The Impact of Exchange Rate Depreciation on Inflation in Malaysia

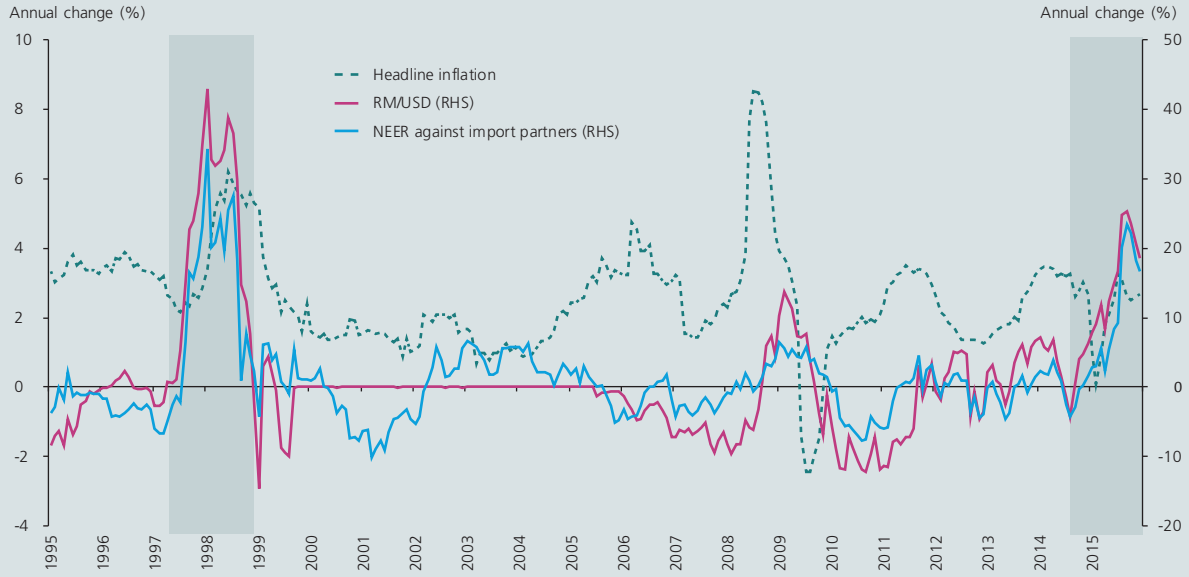
Introduction

The persistent depreciation of the ringgit since September 2014 has raised concerns about the risk of higher inflation in Malaysia. In general, large and persistent exchange rate depreciation in a small and open economy would entail higher domestic inflation as imports become more expensive. The Malaysian experience in the past two decades, however, has shown that episodes of persistent exchange rate depreciation may not always result in significantly higher inflation (Chart 1). The outcome is also dependent on other developments affecting the economy. This is highlighted by the experience that while the ringgit depreciation in the period 1997-1998 resulted in high inflation, the more recent depreciation episode has instead coincided with periods of low inflation.

This article is divided into two parts. The first part presents findings from estimations of the exchange rate pass-through (ERPT) to inflation in Malaysia and the second part provides insights on why inflation could be high in certain episodes of exchange rate depreciation but low in others.

Chart 1

Exchange Rate and Inflation



Note: The nominal effective exchange rate (NEER) against import partners is calculated based on the weighted average of the bilateral exchange rates against Malaysia's top 15 import partners. A positive figure indicates a depreciation in the ringgit against Malaysia's main import partners relative to the year before.

Source: Department of Statistics, Malaysia, Bloomberg and Bank Negara Malaysia

A. Exchange rate pass-through to inflation in Malaysia

ERPT to inflation refers to how much domestic prices change in response to changes in the nominal exchange rate. The transmission from the exchange rate to inflation occurs through two main channels. First is the direct channel via imported finished goods in the CPI basket and second is the indirect channel via imported inputs in the production chain (Diagram 1)[1].

(i) **Direct channel.** Fluctuations in the exchange rate directly impact prices of imported finished goods. The depreciation of the ringgit, against the currencies of Malaysia's import partners, increases the costs of importing finished goods from these economies.

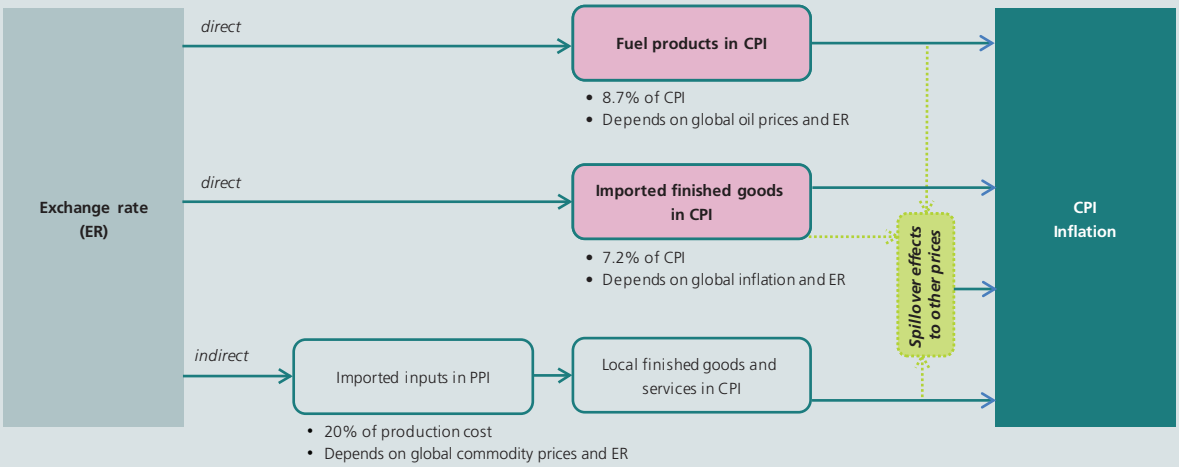
[1] In this article, CPI refers to the Consumer Price Index, CPI-Import is the imported finished goods component of CPI excluding fuel, PPI is Producer Price Index, PPI-Import is the imported component of PPI, and PPI-Local is the domestic component of PPI.

(ii) **Indirect channel.** Exchange rate movements affect input costs of firms that use imported inputs in the production of local goods and services. These imported inputs could be in the form of raw materials like wood and wheat, or in the form of intermediate inputs like fabric and metal rods.

In addition, prices of goods and services that are affected by movements of the exchange rate, through either one or both of the channels, could have spillover effects on prices of other goods and services in the CPI. This can consequently lead to a general increase in prices[2].

Diagram 1

Transmission Channels from Exchange Rate to Inflation in Malaysia



Source: Department of Statistics, Malaysia and Bank Negara Malaysia

The conceptual relationship between exchange rate movements and inflation is illustrated in Chart 2 where depreciation has an inflationary impact while appreciation has a disinflationary impact. The impact of changes in the exchange rate on inflation can differ in strength between periods of appreciation and depreciation[3]. This asymmetry arises because firms typically react more to pass on the increases in the cost of imports to consumer prices following an exchange rate depreciation but firms tend to be less responsive when there is a reduction in costs due to an exchange rate appreciation. In addition, should exchange rate depreciation exceed a certain threshold, firms can change their behaviour significantly, resulting in a larger impact on inflation.

Using historical data over the last two decades, a scatter plot shows a weak positive relationship between the exchange rate[4] and inflation (Chart 3). This suggests that changes in the exchange rate may have a small impact on domestic inflation. Applying standard methodologies from the literature, the ERPT was empirically estimated[5] using the nominal effective exchange rate (NEER) with quarterly data from 1995 to 2015. The results are summarised as follows:

[2] Changes in the exchange rate could also affect domestic inflation indirectly through the substitution effect. If the exchange rate depreciation makes imported goods more expensive, consumers may switch to domestic products and this can exert upward pressures on prices of domestically produced goods. In addition, the depreciation could also lead to higher demand for exports and result in stronger aggregate demand that can create inflationary pressures.

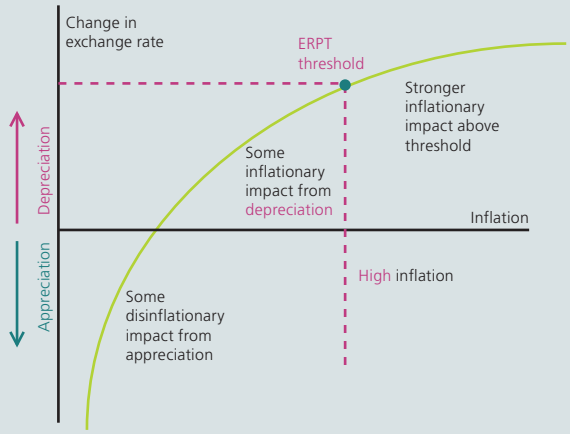
[3] Pricing strategies of firms tend to be different during periods of depreciation and appreciation, which will determine the asymmetric effects of exchange rate pass-through to inflation. Inflationary impact during depreciation tends to be larger in size compared to the disinflationary impact during appreciation.

[4] Unless otherwise stated, the exchange rate in this article refers to the nominal effective exchange rate (NEER).

[5] The empirical specification follows a linear Phillips curve equation, which controls for lagged inflation, global commodity prices and the output gap. The estimations are carried out using the NEER and results are robust for the nominal bilateral exchange rate (RM/USD).

Chart 2

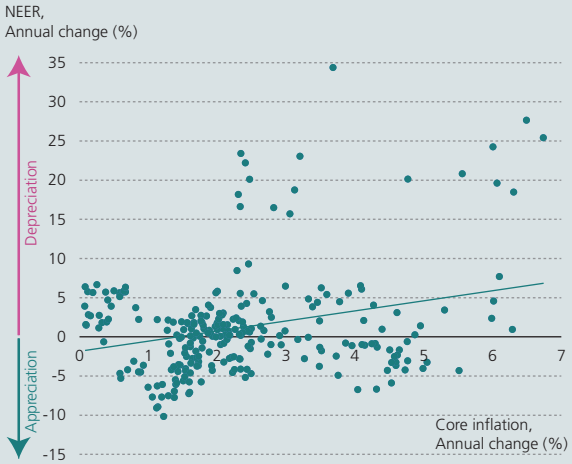
Conceptual Relationship between Exchange Rate Changes and Inflation



Source: Bank Negara Malaysia

Chart 3

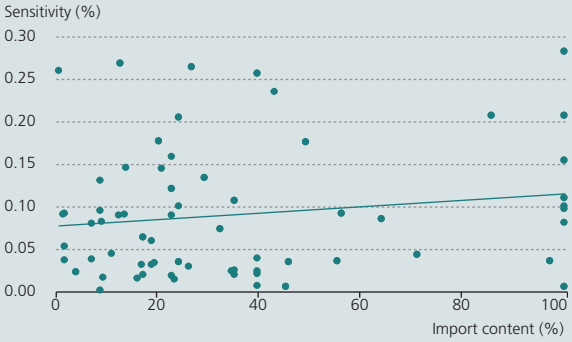
Scatter Plot of Exchange Rate Changes and Inflation



Source: Department of Statistics, Malaysia, Bloomberg and Bank Negara Malaysia

Chart 4

Import Content of CPI Items and Their Price Sensitivity to Exchange Rate Changes



Note: Sensitivity refers to the degree of ERPT for the individual CPI items at the 4-digit level.

Source: Department of Statistics, Malaysia, Bloomberg and Bank Negara Malaysia estimates

Chart 5

Exchange Rate Changes and Inflation

Source: Department of Statistics, Malaysia, Bloomberg and Bank Negara Malaysia estimates

(i) ***Exchange rate pass-through to core inflation is low.*** A 10% depreciation in the exchange rate is associated with an increase in core inflation between 0.2% and 0.6%[6]. Over time, the degree of ERPT has remained low and relatively stable[7].

(ii) ***Analysis of disaggregated CPI data shows no significant positive relationship between import content and sensitivity[8] to the exchange rate***. Conventional wisdom suggests that prices of items with higher import content would be more sensitive to exchange rate changes compared

[6] The range refers to short-run ERPT. Variations in the estimates of pass-through arise from different specifications of the estimating equation (e.g. number of lags for inflation, number of lags for exchange rate and the number of control variables, such as demand conditions, and their lags).

[7] The ERPT remained stable when comparing two sample periods, 1995-2002 against 2003-2015. Mihaljek and Klau (2008) also conclude that the ERPT in Malaysia has been low and stable when comparing two sample periods, 1994-2000 against 1994-2006.

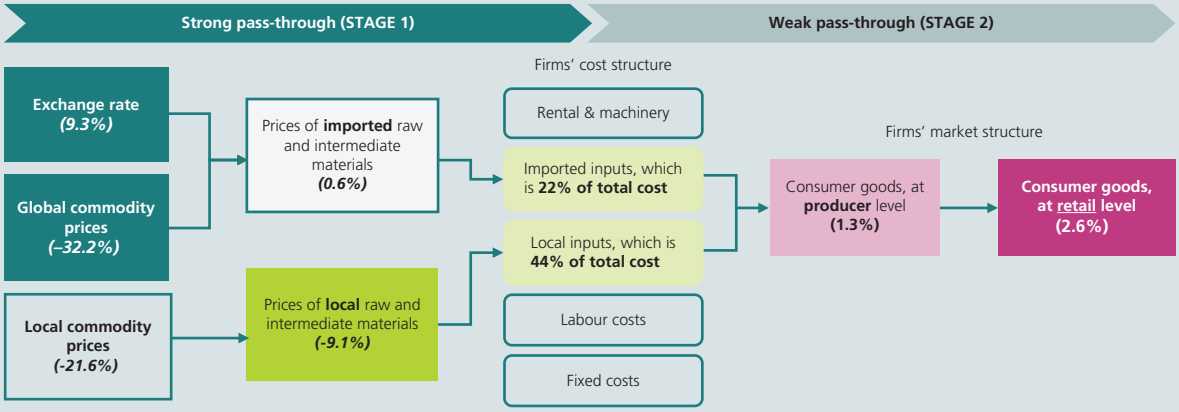
[8] Sensitivity refers to the degree of ERPT for the individual CPI items at the 4-digit level.

to items with lower import content. The scatter plot (Chart 4), however, shows that this relationship is weak[9]. Examining the individual items of the CPI basket shows that most goods and services have moderate import content[10] and estimations of the ERPT for these items indicate that a 10% depreciation is associated with higher inflation of at most 3%.

(iii) ***Analysis by stage of processing using disaggregated PPI data suggests that exchange rate pass-through via the indirect channel is also low and incomplete.*** The ERPT is estimated at two different stages of the production chain, which begins at the firm level and ends at the consumer level (Diagram 2). At the first stage of the production chain, the ERPT to input costs is estimated to be low and incomplete, whereby a 10% change in the exchange rate is associated with a 1.3% change in the costs of imported raw and intermediate inputs. At the second stage, the pass-through from input prices to consumer prices is even smaller, whereby a 10% increase in input prices leads to an increase in prices of consumer goods by only 0.4%.

Diagram 2

Exchange Rate, Global Commodity Prices and Prices Along the Production Chain



Note: Numbers in the parenthesis () represent the average of the annual change in the variables during the depreciation episode between October 2014 and December 2015. For local commodity prices, data is from October 2014 to September 2015.

Source: Department of Statistics, Malaysia, International Monetary Fund (IMF), Bloomberg and Bank Negara Malaysia estimates

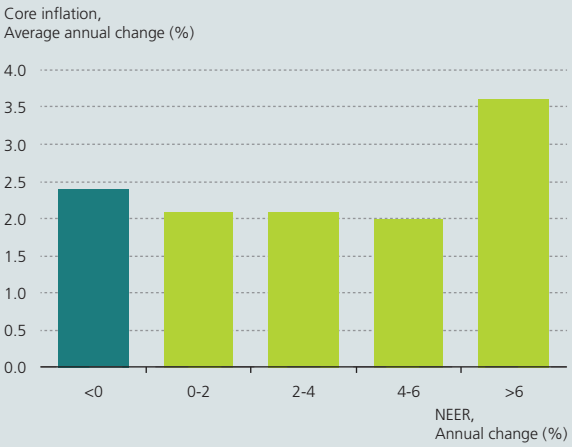
(iv) ***Exchange rate depreciation and appreciation have asymmetric impact on inflation.*** It is important to note that estimations of the ERPT capture both periods of depreciation and appreciation. Studies, however, have shown that the size of the impact on inflation tends to be larger during periods of depreciation compared to periods of appreciation. The asymmetric relationship between exchange rate changes and inflation (as conceptually illustrated in Chart 2) is also observed in the Malaysian data (Chart 5)[11]. Empirical estimations to distinguish ERPT during depreciation and appreciation episodes in Malaysia show that ERPT is indeed larger during periods of depreciation.

(v) ***Lack of robust evidence to suggest threshold effects between exchange rate depreciation and inflation.*** Firms tend to absorb the initial increase in costs if they view the depreciation as small or transitory. As the exchange rate depreciation becomes prolonged and exceeds a certain threshold, firms may change their price-setting behaviour. At this stage, price sensitivity to the exchange rate depreciation may also increase disproportionately. In the case of Malaysia, however, threshold effects are not conclusively observed. Evidence of threshold effects would indicate that as the size of the exchange rate depreciation becomes larger, inflation would also increase at a much faster pace and to some extent

[9] This follows from Forbes (2015). In addition, Choudhri and Hakura (2006) and Aron, MacDonald and Muellbauer (2014) find no significant link between ERPT and openness (import-to-GDP ratio, import dependence and number of importers).
[10] Source: Input-Output Tables 2010 for Malaysia. Most items in the CPI basket have import content less than 40%.
[11] The data fits a logarithmic trendline as the rising rate of change in the exchange rate coincides with higher inflation.

Chart 6

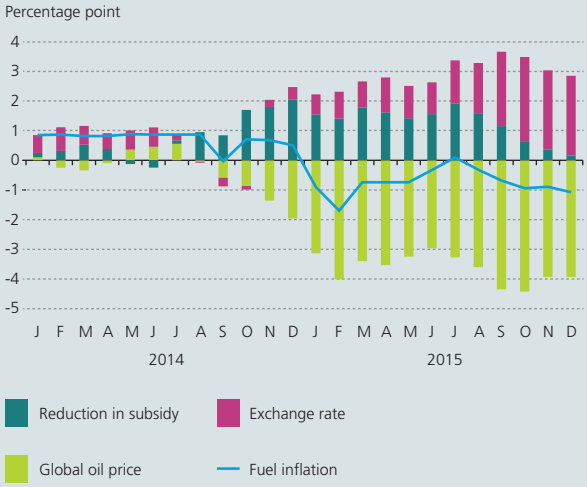
Average Inflation for Different Magnitudes of Exchange Rate Changes



Source: Department of Statistics, Malaysia, Bloomberg and Bank Negara Malaysia estimates

Chart 7

Contribution to Fuel Inflation



Source: Ministry of Domestic Trade, Co-operatives and Consumerism, Department of Statistics, Malaysia, Bloomberg and Bank Negara Malaysia estimates

non-linearly. Chart 6 shows that core inflation in Malaysia remained stable, averaging close to 2% when the exchange rate depreciation was below 6%. As the exchange rate depreciation exceeded 6%, core inflation edged up to average at 3.6%. This, however, was driven mainly by data in the period 1997-1998. Although this observation may seemingly indicate some threshold effects, empirical estimations[12] suggest that the results are not statistically significant. This could be primarily due to the fact that from the sample data, Malaysia has limited experience of both high inflation and large exchange rate depreciation.

In summary, the degree of ERPT has remained relatively low in Malaysia. This is consistent with a previous study[13] by the Bank in 2011 and general findings for Malaysia in the literature. The low ERPT can be attributed to the following factors:

- ***Presence of administered-price policies.*** About 17.5% of the items in the CPI basket are subject to administered-price policies[14]. The Government also implements other measures to ensure price increases are not excessive. These measures include the issuance of more import permits to increase food supplies during periods of shortages, price reduction campaigns and the enforcement of the *Price Control and Anti-Profiteering Act 2011*.
  - This for example has resulted in low sensitivity of fuel inflation to global oil prices and the exchange rate. Prior to December 2014, domestic fuel prices were classified as one of the price-administered items. While fuel for domestic consumption is primarily imported from abroad, their prices were not sensitive to changes in global oil prices and the exchange rate due to the presence of fuel subsidies. This contained the ERPT to inflation. It is, however, important to note that since the removal of the fuel

[12] Estimations are based on threshold regressions from Hansen (1999 and 2000) where the Phillips curve equation is estimated for a series of exchange rate changes that could reflect potential threshold effects.
[13] See Box Article on ``Impact of Ringgit Appreciation on Import Prices and Inflation´´ in BNM Annual Report 2011.
[14] The pricing mechanisms of administered items in the CPI are mainly governed by the *Price Control and Anti-Profiteering Act 2011*, which replaced the *Price Control Act 1946*. In general, there are two types of price-administered items in the CPI. The first comprises items where the Government determines the retail prices for these goods. Examples include flour and cooking oil, which are also subsidised by the Government. The second comprises items that require Government approval for changes to be made on their prices. Examples include cigarettes, electricity tariffs and public transport fares. With the administered-price mechanisms in place, the impact of shocks on domestic prices is smaller, less direct and less immediate.

subsidies and the implementation of the managed-float pricing mechanism for fuel prices in December 2014, movements in both global oil prices and the exchange rate have had a more direct and faster impact on domestic fuel prices (Chart 7)[15].

- ***Limited import content.*** Imported finished goods captured in CPI-Import have a low share in the consumption basket of the average household (7.2%). From the supply side, based on the Input-Output Tables 2010 for Malaysia, intermediate imported inputs account for about 20% of total gross output and PPI-Import accounts for 33% of the total PPI basket. Hence, the limited dependency on imports contributes, in part, to the low ERPT to domestic prices.

- ***Pricing-to-market.*** Price-setting behaviour of firms is greatly influenced by global and domestic market structures. These factors include the degree of competition, product differentiation and substitutability, and the strategic reactions of other firms. Increased competition, due to greater globalisation and liberalisation of markets, has generally increased the elasticity of demand and supply and, in turn, lowered the pricing power of firms. Hence, in response to higher costs amid exchange rate depreciation, firms tend to absorb the higher costs by varying their profit margins or improving cost management by increasing efficiency or switching to cheaper substitutes. In assessing the impact of these factors, anecdotal evidence in Malaysia suggests that firms tend to typically wait for at least six months to assess the strength of demand before reviewing their prices, and either adjust their profit margins or pass on the higher costs. However, some retailers, notably importers of finished goods, tend to fully pass on the higher costs to consumer prices if there are no local substitutes.

B. Inflation developments in Malaysia during episodes of depreciation

Given the low ERPT, expectations are for exchange rate depreciation to have limited impact on inflation. However, past episodes of depreciation have seen different outcomes for inflation. Over the last two decades, Malaysia experienced two episodes of persistent ringgit depreciation. These periods were: (i) April 1997 - December 1998 during the Asian Financial Crisis (AFC); and (ii) October 2014 - December 2015 during the period of a sustained drop in global commodity prices and strengthening of the US dollar. Table 1 and Chart 1 both show that inflation surged during the first episode but remained relatively subdued in the second episode following the depreciation of the ringgit.

Analysing the stylised facts recorded during these episodes highlights that the final overall impact on inflation has to be assessed with consideration to other important factors beyond the ERPT. These factors include the trajectory of the exchange rate depreciation, and other determinants of inflation such as global commodity prices and domestic demand conditions. In the Malaysian experience, these other factors are certainly pivotal in determining the inflationary impact on the economy, which can be clearly contrasted between these depreciation episodes. In particular, during these two episodes there were some ERPT but the mitigating factors in the current episode, namely the prolonged decline in global commodity prices, played a more significant role in containing the overall impact on inflation.

April 1997 - December 1998: Sharp ringgit depreciation caused a spike in import costs and led to an acceleration in inflation

During this period, the NEER depreciated by an average of 13.1%[16]. The depreciation trajectory was sudden and steep amid large and sharp fluctuations in the exchange rate. Globally, commodity prices were also on a declining trend, but at a more modest pace compared to the more recent period. While domestic demand conditions weakened as the economy contracted sharply following the adverse impact from the AFC, there was notable evidence of demand-driven inflationary pressures at the onset

[15] The net impact on inflation would, however, depend on the magnitude and direction of the changes in both global oil prices and the exchange rate. See Chart 7.

[16] Between April 1997 and December 1998, the NEER had depreciated by 31.9%. The depreciation of 13.1% refers to the average of annual change in the NEER on a monthly basis, which is used as a like-for-like comparison against inflation. Inflation is also measured in a similar manner.

Table 1

Selected Economic Indicators during the Two Exchange Rate Depreciation Episodes

Average of annual change during the period, %[1]	*Episode 1* (Apr 1997 – Dec 1998)	*Episode 2* (Oct 2014 – Dec 2015)
Headline CPI	4.1	2.2
Core CPI[2]	4.4	2.3
CPI-Import	5.7	2.5
PPI	7.4	-4.3
PPI-Local	7.5	-6.7
PPI-Import	6.7	0.7
Output gap[3]	-0.1	0.3
Real GDP	-1.0	5.1
NEER against import partners[4]	13.1	9.3
RM/US Dollar	21.2	13.9
IMF Primary Commodity Price Index	-14.4	-32.2
Brent oil price	-24.2	-43.5
Global CPI[5]	4.5	1.1
RON95 petrol price, RM/litre	1.06	2.04
Diesel price, RM/litre	0.65	1.98

[1] With the exception of output gap, petrol and diesel prices, all other indicators refer to average of the annual change during the period. Output gap captures the average deviation of actual output from potential output during the period. Prices for RON95 petrol and diesel refer to the average prices during the period.
[2] Core CPI inflation attempts to measure the underlying inflation. It is computed by excluding price-volatile and price-administered items whose price movements are more likely affected by temporary shocks and volatile supply factors rather than persistent changes in underlying factors affecting demand and supply conditions. In addition, core inflation also excludes the estimated direct impact of GST.
[3] Output gap captures the percentage deviation of actual output from potential output, which is an estimate of the highest level of output that an economy is capable of producing in a non-inflationary environment.
[4] The nominal effective exchange rate (NEER) against import partners is calculated based on the weighted average of the bilateral exchange rates against Malaysia's top 15 import partners. A positive figure indicates a depreciation in the ringgit against Malaysia's import partners relative to the year before.
[5] Global CPI inflation refers to the aggregate inflation of Malaysia's top 15 import partners, weighted by the share of imports from these economies.

Source: Ministry of Domestic Trade, Co-operatives and Consumerism, Department of Statistics, Malaysia, International Monetary Fund (IMF), Bloomberg and Bank Negara Malaysia estimates

of the crisis. In particular, there was a large positive output gap that was reflected in labour market tightness, strong import growth and supply bottlenecks[17]. Together with the sharp ringgit depreciation, the domestic developments created a substantial spike in the cost of imports over a short interval of time and these were quickly passed on to consumer prices. Specifically, these factors precipitated the marked increase in the prices of imported finished goods (CPI-Import), which accelerated by 9.1% in 1998 (1997: 1.8%) and prices of imported inputs (PPI-Import), which surged by 9.3% (1997: 2.8%). The quick and sharp rise in the cost of imports also showed that the moderate decline in commodity prices was insufficient to offset the inflationary impact from the large and sharp ringgit depreciation. As a result, headline inflation increased significantly from 2.1% in July 1997 to peak at 6.2% in June 1998 (averaging 5.3% in 1998). Both headline and core inflation remained persistently above 4% throughout 1998.

October 2014 - December 2015: Persistent ringgit depreciation mitigated by downtrend in commodity prices

In comparison to the AFC, the current depreciation episode differs in two ways: the magnitude of the depreciation was relatively more modest, as the NEER depreciated by an average of 9.3%[18] during the period, and the depreciation trajectory was in fact more gradual and persistent with smaller fluctuations

[17] See BNM Annual Report 1997 and 1998 for details.
[18] Between October 2014 and December 2015, the NEER had depreciated by 20.5%. The depreciation of 9.3% refers to the average of annual change in the exchange rate on a monthly basis, which is used as a like-for-like comparison against inflation. Inflation is also measured in a similar manner.

in the exchange rate. The depreciation did cause CPI-Import[19] to increase by 3.0% in 2015 but the overall impact on inflation was offset by the drop in fuel prices of 9.0%. Of importance, the large decline of 32.2%[20] in global commodity prices during the period played a significant role in mitigating the impact of exchange rate depreciation on inflation. This is reflected by the decline in PPI by 4.8% in 2015 and only a small increase in PPI-Import by 0.7%. The mitigating effects from the prolonged downtrend in global commodity prices were also evident in the developments of the other price indices along the production chain (Diagram 2). Prices of imported raw and intermediate materials only increased by 0.6% during this episode following the ringgit depreciation, while prices of local raw and intermediate materials recorded a large decline of 9.1%. In addition, domestic demand conditions remained moderate with no signs of demand-driven inflationary pressures. Overall, headline inflation remained modest at 2.1% in 2015 while core inflation remained relatively stable at 2.3%.

Conclusion

Analyses of data in the past two decades suggest that the exchange rate pass-through to inflation has generally been low in Malaysia. The low degree of pass-through is due mainly to the prevalence of administered prices in the CPI, moderate dependency on imported goods and pricing-to-market by firms. While the pass-through is generally low, the 1997-1998 experience shows that exchange rate depreciation can be accompanied by substantial changes in inflation. In the more recent period, however, inflationary pressures have remained moderate despite the persistent depreciation. This is mainly on account of the offsetting impact from the large decline in global oil and commodity prices.

Going forward, the changing economic landscape following reforms towards more market-based pricing could change the inflation dynamics in Malaysia. Since 2010, there has been a gradual removal of subsidies from key necessities including food items, fuel products and utilities. Of note are the adjustments that have impacted the price-setting behaviour of firms, namely the minimum wage policy in 2013 and market-based pricing mechanism for fuel products in 2014. These changes could lead to greater flexibility of domestic prices, which in turn could make firms more responsive not only to changes in the exchange rate but also to global prices.

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[19] In the breakdown for CPI-Import, prices of food and non-food components rose from 2.0% and -0.8% respectively in December 2014 to reach 7.5% and 1.5% in December 2015.

[20] Represents average annual change during the period for the IMF Primary Commodity Price Index.

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