

INTERNATIONAL MONETARY FUND

Exchange Rate Pass-Through to Inflation in Singapore

Singapore

Kodjovi Eklou

SIP/2024/039

IMF Selected Issues Papers are prepared by IMF staff as background documentation for periodic consultations with member countries. It is based on the information available at the time it was completed on July 01, 2024. This paper is also published separately as IMF Country Report No 24/256.

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Exchange Rate Pass-Through to Inflation in Singapore
Prepared by Kodjovi Eklou*

Authorized for distribution by Masahiro Nozaki
August 2024

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ABSTRACT: Singapore has addressed high inflation over the past years amid a tight labor market through several rounds of tightening of the exchange rate-based monetary policy. This paper estimates the exchange pass-through to inflation in Singapore with a particular focus on the role of labor market conditions. The paper first finds a strong exchange rate pass-through to inflation in Singapore, after accounting for the potential endogeneity of changes in the exchange rate. Further, it uncovers that labor market tightness dampens exchange rate pass-through and therefore could weaken monetary policy transmission. Overall, the results suggest that monetary policy should be more vigilant under a tight labor market condition. The paper then draws policy implications for taming inflation under tight labor market conditions.

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SELECTED ISSUES PAPERS

Exchange Rate Pass-Through to Inflation in Singapore

Singapore

Prepared by Kodjovi Eklou¹

¹ The author would like to thank Masahiro Nozaki and colleagues of the Monetary Authority of Singapore for helpful comments and Defa Zhao for data support.



SINGAPORE

SELECTED ISSUES

July 1, 2024

Approved By
**Asia and Pacific
Department**

Prepared By Kodjovi Eklou (APD).

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EXCHANGE RATE PASS-THROUGH TO INFLATION IN SINGAPORE

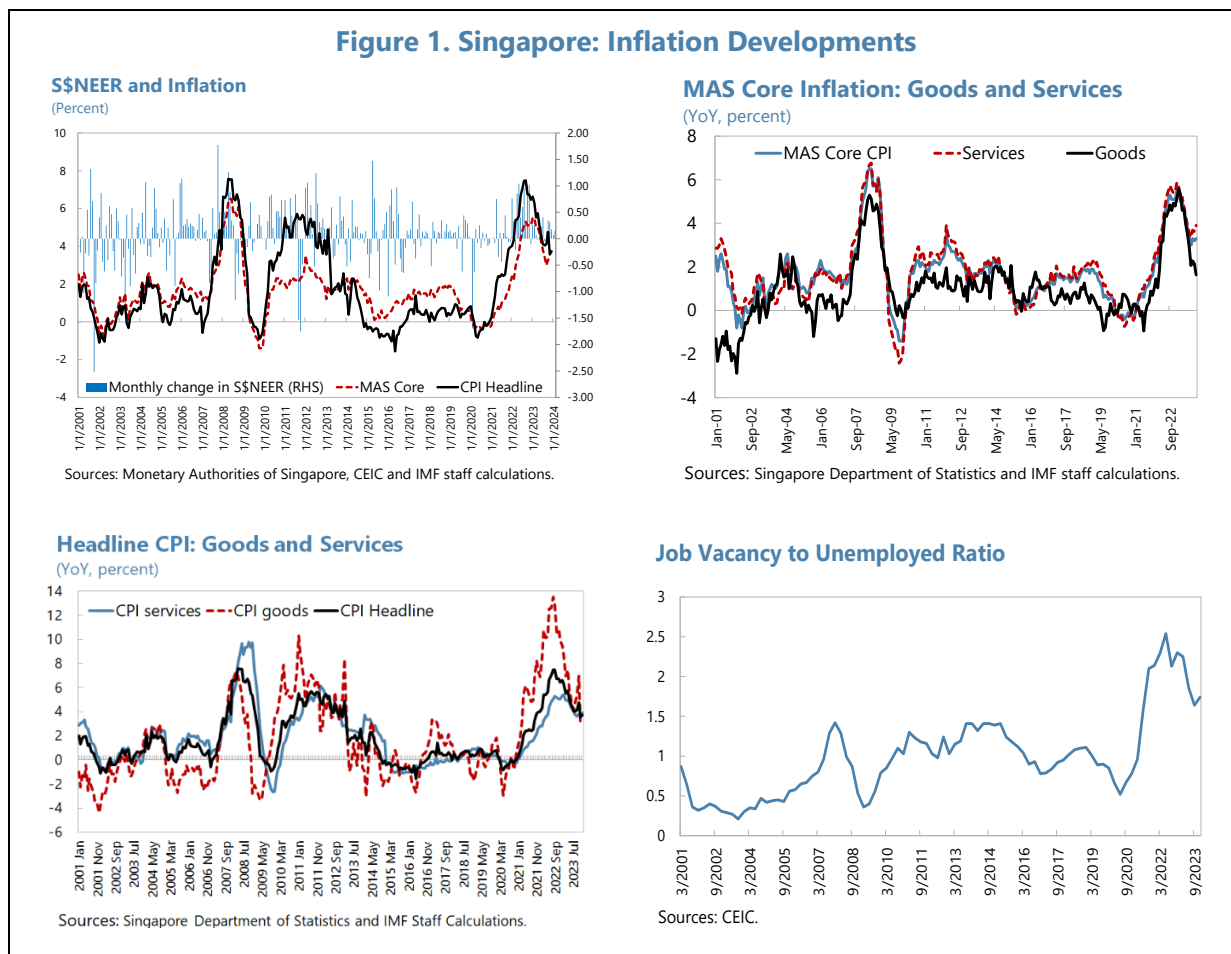
Singapore has addressed high inflation over the past years amid a tight labor market through several rounds of tightening of the exchange rate-based monetary policy. This paper estimates the exchange rate pass-through to inflation in Singapore with a particular focus on the role of labor market conditions. The paper first finds a strong exchange rate pass-through to inflation in Singapore, after accounting for the potential endogeneity of changes in the exchange rate. Further, it uncovers that labor market tightness dampens exchange rate pass-through and therefore could weaken monetary policy transmission. Overall, the results suggest that monetary policy should be more vigilant under a tight labor market condition. The paper then draws policy implications for taming inflation under tight labor market conditions.

A. Background: Taking Stock of Recent Development in Inflation and Monetary Policy Tightening in Singapore

1. The Monetary Authority of Singapore (MAS) operates a basket, band, and crawl (BBC) exchange rate-based monetary policy framework in which the nominal effective exchange rate (S\$NEER) is managed against an undisclosed basket of currencies. The BBC can best be characterized by a forward-looking Taylor rule-like policy reaction function with the S\$NEER, instead of the interest rate, as the short-term policy instrument to minimize output gap and stabilize expected inflation (see Parrado, 2004; McCallum, 2006; and MAS, 2021). Given that Singapore is a small open economy, MAS sees the exchange rate as having a much stronger influence on inflation than the interest rate. The exchange rate is seen to affect prices through both the ‘imported inflation’ channel and the ‘derived demand’ channel. Under the ‘imported inflation’ channel, an appreciation of the Singapore dollar against currencies of major trading partners reduces the S\$ prices of imported goods and services, which subsequently dampens consumer prices. The ‘derived demand’ channel operates when changes in nominal exchange rate affect firms’ demand for domestic factors of production and hence the output gap. Under a positive output gap, an appreciation of the S\$ will reduce aggregate demand, leading firms to cut back on domestic production and hold back on investment and hiring, which narrows the positive output gap and dampens price pressures.

2. After surging amid the post-pandemic recovery, inflation has eased following multiple rounds of monetary policy tightening (Figure 1). Both headline and MAS core inflation increased rapidly in 2022, with the former peaking at 7.5 percent in September 2022 before moderating to 3.7 percent in December 2023. MAS core inflation fell to 3.3 percent in December 2023 from 5.5 percent in February 2023, while still showing some signs of persistence. Looking at the components of the CPI basket, both goods and services inflation have also begun to ease, with the latter showing more persistence. MAS responded to the rising inflationary pressures with five rounds of consecutive

tightening and has remained on pause since April 2023.¹ The labor market remains tight compared to its pre-pandemic level.



B. Estimating Exchange Rate Pass-Through in Singapore

3. A large literature investigates exchange rate pass-through to inflation including in Singapore. Recent cross-country works include Caselli and Roitman (2019), Carrière-Swallow et al. (2023), and Cheikh et al (2023), all putting an emphasis on state-dependent exchange rate pass-through. For instance, Cheikh et al. (2023) show that the exchange rate pass-through to consumer prices is high during periods of geopolitical tensions. Carrière-Swallow et al. (2023) find that while the exchange rate pass-through is low on average, it becomes large when uncertainty is high. The literature on exchange rate pass-through in the specific context of Singapore (see MAS, 2001; Ghosh and Rajan, 2009; and Tan et al., 2011) focused mostly on the exchange rate pass-through to import prices. Tan et al. (2011), the most recent work, find that there is a full-pass-through of exchange rate to import prices within 6 quarters and about 25 percent pass-through to CPI within the year.

¹ See IMF Country Report No. 2023/314 for more detail on the monetary policy tightening cycle.

4. We employ a two-stage empirical strategy consisting of identifying plausibly exogenous changes in exchange rates and estimating the pass-through of such identified exchange rate shocks to inflation. The exchange rate in Singapore is obviously endogenous given the exchange-rate based monetary policy. We follow an approach similar to Romer and Romer (2004) and Holm et al (2021) to identify plausibly exogenous monetary policy shocks. Our approach consists in using MAS monetary policy meetings level data and estimate the following equation.²

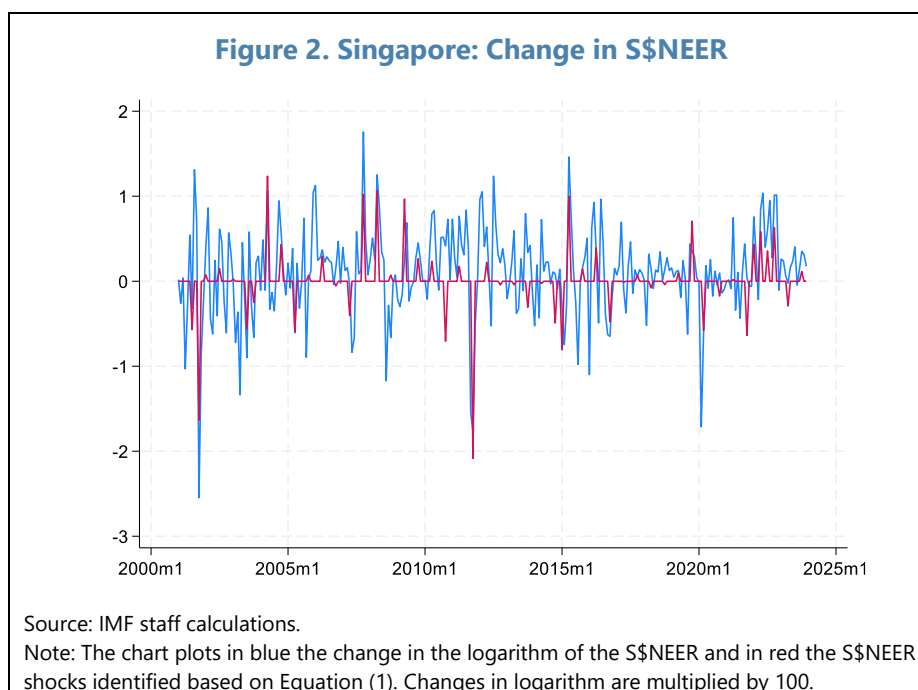
$$\Delta S\$NEER_m = \beta_0 + \beta_1 S\$NEER_{m-1} + \sum_{k=0}^1 \delta_k^\pi \pi_{m,t+k} + \sum_{k=0}^1 \delta_k^y y_{m,t+k} + \eta_m^{NEER} \quad (1)$$

Where $\Delta S\$NEER_m$ is the change in the logarithm of the $S\$NEER_m$ at meeting m , $S\$NEER_{m-1}$ is the logarithm of the $S\$NEER$ in the previous meeting. Meeting m takes place in year t , and control variables include inflation forecasts for the current year ($\pi_{m,t}$) and the next year ($\pi_{m,t+1}$), as well as growth forecasts for the current year ($y_{m,t}$) and the next year ($y_{m,t+1}$). Data on inflation and growth forecasts were taken from the consensus forecast for the corresponding month of each meeting. We take data on $S\$NEER$ as well as dates of monetary policy meetings from the [MAS website](#). Finally, η_m^{NEER} is a measure of exchange rate shock associated with meeting m obtained as a residual from equation (1). The intuition is that we obtain a measure of changes in $S\$NEER$ that is purged from the expectation regarding macroeconomic conditions, including inflation and output. η_m^{NEER} could also be seen as a measure of unexpected changes in $S\$NEER$.

5. We estimate plausibly exogenous exchange rate shocks by OLS using equation (1). Our estimates cover the period 2000m1 to 2023m10 and Table 1 shows results. The model explains about 30 percent of the variation in the change of $S\$NEER$ (similar to finding on monetary policy shocks estimates by Romer and Romer (2004), Holm et al. (2021), and Eklou (2023)). We find that, when MAS expects a strong growth in the current year and the next year, monetary policy is likely to be tightened while it is likely to do so when next year inflation is expected to be high. Figure 2 shows the estimated monetary policy shocks (η_m^{NEER}) from Table 1. As previously discussed, these monetary policy shocks capture unexpected or surprise changes in the $S\$NEER$. For instance, during the global financial crisis, MAS announced an upward recentering in April 2008 (after slight increase in the slope in October 2007), which translates into a surprise appreciation in $S\$NEER$ by about 1 percent in our measure. More recently, during the pandemic, in its March 2020 meeting, MAS set the slope at 0 percent and announced a downward re-centering at the prevailing level of the $S\$NEER$ which translated into an estimated surprise depreciation in the $S\$NEER$ by about 0.6 percent. The July 2022 off-cycle meeting, where MAS announced the upward recentering, translated into a surprise appreciation in the $S\$NEER$ by about 0.4 percent. Following Romer and Romer (2004)

² Our specification is also similar to the reduced form estimate of MAS' implied policy reaction following a Taylor rule (MAS, 2021). [The monetary policy framework](#) of the MAS is arguably complex as not only the slope of the $S\$NEER$ can be changed but also, the width and the level at which the policy band is centered. MAS' monetary policy decisions are typically characterized by shifts in the slope of the $S\$NEER$ policy band and only occasionally by changes in the level of the mid-point (for instance if the growth/inflation outlook changes abruptly and rapidly such as at the time of the global financial crisis) or the width of the band (in face of a significant increase in the level of uncertainty, such as in 2001 and 2010). See Appendix VI of IMF Country report No. 22/233.

and Holm et al (2021), we obtain the monthly estimates of monetary policy shocks over January 2001 to October 2023, setting them to zero in months without a monetary policy meeting.



$S\$NEER_{m-1}$	0.036** (0.016)
$y_{m,t}$	0.001* (0.000)
$y_{m,t+1}$	0.003** (0.001)
$\pi_{m,t}$	-0.002 (0.001)
$\pi_{m,t+1}$	0.001* (0.000)
β_0	-0.188** (0.078)
N	50
R-squared	0.296
Robust standard errors in parentheses.	

6. We estimate exchange rate pass-through to inflation in Singapore, accounting for the potential role of labor market conditions using the local projection framework over the period of 2000m1–2020m3.

Following the recent literature on state-dependent exchange rate pass-through to inflation (Caselli and Roitman, 2019; and Carrière-Swallow et al. 2023), we use the local projection approach. The local projection approach (Jordà, 2005) has interesting properties including being robust to misspecifications and flexible enough to accommodate state dependent analyses. More recently, Montiel Olea and Plagborg-Møller (2021) show that local projection inference is both simpler and more robust than standard autoregressive inference, whose validity is known to depend sensitively on the persistence of the data and on the length of the horizon. We estimate the following equation:

$$Y_{t+h} - Y_{t-1} = \alpha_0^h + \theta^h \eta_t^{NEER} + \lambda^h \eta_t^{NEER} \times vac_ratio_t + \sum_{j=0}^{12} \phi_j^h X_{t-j}^D + \sum_{j=0}^{12} \mu_j^h X_{t-j}^G + \xi_{t+h} \quad (2)$$

Where Y_t is the logarithm of the price index of interest (consumer price index, MAS core index, Goods CPI index and Services CPI index) and η_t^{NEER} is the S\$NEER shock (we also use the change in the logarithm of the S\$NEER in a baseline result).³ vac_ratio_t is the job vacancy ratio (the job vacancy to unemployed person ratio) taken from CEIC.⁴ The vector X_t^D contains domestic control variables and their 12 months lags. These controls include the output gap, lagged inflation, lagged \$NEER shocks, the job vacancy ratio and the lagged changes in log of the manufacturing producer price index. The output gap⁵ captures demand side pressures while the manufacturing producer price captures supply side price pressures. The vector X_t^G includes global factors⁶, including the global output gap, the global supply chain pressures index, and the changes in the logarithm of global food price and oil price indices.

7. We present cumulative impulse responses functions (IRFs) as deviation in percent of initial value. In equation (2), θ^h captures the percent response of prices to a 1 percentage point appreciation (increase) in the S\$NEER shock at a horizon of h months, without accounting for the potential role of job vacancy or labor market tightness. We then compute the cumulative impact of the 1 percent S\$NEER appreciation shock accounting for the role of labor market tightness as $\theta^h + \lambda^h \times p75_{vac}$, where $p75_{vac}$ represents the 75th percentile value of the job vacancy ratio series.

³ MAS core inflation excludes volatile components such as private road transportation and accommodation. We use data on the goods and services categories of the CPI basket and corresponding weight to calculate the corresponding CPI indices. See further details in the Data Appendix.

⁴ This data is not available at the monthly frequency and therefore we use the quarterly data.

⁵ Following Binici et al (forthcoming), we obtain monthly output gap series by applying the HP filter to the monthly industrial production index. The global output gap is obtained similarly, using data on global industrial production from Baumeister and Hamilton (2019).

⁶ The global supply chain pressure index is taken from [the New York Fed website](#). The index is built by Benigno et al. (2022) and captures supply chain disruptions according to the Baltic Dry Index (BDI), the Harpex index, air freight costs, and some components of the Purchasing Managers' Index (PMI), such as delivery time, backlogs, and purchased stocks. Global food and oil price indices are taken from the [IMF website](#).

8. Our results show that the exchange rate pass-through, in absolute terms, could be under-estimated without taking into account potential endogeneities issues. Figure 3 shows the estimates of the pass-through using changes in the logarithm of the S\$NEER, while Figure 4 employs the monetary policy-induced exchange rate shocks (η_m^{NEER}) identified in equation (1). Overall, results show lower pass-through in Figure 3 compared to Figure 4. For instance, considering headline inflation, the average exchange rate pass-through is about twice as large when using the plausibly exogenous exchange rate shocks. Further, when we account for the tightness of the labor market, we fail to identify a pass-through without accounting for the endogeneity of the exchange rate policy. This pattern is similar when looking at the components of the CPI basket (see Figure 5 and Figure 6). Overall, our findings suggest that without taking into account endogeneity issues, the exchange rate pass-through is likely to be perceived as weaker than warranted. This could be due to the fact that exchange rate appreciations are more likely to take place when upward inflationary pressures are expected. The identification strategy that we used in equation (1) allows to mitigate this issue by isolating changes in the S\$NEER that are not driven by expectations on the macroeconomic conditions.

9. We find that the S\$NEER pass-through to inflation is strong (Figure 4). The results show that the exchange rate pass-through to headline inflation could be relatively quick and strong, with a 1 percent appreciation shock leading to a cumulative 2 percentage points reduction in about 9 months. More specifically, the magnitude of the pass-through implies for instance that for an initial inflation rate of 3 percent, a 1 percent appreciation shock in the S\$NEER would lead to an inflation rate of about 1 percent in 9 months. Regarding MAS core inflation, a 1 percent appreciation shock would lead to about 1 percentage point cumulative reduction over 9 months. To compare, recent estimates for advanced economies show a pass-through coefficient about 0.1 percentage point cumulatively over 12 months (see Carrière-Swallow et al., 2021).

10. The pass-through could be however significantly weakened under a tight labor market condition (Figure 4). Labor market tightness severely impacts the transmission of the S\$NEER appreciation shocks to inflation, with a marginal impact representing only about fourth and half of the impact previously discussed for headline and MAS core inflation, respectively. The weaker pass-through from exchange rate to inflation during periods of labor market tightness could be due to the fact that labor market typically tightens more in response to domestic shocks, in which case, the exchange rate pass-through is usually subjected to a substantial time lag. While this concern should be mitigated by the inclusion of the output gap among the controls to account for demand side pressures on inflation, other relevant demand side factors not accounted for could play a role. While the marginal impact estimated for Singapore under a tight labor market conditions is low compared to normal conditions, it remains large compared to estimates found in advanced economies on average.

11. The pass-through is larger for goods than for services (Figure 6). Our results show that the strong pass-through is mainly driven by the goods components of the CPI basket, which tend to respond more quickly and strongly than the services components. More specifically, goods CPI responds to a S\$NEER shock (in statistically significant manner) two months ahead of services CPI. Regarding headline CPI, while a 1 percent appreciation is likely to reduce goods inflation by 2 percent cumulatively in 7 months, it reduces services inflation by about 1 percent. Finally, while both

the pass-through to goods and services CPI is weaker under a tight labor market condition, it is more so for services inflation. Indeed, while the pass-through is about halved for goods CPI, under a tight labor market condition, it represents about fourth of the average effect for services inflation. Overall, this result suggests that exchange rate pass-through to services CPI is likely to be severely weakened under tight labor market conditions.

12. We undertake various robustness checks (Appendix II). These include additional controls (certificate of entitlement quotas, GST hikes), redefining the good and services baskets and employing an alternative measure of job vacancy. First, certificates of entitlement (COE) quotas have a significant impact on the private transport component of headline inflation. We address this by running a robustness check including the changes in the logarithm of COE quotas among domestic controls. Next, goods and services taxes (GST) have a significant influence on inflation and have been historically hiked during periods of tight labor market.⁷ To account for a potential omitted variable bias regarding the exclusion of GST, we control for whether in a given year there was a GST rate hike.⁸ Third, we redefined the goods CPI basket to include “Utilities and other fuels” and estimate the impulse response function. Finally, given that the labor market tightness is a key aspect of our analysis, we employ a different measure. In our baseline, we used the job vacancy to unemployed persons ratio. Although this is a widely accepted measure of labor market slack, one shortcoming in the context of Singapore is that while the numerator accounts for the total workforce, the denominator covers only unemployed residents. We resort therefore to the job vacancy rate, a broader measure, defined as the total number of job vacancies divided by the total demand for manpower.⁹

13. Our results are broadly robust to accounting for potential omitted variables, employing a different measure of labor market tightness and considering a longer horizon for impulse responses (Figure 7-13). We find that, accounting for COEs quotas (Figure 7), controlling for episodes of GST hikes (Figure 8 and 9), redefining the CPI basket by including “Utilities and other fuels” in goods category (Figure 10) and using a broader measure of labor market tightness (Figure 11 and 12) do not materially change our main results. For instance, while the results show a more significant impact of labor market tightness on exchange rate pass-through with the job vacancy rate, they remain in line with our finding of a relatively subdued pass-through under a tight labor market condition.

14. Finally, we also undertake a robustness check considering a 24-months horizon. Our results in Figure 13 show that the transmission of the exchange rate shocks persist mainly only over

⁷ We take data on COE quotas from [Singstat](#) and information on GST hikes from the [Inland Revenue Authority of Singapore](#).

⁸ More specifically, we include a dummy variable taking the value 1 in years where a GST hike took place over the period.

⁹ The data on the job vacancy rate is taken from the Ministry of Manpower.

about 14 months (except for goods CPI where the impact can persist up to 20 months).¹⁰ The extension of the horizon beyond the standard 12-months used in the related literature (e.g., Carrière-Swallow et al., 2023)) could be an area for future research, given that the quality of statistical inference within the local projection framework could be weakened at higher projection horizons.

C. Conclusion and Policy Implications

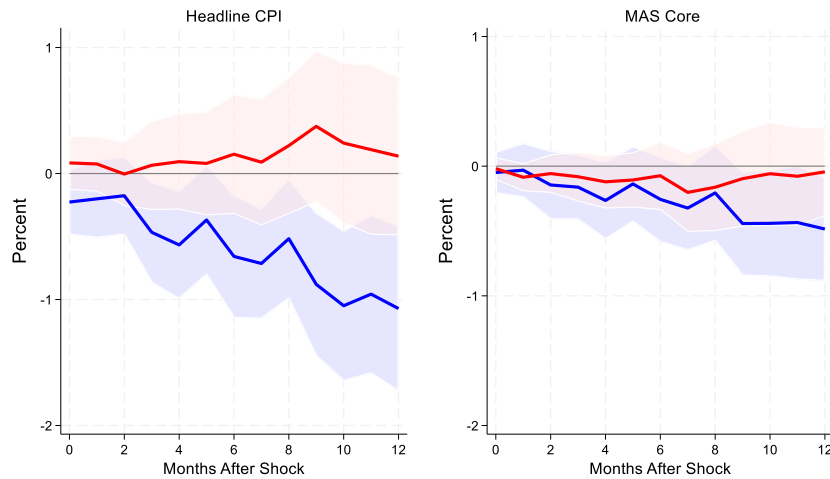
15. Our findings suggest that the exchange rate pass-through to inflation is strong in Singapore but could be weakened under tight labor market conditions, especially for services inflation. Once endogeneity issues are plausibly addressed, the exchange rate pass-through is estimated to be strong, especially for the good components of the CPI basket. However, under tight market conditions, the pass-through is found to be severely weakened and more so for the service components of the CPI basket. Overall, our findings suggest that the exchange rate-based monetary policy serves Singapore well, but it would need to be more vigilant when the labor market is tight.

16. Further, policies designed to ease structural labor market tightness could help support monetary policy to ensure price stability in Singapore. This is consistent with a recent study on the US that suggests that dealing with the inflationary pressures originating from a tight labor market would require policy actions that bring labor demand and supply into a better balance (Bernanke and Blanchard, 2023). Indeed, recent analysis by MAS suggests an important role for persistent matching frictions in the labor market, potentially due to a shortage of technology skills in the short-term and a recent shift in the foreign workforce leading to skill shortages in sectors such as health and social services.¹¹ More specifically, enhancing existing policies such as [Career Conversion Programs](#) to equip workers with skills could help ease matching frictions.

¹⁰ Note that the quality of statistical inference within the local projection framework could be weakened at higher projection horizons.

¹¹ See the [Macroeconomic Review, Volume XXII, Issue 1, April 2023](#).

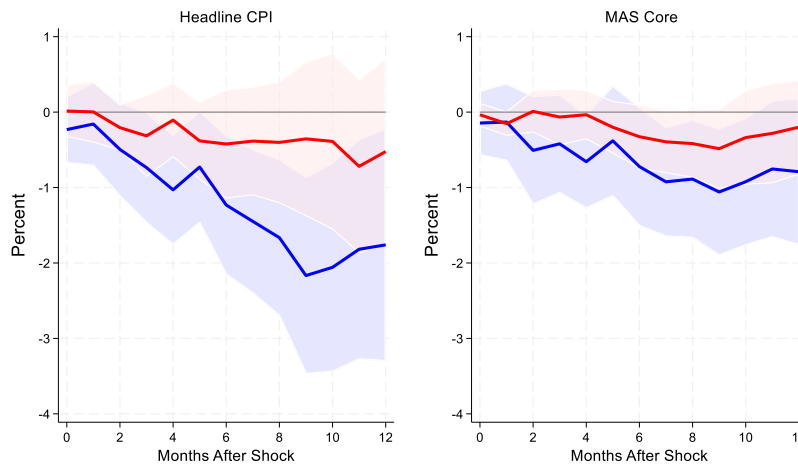
Figure 3. Singapore: Exchange Rate Pass-Through to Headline and MAS Core Inflation – Baseline



Source: IMF staff calculations.

Notes: This figure shows the cumulative response of inflation to 1 percent appreciation in the S\$NEER, on the percentage change in inflation. The blue line shows average impact (θ^h), while the red line the impact of the appreciation, conditional on the 75th percentile of job vacancy ratio in the sample ($\theta^h + \lambda^h \times p75_{vac}$). 90 percent confidence interval in shaded areas is based on Newey-West standard errors (robust to autocorrelation).

Figure 4. Singapore: Exchange Rate Pass-Through to Headline and MAS Core Inflation – Exogenous Changes in S\$NEER



Source: IMF staff calculations.

Notes: This figure shows the cumulative response of inflation to 1 percent appreciation in the S\$NEER, on the percentage change in inflation, using the plausibly exogenous shocks (η_t^{NEER}). The blue line shows average impact (θ^h), while the red line the impact of the appreciation, conditional on the 75th percentile of job vacancy ratio in the sample ($\theta^h + \lambda^h \times p75_{vac}$). 90 percent confidence interval in shaded areas is based on Newey-West standard errors (robust to autocorrelation).

Figure 5. Singapore: Exchange Rate Pass-Through to Goods and Services Inflation – Baseline



Source: IMF staff calculations.

Notes: This figure shows the cumulative response of inflation to 1 percent appreciation in the S\$NEER, on the percentage change in inflation. The blue line shows average impact (θ^h), while the red line the impact of the appreciation, conditional on the 75th percentile of job vacancy ratio in the sample ($\theta^h + \lambda^h \times p75_{vac}$). The MAS core goods exclude private transportation category while MAS core services exclude the accommodation (housing) category. 90 percent confidence interval in shaded areas is based on Newey-West standard errors (robust to autocorrelation).

Figure 6. Singapore: Exchange Rate Pass-Through to Goods and Services Inflation – Exogenous Changes in S\$NEER



Source: IMF staff calculations.

Notes: This figure shows the cumulative response of inflation to 1 percent appreciation in the S\$NEER, on the percentage change in inflation, using the plausibly exogenous shocks (η_t^{NEER}). The blue line shows average impact (θ^h), while the red line the impact of the appreciation, conditional on the 75th percentile of job vacancy ratio in the sample ($\theta^h + \lambda^h \times p75_{vac}$). The MAS core goods exclude private transportation category while MAS core services exclude the accommodation (housing) category. 90 percent confidence interval in shaded areas is based on Newey-West standard errors (robust to autocorrelation).

Appendix I. Data Appendix

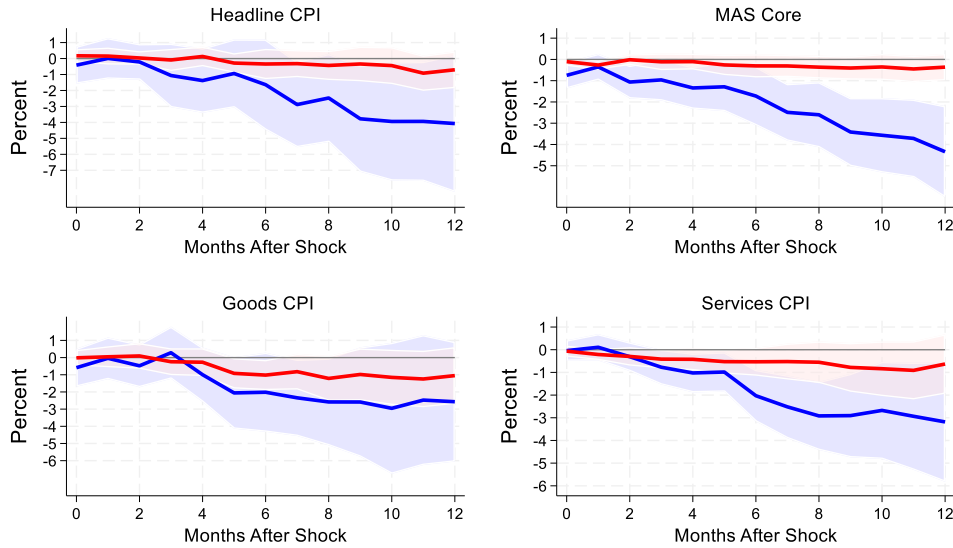
This Appendix describes the components of the CPI baskets included in goods and services.

Table 1. Singapore: MAS CPI -All Items - Goods and Services Components	
Services	Goods
Food Serving Services	Food Excl Food Serving Services
Housing & Utilities	Clothing & Footwear
Household Services & Supplies	Household Durables
Outpatient Services	Medicines & Health Products
Hospital Services	Private Transport
Health Insurance	Telecommunication Equipment
Public Transport	Recreational & Cultural Goods
Other Transport Services	Newspapers, Books & Stationery
Postage & Courier Services	Textbooks & Study Guides
Telecommunication Services	Alcoholic Drinks & Tobacco
Recreational & Cultural Services	Personal Effects
Holiday Expenses	
Tuition & Other Fees	
Personal Care	
Social Services	
Other Miscellaneous Services	

Table 2. Singapore: MAS Core – Goods and Services Components	
Services	Goods
Food Servicing Services	Food excluding services
Utilities and other fuels	Clothing & Footwear
Household Services & Supplies	Household Durables
Healthcare: Outpatient Services	Medicines & Health Products
Healthcare: Hospital Services	Telecommunication Equipment
Public Road Transport	Recreational & Cultural Goods
Other Travel & Transport	Newspapers, Books & Stationery
Postage & Courier Services	Textbooks & Study Guides
Telecommunication Services	Alcoholic Drinks & Tobacco
Recreational & Cultural Services	Personal Effects
Holiday Expenses	
Tuition & Other Fees	
Personal Care	
Notes: Some items were excluded as full series starting from 2000 were unavailable; adjustments were made. MAS Core goods exclude non-durable household goods. MAS Core services exclude domestic & household services, healthcare insurance, social services, other miscellaneous services. Non-durable household goods and domestic & household services were replaced by the broader category of household services & supplies, included in MAS Core services.	

Appendix II. Robustness Tests

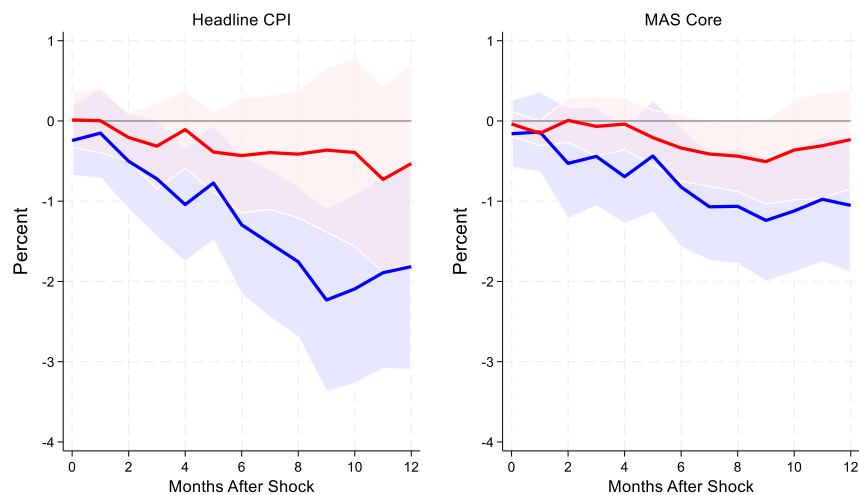
Figure 1. Singapore: Exchange Rate Pass-Through to Inflation – Controlling for Certificate of Entitlement (COEs)



Source: IMF staff calculations.

Notes: This figure shows the cumulative response of inflation to 1 percent appreciation in the S\$NEER, on the percentage change in inflation, using the plausibly exogenous shocks (η_t^{NEER}). The blue line shows average impact (θ^h), while the red line the impact of the appreciation, conditional on the 75th percentile of job vacancy ratio in the sample ($\theta^h + \lambda^h \times p75_{vac}$). 90 percent confidence interval in shaded areas is based on Newey-West standard errors (robust to autocorrelation).

Figure 2. Singapore: Exchange Rate Pass-Through to Inflation – Controlling for GST Hikes



Source: IMF staff calculations.

Notes: This figure shows the cumulative response of inflation to 1 percent appreciation in the S\$NEER, on the percentage change in inflation, using the plausibly exogenous shocks (η_t^{NEER}). We include among domestic controls indicators of GST hikes across the sample period. The blue line shows average impact (θ^h), while the red line the impact of the appreciation, conditional on the 75th percentile of job vacancy ratio in the sample ($\theta^h + \lambda^h \times p75_{vac}$). 90 percent confidence interval in shaded areas is based on Newey-West standard errors (robust to autocorrelation).

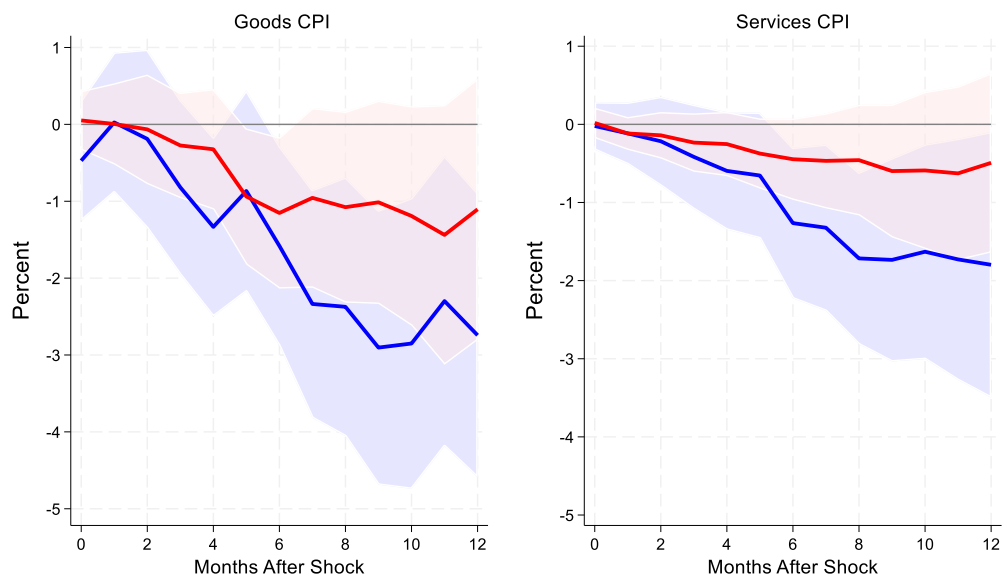
Figure 3. Singapore: Exchange Rate Pass-Through to Goods and Services Inflation – Controlling for GST hikes



Source: IMF staff calculations.

Notes: This figure shows the cumulative response of inflation to 1 percent appreciation in the S\$NEER, on the percentage change in inflation, using the plausibly exogenous shocks (η_t^{NEER}). We include among domestic controls indicators of GST hikes across the sample period. The blue line shows average impact (θ^h), while the red line the impact of the appreciation, conditional on the 75th percentile of job vacancy ratio in the sample ($\theta^h + \lambda^h \times p75_{vac}$). 90 percent confidence interval in shaded areas is based on Newey-West standard errors (robust to autocorrelation).

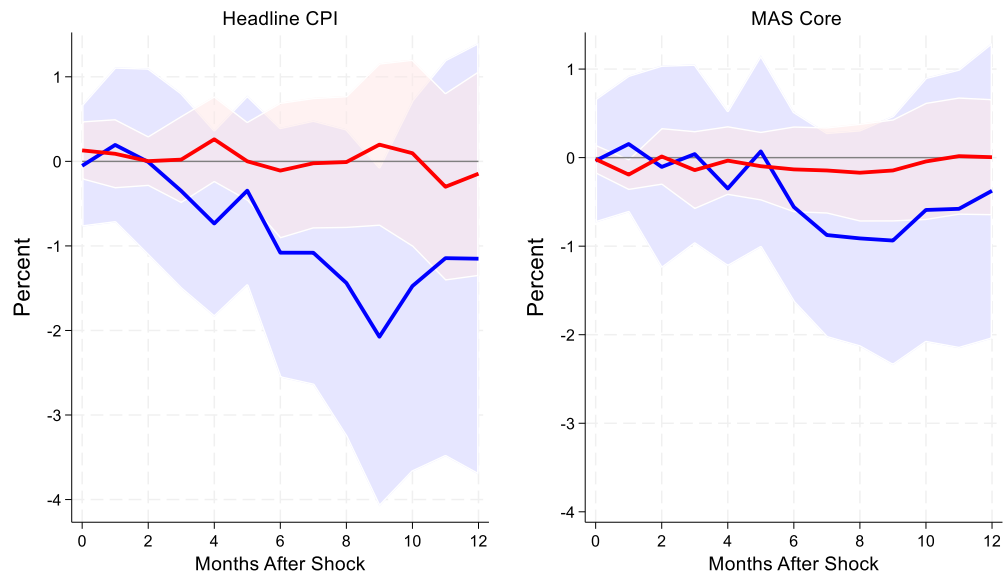
Figure 4. Singapore: Exchange Rate Pass-Through to Good and Services Inflation – Redefining Good and Services Baskets



Source: IMF staff calculations.

Notes: This figure shows the cumulative response of inflation to 1 percent appreciation in the S\$NEER, on the percentage change in inflation, using the plausibly exogenous shocks (η_t^{NEER}). We include the "utilities and other fuels" category in goods basket and exclude it from services compared to the baseline estimates. The blue line shows average impact (θ^h), while the red line the impact of the appreciation, conditional on the 75th percentile of job vacancy ratio in the sample ($\theta^h + \lambda^h \times p75_{vac}$). The MAS core goods exclude private transportation category while MAS core services exclude the accommodation (housing) category. 90 percent confidence interval in shaded areas is based on Newey-West standard errors (robust to autocorrelation).

Figure 5. Singapore: Exchange Rate Pass-Through to Inflation – Using Job Vacancy Rate



Source: IMF staff calculations.

Notes: This figure shows the cumulative response of inflation to 1 percent appreciation in the S\$NEER, on the percentage change in inflation, using the plausibly exogenous shocks (η_t^{NEER}). Job Vacancy Rate for a quarter is defined as the total number of job vacancies divided by the total demand for manpower at the end of the quarter. The blue line shows average impact (θ^h), while the red line the impact of the appreciation, conditional on the 75th percentile of job vacancy ratio in the sample ($\theta^h + \lambda^h \times p75_{vac}$). 90 percent confidence interval in shaded areas is based on Newey-West standard errors (robust to autocorrelation).

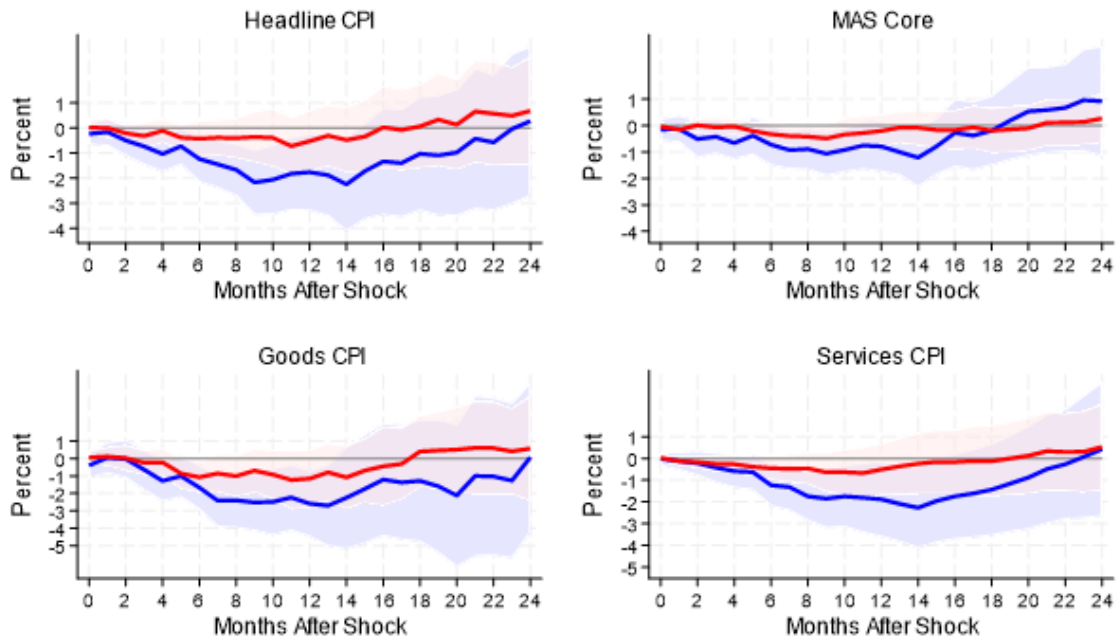
Figure 6. Singapore: Exchange Rate Pass-Through to Goods and Services Inflation – Using Job Vacancy Rate



Source: IMF staff calculations.

Notes: This figure shows the cumulative response of inflation to 1 percent appreciation in the S\$NEER, on the percentage change in inflation, using the plausibly exogenous shocks (η_t^{NEER}). Job Vacancy Rate for a quarter is defined as the total number of job vacancies divided by the total demand for manpower at the end of the quarter. The blue line shows average impact (θ^h), while the red line the impact of the appreciation, conditional on the 75th percentile of job vacancy ratio in the sample ($\theta^h + \lambda^h \times p75_{vac}$). 90 percent confidence interval in shaded areas is based on Newey-West standard errors (robust to autocorrelation).

Figure 7. Singapore: Exchange Rate Pass-Through Inflation – Results Over a 24-Months Horizon



Source: IMF staff calculations.

Notes: This figure shows the cumulative response of inflation to 1 percent appreciation in the S\$NEER, on the percentage change in inflation, using the plausibly exogenous shocks (η_t^{NEER}). The blue line shows average impact (θ^h), while the red line the impact of the appreciation, conditional on the 75th percentile of job vacancy ratio in the sample ($\theta^h + \lambda^h \times p75_{vac}$). 90 percent confidence interval in shaded areas is based on Newey-West standard errors (robust to autocorrelation).

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