US Monetary Policy Uncertainty Spillover and the Role of Exchange Rate Regime*

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February 2026

Abstract

We analyze the international spillover effects of US monetary policy uncertainty shocks on countries with fixed versus flexible exchange rate regimes. Our findings show that such shocks lead to a larger contraction in countries with flexible exchange rates than in those with fixed exchange rates, contradicting the conventional view that flexible exchange rates serve as a buffer against external shocks. We also document that US monetary policy uncertainty shocks raise economic uncertainty more strongly in countries with flexible exchange rate regimes. On the theoretical side, we demonstrate that a standard small open economy New Keynesian DSGE model cannot replicate this empirical result, but an augmented model that incorporates the direct international spillover of policy uncertainty is able to reproduce the findings.

Keywords: Exchange rate regime, Monetary policy uncertainty, International spillover
JEL Classification: E32; F31; F44

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*We appreciate helpful comments by John Higgins, Yun-soo Kim, Annie Soyean Lee, Junseok Lee, Stefano Lord-Medrano, Soo Kyung Woo, Gunho Yang, Tack Yun, and seminar participants at Midwest Macroeconomics Meeting in Spring 2023. Yeonggyu Yun acknowledges financial support from the University of Wisconsin-Madison, Korea Foundation for Advanced Studies, DB Cultural Foundation, and the BK21 FOUR (Fostering Outstanding Universities for Research) funded by the Ministry of Education of Korea and National Research Foundation of Korea (NRF).

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1 Introduction

The international spillover of the uncertainty shock in the US has recently gained attention from empirical studies. While previous studies have focused on measuring shocks to US uncertainty and estimating responses in other economies, this paper analyzes the role of the exchange rate regime in propagating the spillover effects of the US uncertainty shock. We investigate whether the prevailing perspective of a flexible exchange rate as an effective shock absorber for external disturbances continues to hold in this context.

We begin with an empirical investigation into the effects of increased uncertainty regarding US monetary policy on other economies with varying exchange rate regimes. We proxy the uncertainty shock with the structural shock to the US monetary policy uncertainty index of Husted, Rogers, and Sun (2020), estimated by Fasani, Mumtaz, and Rossi (2023) using a factor-augmented VAR. We conduct a series of local projections à la Jòrda (2005) to estimate the aggregate spillover effects of the shock on 189 economies. We utilize the exchange rate regime classification of Ilzetzki, Reinhart, and Rogoff (2019).

We find that the contractionary effect of US monetary policy uncertainty shocks is larger in countries with flexible exchange rates than in those with fixed exchange rates. This result stands in contrast to the existing literature which emphasizes the shock-absorbing role of flexible exchange rates in mitigating the effects of foreign shocks including foreign monetary policy shocks. In our analysis, we observe a sharper decline in consumption and investment demand under flexible regimes relative to fixed regimes. Although the nominal exchange rate depreciates due to a flight-to-safety phenomenon – thereby improving net exports – this adjustment is not sufficient to insulate the economy from the adverse effects of uncertainty shocks. We further verify the robustness of our empirical findings through a series of checks. Specifically, we control for additional country characteristics such as capital account openness, financial development, trade openness, trade linkage with the US, and government effectiveness as well as unobserved country heterogeneity by employing an interactive fixed effects estimator following Bai (2009). Our results also remain consistent when we use alternative measures of US monetary policy uncertainty shocks estimated using the monetary policy uncertainty index of Baker, Bloom, and Davis (2016) and the option-price-based policy rate uncertainty measure of Bundick, Smith, and Van der Meer (2024).

We attribute this phenomenon to elevated exchange rate risk and economic uncertainty under the flexible exchange rate regime. Our analysis reveals that a shock to US monetary policy uncertainty significantly elevates economic uncertainty, as measured by Ahir, Bloom, and Furceri (2022), to a greater extent in flexible exchange rate regimes. Consequently, this results in more pronounced downturns in flexible regimes compared to fixed regimes. Higher uncertainty regarding US monetary policy generates capital flight from other economies and raises the exchange rate risk of investing in countries with flexible exchange rates. This, in turn, heightens the level of economic uncertainty in these floating regimes. Thus, a shock to US monetary policy uncertainty is transmitted more acutely to flexible exchange rate regimes. We also find that credit default swap (CDS) spreads of sovereign bonds rise by 50 basis points more in flexible exchange rate regimes following the shock. This implies that international investors perceive countries with flexible exchange rates as riskier investments when US economic uncertainty surges.

Such international spillover effects of uncertainty shocks are unique to the second-moment shock to the US monetary policy interest rate. We confirm in our robustness checks that the first-moment shock to the US interest rate does not exhibit a differential effect on economic uncertainty across exchange rate regimes, although it still incurs larger contractions under flexible exchange rates. The absence of shock absorption under flexible exchange rates in response to a first-moment shock to foreign monetary policy has been documented in recent work by Corsetti, Kuester, Müller, and Schmidt (2024). While we demonstrate that the effects of the second-moment shocks are qualitatively similar, we also emphasize that the underlying mechanisms may differ from those associated with the first-moment shocks.

On the theoretical side, we construct a standard small open economy New Keynesian model, as extensively studied in the literature (e.g., Born and Pfeifer (2014); Leduc and Liu (2016)), in which monetary policy uncertainty is introduced through a stochastic volatility process of the nominal interest rate set by the monetary authority. We allow for a direct international uncertainty spillover in our baseline analysis. Specifically, a foreign interest rate volatility shock is assumed to amplify domestic interest rate volatility under a fixed exchange rate regime. This is consistent with the empirical impulse response of economic policy uncertainty in floating regimes to US monetary policy uncertainty shocks. In this framework, we find that the recessionary effect is larger under flexible exchange rates than under fixed exchange rates. A surge in economic uncertainty in the flexible exchange rate regime is crucial for depressing aggregate demand as households increase precautionary savings while firms cut back on investment.

We then show that the standard framework without direct uncertainty spillover cannot replicate our key empirical finding – namely, that recessionary dynamics are more pronounced under flexible exchange rates than under fixed exchange rates. In the model without direct uncertainty spillover, a recession is much smaller in the flexible exchange rate regime than in the fixed exchange rate regime. This demonstrates that international spillovers of uncertainty play a critical role in amplifying recessionary dynamics in floating exchange rate systems. While we primarily focus on quantifying the effect of direct transmission of uncertainty in different exchange rate regimes, a complete microfoundation of the mechanism remains a promising avenue for future studies.

This paper primarily contributes to two strands of the literature. First, it extends the scope of previous studies on the international transmission of uncertainty shocks in large economies by focusing on the role of the exchange rate regime. Fernández-Villaverde, Guerrón-Quintana, Rubio-Ramírez, and Uribe (2011) analyze that volatility shocks to the world interest rate generate contractionary dynamics in small open economies, while Lastauskas and Nguyen (2023) demonstrate that volatility shocks to the US interest rate have similar global impacts. Bhattarai, Chatterjee, and Park (2020) analyze that aggregate demand decreases more in emerging market economies in response to financial uncertainty shocks originating in the US. Some studies explore the influence of country characteristics on the spillover effects of US uncertainty shocks, including Carrière-Swallow and Céspedes (2013) and Alessandri and Mumtaz (2019), which emphasize the roles of credit constraints and financial frictions. We expand the scope of the literature by examining the spillover effects of the uncertainty shock in the United States on countries with varying exchange rate regimes.

This paper also contributes to the extensive literature on the heterogeneous effects of foreign shocks under flexible and fixed exchange rates. Since Friedman (1953), numerous studies including Eichengreen and Sachs (1985), Broda (2004), and Edwards and Levy-Yeyati (2005) have emphasized the shock-absorbing role of the flexible exchange rate regime. A more recent study by Obstfeld, Ostry, and Qureshi (2019) highlights the capacity of flexible exchange rate regimes to mitigate the negative responses of capital flows to foreign monetary policy shocks. However, several recent studies have challenged this conventional wisdom. Corsetti, Kuester, Müller, and Schmidt (2021) show that flexible exchange rates do not insulate the economy from foreign monetary policy shocks, using a sample of European countries. Fukui, Nakamura, and Steinsson (2023) find that the depreciation of the US dollar has larger expansionary effects in countries with exchange rate pegs. In line with these studies, we provide evidence that flexible exchange rates do not insulate the domestic economy in the presence of second-moment shocks related to US monetary policy.

This paper is organized as follows. We present our empirical approach in Section 2 and analyze the differential effects of US monetary policy uncertainty shocks across exchange rate regimes in Section 3. We confirm the robustness of our results in Section 4. We construct the small open economy DSGE model in Section 5 and analyze the impulse responses generated by the model in Section 6. Section 7 concludes.

2 Empirical Analysis

2.1 Data

Our main sample consists of seven country-level variables: private consumption expenditure on final goods, gross fixed capital formation, exports and imports of goods and services, the monetary policy-related interest rate, the CPI inflation rate, and the bilateral nominal exchange rate relative to the USD. All data are quarterly and are collected from the IMF International Financial Statistics.[1] Our main sample constitutes an unbalanced quarterly panel of 189 countries from 1985 Q1 to 2016 Q2. For European countries, we exclude periods during which a country was a member of the Eurozone to ensure that our sample comprises small open economies and that no individual country in the sample influences US monetary policy uncertainty.

Our proxy for the shock to US monetary policy uncertainty is the structural shock to the newspaper-based US monetary policy uncertainty index of Husted et al. (2020). Specifically, we employ the quarterly mean of the structural shocks to US monetary policy estimated by Fasani et al. (2023) for the period from 1985 to 2016. They estimate a factor-augmented VAR and employ an external instrument approach to estimate the structural shock to monetary policy uncertainty. This approach is similar to that of Gertler and Karadi (2015). We use their measure of the shock to the monetary policy uncertainty index as the main indicator of an unanticipated uncertainty shock to US monetary policy.

We follow Ilzetzki et al. (2019) to classify the exchange rate regime of each quarterly country observation. We define an observation as either a flexible regime or a fixed regime, depending on the "fine" category classification of Ilzetzki et al. (2019). A full

[1]National account variables are in units of constant local currency prices to control for exchange rate fluctuations.

description of the categories of the exchange rate regime is provided in Table A1. We define observations with scores 1 to 8 as pegs and observations with a score of 13 as floating, as in Fukui et al. (2023). We exclude observations with scores of 9 to 12 from the analysis following Fukui et al. (2023) in our baseline analysis; however, the results do not change qualitatively when we assign regimes with scores of 9 to 12 as pegs or floats. For the pegs, the anchor currency is the US dollar in most cases, although there are a few instances where other currencies, such as the British Pound or the French Franc, are used as anchor currencies.

2.2 Estimation of Impulse Response Functions

We analyze the differential effects of US monetary policy shocks on countries with floating exchange rates and dollar pegs. We estimate the impulse response functions of the eight macroeconomic variables of each country by employing the local projection method, following Jòrda (2005). We estimate the following local projection

$$y_{i,t+h} = \alpha_{h,i} + \alpha_{h,t} + \beta_h u_t \times \text{Float}_{i,t-1} + \gamma_h u_t + \delta_h \text{Float}_{i,t-1} + \sum_{p=1}^{4} A_{h,p} Y_{i,t-p} + \epsilon_{h,i,t}, \quad (1)$$

where $y_{i,t}$ is an economic variable of country i at time t, and Y's are vectors of endogenous variables. u_t denotes the US monetary policy uncertainty shock estimated by Fasani et al. (2023), and a unit increase in u_t corresponds to a one standard deviation shock to US monetary policy uncertainty. $\text{Float}_{i,t-1}$ is the dummy variable that equals 1 if country i imposed free-floating exchange rates a quarter before the shock. In our baseline regression, it is 1 if the Ilzetzki et al. (2019) fine classification score is 13, and 0 if the score is between 1 and 8. We control for the previous quarter's exchange rate regime to eliminate potential endogeneity in the choice of a country's exchange rate regime. We estimate the response of each variable up to $h = 20$ quarters and control for all endogenous variables up to 4 quarters before the shock. Nonstationary variables such as industrial production, consumption, investment, exports, imports, and the bilateral nominal exchange rate relative to USD are log-differenced, and cumulative impulse responses are estimated to show the responses in log-level. We estimate the impulse responses of the CPI inflation rate and the monetary policy-related interest rate from regressions on levels of the variables.[2]

In regression (1), the main object of interest is β_h, the coefficient of the interaction term

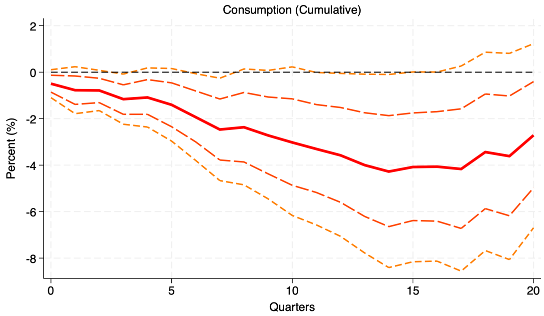
[2] We obtain similar results when we estimate the cumulative impulse response of the level of CPI.

of the US monetary policy uncertainty shock u_t and the exchange rate regime $\text{Float}_{i,t-1}$ because it measures the differential effect on a country with a floating exchange rate regime relative to a country with a fixed exchange rate regime. The spillover effect of the US monetary policy uncertainty shock in the fixed exchange rate regime is measured by γ_h. In the actual estimation, however, we control for both country and time-fixed effects to account for the impacts of country-specific and global shocks. Hence, $\gamma_h u_t$ is eliminated as we control for the time-fixed effects.

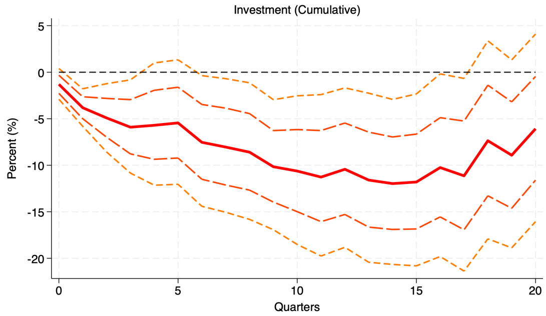
3 Differential Effects of US Monetary Policy Uncertainty Shock

We plot estimates of β_h from the regression specification (1) up to 20 quarters following the US monetary policy uncertainty shock in Figures 1 and 2. In Figure 1, US monetary policy uncertainty shocks significantly diminish aggregate demand, particularly in countries with floating exchange rates. Consumption expenditure and investment exhibit greater declines in these countries, with the differential effect amplifying over time. Specifically, consumption and investment decrease by 4% and 10% respectively after 15 quarters in nations with floating exchange rates. The shock does not yield a statistically significant differential effect on exports. In countries with floating exchange rates, an exchange rate depreciation typically boosts exports; however, an escalation in exchange rate risks, as will be discussed later, can produce conflicting outcomes. Imports decline by 10% more after 15 quarters in countries with floating exchange rates. As a result of the decline in imports, net exports increase as predicted by conventional theory. However, the decline in consumption and investment outweighs the increase in the trade balance. We confirm that private-sector output, measured as the sum of private consumption, investments, and net exports, declines over time in panel (a) of Figure 2. It declines by approximately 3% in 20 quarters. While our primary focus remains on the differential effects of the US monetary policy uncertainty shock across exchange rate regimes, we also validate that the shock generally induces contraction by estimating the coefficient γ_h in regression (1) in Appendix B.

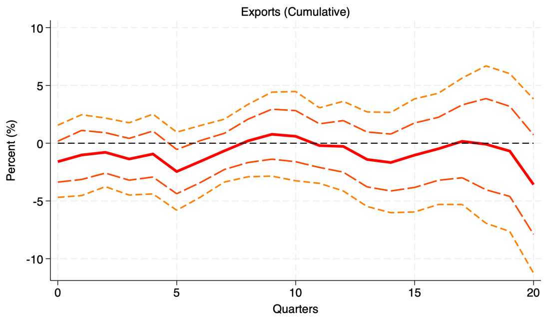
We observe that the nominal exchange rate against the USD depreciates by up to 10% more in the countries classified as flexible exchange rate regimes as the US uncertainty shock worsens the risk appetite of international investors. This is consistent with the



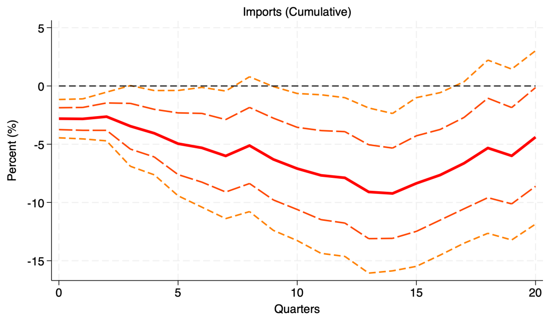
(a) Consumption



(b) Investment



(c) Exports



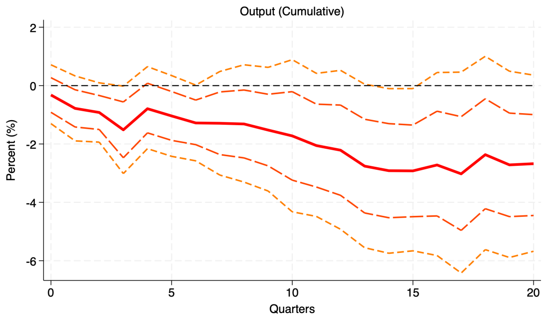
(d) Imports

Figure 1: Differential Effects of US Monetary Policy Uncertainty Shock (1)

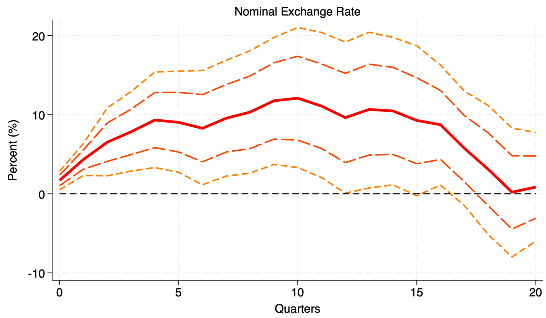
Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

analysis by Lakdawala, Moreland, and Schaffer (2021), who documented exchange rate depreciation coupled with capital flight under higher uncertainty. The CPI inflation rate tends to rise, which can be explained by exchange rate depreciation and a subsequent increase in import prices. While the import prices drive up the CPI, the effect is dampened due to lower aggregate demand, and the response of the CPI inflation rate is generally insignificant. The monetary policy interest rate increases slightly more in the flexible regime, although this is statistically not significant. We interpret this as a result of the monetary authority raising policy rates to mitigate the inflationary pressure caused by exchange rate depreciation. Panels (a) and (b) of Figure 2 show that nominal depreciation is insufficient to lift aggregate demand in response to the foreign uncertainty shock, resonating with the findings of Corsetti et al. (2021) that indicate flexible exchange rates do not insulate the economy against foreign monetary policy tightening shocks.

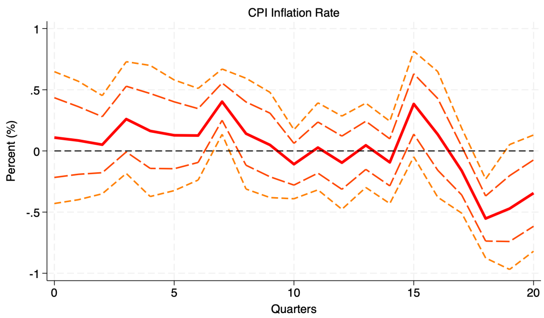
Lower aggregate demand in floating regimes than in fixed regimes may appear puzzling, but this coincides with the fact that the US monetary policy shock elevates macroe-



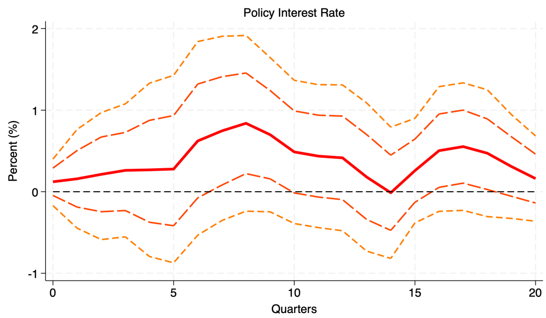
(a) Output



(b) Nominal Exchange Rate w/ USD



(c) CPI Inflation Rate



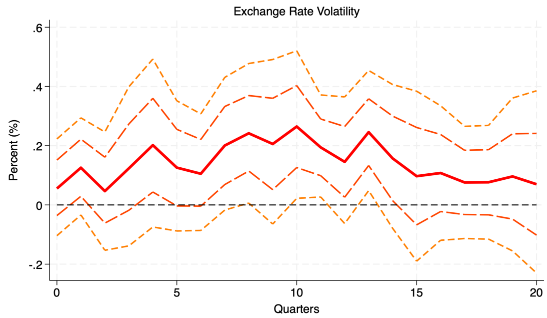
(d) Monetary Policy Interest Rate

Figure 2: Differential Effects of US Monetary Policy Uncertainty Shock (2)

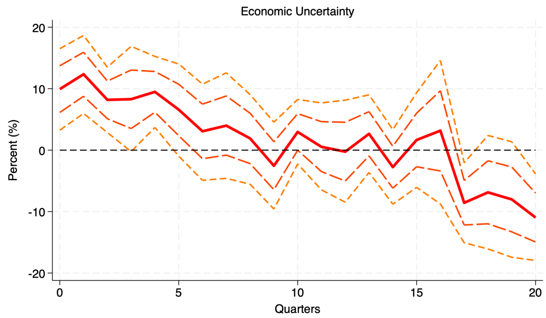
Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

conomic uncertainty and risk in the flexible regimes more significantly. Higher uncertainty associated with the Fed's interest rate policy causes capital outflows in other economies and generates a flight-to-safety, as widely studied by the literature. This makes exchange rates more volatile in countries with flexible exchange rates and elevates the exchange rate risk that international investors face when investing in these countries. Panel (a) of Figure (3) plots the differential effects of the US uncertainty shock on exchange rate volatility in flexible exchange rate regimes while controlling for all the endogenous variables used in the regression (1). Exchange rate volatility is measured as a moving average of the standard deviation of daily exchange rate returns, and we use the quarterly mean of the volatility measure. We observe that the standard deviation of exchange rate returns increases by 0.2% after 10 quarters following the shock in flexible exchange rate regimes.

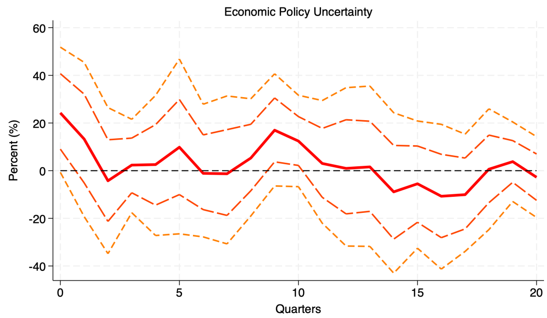
Elevated exchange rate risk translates to higher economic uncertainty in flexible exchange rate regimes, which makes government policy responses more unpredictable in these regimes. Hence, US monetary policy uncertainty directly raises economic policy un-



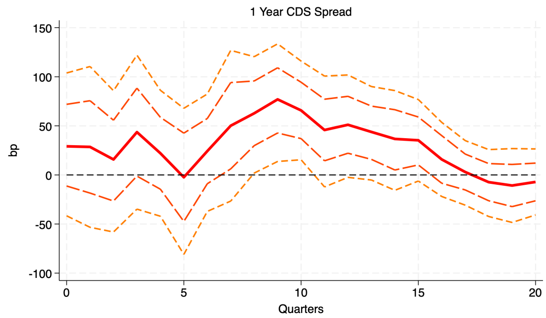
(a) Exchange Rate Volatility



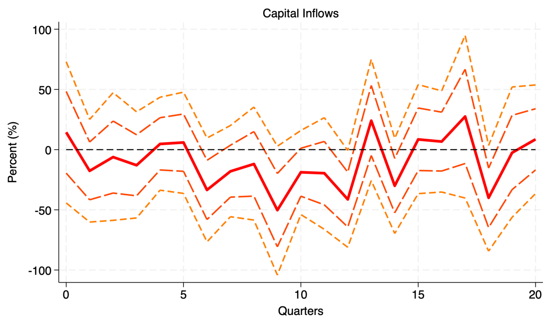
(b) Economic Uncertainty



(c) Economic Policy Uncertainty



(d) 1-Year Sovereign CDS Spread



(e) Gross Capital Inflows

Figure 3: Differential Transmission Channels of US Monetary Policy Uncertainty Shock

Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

certainty and overall macroeconomic uncertainty in flexible exchange rate regimes compared to fixed exchange rate regimes. We examine this effect by running a regression (1) with the country-level uncertainty index measured by Ahir et al. (2022) and each country's economic policy uncertainty index measured by Baker et al. (2016) for the available countries.[3] In panels (b) and (c) of Figure 3, we find that economic uncertainty and eco-

[3]While there is no separate monetary policy uncertainty index available for all the countries in our sample, it is reasonable to consider EPU as closely associated with their monetary policy uncertainty, given that

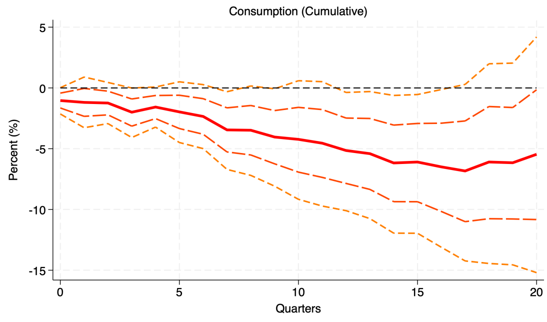
nomic policy uncertainty increase by 10 percentage points and 20 percentage points, respectively, in flexible exchange rate regimes in the next quarter after the US uncertainty shock compared to fixed exchange rate regimes.

While these effects are consistent with the well-known flight-to-safety effects, the decrease in gross capital inflows is not as pronounced as the response of macroeconomic uncertainty to the shock. Hence, we consider that the surge in economic uncertainty is the key driver of the contractionary dynamics in flexible exchange rate regimes, significantly leading domestic agents to reduce investment and consumption demand.

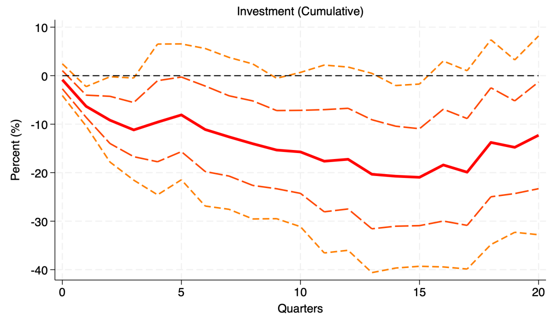
We further find that the risk appetite of international investors towards countries with flexible exchange rates deteriorates after the shock, consistent with greater economic uncertainty in these countries. We estimate the differential effects of the US monetary policy uncertainty shock on 1-year credit default swap (CDS) spreads of sovereign bonds and gross capital inflows while controlling for the dependent variables in (1). To be specific, we examine the differential effects of the shock on 1-year CR14 sovereign CDS spreads collected from Markit and gross capital inflows measured by Forbes and Warnock (2021). Panel (c) of Figure 3 shows that the CDS spread increases by roughly 80 basis points more in flexible regimes after 9 quarters following the shock. In panel (d) of Figure 3, we observe that gross capital inflows decrease by up to 50% after 9 quarters from the shock. Consistently, gross capital inflow, which measures the sum of both direct and indirect investments made by foreign investors, decreases more in flexible exchange rate regimes until 9 quarters after the shock.

In summary, we find empirical evidence that US monetary policy uncertainty shocks induce larger recessions in foreign countries under flexible exchange rate regimes than under fixed exchange rate regimes. However, our findings do not necessarily imply that maintaining a fixed exchange rate regime is optimal. Historically, fixed exchange rate regimes have been difficult to defend and have often collapsed. From a broader policy perspective, flexible exchange rate regimes may be preferable given their greater policy manageability. Rather, we interpret our evidence as identifying a specific circumstance in which a fixed exchange rate regime outperforms a flexible regime when the fixed regime can credibly maintain exchange rate stability.

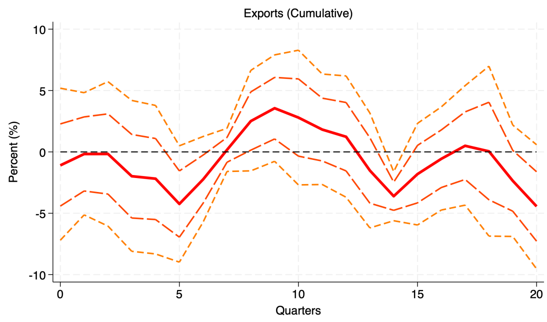
the correlation between the US EPU and MPU indices measured by Baker et al. (2016) is 0.7602. We also confirm that each country's EPU index is positively associated with each country's short-term interest rate volatility, with the average correlation coefficient of EPU and the monthly standard deviation of 1-year sovereign CDS spreads being 0.3869 in our sample.



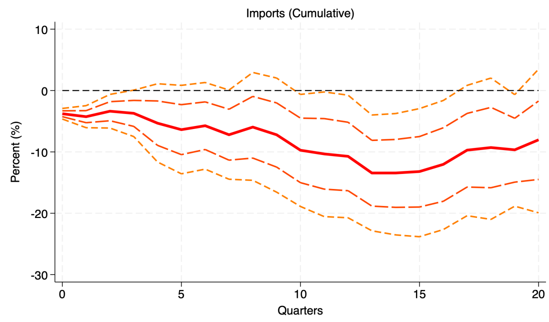
(a) Consumption



(b) Investment



(c) Exports



(d) Imports

Figure 4: Differential Effects Controlling for Other Country Characteristics (1)

Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

4 Robustness Checks

4.1 Controlling for Country-specific Characteristics

We verify that the differential effects across the exchange rate regimes are robust when controlling for other country characteristics in the analysis by conducting two additional analyzes. First, we add controls for each country's financial account openness, financial market development, trade openness, trade linkages to the US, and government effectiveness. To be specific, we use the financial openness index constructed by Chinn and Ito (2006) and the IMF Financial Development Index. For trade openness and trade linkages to the US, we use trade as a fraction of GDP and the fraction of trade with the US in total trade values as respective measures. Lastly, we use the government effectiveness index from the Worldwide Governance Indicators database collected by the World Bank.

Following Iacoviello and Navarro (2019) and Lakdawala et al. (2021), we augment the baseline regression (1) by adding orthogonalized interaction terms of the US monetary policy uncertainty shock and country-specific characteristics as

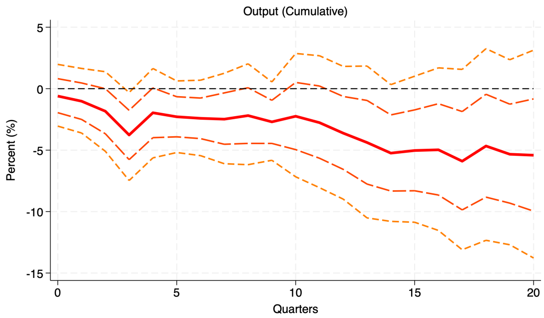
$$y_{i,t+h} = \alpha_{h,i} + \alpha_{h,t} + \gamma_h u_t + \sum_{\nu \in \mathcal{V}} \left(\beta_h^{\nu} \left(u_t \times \nu_{i,t-1}\right)^{\perp} + \delta_h^{\nu} \nu_{i,t-1} \right) + \sum_{p=1}^{4} A_{h,p} Y_{i,t-p} + \epsilon_{h,i,t}, \quad (2)$$

where $\mathcal{V} \equiv \{FX, KA, FD, TO, TL, GE\}$ is the set of six country characteristics: exchange rate regime (FX), capital openness (KA), financial development (FD), trade openness (TO), trade linkage with the US (TL), and government effectiveness (GE). First, we normalize the country characteristics relative to the sample mean and sample standard deviation and apply a logistic transformation to the normalized values. Second, we scale the transformed values to the distance between the 50th and 95th percentile values in the pooled sample, as in Iacoviello and Navarro (2019), which we denote as ν_{it} henceforth. For the exchange rate regime variables, we transform them to represent the distance from the 50th percentile value, which corresponds to the value of a fixed exchange rate regime. Lastly, we multiply the shock u_t by the lagged country characteristic values $\nu_{i,t-1}$ and sequentially orthogonalize the interaction term with respect to the shock term and the endogenous variables in the order of exchange rate regime, capital openness, financial development, trade openness, government effectiveness, and trade linkage with the US. The orthogonalized terms are denoted as $(u_t \times \nu_{i,t-1})^{\perp}$ in (2). As in the baseline analysis, β_h^{FX} captures the differential effects of US monetary policy uncertainty shocks across the exchange rate regimes. Figures 4 and 5 plot the estimates of β_h^{FX} from the onset of the shock to 20 quarters after the shock.

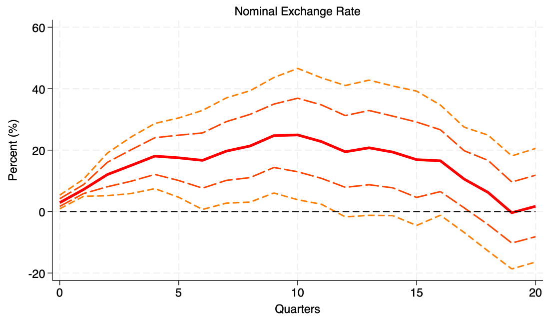
We find that the estimated impulse responses are qualitatively similar to the baseline estimates in Figures 1 and 2. The coefficient estimates are almost the same as the baseline estimates for the responses of consumption and investment. We observe an increase in exports after 8 to 9 quarters following the shock in flexible exchange rate regimes, which is consistent with the depreciation of the exchange rate. However, such improvements in the trade balance do not significantly boost aggregate demand, and consumption and investment continue to fall until 15 to 16 quarters after the shock. We obtain qualitatively similar results when we place FX as the fifth variable in the sequence of orthogonalization. The results under an alternative ordering are summarized in Appendix E.[4]

As an additional robustness check for uncontrolled country characteristics, we control for the interactive fixed effect to account for the unobserved country characteristics. We

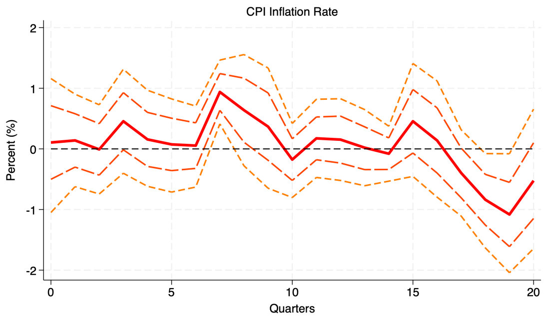
[4]We abstain from decomposing the estimated impulse responses into effects due to exchange rate stabilization and more stringent capital controls in pegs, but this remains a fruitful avenue for future studies.



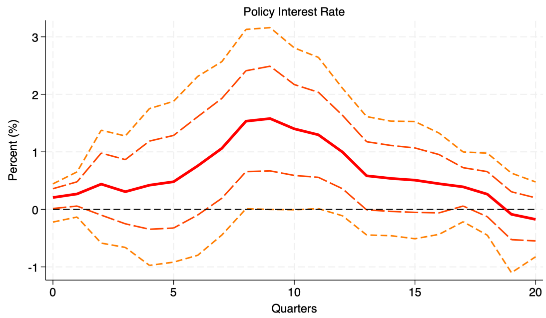
(a) Output



(b) Nominal Exchange Rate w/ USD



(c) CPI Inflation Rate



(d) Monetary Policy Interest Rate

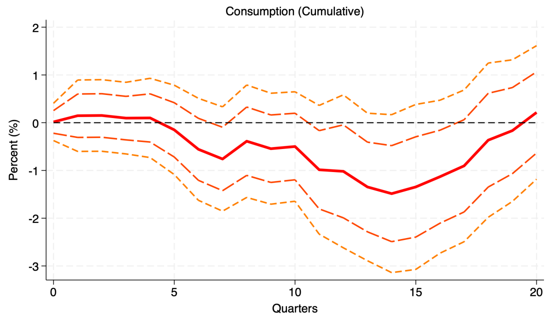
Figure 5: Differential Effects Controlling for Other Country Characteristics (2)

Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

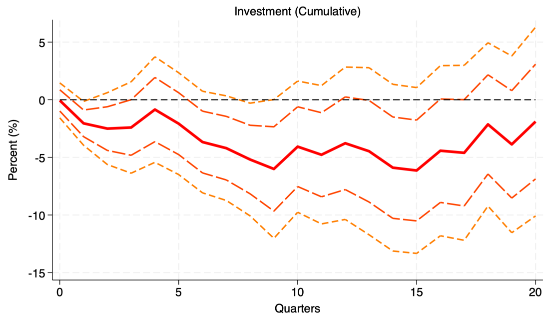
consider that there may be latent country characteristics that could potentially affect the differential effects in the baseline local projection. We augment the baseline local projection following the method of Bai (2009) by including the interactive fixed effect as

$$y_{i,t+h} = \alpha_{h,i} + \beta_h u_t \times \text{Float}_{i,t-1} + \delta_h \text{Float}_{i,t-1} + \lambda_{h,i} f_{h,t} + \sum_{p=1}^{4} A_{h,p} Y_{i,t-p} + \epsilon_{h,i,t}, \tag{3}$$

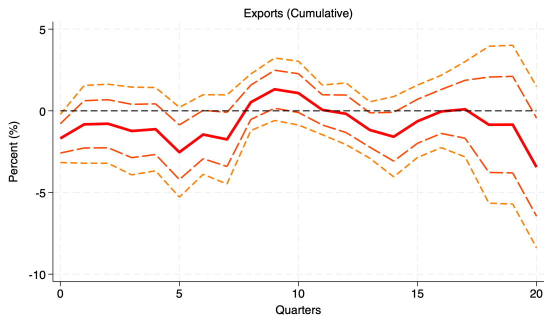
where the latent factors $f_{h,t}$ can be interpreted as the global common shock at time $t+h$, as explained by Bai (2009). The factor loading $\lambda_{h,i}$ is the heterogeneous response of each country's macroeconomic variable to the shock, which is potentially determined by unobserved country characteristics. It also captures how the feedback effects from the rest of the world propagate the global shock in country h differently, as such effects have been documented by Lastauskas and Nguyen (2024) to play a major role in the transmission of US uncertainty shocks to other economies. Figures 6 and 7 plot the estimates of β_h, controlling for the interactive fixed effects.



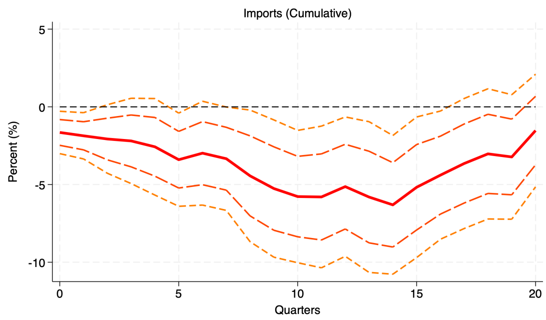
(a) Consumption



(b) Investment



(c) Exports



(d) Imports

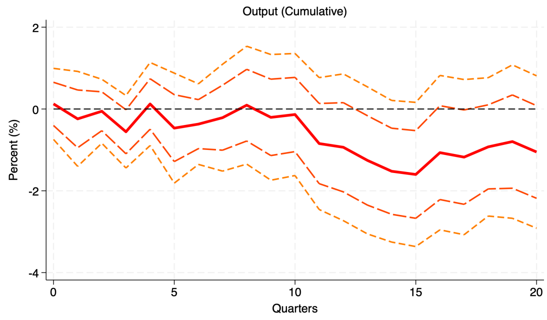
Figure 6: Differential Effects Controlling for Interactive Fixed Effects (1)

Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained with Cameron et al. (2011) two-way clustered standard errors.

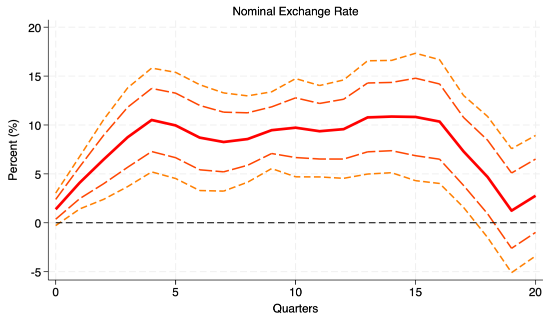
We obtain qualitatively similar estimates when we control for the heterogeneous responses of countries to a common global shock by including the interactive fixed effect. The impulse responses are less persistent and gradually fade away after 20 quarters from the onset of the US monetary policy uncertainty shock. However, this result does not overhaul our baseline analysis that flexible exchange rates do not insulate the economy against contractionary foreign shocks.

4.2 Alternative Measures of US Monetary Policy Uncertainty Shock

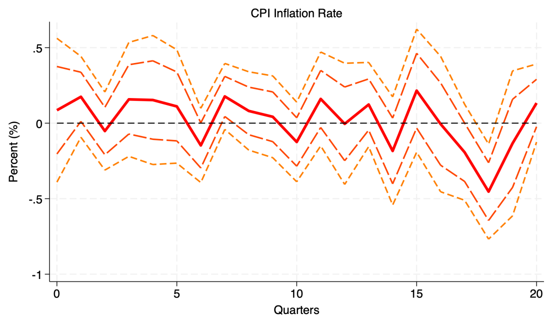
We further confirm the robustness of our empirical results by using two alternative measures of US monetary policy uncertainty shocks. First, we construct the shock measure in the same way as in the baseline estimation while using the newspaper-based measure of US monetary policy uncertainty estimated by Baker et al. (2016). Second, we also construct the shock measure using the option price-based measure of US policy rate uncertainty constructed by Bundick et al. (2024). We replace the baseline measure of US



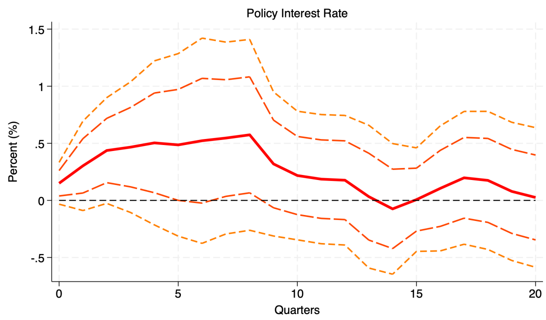
(a) Output



(b) Nominal Exchange Rate w/ USD



(c) CPI Inflation Rate



(d) Monetary Policy Interest Rate

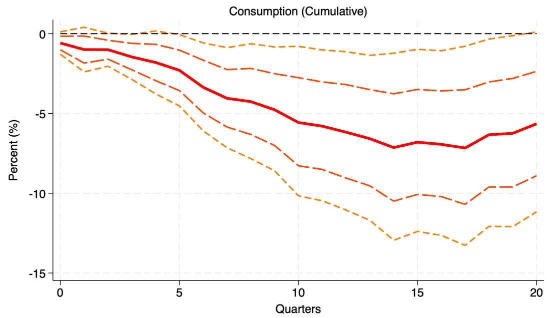
Figure 7: Differential Effects Controlling for Interactive Fixed Effects (2)

Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained with Cameron et al. (2011) two-way clustered standard errors.

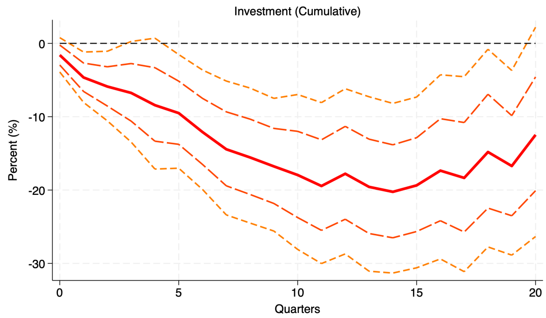
monetary policy uncertainty shock with the alternative shock measures and estimate the local projection specification in (1).

Figures 8 and 9 plot the coefficient estimates of β_h with the alternative shock measure constructed based on the Baker et al. (2016) monetary policy uncertainty index (MPU). We observe that the US monetary policy uncertainty shock incurs a larger recession in flexible exchange rate regimes. Aggregate consumption, investment, and private sector output all decrease after 20 quarters following the shock. The nominal exchange rate depreciates by up to 20% after 15 quarters from the shock and appreciates back to the initial level thereafter. The CPI inflation rate does not change. We see a slight increase in monetary policy interest rates.

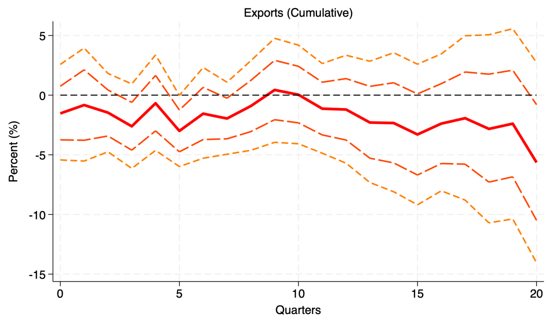
We also confirm that the results are qualitatively similar when we use the shock constructed from the Kansas Fed policy rate uncertainty estimated by Bundick et al. (2024). This uncertainty measure is estimated based on the prices of options on Eurodollar futures and is constructed in the same way that the VIX index is measured. It captures the



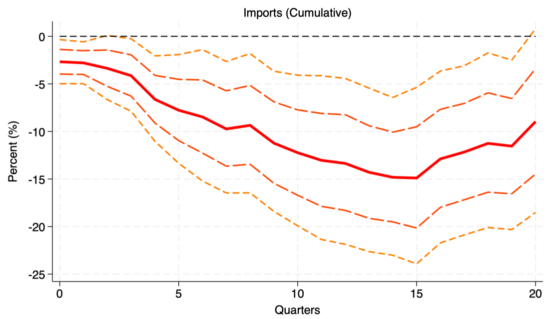
(a) Consumption



(b) Investment



(c) Exports



(d) Imports

Figure 8: Differential Effects of Baker et al. (2016) MPU Shock (1)

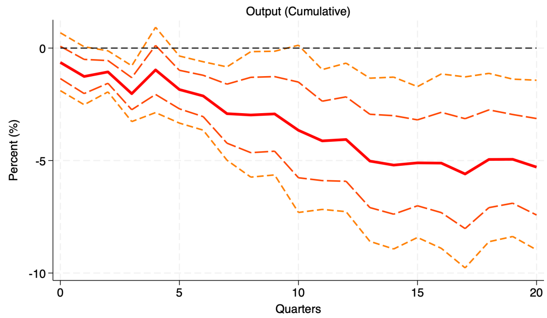
Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

one-year-ahead uncertainty associated with future short-term interest rates. Figures 10 and 11 plot the impulse responses to a one standard-deviation shock to the Kansas Fed policy rate uncertainty.

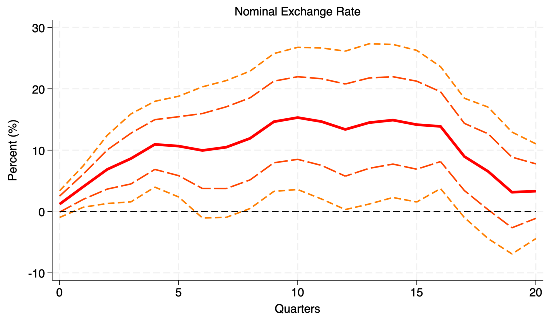
As an additional robustness check, we also reconstruct the shock measure following the FAVAR method of Fasani et al. (2023) while excluding the firm entry and exit measures from the instrumental variables. Results in Appendix F show that accounting for firm entry and exit does not qualitatively change our baseline results.

4.3 Alternative Classification of Exchange Rate Regimes

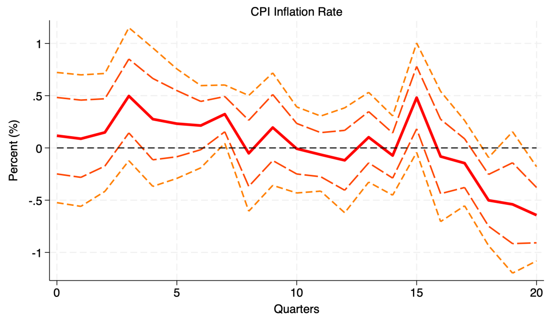
We treat observations with the Ilzetzki et al. (2019) exchange rate regime classification scores between 9 and 12 as missing observations in the baseline analysis, similarly to Fukui et al. (2023), who points out that the regimes are inadequate to be classified as either floats or pegs. We confirm that the baseline results do not qualitatively change



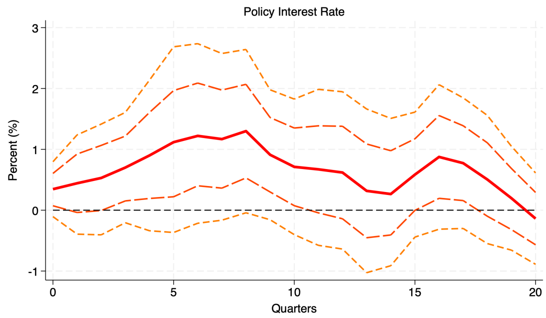
(a) Output



(b) Nominal Exchange Rate w/ USD



(c) CPI Inflation Rate



(d) Monetary Policy Interest Rate

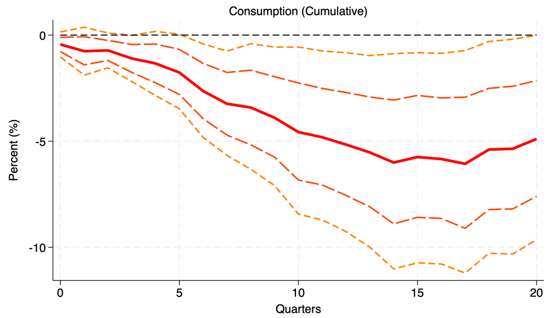
Figure 9: Differential Effects of Baker et al. (2016) MPU Shock (2)

Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

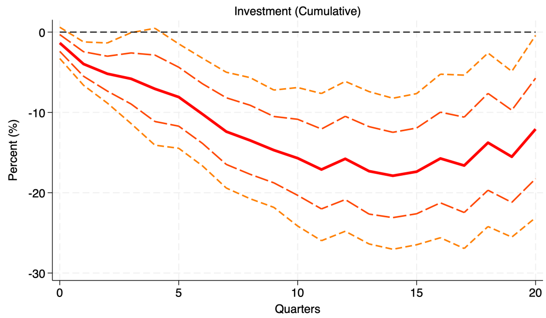
when we treat those observations as either floating exchange rate regimes or dollar pegs in Appendix C as a robustness check.

We have not controlled for potential exchange rate regime changes after a US monetary policy uncertainty shock is realized in the baseline analysis. However, controlling for the time-varying nature of exchange rate regimes would not dramatically change our results because there were only 2 cases in our sample that went through a change in exchange rate regime.[5] We verify this by estimating the regression (1) while treating countries under different regimes as different units. The impulse responses controlling for changes in exchange rate regimes are summarized in Appendix D, and they are qualitatively similar to the baseline estimates.

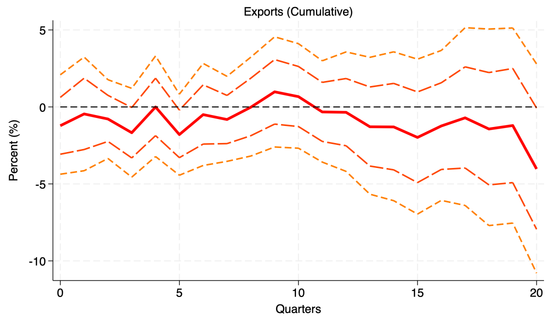
[5]Gambia in 1991 Q4 and Malaysia in 1998 Q4 changed their exchange rate regimes in our sample.



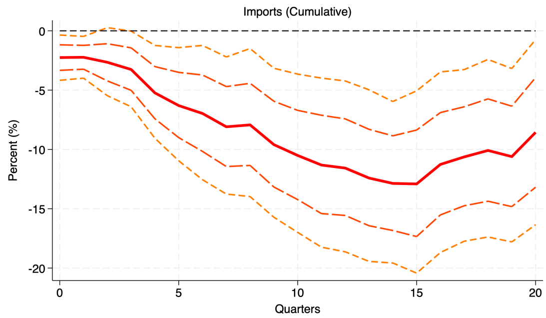
(a) Consumption



(b) Investment



(c) Exports



(d) Imports

Figure 10: Differential Effects of Kansas Fed Policy Rate Uncertainty Shock (1)

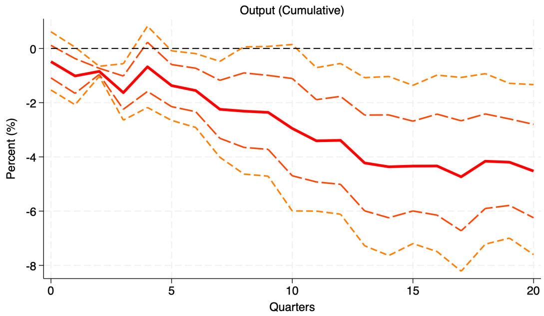
Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

4.4 Comparison to First Moment Shocks

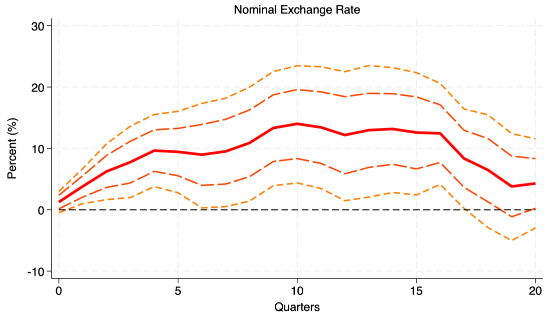
We have so far focused on the effects of the second moment shock to the Fed's interest rate across flexible and fixed exchange rate regimes. We confirm that the results are not driven by first-moment shocks to the Fed's interest rate.

Recent studies such as Corsetti et al. (2024) find that flexible exchange rate regimes do not insulate the economy against foreign interest rate shocks, which are first moment shocks. In light of this analysis, we also examine the effects of US monetary policy surprises on different exchange rate regimes. To be specific, we use the monetary policy surprises identified from the FOMC announcements estimated by Bauer and Swanson (2023) as the shock term in the regression (1). Figures 12 and 13 summarize the differential effects of a 1-bp shock on US interest rates across the exchange rate regimes.

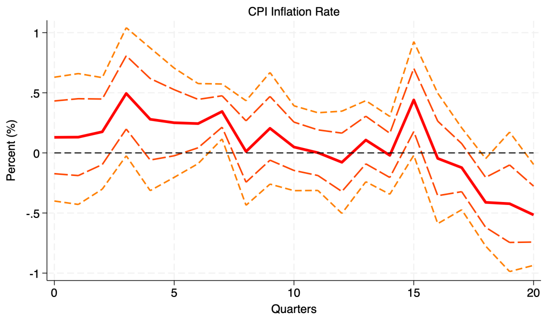
We observe that the macroeconomic effects of a 1-bp shock on the interest rate are similar to those of second moment shocks. It corresponds to a 0.25 standard deviation shock



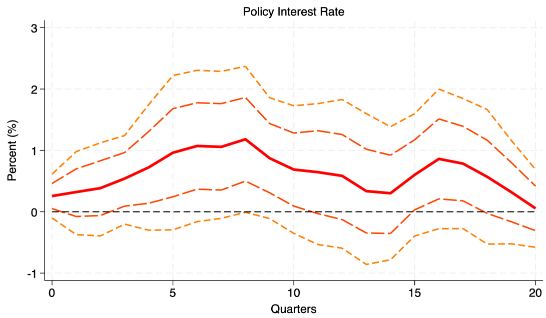
(a) Output



(b) Nominal Exchange Rate w/ USD



(c) CPI Inflation Rate



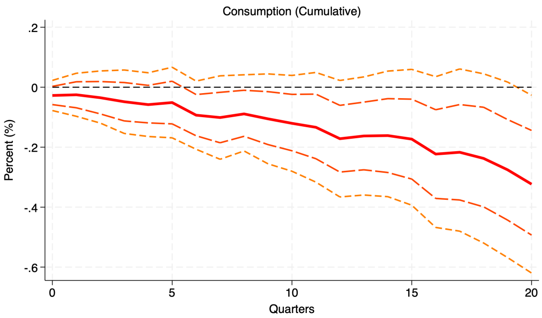
(d) Monetary Policy Interest Rate

Figure 11: Differential Effects of Kansas Fed Policy Rate Uncertainty Shock (2)

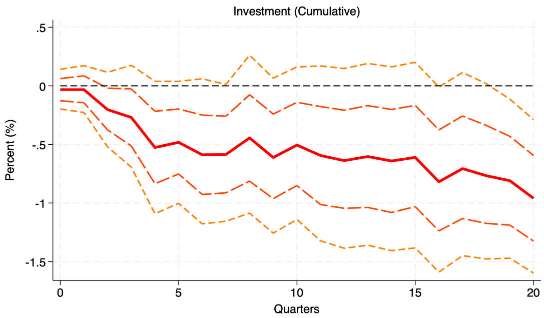
Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

on the US monetary policy interest rate, given that the standard deviation of Bauer and Swanson (2023) monetary policy surprise is 4.015 basis points in our sample.[6] Consumption, investment, and private output continue to fall after 20 quarters from the shock, while exports do not increase despite the nominal exchange rate depreciation. Responses of CPI inflation and monetary policy interest rates are generally insignificant. While our results resonate with the findings of Corsetti et al. (2024) in the context of US monetary policy shocks on different exchange rate regimes, the response of economic uncertainty to the first moment shock differs from the response to the second moment shock, as shown in panel (d) of Figure 13. Whereas the US monetary policy uncertainty shock sharply increased macroeconomic uncertainty in flexible exchange rate regimes relative to fixed exchange rate regimes, we observe that such an effect is muted for the first moment shocks. Hence, the transmission channels of the first and second moment shocks are different de-

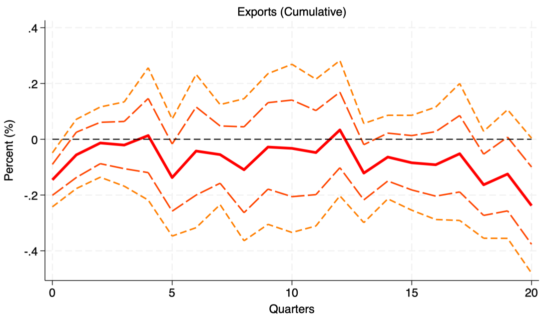
[6] In our baseline analysis, we analyze the effects of a one standard deviation shock on the Husted et al. (2020) monetary policy uncertainty index. The impulse responses in Figures 12 and 13 show that our baseline shocks have effects of a similar magnitude to a 1-bp shock on the Fed's interest rate.



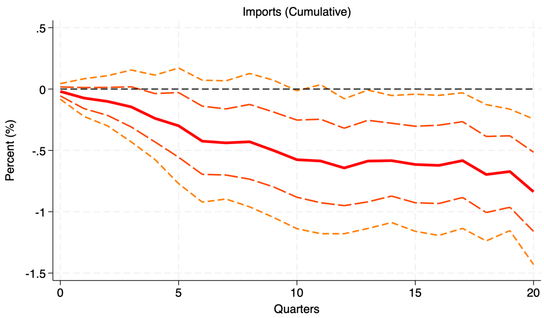
(a) Consumption



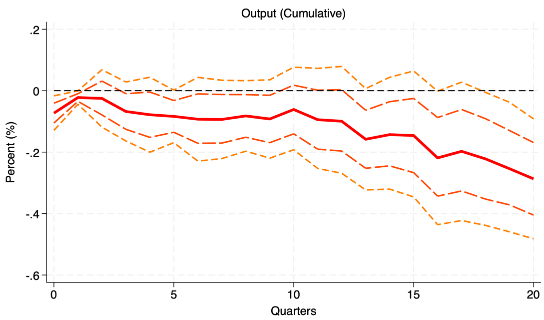
(b) Investment



(c) Exports



(d) Imports



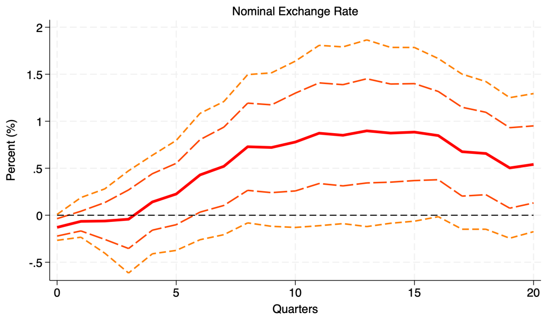
(e) Output

Figure 12: Differential Effects of US Monetary Policy Surprise (1)

Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

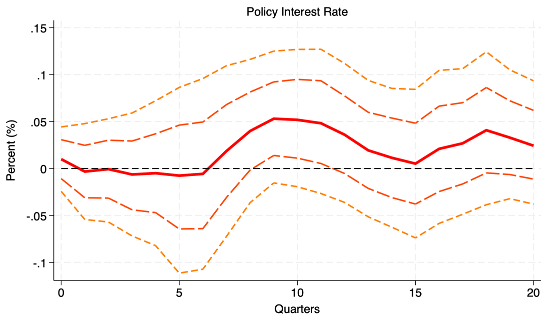
spite their similar differential effects across the exchange rate regimes, which remain an interesting avenue for future studies.

We also confirm that the baseline effects of the US monetary policy uncertainty shock are robust when we control for the first-moment shocks to the US monetary policy interest rate. The two shocks are not very correlated in the sense that the correlation coefficient of Bauer and Swanson (2023) monetary policy surprise and our baseline measure of the

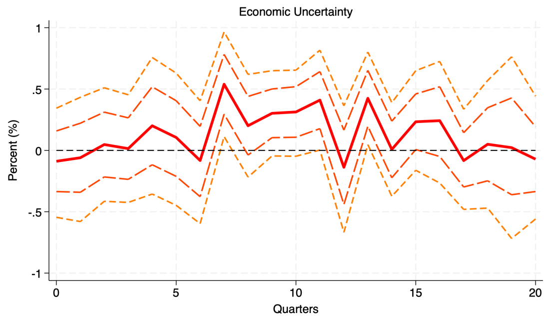


(a) Nominal Exchange Rate w/ USD

(b) CPI Inflation Rate



(c) Monetary Policy Interest Rate



(d) Economic Uncertainty

Figure 13: Differential Effects of US Monetary Policy Surprise (2)

Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

monetary policy uncertainty shock is 0.0365. Additionally, we obtain similar impulse responses of the macroeconomic variables when we use the component of the monetary policy uncertainty shock that is orthogonal to the Bauer and Swanson (2023) monetary policy surprise as the shock term in (1). The impulse responses are summarized in Appendix G.

5 Model

We now examine whether a standard DSGE model can reproduce the empirical regularities documented in the previous sections—most notably, the finding that US monetary policy uncertainty shocks generate deeper recessions in countries with floating exchange rate regimes than in those with fixed regimes. To this end, we construct a small open economy DSGE model by extending a single-country New Keynesian framework commonly used to study uncertainty shocks (Born and Pfeifer (2014); Leduc and Liu (2016)).

The small open economy setting is derived as a limiting case of a two-country DSGE model, following de Paoli (2009), with the addition of risk-averse financial intermediaries that generate endogenous deviations from the uncovered interest parity condition. In this framework, domestic variables are influenced by foreign variables and shocks, while foreign variables remain unaffected by domestic conditions. Monetary policy uncertainty is modeled through stochastic volatility in the nominal interest rate process. We show that this standard model fails to reproduce the empirical findings. However, once we introduce a modest extension — namely, a direct uncertainty spillover from the US to the home economy — the model is able to replicate the empirical evidence.

5.1 Households

We impose a unit measure of homogeneous households in the home economy. The foreign economy is constructed analogously, and the superscript * denotes foreign variables. The representative household maximizes its lifetime utility, defined as

$$E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{C_t^{1-\sigma}}{1-\sigma} - \kappa \frac{N_t^{1+\eta}}{1+\eta} \right), \tag{4}$$

where C_t and N_t denote the household's composite consumption and labor supply. We scale labor disutility by a factor of κ and denote relative risk aversion and inverse Frisch elasticity of labor supply as σ and η, respectively. We also denote the elasticity of substitution between home and foreign goods as ϕ and trade openness as $\alpha_H \in (0,1)$. Consumption C_t is a CES aggregate of goods produced at home and abroad, which are denoted as C_{Ht} and C_{Ft}, respectively, and is written as

$$C_t = \left[\alpha_H^{\frac{1}{\phi}} C_{Ht}^{\frac{\phi-1}{\phi}} + (1-\alpha_H)^{\frac{1}{\phi}} C_{Ft}^{\frac{\phi-1}{\phi}} \right]^{\frac{\phi}{\phi-1}}. \tag{5}$$

The household's optimal allocation of consumption expenditure between home and foreign goods yields

$$C_{Ht} = \alpha_H \left(\frac{P_{Ht}}{P_t} \right)^{-\phi} C_t, \tag{6}$$

$$C_{Ft} = (1-\alpha_H) \left(\frac{P_{Ft}}{P_t} \right)^{-\phi} C_t, \tag{7}$$

with the consumer price index $P_t = \left(\alpha_H P_{Ht}^{1-\phi} + (1-\alpha_H) P_{Ft}^{1-\phi}\right)^{\frac{1}{1-\phi}}$. P_{Ht} and P_{Ft} are aggregate levels of prices for home goods and foreign imported goods. P_{Ht} is set by the competitive final goods producer, and P_{Ft} satisfies the law of one price, so $P_{Ft} = e_t P_t^*$, where e_t is the nominal exchange rate and P_t^* is the consumer price index in the foreign economy.

Capital accumulation is conducted through the household's investment I_t, which is purchased from the representative domestic final goods producer. Hence, the price index for investment goods is P_{Ht}. The law of motion for capital follows $K_{t+1} = (1-\delta)K_t + I_t$ with a depreciation rate δ, and there is a quadratic adjustment cost of investment in units of domestically produced goods.[7]

In summary, the representative household chooses consumption, investment, and savings to maximize its lifetime utility (4) subject to the budget constraint

$$\begin{aligned} P_t C_t + P_{Ht}\left(1 + \frac{\iota}{2}\left(\frac{I_t}{I_{t-1}} - 1\right)^2\right) I_t + B_{H,t+1} + B_{t+1} + P_t \frac{\psi}{2}\left(\frac{B_{H,t+1}}{P_t}\right)^2 = \\ = W_t N_t + R_t K_t + (1 + i_{t-1}) B_t + R_{t-1}^B B_{Ht} + \Omega_{Ht} + \tilde{W}_t, \end{aligned} \tag{8}$$

and the law of motion for capital. In terms of saving, we assume that the household can save B_{t+1} at the nominal interest rate set by the central bank or trade local currency bonds $B_{H,t+1}$ issued by financial intermediaries at an interest rate R_{t-1}^B known today. We assume that there is a real quadratic cost of external debt adjustment to close the model, following Schmitt-Grohé and Uribe (2003), where we impose a sufficiently small value for ψ to limit its effects on the UIP deviation. The household also buys home-produced investment goods I_t at price P_{Ht} and rents capital to domestic producers. Sources of household income include interest returns from bond savings, labor income $W_t N_t$, capital rental income $R_t K_t$, rebated profits from domestic intermediate good producers Ω_{Ht}, and profits from financial intermediaries $\tilde{W}_t$.

The first-order conditions of the household's utility maximization with respect to the bond savings $B_{H,t+1}$ and B_{t+1} imply

$$U_{ct} = \beta \mathbb{E}_t \left[U_{c,t+1} \frac{1 + i_t}{\Pi_{t+1}}\right] = \beta \left(1 + \psi \frac{B_{H,t+1}}{P_t}\right)^{-1} \mathbb{E}_t \left[U_{c,t+1} \frac{R_t^B}{\Pi_{t+1}}\right]. \tag{9}$$

[7]We denote I_t as the investment net of adjustment costs, which directly adds to the physical capital stock in the next period.

where $q_t = e_t P_t^*/P_t$ denotes the real exchange rate and $\Pi_t = P_t/P_{t-1}$ denotes the gross CPI inflation rate. Combining these two conditions yields uncovered interest rate parity at steady state with zero net supply of foreign bonds.

5.2 Final Good Producer

We impose competitive final goods producers for domestically produced goods. A representative final goods producer aggregates intermediate goods $Y_{Ht}(i)$ into final goods Y_{Ht} that are distributed for domestic consumption C_{Ht} and investment I_t. Y_{Ht} is a CES aggregate of domestic intermediate goods $Y_{Ht}(i)$ defined as

$$Y_{Ht} = \left[\int_0^1 Y_{Ht}(i)^{\frac{\theta-1}{\theta}} di \right]^{\frac{\theta}{\theta-1}}, \tag{10}$$

where the elasticity of substitution across the intermediate goods is denoted as θ. Minimizing expenditure on intermediate goods yields the home producer price index P_{Ht} as

$$P_{Ht} = \left[\int_0^1 P_{Ht}(i)^{1-\theta} di \right]^{\frac{1}{1-\theta}}, \tag{11}$$

where each intermediate good producer sets $P_{Ht}(i)$ in a manner described below.

5.3 Domestic Intermediate Good Producers

We assume a continuum of monopolistically competitive domestic intermediate good producers $i \in [0, 1]$ that set home good price $P_{Ht}(i)$ and export good price $P_{Ht}^*(i)$ à la Rotemberg.[8] We impose the local currency pricing scheme as in Engel (2011) and Corsetti, Dedola, and Leduc (2023) to allow for deviations from the law of one price. This allows domestic producers in the flexible exchange rate regime to set prices while considering fluctuations in exchange rates due to foreign monetary policy uncertainty shocks.

We assume a standard Cobb-Douglas production technology $Y_t(i) = Z_t N_t(i)^\gamma K_t(i)^{1-\gamma}$. Each producer is subject to negatively sloped demand curves $Y_{Ht}(i) = (P_{Ht}(i)/P_{Ht})^{-\theta} Y_{Ht}$ at home and $Y_{Ht}^*(i) = (P_{Ht}^*(i)/P_{Ht}^*)^{-\theta} Y_{Ht}^*$ abroad, with aggregate final goods demand

[8] Oh (2020) shows that the inflation rate exhibits contrasting dynamics under Rotemberg and Calvo price adjustments when there is a volatility shock to the nominal interest rate. We impose Rotemberg-type adjustment to ensure that a hike in the volatility of the monetary policy rate lowers the inflation rate.

Y_{Ht} at home and Y_{Ht}^* abroad. Foreign demand for exports is set as the sum of foreign consumption of home-produced goods $\omega \left(P_{Ht}^*/P_t^*\right)^{-\phi} C_t^*$ and price adjustment costs. Each domestic producer maximizes the expected present discounted value of profits

$$E_t \sum_{j=0}^{\infty} \Lambda_{t,t+j} \left[\frac{P_{H,t+j}(i)}{P_{t+j}} Y_{H,t+j}(i) + \frac{e_{t+j} P_{H,t+j}^*(i)}{P_{t+j}} Y_{H,t+j}^*(i) - \frac{MC_{t+j}}{P_{t+j}} \left(Y_{H,t+j}(i) + Y_{H,t+j}^*(i) \right) \right.$$
$$\left. - \frac{\alpha}{2} \left(\frac{P_{H,t+j}(i)}{P_{H,t+j-1}(i)} - 1 \right)^2 Y_{H,t+j} - \frac{\alpha}{2} \left(\frac{P_{H,t+j}^*(i)}{P_{H,t+j-1}^*(i)} - 1 \right)^2 Y_{H,t+j}^* \right], \tag{12}$$

by setting a sequence of prices $\{P_{H,t+j}(i), P_{H,t+j}^*(i)\}_{j=0}^{\infty}$ where α governs the Rotemberg price adjustment cost and $\Lambda_{t,t+j}$ denotes the stochastic discount factor between time t and $t+j$. Due to price adjustment costs, the goods market clearing conditions for goods traded at home Y_{Ht} and exported goods Y_{Ht}^* are written as

$$C_{Ht} + \left(1 + \frac{\iota}{2} \left(\frac{I_t}{I_{t-1}} - 1 \right)^2 \right) I_t + \frac{\alpha}{2} \left(\frac{P_{Ht}}{P_{H,t-1}} - 1 \right)^2 Y_{Ht} = Y_{Ht}, \tag{13}$$

$$C_{Ht}^* + \frac{\alpha}{2} \left(\frac{P_{H,t}^*}{P_{H,t-1}^*} - 1 \right)^2 Y_{Ht}^* = Y_{Ht}^*. \tag{14}$$

5.4 Financial Intermediaries

We assume that the international financial market is segmented and that there is a continuum of risk-averse financial intermediaries who issue bonds $B_{H,t+1}$ denominated in domestic currency. The intermediaries invest in foreign bonds $B_{F,t+1}$ denominated in foreign currency that pay an interest rate i_t^* set by the foreign monetary authority. Each intermediary maximizes static expected utility each period by choosing portfolio choices $B_{H,t+1}$ and $B_{F,t+1}$ and rebates its net worth to households. For simplicity, we impose mean-variance preferences for these intermediaries that depend on the real net worth in domestic currency at $t+1$. A representative intermediary's problem at period t can be written as

$$\max_{B_{H,t+1}, B_{F,t+1}} \mathbb{E}_t \left[\frac{\tilde{W}_{t+1}}{P_{t+1}} \right] - \frac{\xi}{2} Var_t \left(\frac{\tilde{W}_{t+1}}{P_{t+1}} \right), \tag{15}$$

$$\text{s.t.} \quad \tilde{W}_{t+1} = e_{t+1} \left(1 + i_t^* \right) B_{F,t+1} - R_t^B B_{H,t+1}, \tag{16}$$

$$B_{H,t+1} = e_t B_{F,t+1}. \tag{17}$$

Optimal foreign bond holding $\frac{B_{F,t+1}}{P_t^*}$ satisfies

$$\mathbb{E}_t\left[\frac{q_{t+1}}{q_t}\frac{1+i_t^*}{\Pi_{t+1}^*}-\frac{R_t^B}{\Pi_{t+1}}\right]-\xi Var_t\left(\frac{q_{t+1}}{q_t}\frac{1+i_t^*}{\Pi_{t+1}^*}-\frac{R_t^B}{\Pi_{t+1}}\right)\frac{q_t B_{F,t+1}}{P_t^*}=0, \tag{18}$$

where q_t is the real exchange rate at period t. Hence, capital outflows are higher when the expected return on investing in foreign bonds is high and the volatility of investing in foreign bonds is low. This implies that higher interest rate volatility hinders capital flows across countries and limits consumption risk sharing between the domestic and foreign economies.

5.5 Monetary Policy

We impose a Taylor-type rule for monetary policy similar to Monacelli (2004) in the sense that monetary policy targets changes in the nominal exchange rate e_t. The monetary authority follows a policy rule that targets the CPI inflation rate Π_t, the output gap Y_t, and changes in the nominal exchange rate with sluggish interest rate adjustment. We assume that the nominal interest rate follows

$$\frac{1+i_t}{1+i}=\left(\frac{1+i_{t-1}}{1+i}\right)^{\rho_i}\left[\left(\frac{\Pi_t}{\Pi}\right)^{\phi_\Pi}\left(\frac{Y_t}{Y}\right)^{\phi_Y}\right]^{1-\rho_i}\left(\frac{e_t}{e_{t-1}}\right)^{\frac{\phi_e}{1-\phi_e}}\exp\left(\sigma_{M,t}\epsilon_{M,t}\right), \tag{19}$$

where i, Π, and Y denote the steady state interest rate, CPI inflation rate, and output, respectively.[9] We approximate around the zero-inflation steady state in the analysis in the next section. $\epsilon_{M,t} \sim N(0,1)$ is an i.i.d. level shock to the nominal interest rate, and $\sigma_{M,t}$ denotes the stochastic volatility of the monetary policy shock, which follows an AR(1) process, as will be discussed later. We specify the monetary policy uncertainty shock as a second moment shock to $\sigma_{M,t}$.

We set the degree of exchange rate regime flexibility ϕ_e to 0 for the flexible exchange rate regime and 0.99 for the fixed exchange rate regime.[10] Under the fixed exchange rate regime, the home interest rate is set to maintain the nominal exchange rate e_t and follows the dynamics of the foreign interest rate, as implied by the UIP condition derived from the household's optimal conditions.

[9]Foreign monetary policy does not target the nominal exchange rate.

[10]We assume that the regime is exogenously fixed over time. While this being a simplifying assumption, it reflects that only 5 out of 189 countries in our sample changed their exchange rate regime within the sample period.

5.6 Exogenous Processes

There are six variables that follow exogenous stochastic processes in the economy: total factor productivity Z_t and Z_t^*, monetary policy shocks $\epsilon_{M,t}$ and $\epsilon_{M,t}^*$, and the stochastic volatility of the nominal interest rate $\sigma_{M,t}$ and $\sigma_{M,t}^*$ in the two economies. We focus on describing the exogenous processes for interest rate volatility as we analyze how a shock to $\sigma_{M,t}^*$ affects the home economy in the following sections.

The stochastic volatility terms $\sigma_{M,t}$ and $\sigma_{M,t}$ follow AR(1) processes as

$$\log \sigma_{M,t} = (1-\rho_\sigma)\log \sigma_M + \rho_\sigma \log \sigma_{M,t-1} + \epsilon_{\sigma,t}, \tag{20}$$

$$\log \sigma_{M,t}^* = (1-\rho_\sigma)\log {\sigma_M}^* + \rho_\sigma \log \sigma_{M,t-1}^* + \epsilon_{\sigma,t}^*, \tag{21}$$

$$\text{where } \begin{pmatrix} \epsilon_{\sigma,t} \\ \epsilon_{\sigma,t}^* \end{pmatrix} \sim N \begin{pmatrix} \sigma_\sigma^2 & \lambda \\ \lambda & \sigma_\sigma^2 \end{pmatrix}. \tag{22}$$

We denote the covariance of $\epsilon_{\sigma,t}$ and $\epsilon_{\sigma,t}^*$ as λ. λ determines the degree of spillover of foreign monetary policy uncertainty shocks to the home economy.[11] As will be discussed later, we compare impulse responses under different values of λ to examine the role of direct uncertainty spillover from the US to other economies, as observed in the data. Lastly, we set the TFP variables to follow standard AR(1) processes.

6 Impulse Response Analysis and Discussion

6.1 Calibration and Solution Method

We summarize the calibrated parameter values used for simulation in Table 1. With parameter values similar to those used in previous studies such as Oh (2020), the value of κ is chosen to obtain the zero-inflation steady state. The value of ω is chosen to match the zero-inflation, zero-debt steady state with $Y = Y^* = 1$. The Rotemberg price rigidity parameter α is set to match the Calvo price rigidity of 0.7. Lastly, we choose $\xi = 59$ in line with the literature that studies sovereign default with risk-averse international investors, including Hatchondo, Martinez, and Sosa Padilla (2014).

[11] While we abstract from specifying volatility shocks to the TFP or separately constructing a fiscal sector that can add fiscal uncertainty to the economy, allowing for the direct uncertainty spillover only in terms of interest rates still yields impulse responses similar to the data.

Table 1: Summary of Calibrated Parameters

Parameter	Value	Definition
β	0.99	Time discount factor
σ	2	Relative risk aversion
η	2	Inverse Frisch elasticity
α_H	0.8	Home bias in consumption
ϕ	4	Elasticity of substitution between differentiated goods
θ	1.5	Elasticity of substitution between home and foreign goods
α	38.0022	Rotemberg price adjustment cost
δ	0.025	Capital depreciation rate
ι	3	Capital investment adjustment cost
γ	0.66	Labor share of production
ω	0.2	Share of home-produced good in foreign consumption
ξ	59	Risk aversion parameter of international investors
ψ	10^{-5}	Portfolio adjustment cost
ρ_i	0.7	Interest rate persistence
ϕ_Π	1.5	Taylor coefficient for home-good inflation rate
ϕ_Y	0.25	Taylor coefficient for output
ρ_z	0.9	TFP persistence
σ_z	0.01	Standard deviation of TFP shock
σ_M	0.01	Mean of monetary policy shock volatility
ρ_σ	0.7	Monetary policy shock volatility persistence
σ_σ	0.5	Standard deviation of monetary policy shock volatility

We numerically solve for the responses of endogenous variables to a one standard-deviation shock to the foreign monetary policy volatility $\epsilon^*_{\sigma,t}$ to study how a monetary policy uncertainty shock in a large economy translates to a small open economy. We analyze three cases for the small economy: the flexible exchange rate regimes with and without uncertainty spillover, and the fixed exchange rate regime. We consider the flexible regime with uncertainty spillover and the fixed regime to resemble the flexible and fixed regimes observed in the data. We also compare the flexible regimes with and without uncertainty spillover to emphasize the role of direct uncertainty spillover from the US to other economies.

The extent to which foreign uncertainty shocks are directly transmitted to the home economy depends on the covariance λ between the shock terms related to interest rate volatility, both at home and abroad. Domestic and foreign interest rates satisfy

$$\mathbb{E}_t\left[\frac{1+i_t}{\Pi_{t+1}}\right]=\mathbb{E}_t\left[\frac{q_{t+1}}{q_t}\frac{1+i_t^*}{\Pi_{t+1}^*}\right], \tag{23}$$

at the stochastic steady state with zero net foreign assets. To keep the exchange rate fixed, the domestic interest rate i_t changes to offset the change in nominal exchange rates and follows the process of the foreign interest rate i_t^* up to the first order. Hence, the correlation between i_t and i_t^* can be considered to be 1 under fixed exchange rates, which implies $\lambda = \sigma_\sigma^2$. For the flexible exchange rate regime, we observe that macroeconomic uncertainty rises by 10 percentage points more in flexible exchange rate regimes compared to fixed exchange rate regimes after the US monetary policy uncertainty shock, as shown in Figure 3. Hence, we impose $\lambda = 1.1^2\sigma_\sigma^2$, which implies that a unit shock to foreign interest rate volatility directly increases home interest rate volatility by 1.1 in the flexible regime.[12]

In the model, we refer to the covariance structure between the shock terms of the interest rate volatilities as direct uncertainty spillover. Since our empirical analysis provides reduced-form evidence, it is unclear how US monetary policy uncertainty is transmitted to other countries. Here we conduct a simple exercise by assuming a direct uncertainty spillover. To highlight the role of direct uncertainty spillover, we also solve for the case when the two volatility shocks to interest rates are independent of each other ($\lambda = 0$) to analyze the dynamics under flexible exchange rates without uncertainty spillover.

Since the monetary policy uncertainty shock is incorporated as a second moment shock to the nominal interest rate, we use the pruned third-order approximation following Andreasen, Fernández-Villaverde, and Rubio-Ramírez (2018) to obtain impulse response functions of endogenous variables.[13] We follow the simulation method proposed by Basu and Bundick (2017) and obtain impulse responses with respect to the stochastic steady state. We run 20,000 iterations to obtain the impulse responses to the foreign monetary policy uncertainty shock.

[12]We match the increase in the WUI index in our empirical results. Since both WUI and EPU are news-based measures and are not exactly the same as interest rate volatilities, we take a conservative view in the model simulation by targeting the 10-pp increase in domestic uncertainty rather than the 20-pp increase estimated from the response of EPU. The contractionary effects of a foreign MPU shock will be larger in the model if we target the 20-pp increase.

[13]We use a third-order approximation because we focus on the aggregate effects of a one-shot shock to foreign monetary policy uncertainty. Diercks, Hsu, and Tamoni (2024) analyze that the order of approximation can matter when there are consecutive uncertainty shocks in the model because the shocks are super-additive.

6.2 Impulse Response Analysis

We study the differential effects of a shock to foreign interest rate volatility between the flexible and fixed exchange rate regimes through the lens of the model. In our baseline analysis, we introduce the direct uncertainty spillover from the foreign economy to the home economy and reproduce impulse responses that are consistent with our empirical estimates. The recessions are larger in the flexible exchange rate regime than in the fixed exchange rate regime.

Figures 14 and 15 display the responses of domestic variables as percentage deviations from the steady state to the foreign monetary policy uncertainty shock. We observe in Figure 14 that output, consumption, and investment all decrease more under the flexible regime than under the fixed regime, as shown in Figure 1. Aggregate demand shrinks as households increase their precautionary savings amid higher interest rate volatility in both cases, and the uncertainty associated with the return of savings becomes even greater in the flexible exchange rate regime due to the direct uncertainty spillover. This generates larger recessionary dynamics at home, a trend that previous studies, including Fernández-Villaverde et al. (2011) and Oh (2020), have documented. Hence, households are willing to save at lower real interest rates in the flexible regime.

Exchange rate depreciation in the flexible regime inflates net exports, consistent with studies that emphasize the role of exchange rate fluctuations as shock absorbers in difficult times. However, this effect is mainly driven by a fall in import demand. We see that the decrease in imports is larger than the increase in exports in Figure 14. Exports drop right after the shock in both flexible and fixed exchange rate regimes due to the recession in the foreign economy, but the real exchange rate depreciation dampens the drop in the flexible exchange rate. In the following periods through 8 quarters after the shock, exports increase as the price effect due to real depreciation outweighs the effect of lower demand in the foreign economy. Imports decrease in both exchange rate regimes, and they drop even more under flexible exchange rates, mainly due to lower aggregate demand in the flexible exchange rate regime. We later show that the real exchange rate depreciation alone does not decrease imports, as we compare the baseline float to the case without direct uncertainty spillover. Overall, the increase in net exports does not outweigh the drops in consumption and investment demand, so output falls under higher domestic uncertainty in the flexible regime. This is consistent with the empirical impulse responses obtained in Figures 1 and 2 as we introduce larger direct uncertainty spillover

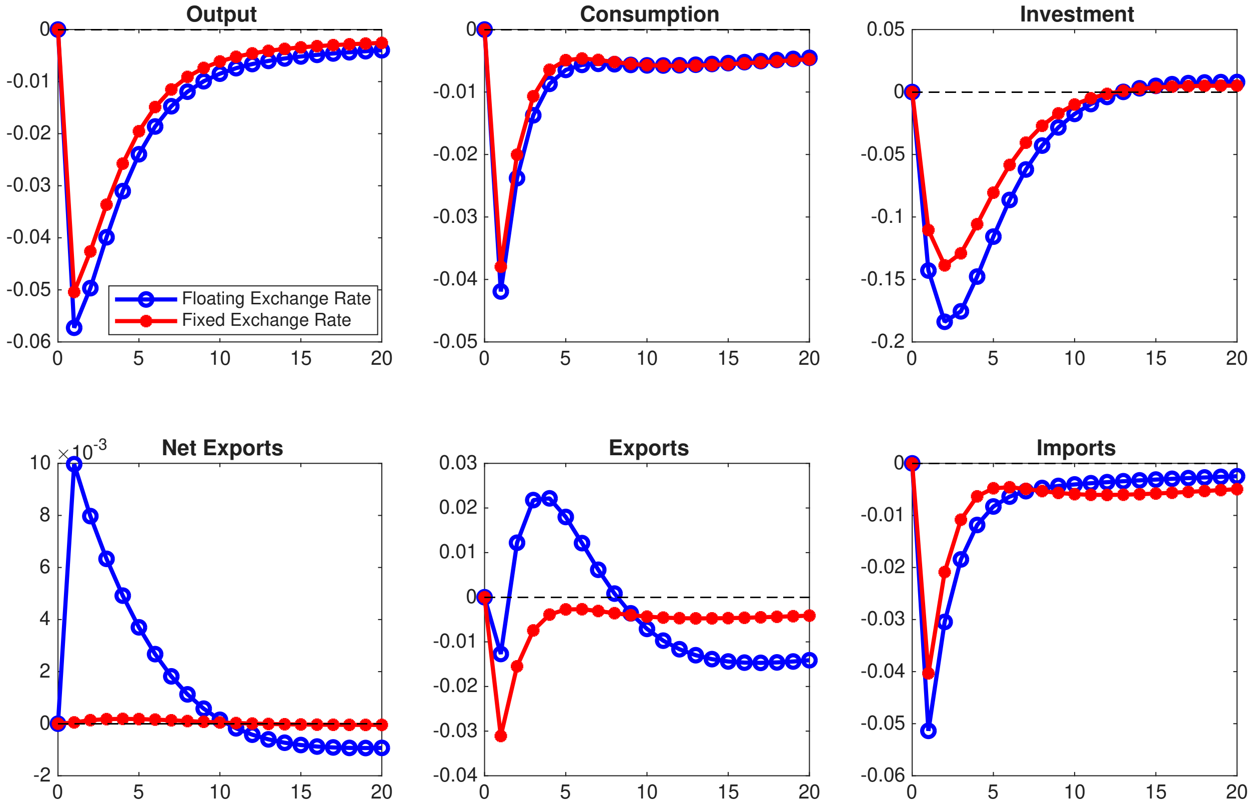


Figure 14: Responses to Foreign Monetary Policy Volatility Shock (1)

under the flexible exchange rate regime compared to the fixed exchange rate regime.

Then why does the exchange rate depreciate in the flexible exchange rate regime? Recall that a foreign monetary policy uncertainty shock raises the volatility of the domestic interest rate i_t when there is a direct uncertainty spillover from the foreign economy. As in Mumtaz and Zanetti (2013), this increases the precautionary savings of households under the flexible exchange rate, and households significantly reduce consumption and domestic investment after the shock, as shown in Figure 14.[14] Rather, they increase their holdings of bonds $B_{H,t+1}$ issued by financial intermediaries who invest in foreign assets that are now safer than domestic assets. Such capital flight depreciates the exchange rate in the flexible regime. In equilibrium, this reduces the investment demand for domestic capital, and we observe that the differential effect between the two regimes is most profound for capital investment.

The fall in aggregate demand acts as a force that reduces the price level after the shock, and the CPI inflation rate decreases at the onset of the shock in the fixed regime in Figure

[14] Larger interest rate volatility at home increases the future marginal utility of consumption at home relative to the foreign economy, which lowers the domestic real interest rate.

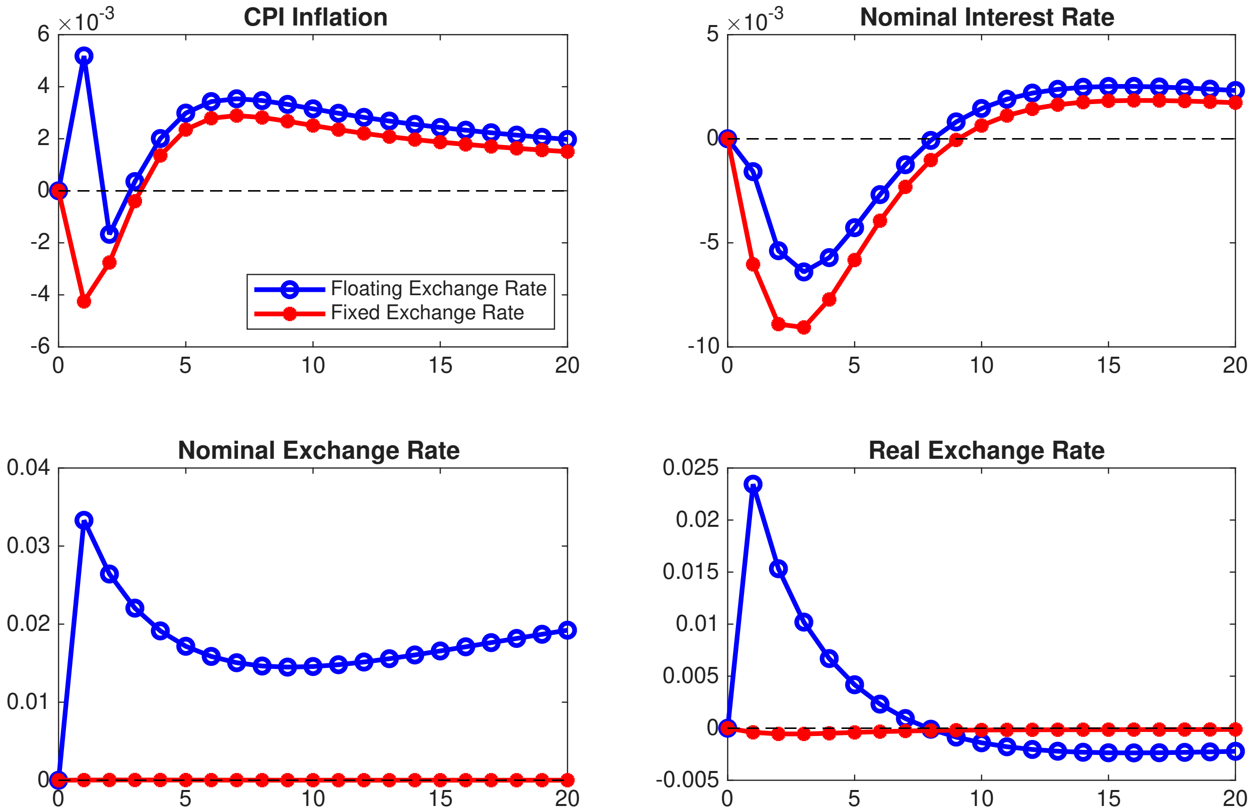


Figure 15: Responses to Foreign Monetary Policy Volatility Shock (2)

15. In the flexible regime, however, we observe a spike in the CPI inflation rate at the onset of the shock as the exchange rate depreciates sharply, resulting in a surge in import prices as the interest rate becomes more volatile at home. Then it goes down after 2 periods from the shock as the inflationary pressure from depreciation weakens. Still, the inflation rate jumps back up to a positive level after 4 periods following the shock because marginal costs increase due to reduced investment and capital stock.[15]

In summary, feeding larger uncertainty spillover into the flexible exchange rate regime yields impulse responses consistent with our empirical observations. The recessionary effects of the foreign monetary policy uncertainty shock are more severe under flexible exchange rates mainly because economic policy uncertainty increases more at home, as observed in the data. We now proceed to analyze what would happen in this economy under flexible exchange rates when there is no direct uncertainty spillover from the foreign economy to the home economy.

[15]The response of the CPI inflation rate crucially depends on the investment adjustment cost parameter ι, as shown in Figure A11. When the adjustment cost is low ($\iota \approx 0$), investment plummets at the onset of the shock and drives up marginal costs. This boosts the CPI inflation rate immediately after the shock.

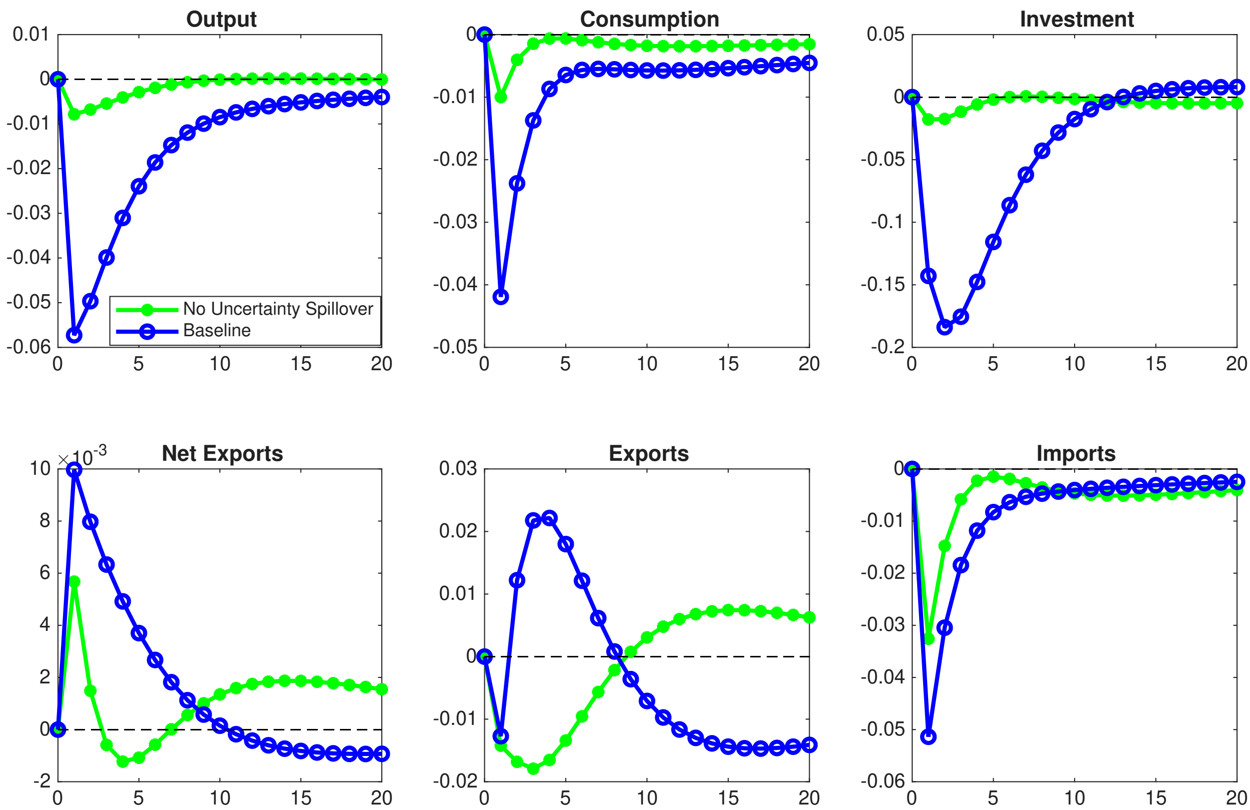


Figure 16: Comparison of Floats with and without Direct Uncertainty Spillover (1)

6.3 Role of Direct Uncertainty Spillover

We now show that the direct uncertainty spillover plays a key role in generating larger recessions in the flexible exchange rate regime than in the fixed exchange rate regime. As shown in the green lines in Figure 16, a standard model without direct uncertainty spillover with $\lambda = 0$ cannot reproduce impulse responses that are consistent with our empirical results. Introducing the direct uncertainty spillover by imposing a positive value for λ makes the model's impulse responses consistent with our empirical findings.

We compare the dynamics following a foreign monetary policy uncertainty shock in the baseline economy under flexible exchange rates to the case in which we eliminate the direct uncertainty spillover and assume that the volatility shocks to interest rates are independent across economies. Impulse responses of domestic economic variables under the two cases are displayed in Figures 16 and 17. Without the direct uncertainty spillover featured in our baseline analysis, the contractionary effects of foreign monetary policy uncertainty shocks are significantly reduced. We observe that output, consumption, and investment decrease only slightly after the shock in Figure 16. It is also notable that, with-

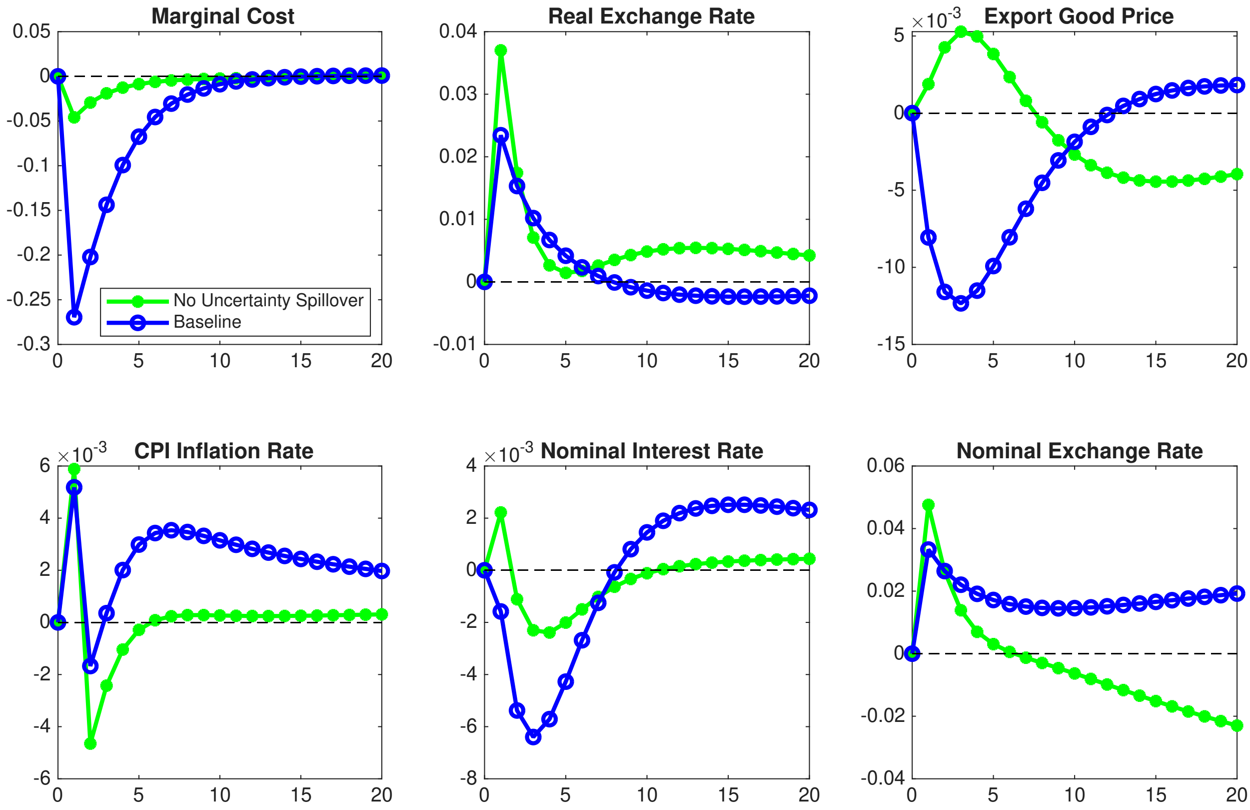


Figure 17: Comparison of Floats with and without Direct Uncertainty Spillover (2)

out the direct uncertainty spillover, the negative effects on output in the flexible exchange rate regime are far smaller than those in the fixed exchange rate regime (reported in Figure 14). Output decreases by 5% in the fixed exchange rate regime, whereas it decreases by only 1% in the flexible exchange rate regime without direct uncertainty spillover.

However, the dynamics of exchange rates and trade variables are different in the two cases, with and without direct uncertainty spillover. First, the real exchange rate depreciates more sharply in an economy without direct uncertainty spillover. However, this is not due to the flight-to-safety effect in the baseline float but rather a natural result of consumption risk sharing across countries. In the absence of direct uncertainty spillover, households do not increase precautionary savings, so aggregate demand is sustained at a higher level than in the baseline. As consumption is higher in the home economy, this induces a real exchange rate depreciation. In the baseline float, the exchange rate depreciates as households save more in the bonds issued by financial intermediaries, but the drop in consumption partly dampens the real depreciation because the recession is more pronounced in the home economy.

This contributes to a larger nominal exchange rate depreciation in the economy with-

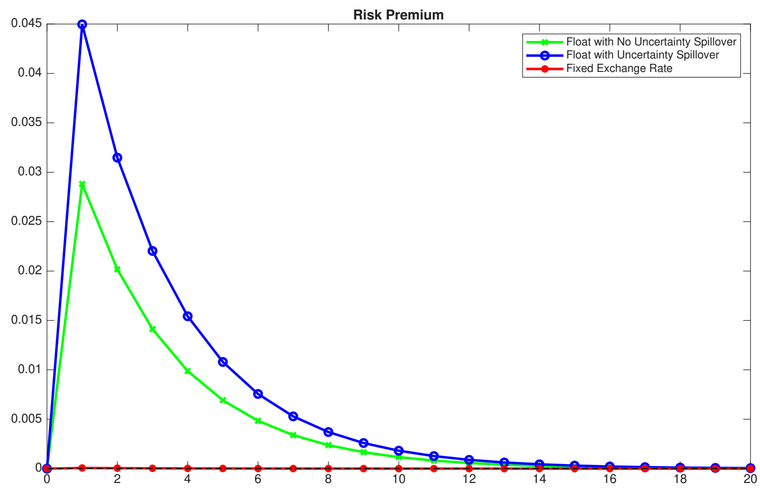


Figure 18: Risk Premium

out direct uncertainty spillover at the onset of the shock. As explained earlier, the exchange rate depreciation is not driven by capital flight to safety when there is no uncertainty spillover. As mentioned before, import demand in the home economy decreases less, and the price of foreign goods at home, P_{Ft}, decreases by less than the foreign prices P_t^*, which puts appreciation pressure on the real exchange rate. Moreover, the foreign real interest rate decreases more than the domestic real interest rate as the foreign economy undergoes a larger contraction. This requires the nominal exchange rate to sharply depreciate in equilibrium so that the expected return on investing in foreign bonds and the domestic real interest rate are equalized in (18).

When we look at exports and imports in Figure 16, both decrease when there is no uncertainty spillover. Imports decrease, but the drop is smaller in magnitude relative to the baseline because consumption demand is sustained at a higher level. However, exports decrease much more than in the baseline because firms raise the relative price of exported goods in the foreign market as the marginal cost does not drop significantly, as shown in 17. In the baseline float, marginal cost plummets as demand shrinks in both home and foreign economies, so firms lower the price of exported goods, which improves exports for up to 8 quarters following the shock.

We have also shown in the empirical analysis that the measures of risk, such as the CDS spread, increase more in the flexible exchange rate regime than in the fixed exchange rate regime. To offer consistent results with our empirical analysis, we plot the risk premium that foreign investors would have to bear when investing in domestic bonds, which is defined as $R_t^B \frac{e_t}{\mathbb{E}_t e_{t+1}} - (1 + i_t^*)$ in Figure 18. The exchange rate depreciation increases this

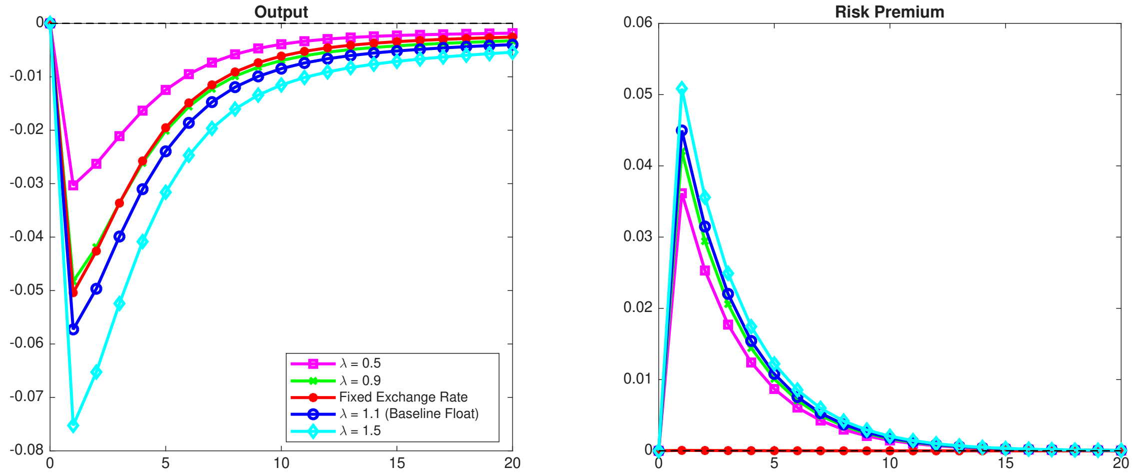


Figure 19: Comparison with Different Values of Uncertainty Spillover λ

risk premium in flexible exchange rates, both with and without uncertainty spillover. However, the increase is more significant when we introduce direct uncertainty spillover.

When we compare impulse responses under different degrees of uncertainty spillover, we observe that the responses become smaller as we decrease the value of λ in the model depicted in Figure 19. Specifically, we observe that the output response in the flexible exchange rate regime becomes comparable to that of the fixed exchange rate regime when λ is approximately 0.9, which occurs when economic uncertainty increases by a smaller fraction in the float than in the peg. Such a value of λ is inconsistent with our empirical impulse response of country-level economic uncertainty to the US monetary policy uncertainty shock. Increasing it to a value comparable to the empirical impulse responses enhances the coherence of the model impulse responses with the empirical estimates. The comparison of impulse responses under different values of λ confirms that the microfoundation of varying λ values under flexible exchange rates is an interesting avenue for future studies.

In summary, we confirm that the direct uncertainty spillover in our baseline analysis generates larger recessionary dynamics under the flexible exchange rate regime compared to the fixed exchange rate regime. Without the direct spillover, the contractionary effects of foreign monetary policy uncertainty shocks become much smaller, as the existing literature on the shock-absorbing role of flexible exchange rates has pointed out.

7 Concluding Remarks

We offer a new finding that a shock to US monetary policy uncertainty has heterogeneous spillover effects on countries, depending on their exchange rate regimes. Our empirical analysis shows that aggregate demand declines more in floating exchange rate regimes, which is confirmed by a battery of robustness checks. We attribute this to higher economic uncertainty following the shock in floating exchange rate countries compared to those with fixed exchange rates. Using a small open economy New Keynesian model, we demonstrate that the direct spillover of interest rate volatility plays a key role in generating more severe recessionary dynamics under floating exchange rate regimes compared to fixed exchange rate regimes, aligning with the empirical findings.

Countries with fixed exchange rates impose more stringent capital controls in general, which could have contributed to better insulation against the US monetary policy uncertainty shocks by stabilizing cross-border capital flows. We abstain from decomposing the estimated impulse responses into parts that could be purely attributed to exchange rate stability and the effects of capital flow stabilization in this paper. Such decomposition would help clarify the microfoundation of the source of direct uncertainty spillover found in our empirical analysis. Modeling such capital controls and financial frictions in cross-border lending markets could also theoretically justify the insulation in fixed exchange rate regimes, and we leave it as an interesting area for future studies.

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A Exchange Rate Regime Classification

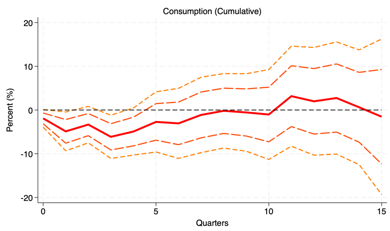
We list descriptions of the exchange rate regime classification scores of Ilzetzki et al. (2019) in Table A1.

Table A1: Exchange Rate Regime Classification of Ilzetzki et al. (2019)

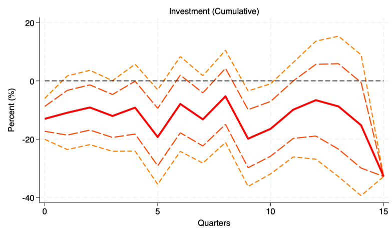
Fine	Coarse	Description
1	1	No separate legal tender or currency union
2	1	Pre announced peg or currency board
3	1	Pre announced horizontal band that is narrower than or equal to $\pm 2\%$
4	1	De facto peg
5	2	Pre announced crawling peg
5	2	De facto moving band narrower than or equal to $\pm 1\%$
6	2	Pre announced crawling band that is narrower than or equal to $\pm 2\%$
6	2	De facto horizontal band that is narrower than or equal to $\pm 2\%$
7	2	De facto crawling peg
8	2	De facto crawling band that is narrower than or equal to $\pm 2\%$
9	3	Pre announced crawling band that is wider than or equal to $\pm 2\%$
10	3	De facto crawling band that is narrower than or equal to $\pm 5\%$
11	3	Moving band that is narrower than or equal to $\pm 2\%$
12	3	De facto moving band $\pm 5\%$ or managed floating
13	4	Freely floating
14	5	Freely falling
15	6	Dual market with missing parallel market data

B Effects of US Monetary Policy Uncertainty Shock in Fixed Exchange Rate Regimes

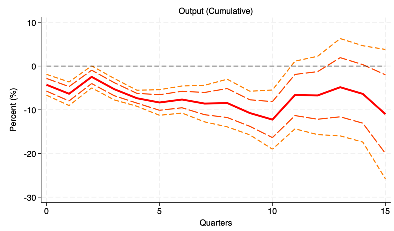
We also check if the US monetary policy uncertainty shock incurs recessionary effects in countries classified as fixed exchange rate regimes. We estimate the coefficient γ_h of the uncertainty shock variable in the baseline regression (1). We find that consumption and investment also drop in fixed exchange rate regimes. Exports slightly increase at the onset of the shock but decrease in later periods. Imports increase by more than 20% after 4 quarters from the shock, which could be related to trade substitution by consumers and import retailers as import prices become cheaper.



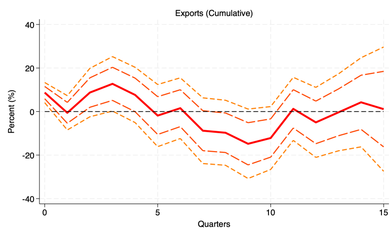
(a) Consumption



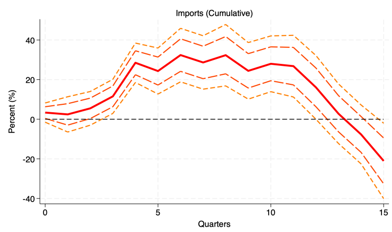
(b) Investment



(c) Output



(d) Exports



(e) Imports

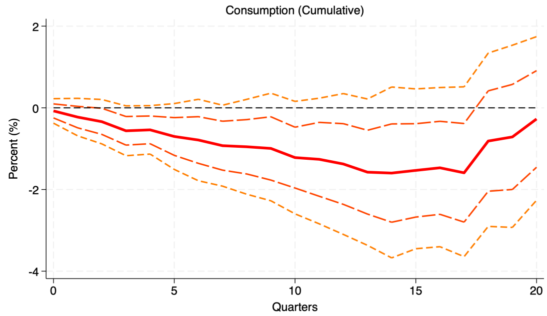
Figure A1: Common Effects of US Monetary Policy Uncertainty Shock

Note: Dotted and dashed lines are 90% and 68% confidence intervals with Cameron et al. (2011) two-way clustered standard errors.

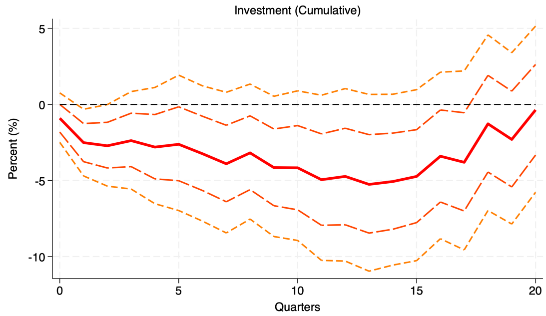
C Alternative Classification of Regimes

We run the baseline regression specification (1) with alternative classifications of exchange rate regimes, treating observations with classification scores between 9 and 12 as either the floating regime or the pegged regime. We confirm that the baseline results do not change qualitatively.

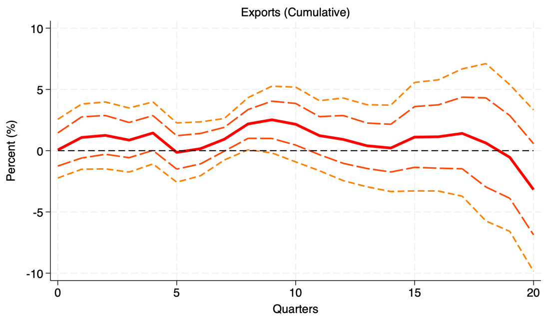
C.1 Classifying Scores 9–12 as Pegged Regimes



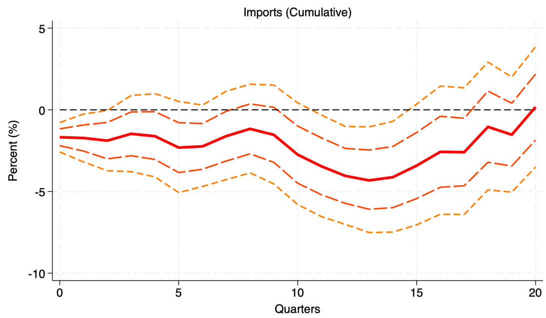
(a) Consumption



(b) Investment



(c) Exports

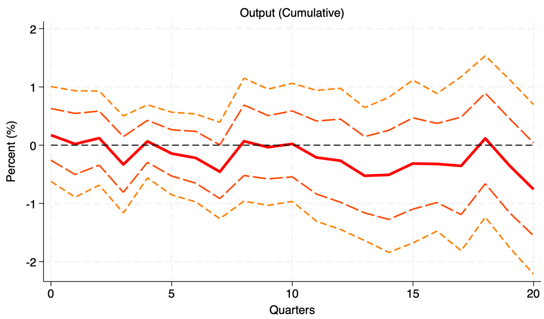


(d) Imports

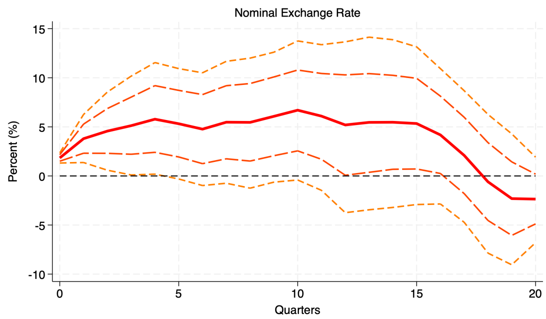
Figure A2: Differential Effects of US Monetary Policy Uncertainty Shock (1)

Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

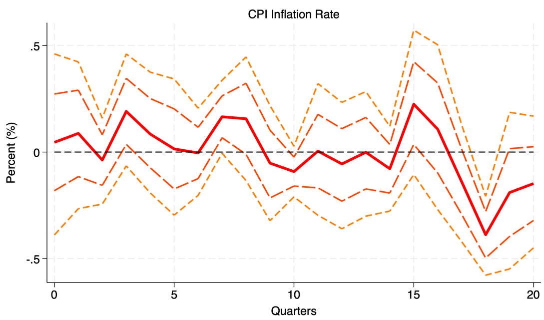
We classify observations with scores between 9 and 12 as pegged regimes and estimate β_h in regression (1). Results are plotted in Figures A2 and A3. While the response of consumption is less statistically significant than in the baseline estimation, the rest of the effects are qualitatively consistent with Figures 1 and 2.



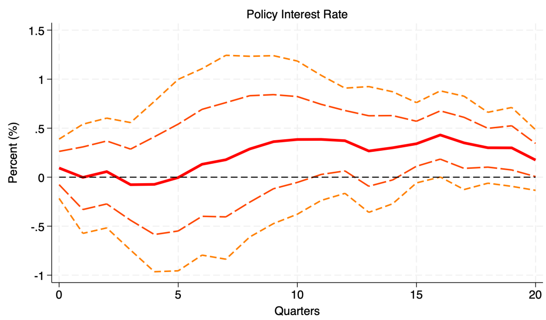
(a) Output



(b) Nominal Exchange Rate w/ USD



(c) CPI Inflation Rate

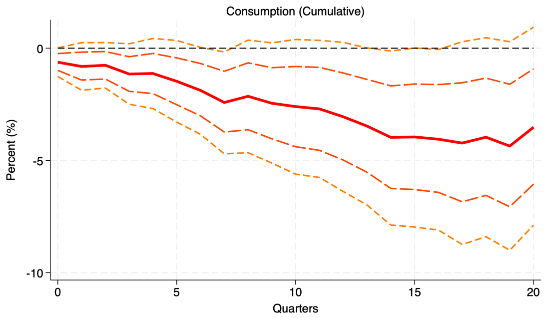


(d) Monetary Policy Interest Rate

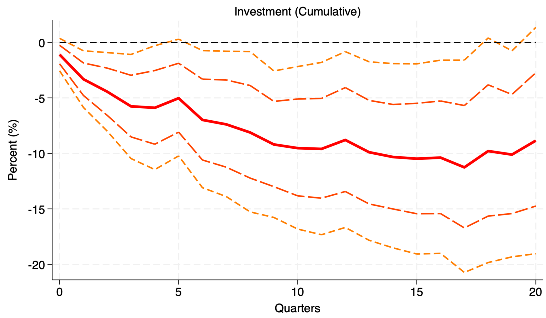
Figure A3: Differential Effects of US Monetary Policy Uncertainty Shock (2)

Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

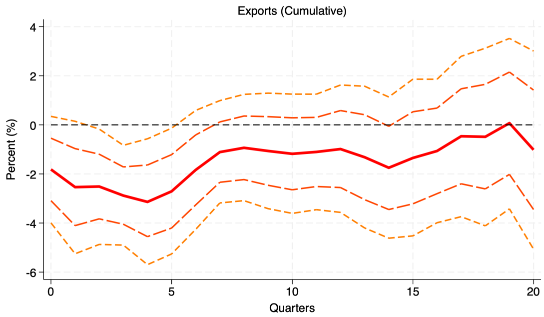
C.2 Classifying Scores 9–12 as Floating Regimes



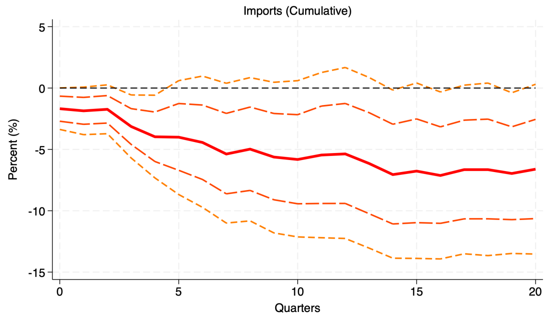
(a) Consumption



(b) Investment



(c) Exports

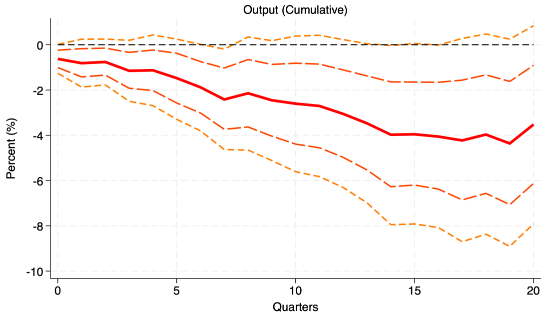


(d) Imports

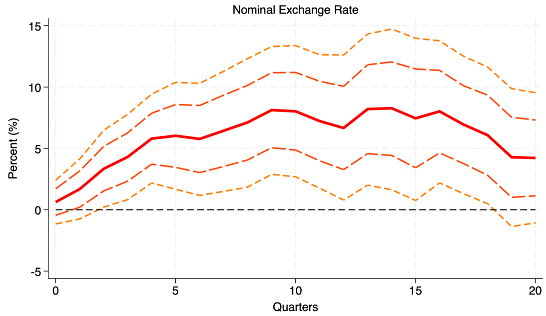
Figure A4: Differential Effects of US Monetary Policy Uncertainty Shock (1)

Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

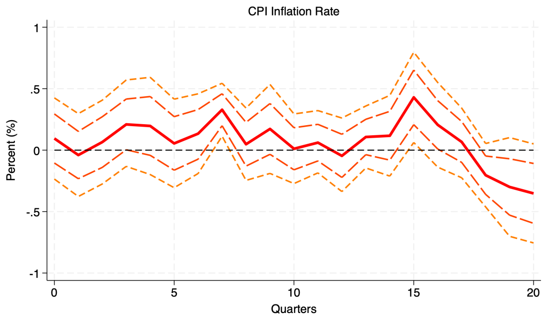
We classify observations with scores between 9 and 12 as floating regimes and re-estimate β_h in regression (1). Results are plotted in Figures A4 and A5. While the responses of output and exports are more negative and significant than in the baseline estimation, the other effects are qualitatively consistent with Figures 1 and 2.



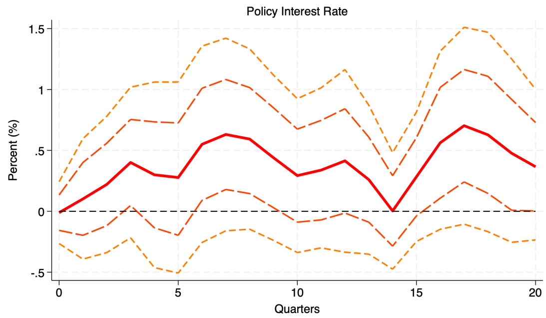
(a) Output



(b) Nominal Exchange Rate w/ USD



(c) CPI Inflation Rate



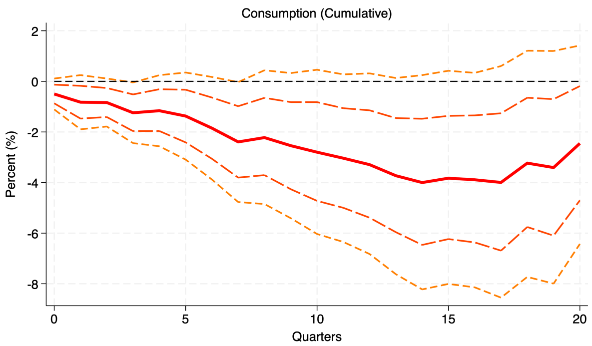
(d) Monetary Policy Interest Rate

Figure A5: Differential Effects of US Monetary Policy Uncertainty Shock (2)

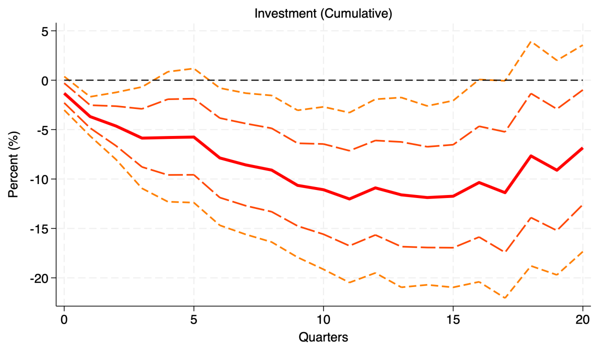
Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

D Controlling for Changes in Exchange Rate Regime

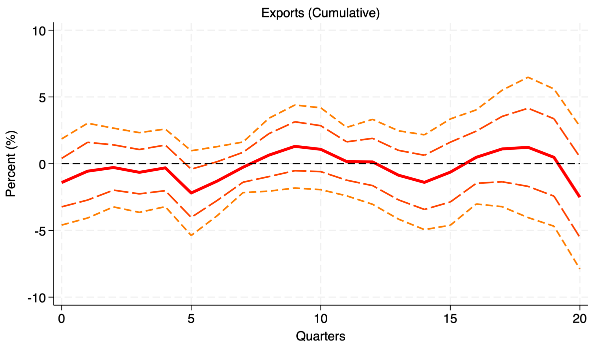
We estimate regression (1) while treating the countries that changed exchange rate regimes as separate units before and after the regime change. The exchange rate regime changed in Gambia in 1991 Q4 and Malaysia in 1998 Q4. We also exclude the periods when European countries adopted the Euro from the sample. The impulse responses obtained after modifying the sample are summarized in Figures A6 and A7.



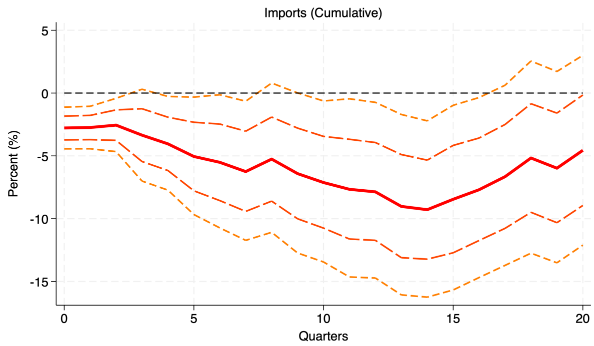
(a) Consumption



(b) Investment



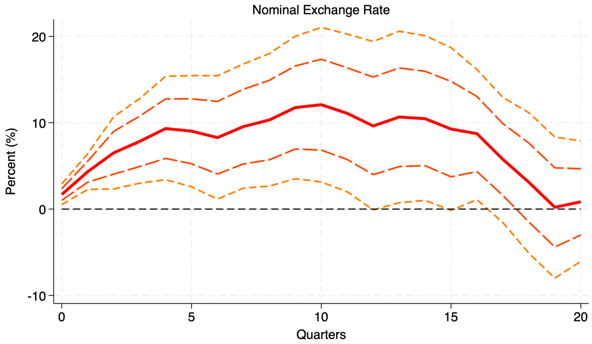
(c) Exports



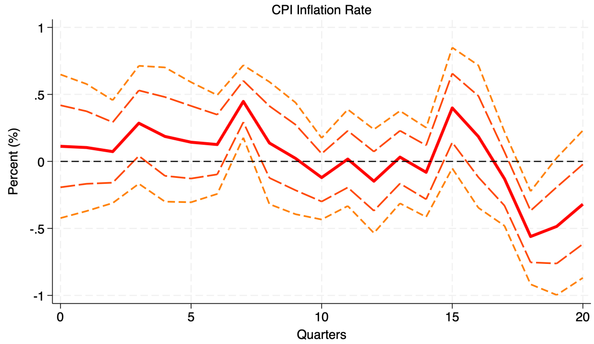
(d) Imports

Figure A6: Differential Effects of US Monetary Policy Uncertainty Shock (1)

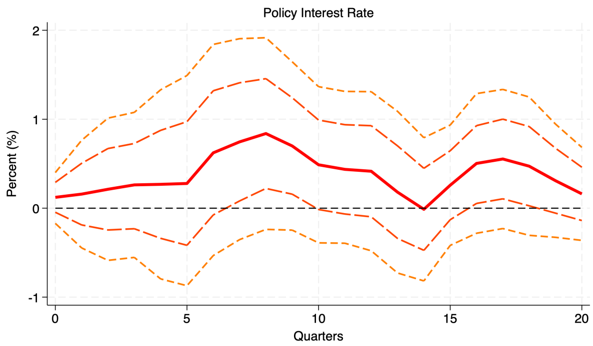
Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).



(a) Nominal Exchange Rate w/ USD



(b) CPI Inflation Rate



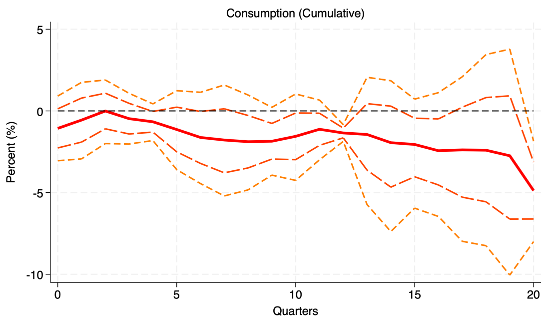
(c) Monetary Policy Interest Rate

Figure A7: Differential Effects of US Monetary Policy Uncertainty Shock (2)

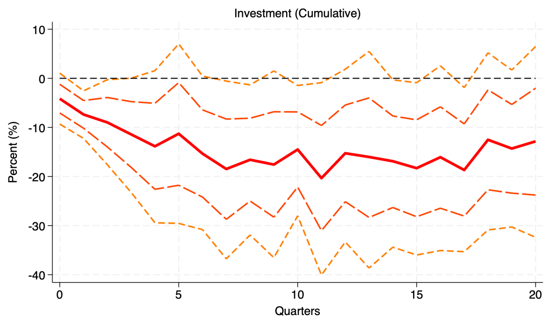
Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

E Alternative Ordering of Country Characteristics

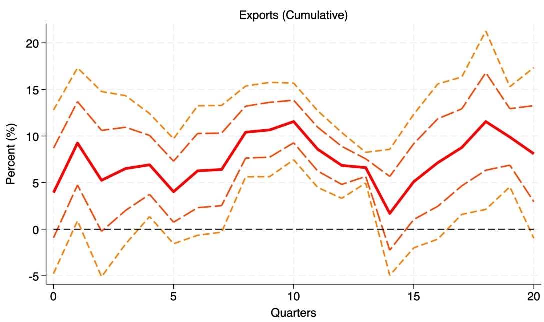
Our baseline results are robust to an alternative ordering $\{FD, TL, GE, TO, FX, KA\}$ in regression (2). We place KA last since a country's choice of *de jure* capital openness depends on the exchange rate regime. The results under the alternative ordering are qualitatively similar to the baseline, as shown in Figure A8.



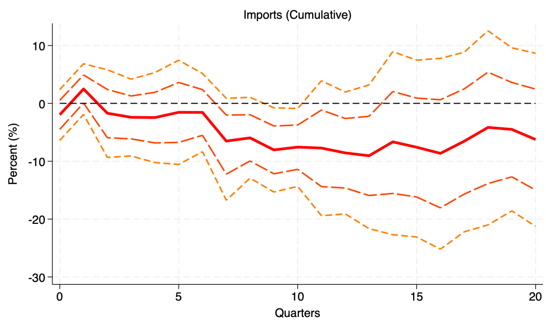
(a) Consumption



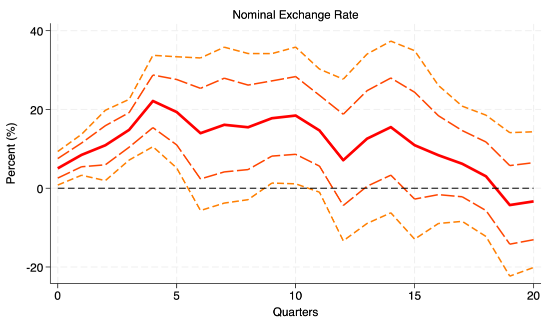
(b) Investment



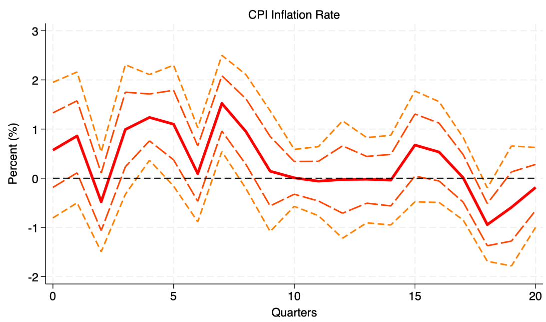
(c) Exports



(d) Imports



(e) Nominal Exchange Rate w/ USD



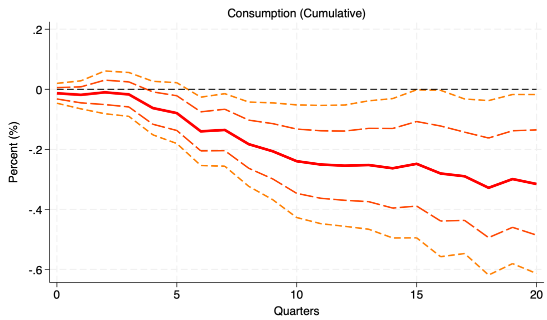
(f) CPI Inflation Rate

Figure A8: Differential Effects under Alternative Ordering of Country Characteristics

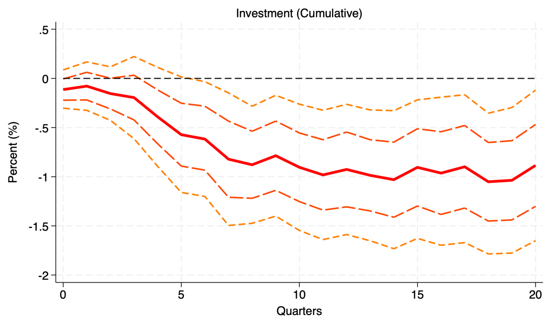
Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

F Excluding Firm Entry and Exit from FAVAR

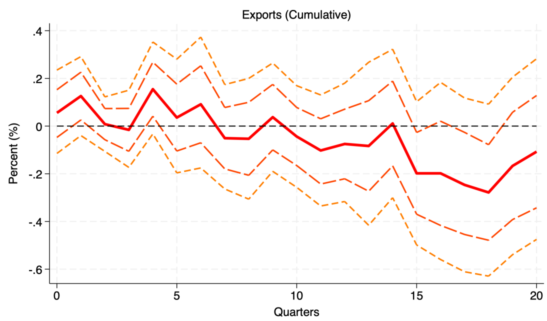
We confirm that the baseline results hold when we exclude the firm entry and exit variables from the set of instrumental variables in the FAVAR estimation of shocks. We re-estimate the shock while excluding the firm entry and exit variables and use it as the shock term in the regression (1), obtaining results similar to those plotted in Figure A9.



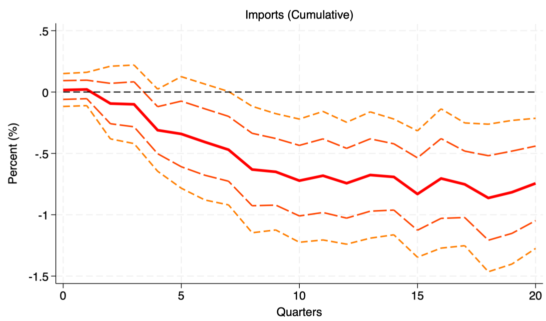
(a) Consumption



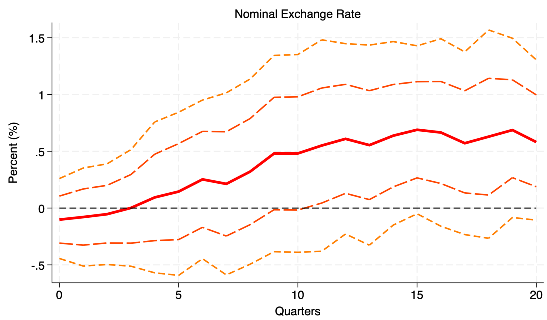
(b) Investment



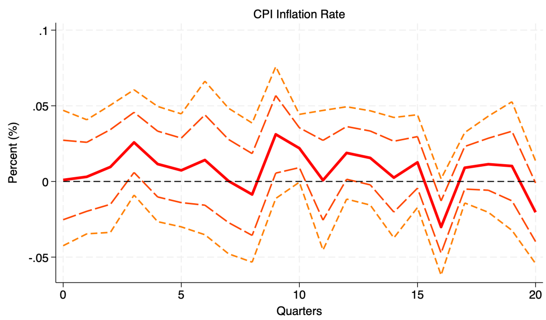
(c) Exports



(d) Imports



(e) Nominal Exchange Rate w/ USD



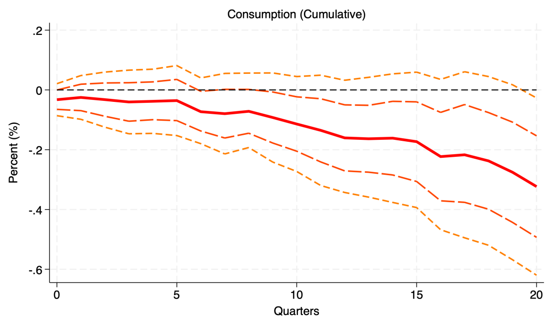
(f) CPI Inflation Rate

Figure A9: Differential Effects of Shock without Firm Entry and Exit

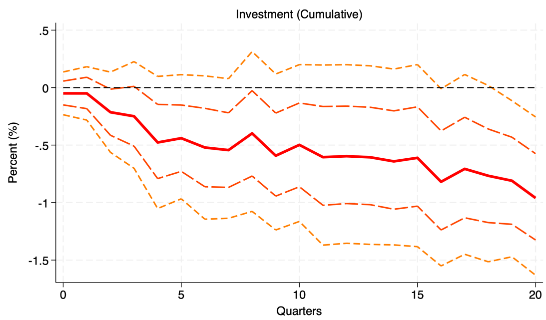
Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

G Orthogonalized US Monetary Policy Uncertainty Shock

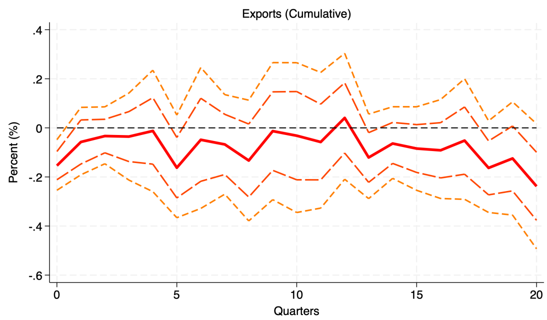
We confirm that the baseline effects of the US monetary policy uncertainty shock are not driven by the contemporaneous first-moment shocks. We orthogonalize the baseline US monetary policy uncertainty shock (mpu_t) with respect to the first-moment shock measured by Bauer and Swanson (2023). Then we use the residual of mpu_t as the shock term in (1). The impulse responses are similar to the baseline results as plotted in Figure A10.



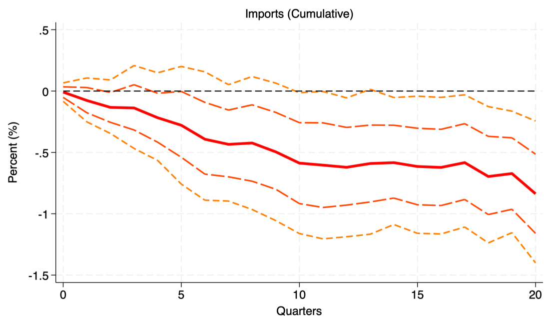
(a) Consumption



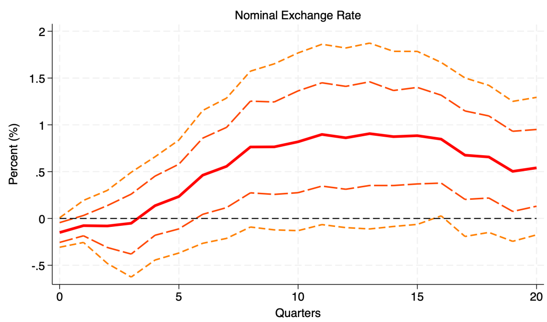
(b) Investment



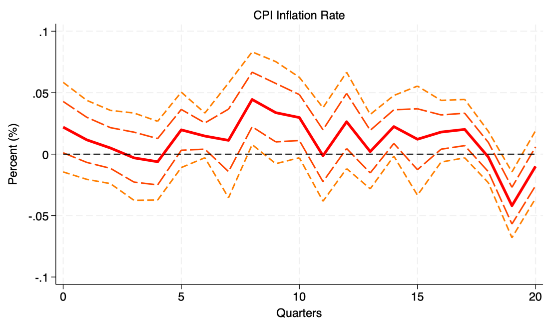
(c) Exports



(d) Imports



(e) Nominal Exchange Rate w/ USD



(f) CPI Inflation Rate

Figure A10: Differential Effects of Shocks Orthogonal to First-moment Shocks

Note: Dotted and dashed lines are 90% and 68% confidence intervals obtained using two-way clustered wild bootstrap standard errors following the method of Roodman et al. (2019) and MacKinnon et al. (2021).

H Sensitivity Analysis

We check the sensitivity of the model to the investment adjustment cost parameter ι. We compare how the model-implied impulse responses to a 1 standard-deviation shock to foreign interest rate volatility change under three values of $\iota \in \{0, 0.8, 1.5\}$, where $\iota = 0.8$ corresponds to the baseline calibration. We compare impulse responses under floating exchange rates with uncertainty spillover.

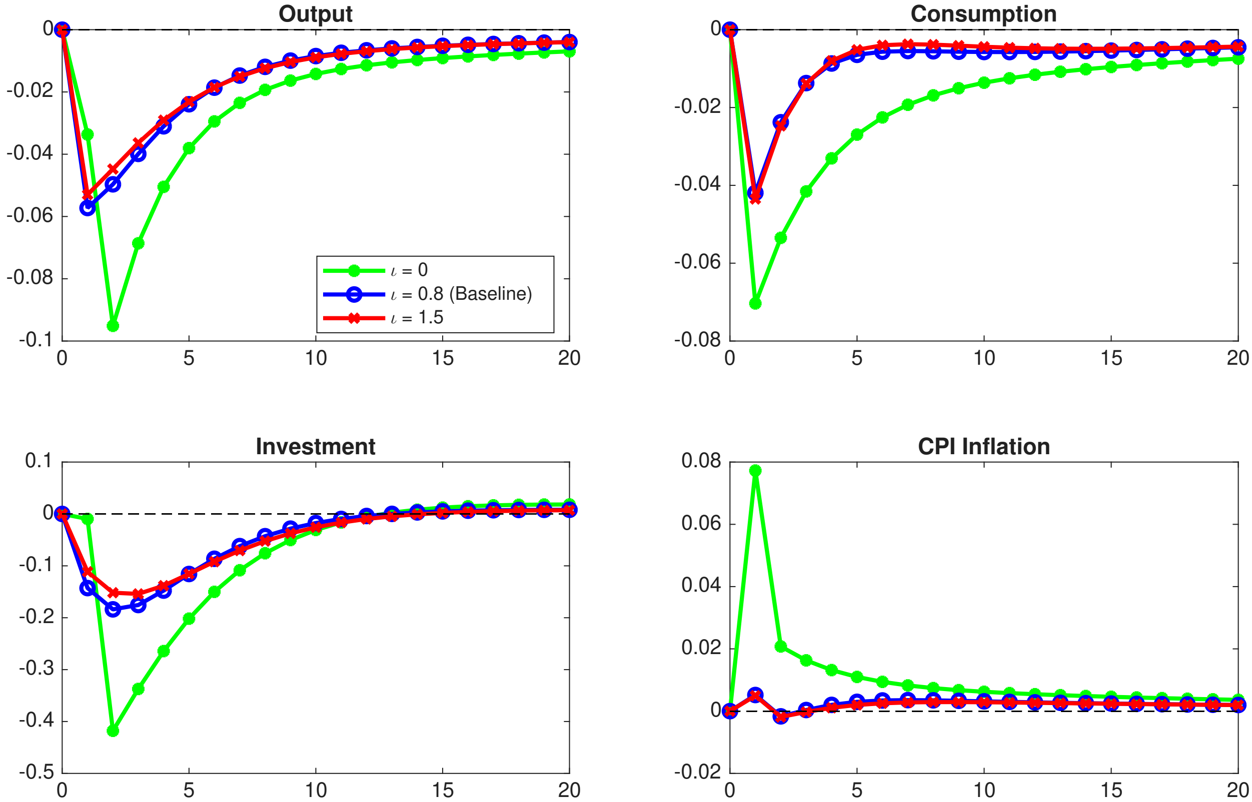


Figure A11: Sensitivity Check with Different Investment Adjustment Costs

Changing the investment adjustment cost parameter does not affect the dynamics of real variables such as output, consumption, and investment. One thing to notice is that when $\iota = 0$, output falls less at the onset of the shock, but consumption plummets relative to the baseline because investment increases. This is because households substitute consumption for investment as higher uncertainty acts as a deflationary force that lowers the price of home-produced goods P_{Ht}. In general equilibrium, however, everyone invests more, which boosts the CPI inflation rate. Hence, we see a spike in the inflation rate right after the shock when $\iota = 0$. We impose a sufficiently high value of ι in the baseline analysis to ensure that the inflation rate also decreases in response to the shock.