denotes the nominal exchange rate (Malaysian ringgit per US dollar—an increase represents a depreciation), E_t is the expectations operator (conditional on information up to time t), and Φ_t is the sudden stop shock (also referred to an exchange rate shock or UIP shock other in the literature). Therefore, as in Gertler and others (2007), a shock that triggers large capital outflows is captured by this exogenous term which is appended to an otherwise standard UIP condition. This sudden stop shock would serves to capture an important dimension of the financial aspect of the recent crisis.

The (financial) uncertainty shock

The description of this shock warrants some background. In this model, the real cost of capital departs from the standard representation in other studies because of the existence of an external finance premium. Consider the equation below:

$$E_t[R_{t+1}^k] = \chi_t(\cdot) E_t[R_{t+1}]$$

where we have that the real cost of capital, R_t^k, is equal to the real interest rate, R_{t+1}, augmented by the external finance premium represented by the term $\chi_t(\cdot)$. In turn, the external finance premium depends on the leverage ratio (assets scaled by net worth) of the entrepreneurs:

$$\chi_t = \chi_t \left(\frac{Q_t K_{t+1}}{N_{t+1}}\right)$$

Note that total assets, $Q_t K_{t+1}$, depends on the price of equity, Q_t, which is not sticky (in contrast to goods prices or wages). This implies that the leverage ratio is quite sensitive to asset price fluctuations.

The precise specification of the evolution of net worth, N_{t+1}, is complex (and shown in Alp and Elekdag, 2011), so here we use an abridged version:

$$N_{t+1} = \varrho_t V_t + W_t^e$$

where W_t^e and V_t , denote the entrepreneurial wage bill and the value of the firm, respectively. The (financial) uncertainty shock is an exogenous process, represented by the term, ϱ_t, which by construction has a direct impact on the level of aggregate net worth and therefore the external financial premium. Put differently, the net worth shock could be interpreted as a shock to the rate of destruction of entrepreneurial financial wealth (in line

with several other studies). This shock directly affects entrepreneurial net worth and has been used in various forms by Elekdag and others (2006), Curdia (2007), Christiano and others (2010), and more recently by Alp and Elekdag (2011). Another way to think about this shock is that it could be thought of capturing counterparty risk—owing part to Knightian uncertainty—a key consideration during the global financial crisis. This heightened uncertainty regarding cash flows, for example, would impair assets and thus disrupt the financial system.

B. What Role for Monetary Policy?

In our model, the central bank alters interest rates in an attempt to achieve certain policy objectives. Before proceeding to the details, note that the policy rule to be described below implies that the monetary authority sets the nominal interest rate, taking into consideration the inflation rate deviation from the time-varying inflation objective, the output gap, the rate of exchange rate depreciation, and the previous period's interest rate (policy smoothing).

A simplified version of the empirical interest rate rule takes the following (log-linear) form (for further details, see Alp and Elekdag, 2011):

$$\hat{\imath}_t = \rho_i \hat{\imath}_{t-1} + \tau_\pi (E_t \hat{\pi}_{t+1} - \rho_{\bar{\pi}} \hat{\pi}_t^T) + \ + \tau_y \hat{y}_t + \tau_s \Delta \hat{s}_t + \epsilon_t^i$$

where in this flexible specification, $\hat{\imath}_t, \hat{\pi}_{t+1}, \hat{y}_t, \hat{s}_t$ denote the (short-term policy) interest rate, the (core CPI) inflation rate, the output gap, and the nominal exchange rate, respectively. Note that ϵ_t^i denotes the monetary policy shock—interest rate changes that deviate from the (empirical) interest rate rule would be captured by this disturbances and could be considered discretionary monetary policy. The time-varying inflation objective, $\hat{\pi}_t^T$, is assumed to evolve according to the following stochastic process:

$$\hat{\pi}_t^T = \rho_{\bar{\pi}} \hat{\pi}_{t-1}^T + \epsilon_t^\pi$$

The time-varying inflation objective has also been used in the literature to capture structural changes in the conduct of monetary policy that are not captured otherwise (see Adolfson and others, 2007, for further details).

Anticipating the results to follow, notice that when the output gap is negative—that is, output is below potential—strict adherence to the rule above would imply that the interest rate decreases by an amount dictated by the coefficient, τ_y . However, the monetary authority (BNM) might decrease interest rates by more than what the systematic component of the rule would imply. Recall that this deviation from the rule is capture by the error term, ϵ_t^i, which is the monetary policy shock—thereby capturing discretionary monetary loosening. As will be discussed in further detail below, during the most intense episode of the global financial crisis, interest rates decreased by more than the amount the empirical counterpart of the rule would have implied, helping soften the impact of the global financial crisis.

C. The Monetary Transmission Mechanism

Before continuing, it might be useful to provide an overview of how monetary policy is transmitted throughout the economy. Reviewing the monetary transmission mechanism would also provide further insight regarding the dynamics of the model. Countercyclical monetary policy is propagated via three main channels in the model; for illustrative purposes, consider an interest rate increase:

- The first channel operates as interest rates affect domestic demand, which is primarily comprises consumption and investment. Working through the Euler equation, higher real interest rates foster an increase in saving as consumption is postponed to later periods. At the same time, higher real interest rates increase the opportunity cost of investment, decreasing the rate of capital accumulation. As a result, domestic demand decreases, putting downward pressure on inflation.

- The second channel brings out the open economy features of the model as it works via the exchange rate. Because of the nominal rigidities, the increase in the nominal interest rate translates into higher real interest rates and is associated with an increase in the real exchange rate. In turn, this appreciation of the real exchange rate suppresses net exports (the expenditure switching effect), further decreasing aggregate demand.

- The third channel is characterized by the financial accelerator mechanism. Higher interest rates depress asset prices (the real price of capital) bringing about a deterioration in net worth. Weaker balance sheet fundamentals cause an increase in the external finance premium thereby raising the opportunity cost of investment above and beyond the initial effect generated by the monetary tightening. This brings about an even sharper contraction in investment, which is the primary determinant of the deeper contraction. As discussed in further depth in other papers, the financial accelerator mechanism can amplify the effects of certain shocks (Bernanke, Gertler, and Gilchrist, 1999).

IV. Estimation of the Model for Malaysia

This section gives an overview of model estimation. It briefly reviews issues pertaining to data, parameter calibration, choice of prior distributions, and the resulting posterior distributions. An extensive discussion of these issues is covered in Alp and Elekdag (2011).

A. Data

The log-linearized model is estimated using Bayesian methods popularized by Smets and Wouters (2003, 2007). The model is estimated using quarterly data covering the years 2000–2010 using 12 standard time series, a few of which are shown in **Figure 1**. Specifically, in line with many other studies, we have chosen to match the following set of variables: the levels of the domestic policy and foreign interest rates, the inflation rates of domestic GDP deflator and core consumer price and foreign consumer price indices, as well as the growth rates of GDP, consumption, investment, exports, imports, foreign GDP, and the real exchange rate.

B. Model Parameters

We followed the literature and calibrate certain parameters (see, for example, Christiano and others, 2010), which could be thought of as infinitely strict priors. Many of the parameters are chosen to pin down key steady state ratios characterizing the Malaysian economy (including trade openness, as measured by, for example, the exports-to-GDP ratio), while the remaining parameters are taken from the literature as summarized in **Table 1**.

The remaining 43 parameters, shown in **Table 2**, are estimated. These parameters determine the degree of the real and nominal rigidities, the monetary policy stance, as well as the persistence and volatility of the exogenous shocks. The table shows the assumptions pertaining to the choice of distribution, the means, standard deviations, or degrees of freedom. The choice of priors is in line with other studies (see Alp and Elekdag, 2011, for a selected review of the literature). The posterior estimates of the variables are shown in the same table, which reports the means along with the 5^{th} and 95^{th} percentiles of the posterior distribution of the estimated parameters obtained through the Metropolis-Hastings sampling algorithm. In general, the parameter estimates are in line with those found in other studies. We also considered a few robustness exercises, which, for example, consider different monetary policy regimes (for example, a fixed exchange rate regime)—overall results are decisively in favor of the baseline.

V. The Role of Monetary Policy During the Crisis

This section of the paper presents our main quantitative findings. Using the estimated structural model briefly discussed above, counterfactual policy simulations are conducted to assess the role of monetary policy implemented by the BNM during the global financial crisis of 2008-09. We find that without a flexible exchange rate regime and active countercyclical monetary policy, the impact of the recent global financial crisis would have been substantially more severe. Put differently, the BNM's monetary policy framework (which is underpinned by a flexible exchange rate) seems to have increased the robustness of the Malaysian economy to shocks.

In fact, model-based counterfactual simulations indicate that without the countercyclical and discretionary interest rates cuts implemented by the BNM, growth over the 2008:Q4–2009:Q3 period would have decreased from the actual realization of –2.9 percent to –3.4 percent. Moreover, if a fixed exchange rate regime were in place instead of the current monetary policy regime (which is underpinned by a flexible exchange rate), the results indicate that growth in over the same four quarters would have been –5.5 percent.

A. Setting Up the Counterfactual Simulations

Recall that this paper is trying to assess the role of the BNM's monetary policy framework in terms of mitigating the impact of the global financial crisis on the Malaysian economy.

Though intimately related, the model allows us to separately investigate the contributions of countercyclical interest rate policy and exchange rate flexibility in terms softening the impact of the crisis. Therefore, in what follows, we consider three counterfactual simulations and compare them with the actual realization which is our baseline. Under the baseline, the monetary policy framework (which is underpinned by a flexible exchange rate) operates in accordance with estimated baseline interest rate rule discussed above. In this context, the three counterfactual experiments are as follows:

- **No monetary policy shocks**: this counterfactual posits strict adherence to the baseline empirical interest rate rule. It is a simulation which excludes the monetary policy shocks—that is, the monetary policy shocks, ϵ_t^i, are all set to zero in this simulation. It serves to address the following question: What would the dynamics of output have been if the BNM did not implement any discretionary loosening (deviations from the interest rate rule) during the crisis?

- **Peg**: in this counterfactual, the BNM is assumed to implement a strict fixed exchange rate regime. Intuitively, there are no discretionary deviations from the rule (which solely focuses on stabilizing the nominal exchange rate). Here we seek to address the following question: What would the dynamic of output growth have been if the BNM was implementing a fixed exchange rate regime?

- **Peg with heightened financial vulnerability**: under the last counterfactual, the BNM is presumed to operate under a fixed exchange rate regime as above, but with heightened financial vulnerabilities (achieved by calibrating the leverage ratio to three, rather than two under the baseline, see Alp and Elekdag, 2011, for further details). While not the main focus of the paper, our modeling framework allows us to construct such an *illustrative* counterfactual serving to address the following question: What would the dynamic of output growth have been if the BNM was implementing a fixed exchange rate regime *and* the economy was financially more vulnerable?

B. Results Based on the Counterfactual Simulations

Figure 2 depicts the level of real GDP with the first quarter of 2008 (the pre-crisis peak) normalized to 100 to allow the reader to better distinguish the (cumulative) effects of each counterfactual. To further highlight the main results, the figure starts in 2006, and only shows the counterfactuals over the 2008:Q1–2009:Q3 period (full set of results available from authors upon request). The figure depicts (1) the actual realization of real GDP (the baseline scenario), (2) the counterfactual scenario without the monetary policy shocks, (3) the counterfactual scenario with the fixed exchange rate regime (peg), and (4) an illustrative counterfactual scenario with the peg under heightened financial vulnerabilities.

As clearly seen from **Figure 2**, the BNM's current monetary policy framework underpinned by a flexible exchange rate regime clearly softened the impact of the global financial crisis of 2008-09. More specifically, it is useful to discuss two main results:

- First, as expected, output growth declines the most under the fixed exchange rate regime. The lack of the exchange rate to serve as a shock absorber decreases the resiliency of the economy to the shocks that ensued during the global crisis. Intuitively, the illustrative counterfactual experiment with heightened financial vulnerabilities, and thereby a more pronounced balance sheets channel, leads to an even sharper decline in output. These counterfactual experiments highlight the role of the exchange rate flexibility as well as financial reforms that promote the soundness of the financial system. However, it should be noted that—consistent with BNM guiding principles—the simulations assume orderly exchange rate adjustments. Also, given the experience during the height of the global financial crisis, a significantly weak

exchange rate may not necessarily lift export performance given exceptionally weak external demand.

- Second, as discussed in the previous section, there is an important role for the discretionary departure from the interest rate rule, which helped soften the impact of the crisis. At first glance, while they may seem small, as we discuss in further detail in the next subsection, the role of these discretionary departures from the interest rate rule (the monetary policy shocks) are very much in line with the literature.

C. How Do Our Results Compare with Those in the Literature?

We now focus on the growth implications associated with the counterfactuals discussed above. This section tabulates the precise contributions to growth under the various counterfactuals discussed above, which are shown in **Table 3**. As before, the intention is to focus on the most intense period of the global financial crisis, which for Malaysia covered the four quarters spanning the 2008:Q4–2009:Q3 period.

Before investigating the details, it would be useful to clarify the information contained in **Table 3**. The values under columns show either the average or cumulative contributions to growth during the 2008:Q4–2009:Q3 period. It presents our results, as well as the results of Christiano and others (2008)—the most closely related study to ours in terms of conducting counterfactual experiments. After tabulating the number of quarters, columns [1] through [4] indicate the incremental contribution to growth owing to the consecutive implementation of each policy. For example, Column [3] indicates that reducing financial vulnerabilities added, on average, 63 basis points to growth. In addition to this effect, the incremental growth contribution of adopting a flexible exchange rate regime, denoted under column [2], is 1.96 percentage points.

It would be useful to compare the results in **Table 3** with the literature. Turning our attention to column [1], we see that the average contribution of the monetary shocks (discretionary deviations from the empirical interest rate rule) to output growth is about 77 basis points, which lies in between the values found by Chrisitiano and others (2007) for the U.S. (0.75 percent) and the euro area (1.27 percent). The cumulative growth contributions also seem reasonable, and give some further context on the role of monetary policy in terms of softening the impact of the crisis.

Table 4 summarizes our main findings. During the year covering 2008:Q4–2009:Q3, the actual growth rate was –2.9 percent. Our model-based simulations suggest that if the BNM had not departed from the empirical interest rate rule, growth would have instead been –3.4 percent. Furthermore, if instead of the current monetary policy regime, an exchange rate peg was in place, the results imply a growth rate of –5.5 percent. In sum, without the adoption of the flexible exchange rate regime, and active countercyclical monetary policy, the impact of the recent global financial crisis would have been substantially more severe.

While our results suggest that the current monetary policy framework underpinned by a flexible exchange rate supported growth during the global financial crisis, clearly other policies also played a role. It should be noted that we do not capture the direct effects of other measures implemented in response to the crisis including the provision of liquidity in the

financial system, the backing of wholesale lending, and the reduction in reserve requirements.[3] During a severe economic crisis like the one seen during the 2008-09 global financial crisis, interest rate cuts by themselves may not be enough. Rather, complementary measures need to be introduced to reach specific sectors of the economy. Hence, in addition to easing interest rates and the measures noted above, the authorities' introduced a number of targeted measures to ensure continued access to financing, temporary extension of safety net, safeguarding the value of wealth and real income of deposits and cushioning highly vulnerable borrowers from the full impact of the crisis. Therefore, the results from the counterfactual scenarios on the extent to which BNM policies help soften the crisis could be viewed as conservative estimates.

VI. Summary and Main Policy Implications

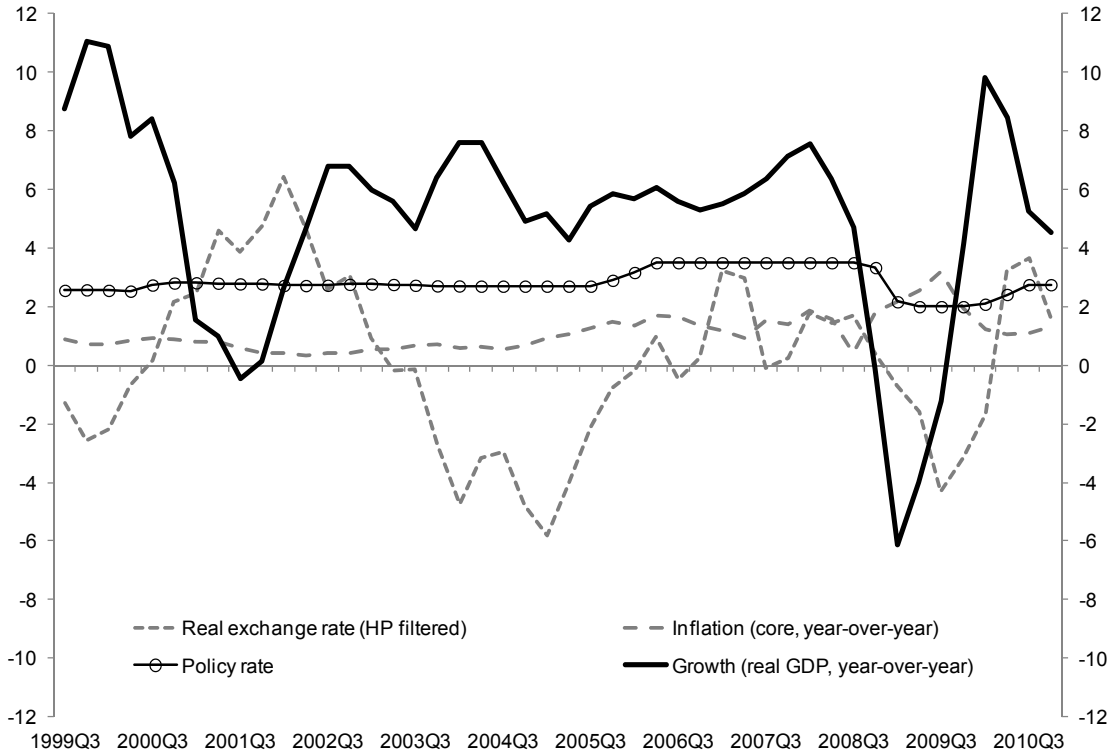
This paper argues that monetary policy implemented by the Bank Negara Malaysia (BNM) helped soften the impact of the global financial crisis. Specifically, the findings suggest that without the countercyclical and discretionary interest rate cuts along exchange rate flexibility, the global financial crisis would have been associated with a much deeper economic contraction in Malaysia.

The most intuitive way to communicate our quantitative findings is by taking the growth rate during the most intense year of the global financial crisis, as our baseline, namely the 2008:Q4–2009:Q3 period. Model-based counterfactual simulations indicate that without exchange rate flexibility and the countercyclical and discretionary interest rates cuts allowed under the BNM's monetary policy framework, growth over the most intense period of the crisis would have decreased from the actual realization of –2.9 percent to –5.5 percent. These results are based on counterfactual simulations derived from an estimated dynamic stochastic general equilibrium (DSGE) model which, and highlight the favorable output stabilization properties owing to the combination of countercyclical monetary policy and exchange rate flexibility.

In sum, given the openness of the Malaysian economy through both trade and financial channels, the flexibility and resilience of the economy are especially important when faced with exogenous shocks coming from elsewhere. In line with this, the monetary policy regime implemented by the BNM, which is underpinned by a flexible exchange rate, is well suited to the characteristics of the Malaysian, as demonstrated through the counterfactual experiments discussed in this paper in the context of the 2008–09 global financial crisis.

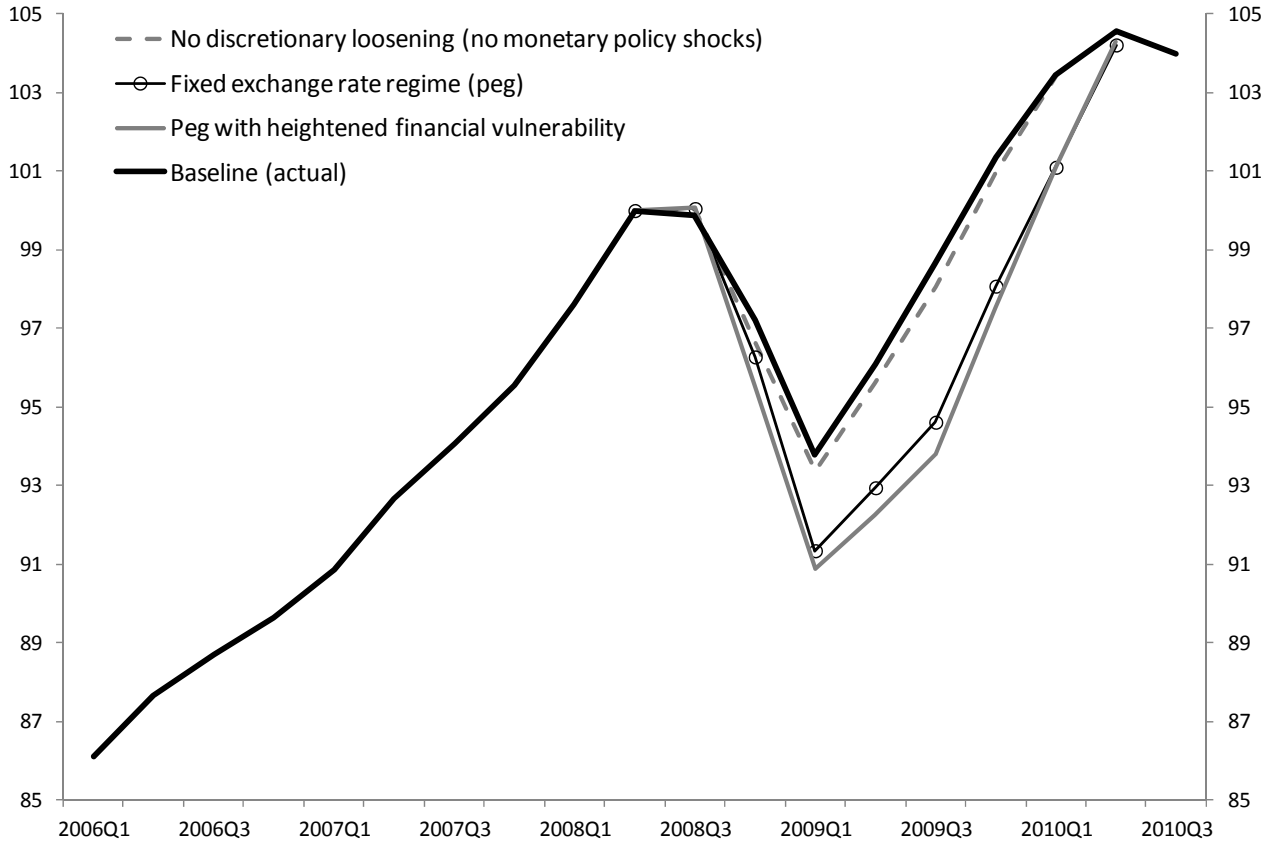
[3] See IMF staff report (2009) for further details: http://www.imf.org/external/pubs/cat/longres.aspx?sk=23189.0.

Figure 1. Malaysia: Selected Macroeconomic Indicators



Source: IMF APDCore database and authors' calculations.

Figure 2. Counterfactual Scenarios: The Role of Monetary Policy and Real GDP



Source: Authors' calculations.
Note: Figure denotes the level of real GDP as an index with 2008Q1=100.
Baseline denotes the actual evoluation of Malaysian real GDP.

Table 1. Calibrated Parameters

Parameter	Symbol	Value
Discount factor	β	0.9988
Consumption intra-temporal elasticity of substitution	ρ	1.00
Share of domestic goods in consumption	γ	0.05
Investment intra-temporal elasticity of substitution	ρ_i	0.25
Share of domestic goods in investment	γ_i	0.05
Inverse of the elasticity of work effort with respect to the real wage	σ_l	1.00
Share of capital in production function	α	0.80
Elasticity of marginal depreciation with respect to utilization rate	ϵ	1.00
Steady state markup rate for domestically produced goods	μ^H	1.15
Steady state markup rate for imported goods	μ^F	1.15
Steady state markup rate for wages	μ^W	1.15
Share of entrepreneurial labor	$1-\Omega$	0.01
Steady state external finance premium	χ	1.03
Number of entrepreneurs who survive each period (at steady state)	ϱ	0.9728
Variance of idiosyncratic shock to entrepreneur production	σ_ω	0.40
Fraction of monitoring cost	μ_ω	0.15
Depreciation rate (at steady state)	δ	0.0225
Elasticity of country risk premium with respect to net foreign debt	Φ	0.001

Source: Authors' calculations.

Table 2. Prior and Posterior Distributions

Parameter		Prior distribution			Posterior distribution		
Description	Symbol	Type	Mean	Standard deviation	Mean	Confidence interval 5%	95%
Calvo parameter							
Domestic prices	θ_H	Beta	0.50	0.10	0.859	0.824	0.891
Import prices	θ_F	Beta	0.50	0.10	0.498	0.411	0.574
Wages	θ_w	Beta	0.50	0.10	0.456	0.307	0.624
Indexation							
Domestic prices	γ_H	Beta	0.50	0.10	0.377	0.261	0.504
Import prices	γ_F	Beta	0.50	0.10	0.502	0.365	0.641
Wages	γ_w	Beta	0.50	0.10	0.521	0.346	0.676
Monetary policy							
Interest rate smoothing	ρ_i	Beta	0.70	0.20	0.862	0.825	0.904
Inflation reponse	τ_π	Normal	1.50	0.20	1.921	1.665	2.123
Output gap response	τ_y	Beta	0.20	0.10	0.011	0.005	0.018
Nominal exchange rate depreciation response	τ_s	Normal	0.10	0.05	0.202	0.152	0.272
Others							
Export demand elasticity	χ	Normal	1.00	0.20	0.460	0.227	0.752
Export demand interia	ϖ	Beta	0.50	0.20	0.712	0.532	0.917
Habit formation	b	Beta	0.70	0.20	0.890	0.862	0.928
Invesment adjustment cost	ψ	Normal	4.00	0.50	3.833	3.225	4.352
Shock persistence							
Stationary technology	ρ_a	Beta	0.80	0.10	0.881	0.841	0.915
Unit root technology	ρ_ζ	Beta	0.80	0.10	0.371	0.295	0.493
Investment specific technology	ρ_{inv}	Beta	0.80	0.10	0.432	0.307	0.579
Domestic markup	ρ_{μ^h}	Beta	0.80	0.10	0.609	0.456	0.715
Import markup	ρ_{μ^f}	Beta	0.80	0.10	0.928	0.898	0.954
Foreign inflation	ρ_{π^*}	Beta	0.80	0.10	0.573	0.463	0.703
Foreign interest rate	ρ_{i^*}	Beta	0.80	0.10	0.868	0.785	0.939
Foreign demand	ρ_{y^*}	Beta	0.80	0.10	0.984	0.974	0.994
Country risk premium	ρ_Φ	Beta	0.80	0.10	0.604	0.429	0.808
Preference	ρ_c	Beta	0.80	0.10	0.755	0.638	0.880
Labor supply	ρ_l	Beta	0.80	0.10	0.791	0.639	0.948
Exogenous spending	ρ_g	Beta	0.80	0.10	0.894	0.829	0.972
Net worth	ρ_N	Beta	0.80	0.10	0.945	0.884	0.995
Inflation target	$\rho_{\bar{\pi}}$	Beta	0.80	0.10	0.706	0.571	0.835
Shock volatility							
Stationary technology	σ_a	Inverse gamma	0.01	2.00	0.118	0.086	0.157
Unit root technology	σ_ζ	Inverse gamma	0.01	2.00	0.057	0.044	0.069
Investment specific technology	σ_{inv}	Inverse gamma	0.01	2.00	0.671	0.496	0.811
Domestic markup	σ_{θ^H}	Inverse gamma	0.01	2.00	0.010	0.009	0.011
Import markup	σ_{θ^F}	Inverse gamma	0.01	2.00	0.020	0.015	0.027
Foreign inflation	σ_{π^*}	Inverse gamma	0.01	2.00	0.004	0.003	0.005
Foreign interest rate	σ_{i^*}	Inverse gamma	0.01	2.00	0.001	0.001	0.002
Foreign demand	σ_{y^*}	Inverse gamma	0.01	2.00	0.076	0.061	0.093
Country risk premium	σ_Φ	Inverse gamma	0.01	2.00	0.003	0.002	0.004
Preference	σ_c	Inverse gamma	0.01	2.00	0.151	0.107	0.203
Labor supply	σ_l	Inverse gamma	0.01	2.00	0.007	0.003	0.010
Exogenous spending	σ_g	Inverse gamma	0.01	2.00	0.025	0.022	0.029
Net worth	σ_N	Inverse gamma	0.01	2.00	0.006	0.003	0.008
Inflation objective	$\sigma_{\bar{\pi}}$	Inverse gamma	0.01	2.00	0.005	0.002	0.007
Monetary policy		Inverse gamma	0.01	2.00	0.002	0.001	0.002

Source: Authors' calculations.
Note: Log data density is 1,265. For inverse gamma distributions, mean and degrees of freedom are reported.

Table 3. The Role of Monetary Policy during the Global Financial Crisis of 2008–09

		Growth contributions of monetary policy owing to:			
		[1]	[2]	[3]	[4]
	Quarters	Monetary policy shocks	Flexible exchange rate regime	Reduced financial vulnerability	All factors ([1]—[3])
Average					
2008Q4—2009Q3	4	0.51	1.96	0.63	3.23
Christiano and others (2008)					
United States (2001Q2-2002Q2)	4	0.75			
Euro area (2001q4-2004q4)	13	1.27			
Cumulative					
2008Q4—2009Q3	4	2.05	7.82	2.53	12.93
Christiano and others (2008)					
United States (2001Q2-2002Q2)	4	3.00			
Euro area (2001q4-2004q4)	13	17.00			

Source: Authors' calculations.
Note: Growth contributions in percent.

Table 4. Summary of the Role of Monetary Policy

	2008Q3—2009Q3	Difference	Cumulative Difference
Baseline (actual)	–2.9		
No monetary policy shocks	–3.4	–0.5	–0.5
Fixed exchange rate regime (peg)	–5.5	–2.1	–2.6
Peg with heightened financial vulnerability	–6.1	–0.6	–3.2

Source: Authors' calculations
Note: Table presents real GDP growth rates (year-over-year, in percent).

REFERENCES

Adolfson, Malin, Stefan Laseen, Jesper Linde, Mattias Villani, 2007, "Bayesian Estimation of an Open Economy DSGE Model with Incomplete Pass-Through," *Journal of International Economics*, Vol. 72, pp. 481–511.

Alp, Harun, and Selim Elekdag, 2011, "The Role of Monetary Policy in Turkey during the Global Financial Crisis," IMF Working Paper, No. 11/150 (Washington: International Monetary Fund).

Alp, Harun, Selim Elekdag, and Subir Lall, 2012, "Did Korean Monetary Policy Help Soften the Impact of the Global Financial Crisis of 2008–09?" IMF Working Paper, No. 12/05 (Washington: International Monetary Fund).

Bernanke, Ben, and Mark Gertler, and Simon Gilchrist, 1999, "The Financial Accelerator in a Quantitative Business Cycle Framework," *Handbook of Macroeconomics,* Vol. 1C, pp. 1341–93 (Elsevier: Amsterdam).

Calvo, Guillermo, Alejandro Izquierdo, and Luis. F. Mejia, 2004, "On the Empirics of Sudden Stops: The Relevance of Balance-Sheet Effects," NBER Working Paper, No. 10520 (Cambridge, Massachusetts: National Bureau of Economic Research).

Cardarelli, Roberto, Selim Elekdag, and Subir Lall, 2011, "Financial Stress and Economic Contractions," *Journal of Financial Stability*, Vol. 7, No. 2 (June), pp. 78–97.

Cespedes, Luis F., Roberto Chang and Andres Velasco, 2004, "Balance Sheets and Exchange Rate Policy," *American Economic Review*, Vol. 94, pp. 1183–93.

Christiano, Lawrence J., Roberto Motto, and Massimo Rostagno, 2008, "Shocks, Structures, or Monetary Policies? The Euro Area and U.S. After 2001," *Journal of Economic Dynamics and Control*, Vol. 32, pp. 2476–2506.

Christiano, Lawrence J., Roberto Motto, and Massimo Rostagno, 2010, "Financial Factors in Economic Fluctuations," ECB Working Paper No. 1192 (Frankfurt, Germany: European Central Bank).

Curdia, Vasco, 2007, "Monetary Policy under Sudden Stops," FRBNY Staff Report No. 278 (New York: Federal Reserve Bank of New York).

Devereux, Michael B., and Charles Engel, 2002, "Exchange rate pass-through, exchange rate volatility, and exchange rate disconnect," *Journal of Monetary Economics*, Vol. 49, No. 5, pp. 913–40.

Elekdag, Selim, Alejandro Justiniano, and Ivan Tchakarov, 2006, "An Estimated Small Open Economy Model of the Financial Accelerator," *IMF Staff Papers*, Vol. 53, pp. 219−41 (Washington: International Monetary Fund).

Elekdag, Selim and Ivan Tchakarov, 2007, "Balance Sheets, Exchange Rate Policy, and Welfare," *Journal of Economic Dynamics and Control*, Vol. 31, pp. 3986–4015.

Gali, Jordi, and Tommaso Monacelli, 2005, "Monetary Policy and Exchange Rate Volatility in a Small Open Economy," *Review of Economic Studies*, Vol. 72, No. 3, pp. 707–34.

Garcia-Cicco, Javier, 2010, "Estimating Models for Monetary Policy Analysis in Emerging Countries," Central Bank of Chile Working Paper No. 561 (Chile: Central Bank of Chile).

Gertler, Mark, Simon Gilchrist, Fabio Natalucci, 2007, "External Constraints on Monetary Policy and the Financial Accelerator," *Journal of Money, Credit and Banking,* Vol. 39, No. 2–*3*, pp. 295–330.

Knight, Frank H., 1921, *Risk, Uncertainty, and Profit*. (Boston, MA: Hart, Schaffner & Marx; Houghton Mifflin Company).

Lubik, Thomas A., and Frank Schorfheide, 2007, "Do Central Banks Respond to Exchange Rate Movements? A Structural Investigation," *Journal of Monetary Economics*, Vol. 54, pp. 1069–87.

Mendoza, Enrique, 1991, "Real Business Cycles in a Small Open Economy," *American Economic Review,* Vol. 81, pp. 7973–818.

Smets, Frank and Rafael Wouters, 2003, "An Estimated Stochastic General Equilibrium Model of the Euro Area," *Journal of the European Economic Association*, Vol. 1, pp. 1123–75.

Smets, Frank and Rafael Wouters, 2007, "Shocks and Frictions in US Business Cycles: A Bayesian DSGE Approach," *American Economic Review*, Vol. 97, No. 3. pp. 586−605.