Risk-off Shocks and Spillovers in Safe Havens

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Abstract

This paper examines real and financial spillovers to safe haven financial flow destinations due to risk-off shocks in global financial markets. Using country-specific structural vector autoregression (VAR) models over the period 1990 to 2021, we show that dynamics for Japan appear to be different to those of Switzerland and the US in three main ways. First, in response to risk-off episodes, the yen real effective exchange rate (REER) appreciated significantly, with the effect persisting for around 25 days. Second, no significant effects on portfolio flows to Japan are found, in spite of the exchange rate effects, suggesting a rapid adjustment of financial markets to shifts in equilibrium exchange rates. Third, negative real spillovers from risk-off shocks appear to only apply to Japan with exchange rate appreciation exacerbating declines in GDP growth. Our findings have important implications for policymakers in safe haven destinations in managing domestic financial vulnerabilities associated with risk-off episodes.

Keywords: risk-off episodes, safe haven assets, economic policy uncertainty

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1. Introduction

During periods of heightened financial stress or for portfolio diversification, global investors place funds in "safe haven" and "hedge" assets. Baur and Lucey (2010) define a "hedge" security as a security that is uncorrelated with stocks or bonds on average, while a "safe haven" security is a security that is uncorrelated with stocks and bonds in a market crash. Hossfeld and MacDonald (2014) refine further this definition, where a safe haven currency is defined as a currency whose effective returns are negatively related to global stock market returns in times of high financial stress, while a hedge currency is a currency whose effective returns are negatively related to global stock market returns on average (i.e., unconditional on the stress-regime).

Many investors have long perceived Japanese financial assets (including Japanese government bonds (JGBs) and stocks) and the Japanese Yen (JPY) as safe-haven instruments. JGBs and the JPY are highly related because investors buy (sell) the JPY when they purchase (sell) JPY-denominated JGBs. Japanese financial assets and the JPY have notable negative correlations with global stock and bond market returns during global financial crises. Foreign investors bought Japanese assets and the JPY during crises, such as the 2001 dot.com crisis and the 2007/08 – 2008 Global Financial Crisis. Some studies point out Japan's net surplus in its international investment position and monetary policy sovereignty are the main reasons behind Japanese financial assets and the JPY's safe haven status. While safe havens offer investors a hedge during periods of crisis, domestic currency appreciations can worsen competitiveness, negatively affecting the domestic stock market, with subsequent negative wealth effects. With a focus on Japan, also making comparisons to two other key safe haven destinations, namely Switzerland and the US, this paper aims to empirically examine real and financial spillovers due to risk-off shocks in financial markets.

Country-specific structural vector autoregression (VAR) models are estimated over the period 1990 to 2021 to identify the response of domestic output, policy uncertainty, financial markets, and capital flows in safe havens to risk-off shocks. Overall, we find that Japan responds differently in three main ways. First, in response to risk-off episodes, the yen real effective exchange rate (REER) appreciates significantly, with the effect exhibiting some persistence. Second, no significant effect on portfolio flows to Japan are found, in spite of the appreciating exchange rate effect, suggesting a rapid adjustment of financial markets to shifts in equilibrium exchange rates. Third, negative real spillovers from risk-off shocks appear to only apply to Japan with exchange rate appreciation exacerbating declines in GDP growth. We offer implications for policy makers based on these findings, aimed mainly at addressing risks to domestic financial stability that result from risk-off shocks. The remainder of the paper is organized as follows: Section 2 reviews the related literature on safe haven currencies and assets. Section 3 explores the stylized facts on risk-off episodes in safe haven financial markets. Section 4 describes the data and methodology. Section 5 analyzes the empirical results. Section 6 concludes.

2. Related Literature

This paper contributes to the literature on safe haven financial flows. During periods of heightened financial stress, it is well documented that investors re-balance their assets towards so-called safe haven currencies, which are low-yielding currencies that appreciate in times of higher global financial uncertainty (e.g., Habib and Stracca 2012). Typically, these periods are also characterized by financial fragmentation at the global level (e.g. Beck et al., 2015). Traditionally, the US dollar (USD), the Japanese yen (JPY) and the Swiss franc (CHF) are considered safe haven currencies, with Todorova (2020) noting that global investors tend to place their funds in the JPY and the CHF whenever uncertainty arises in the US stock market or the USD weakens (see also Botman, De Carvalho Filho, and Lam 2013; Ranaldo and Söderlind 2010; De Bock and De Carvalho Filho 2013; Masujima 2017; and Balcilara et al. 2020).

Among the safe haven currencies, Cho and Han (2021) observed that the yen, euro and Swiss franc are more likely to appreciate in periods of high volatility in foreign exchange markets and rising US Treasury bond yields. In addition, it is noted that the decline in US stock returns is related only to yen appreciation. According to Fatum and Yamamoto (2015), the yen appreciates as market uncertainty increases regardless of the prevailing level of uncertainty whereas all other bilateral USD rates display a nonlinear pattern. They find that the JPY is the "safest" of safe haven currencies and that only the JPY has appreciated when market uncertainty increased. The CHF and the USD are the "second safest" and "third safest", respectively. When uncertainty rises, the CHF appreciates significantly against all other currencies but the JPY, while the USD appreciates significantly against all but the JPY and the CHF.

Safe haven currencies tend to be associated with three key factors: low interest rates (carry-trade opportunity); net foreign asset positions; and highly liquid financial markets. Indeed, Habib and Stracca (2012) stress the feature of net foreign asset positions, which (after controlling for carry trade) is the most consistent and robust predictor of a safe haven status, as well as being a key indicator of country risk and external vulnerability. Other important factors characterizing safe havens include their level of financial development and the depth of liquidity in the foreign exchange market. In addition, for currencies that are subject to carry trade, the interest rate spread relative to the US is significant for advanced countries. Confirming that the unwinding of carry trade causes the yen to appreciate against the dollar, Nishigaki (2007) finds that the US stock price has a dominant impact on yen carry trade. The study also indicates that the interest rate differential between Japan and the US and the interest rate adjustment by the Bank of Japan (BOJ) does not influence carry trade activity. Related to this, Imakubo, Kamada, and Kan (2015) discuss the "currency premium" (i.e., the expected excess return on that currency) that determines the demand for safe haven currencies. In their model, the currency premium consists of two disequilibrium factors: (i) the interest rate gap (i.e., the deviation of real interest rates, domestic and foreign, from their equilibrium values; and (ii) the exchange rate misalignment (i.e., the deviation of real exchange rates from their equilibrium values).

Min, McDonald, and Shin (2016) relate a "safe haven" status to negative dynamic conditional correlations (DCCs) between equities and currencies, with currency returns negatively correlated with stock returns in safe haven countries. They also found that stock and foreign exchange volatility indexes increase DCCs for countries without safe assets, while the opposite is found for countries with safe assets, i.e., reducing DCCs. Moreover, higher country-specific risk, as measured by the US Treasury-Euro Dollar (TED) spread and credit default swap (CDS) spread, means higher DCCs, a feature of economies without safe haven status. More recently, Habib, Stracca, and Venditti (2020) noted that inertia (whether the bond behaved as a safe asset in the past) and good institutions foster a safe asset status, while the size of the debt market is also significant, reflecting the special role of the US. There are also differences depending on the level of economic development; the political risk rating and the size of the debt market are found to be important for advanced countries only, while inertia, real GDP, and external sustainability (measured by the current account) are important for emerging markets only.

Hossfeld and MacDonald (2014) identify the safe haven currencies among the G10 countries (i.e., the AUD, CAD, CHF, EUR, JPY, NOK, NZD, SEK, GBP, and USD) by making a distinction between the "safe haven" flows (i.e., capital movements by investors who believe that a particular currency area is a relatively safe place to invest) and the unwinding of currency carry trades (i.e., speculative transactions where investors seek to take advantage of interest rate differentials to generate superior returns) during a crisis. They find that the CHF and USD are safe haven currencies. The JPY appreciation in times of crisis is mainly attributable to the unwinding of the carry trades rather than caused by the "safe haven" inflows. Meanwhile, the EUR does not show any crisis-specific reaction. Grisse and Nitschka (2015) note that the yen is a better hedge than the Swiss franc because of the limited asset market size and liquidity of the Swiss franc. Beckmann and Czudaj (2016) find that the yen is exceptional in two ways: expectation errors decrease with higher uncertainty, especially for monetary policy uncertainty; the yen is the only currency to appreciate in case of higher uncertainty. Rogoff and Tashiro (2015) discuss the "exorbitant" privilege of the JPY due to the country's ability to borrow from abroad at lower rates than other countries, as well as being able to attain a cost advantage in any kind of borrowing or investment instrument in a broader sense. This is similar to the US experience in the post-war period.

Botman, De Carvalho Filho, and Lam (2013) point out the driver of yen risk-off appreciation appears to be unrelated to capital inflows (cross-border transactions) and also not linked to expectations about the relative stance of global monetary policies. Instead, they show that portfolio rebalancing through offshore derivative transactions occur contemporaneously to yen risk-off appreciations. In particular, they find that the JPY on average appreciates against the USD during the risk-off episodes in the global financial market. They find that capital inflows or expectations of the future monetary policy stance cannot explain the safe haven behavior of the JPY. Instead, changes in market participants' risk perceptions trigger derivatives trading, which leads to changes in the spot exchange rate without capital flows. Specifically, the risk-off episodes coincide with the forward hedging and reduced net short positions or a buildup of net long positions in the JPY. On the relationship between monetary policy and safe haven status, Beckmann and Czudaj (2017) argue that monetary policy is a substantial driver for exchange rate expectations and unconventional monetary policy has strong spillover effects across

borders, leading to an unexpected safe haven status of the US dollar after 2008 crisis. Moreover, noting that the appreciation of safe haven currency is resilient to the changes in monetary policy, Jäggi, Schlegel, and Zanetti (2019) find that the Japanese yen and Swiss franc respond nonlinearly, depending on the direction of the effect on the exchange rate, with a stronger reaction to surprises generating an appreciation compared to surprises leading to depreciation. Additionally, both currencies also systematically respond to changes in the general market environment.

On Japan, Masujima (2017) suggests that while the yen's strength is driven by its safe haven status, this may slow down the post-crisis recovery via net exports. In addition, large-scale monetary easing as a policy response may mask financial vulnerabilities related to the sustainability of the public finances. However, Iwaisako and Nakata (2017) warn that the impact of yen appreciation on export fluctuations should not be exaggerated, noting that aggregate global demand played a more important role in the trade decline after the 2008 crisis. A more recent study by Belke and Volz (2020) provided insights on how yen appreciation contributed to the structural change of the Japanese economy – the hollowing out of Japanese industry.

Moreover, Dekle (1998) found that the price change induced by exchange rate fluctuation has sizable long-term effect on the Japanese employment market. In other work, Lam and Tokuoka (2013) observe that the yields of the Japanese government bonds (JGBs) have remained low and stable because of steady inflows from the Japanese household and corporate sector, the high domestic ownership of the JGBs, and safe haven inflows. That said, there are risks to the JGB markets, including the decline of private-sector savings (partly due to the aging population) and potential spillovers from global financial distresses (which can push the JGB yields higher). In addition, Horioka, Nomoto, and Terada-Hagiwara (2014) notes that while Japan's excessive government debt has not resulted in high economic costs in the past because of the country's robust domestic savings, it may lead to substantial costs in the future as domestic savings decline (as a result of population aging) and due to the temporary nature of foreign capital inflows to Japanese government securities.

The literature overall highlights the negative impact on the domestic economy due to a safe haven status. Habib, Stracca and Venditti (2020) note that the high demand for safe assets in crisis times can lead to a decline in the natural real interest rate, with adjustment mechanisms disrupted due to exchange rate appreciation and a contraction in global demand emanating. Transitory real appreciation may create hefty adjustment costs to the economy, and subsequently, economic dislocation when exchange rates eventually revert back (e.g., Bussière, Lopez, and Tille 2013). The longer-lasting the real appreciation and surge in capital flows, the greater the potential for vulnerabilities to build up in either private or public sector balance sheets. Moreover, in economies with already low inflation and interest rates close to the zero bound, real appreciations driven by risk-off episodes could feed deflation risks and place downward pressures on aggregate demand.

This paper contributes to the prevailing literature by empirically examining real and financial spillovers in safe haven financial flow destinations in response to risk-off shocks. Focusing on responses to risk-off shocks in output, economic policy

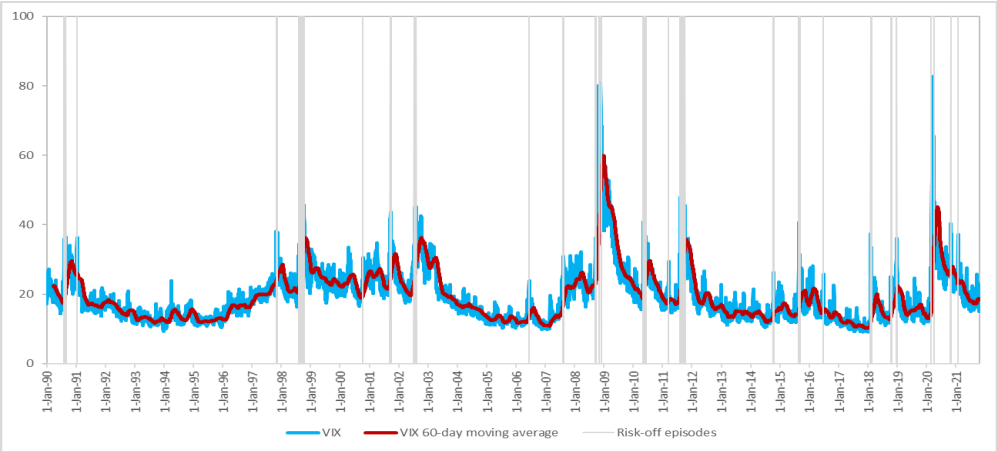
uncertainty, financial markets, and capital flow dynamics, we aim to uncover similarities and differences across key safe haven destinations in Asia, Europe, and the US. In this way, we can examine whether the conventional characteristics of safe havens apply in a uniform manner.

3. Stylized Facts on Risk-off Episodes in Safe Haven Financial Markets

Prior to discussing the empirical approach and findings, this section presents an overview of the risk-off episode definition and the basic relation between risk-off episodes and developments in financial markets of safe havens. We focus the discussion on Japan, while also making some references to Switzerland and the US. We base our definitions of the risk-off event and episode on a method introduced by De Bock and De Carvalho Filho (2013), which uses the Chicago Board Options Exchange's Volatility Index (i.e., the VIX) as a benchmark. Botman, De Carvalho Filho, and Lam (2013) also use this method. In this method, a risk-off event occurs when the VIX is 10 percentage points higher than its 60-day backward-looking moving average (MA).

Fig. 3.1 displays the VIX movements and the risk-off episodes (i.e., series of risk-off events) from 1990 to 2021, while Table 3.1 lists the initial date of those risk-off episodes. The data sets in those two studies end in 2011, while ours continues until October 2021. We identify six risk-off episodes from 2012 to 2021, including the latest one that started in February 2020 due to the COVID-19 pandemic outbreak.

Fig. 3.1 Risk-off Episodes, 1990–2021



Note: Plotted are fluctuations in the VIX, its 60-day moving average, and our calculated risk-off episodes.

Source: Bloomberg, Authors' calculation.

Table 3.1. Risk-off Episodes Initial Date

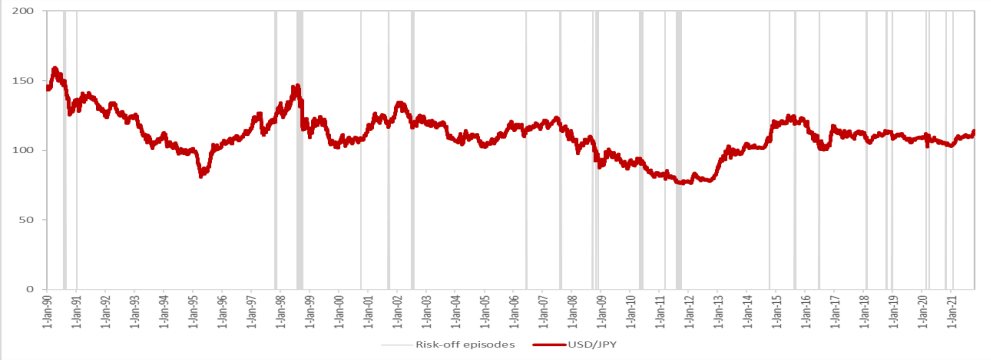
No.	Risk-off event initial date	Our Paper	Botman, De Carvalho Filho, and Lam (2013)	De Bock and de Carvalho Filho (2013)
1	US savings and loans	03-Aug-90	03-Aug-90	---
2	Iraq War	14-Jan-91	14-Jan-91	---
3	Escalation of Asian crisis	29-Oct-97	29-Oct-97	29-Oct-97
4	Concerns on Russian economy	04-Aug-98	04-Aug-98	04-Aug-98
5	Fear of slowing US economy	12-Oct-00	12-Oct-00	12-Oct-00
6	9/11 Attacks	17-Sep-01	11-Sep-01	17-Sep-01
7	Fear of slowing US economy	10-Jul-02	10-Jul-02	10-Jul-02
8	Concerns over rising US inflation	13-Jun-06	---	---
9	BNP Paribas halts withdrawals from three money market mutual funds	09-Aug-07	10-Aug-07	10-Aug-07
10	Disruptions in USD money markets	---	12-Nov-07	12-Nov-07
11	Lehman failure	17-Sep-08	17-Sep-08	17-Sep-08
12	Greek crisis	06-May-10	06-May-10	06-May-10
13	Uncertainty over impact of Japan's March 11 earthquake	16-Mar-11	16-Mar-11	16-Mar-11
14	Confrontation over US debt ceiling and deterioration of crisis in Euro Area	04-Aug-11	04-Aug-11	04-Aug-11
15	Concerns over deteriorating earning reports (US stock markets fall)	13-Oct-14	---	---
16	Thalys train attack, rising tension in Korean Peninsula	21-Aug-15	---	---
17	UK referendum decision: Brexit	24-Jun-16	---	---
18	Concerns over rising US inflation	05-Feb-18	---	---
19	Concerns over rapidly rising US interest rates	11-Oct-18	---	---
20	Concerns over COVID-19 outbreak	24-Feb-20	---	---

Source: Botman, De Carvalho Filho, and Lam (2013), De Bock and De Carvalho Filho (2013), Bloomberg, Authors' calculation.

The JPY is both a hedge and a safe haven currency. Global investors buy the JPY both when they seek to hedge their investments during the risk-off episodes. The JPY tends to appreciate against the USD during the risk-off episodes (Fig. 3.2).[3]

[3] The period following the Russian Federation's invasion of Ukraine on 24 February 2022 coincided with a sharp depreciation of the yen relative to the US dollar, which was driven by widening yield differentials between the US and Japan and rising energy prices worsening Japan's balance of payments position. Aggressive monetary policy tightening by the US Federal Reserve to combat inflation, in conjunction with higher global risk aversion, meant that the US dollar soared during this period at the global level, including against traditional safe haven currencies such as the yen and Swiss franc. While risk aversion at the global level prevailed, higher relative yields in the US and pressure on the yen are consistent with the assertion of market commentators such as Clynch (2020), who inferred at that time that the return of risk appetite could test further the safe haven status of the yen. Although risk appetite did not resume, higher yields in the US relative to Japan triggered net capital outflows and currency depreciation. The trend halted in November 2022, however, when the US signaled a slowdown in the pace of its monetary tightening.

Fig. 3.2 USD/JPY and Risk-off Episodes



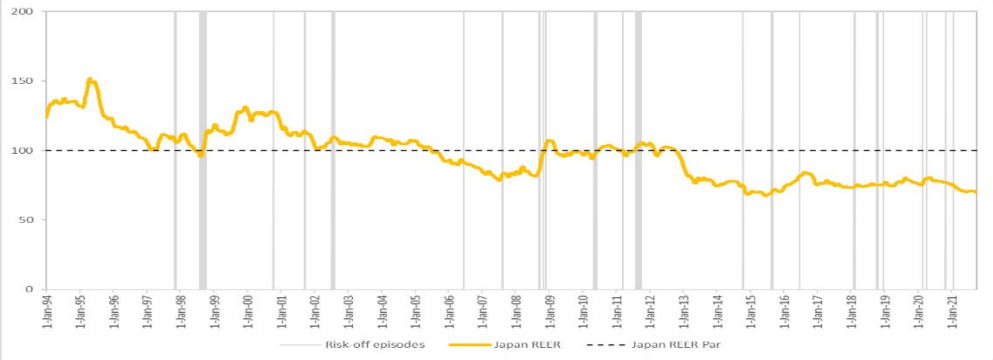
Note: Plotted are the bilateral nominal USD/JPY exchange rate and our calculated risk-off episodes.
Source: Bloomberg, Authors' calculation.

At the start of the global financial crisis (GFC) in 2007, investors tilted portfolios towards the yen in search of safety amid prevailing high-risk aversion. The yen appreciated strongly during this period as a result. This appreciation was bolstered by the Tōhoku earthquake and tsunami of March 2011 as Japanese investors sold assets denominated in foreign currency. At the end of 2012, the announcement by new Japan Prime Minister Shinzo Abe that the Bank of Japan should aggressively increase the money supply to stimulate inflation (part of the so-called "Abenomics" strategy) triggered a yen depreciation. Global risk appetite resumed as investors engaged in yen carry-trade operations, borrowing in the low-yielding yen to fund investment in risky assets abroad. An equity market shock and slowdown in the People's Republic of China (PRC) at the end of 2015 increased global market volatility, leading to yen safe haven flows, marking the end of the depreciating trend that had been in place since the end of 2012. Since 2017, the yen has been relatively stable, even during the COVID-19 crisis, although a mild appreciation was observed in the first stage of the pandemic, which later reverted towards the end of 2020 as uncertainty declined. This has prompted some analysts (e.g., Clynch 2020; Lewis 2020) to suggest that the JPY may no longer be as attractive as a safe haven as it was in the 2000s. Demand for the JPY during the risk-off episodes in recent years has been weaker than in two decades ago. The JPY's trading range has stabilized below 10%, much lower than in the 2000s (Clynch 2020).

Lewis (2020) lists three main reasons behind the underperforming JPY (i.e., it appreciated less than market players' expectations): (1) Japan is suffering from trade deficits; (2) Japanese assets managers continue to purchase foreign assets; and (3) Japanese companies are increasingly investing overseas. Clynch (2020) argues that in the short run, global demand for the JPY can keep the currency's safe haven status despite the massive policy easing by the Bank of Japan (BOJ) during the COVID-19 pandemic. That said, the BOJ's monetary policy easing may pose a threat to the JPY's safe haven status in the long run when the risk appetite is back among global investors.

Fig. 3.3 displays Japan's REER and the risk-off episodes (the REER value below the par value means that the JPY is undervalued, while it is overvalued when above the par). Japan's REER also tends to increase during the risk-off episodes. That said, the JPY has been undervalued since October 2012. It implies that from that month until the end of September 2021 (the last REER observation in our study), the JPY appreciation during the risk-off episodes might not severely harm Japan's competitiveness in international trade.

Fig. 3.3 Japan's REER and Risk-off Episodes



Note: Plotted are Japan's real effective exchange rate and our calculated risk-off episodes.
Source: BIS, Authors' calculation.

Bond markets, stock markets, and capital flow dynamics in safe haven destinations are also subject to sharp fluctuations during periods of heightened financial stress in global markets.[4] For example, the yields of Japanese government bonds (JGBs) tend to fall during the risk-off episodes due to purchases of JGBs by domestic and foreign investors. Although the Japanese government debt and the amount of the debt securities (i.e., JGBs and Japanese government treasury bills—JGTs) has continued to pile up during the COVID-19 pandemic, global investors still perceive Japanese debt securities as safe haven assets because most of these securities are owned by Japanese domestic investors. The yield of the 10-year JGB rose by at most 24 basis points during the COVID-19 pandemic episode from 24 February to 7 April 2020.

Based on Japan's Ministry of Finance (MoF) data as of the end of June 2021, foreign ownership of the Japanese debt securities was recorded at ¥161.8 trillion (about 13% of the total amount of government debt securities). Foreign investors place their funds mostly in the JGTs, where the amount of foreign ownership stood at ¥85.4 trillion (around 51% of the total amount of the JGTs) as of the end of June 2021. While foreign investors place almost the same amount in the JGBs (¥76.4 trillion as of the end of June 2021), the share of foreign ownership of foreign investors was only about 7% of the total amount of JGBs (Ministry of Finance Japan 2021). Japanese debt securities investors have been heavily skewed toward advanced economies that have large, deep, mature debt securities markets, particularly the United States and the European Union countries (Shirai and Sugandi 2019). These countries' government debt securities have higher yields than those of Japan, thus offering a higher rate of return to Japanese investors. The low interest rates in Japan have also induced foreign investors to conduct carry trading, i.e., by borrowing in Japan for investment in higher-yield countries.

While foreign investors have continued to engage in carry trading during the COVID-19 pandemic, the rising yields of long-term JGBs vis- à-vis the yields of other advanced economies—largely due to "unlimited scope and length" of the BOJ quantitative—narrow the premium of Japanese investors' overseas investments (Clynch 2020; Pattanaik 2020). This can discourage Japanese investors from investing abroad and foreign investors from participating in the carry trade.

[4] Please refer to Figs A1.1 to A1.7 in Appendix for details.

Unlike the JGBs (and Japanese debt securities), the Japanese equities are not regarded as safe haven assets, however. The benchmark Nikkei-225 stock market index falls during the risk-off episodes, in line with the movements of major stock indexes in the United States. Foreign investors have a substantial investment in Japanese equities, with a share of around 30% in 2020 (CEIC data). Japan's cross-border equity investment liabilities towards the United States account for more than half of Japan's cross-border equity (International Monetary Fund 2021; Shirai and Sugandi 2019). On capital flows, foreign investors tend to reduce their investment in Japanese equities during the risk-off periods. Meanwhile, the net flows of other investments (i.e., cross-border banking flows) to Japan tend to be, but not always, positive or increasing during the risk-off periods. Japanese investors tend to repatriate their overseas investment to domestic banking accounts during the risk-off episodes.

Overall, it is apparent from the basic analysis of the raw data that risk-off episodes are associated with appreciating exchange rates in safe havens. The extent of these appreciations may not be uniform across the major safe haven destinations, however. In our empirical analysis, we assess the magnitude and duration of impact through which risk-off shocks affect real and financial variables in Japan, Switzerland, and the US.

4. Data and Empirical Methodology

We employ a VAR approach to investigate the main financial channels during the risk-off episodes. While focusing on the Japanese financial markets, we also estimate the VAR models for Switzerland and the United States for comparison. The generic form of our VAR models is specified as follows:

$$Y_t = \sum_{\tau=1..k} Y_{t-\tau} A_\tau + X_t B_t + c_t + \varepsilon_t \qquad (1)$$

where Y_t is the vector of endogenous variables; X_t is the matrix of exogenous variables; A_τ and B_t are the coefficient matrixes; c_t is the vector of constants; and ε_t is the vector of error terms. Indexes t and τ are the time indexes, while k is optimum time lag for the VAR model based on the Akaike Information Criterion (AIC).

The endogenous variables in our VAR model for each country based on their ordering are: (1) risk-off events ("Risk-off"); (2) log of world uncertainty index ("WUI"); (3) the spread between the yield of Japan's or Switzerland's 10-year government bond and the 10-year US Treasury bond ("Spread") (only for the Japanese and the Swiss models, not used for the US models); (4) log of real gross domestic product ("RGDP"); (5) log of the real effective exchange rate ("REER"); (6) log of the stock market index ("Stock Index"); (7) net portfolio investment inflows to debt securities as a percentage of nominal GDP ("Debtsec"); (8) net portfolio investment inflows to equity as a percentage of nominal GDP ("Equity"); (9) net other portfolio investment inflows as a percentage of nominal GDP ("Other"); and (10) net inflows of direct investment as a percentage of nominal GDP ("Direct"). The exogenous variables are the time dummy and the seasonal dummies.

For each country, our baseline model is a recursively restricted VAR, with impulse responses generated based on a one-standard deviation structural shock on the Risk-off variable relative to all endogenous variables in each model. A Cholesky identification scheme is used. We also estimate the VAR in unrestricted form. In the

unrestricted VAR estimation, each endogenous variable in the model is affected by the lagged values of itself and other endogenous variables. In the restricted estimation, we set the model so that the Risk-off variable is only affected by its own lagged values, while other endogenous variables are affected by each other's lagged values and are affected by the lagged values of the Risk-off variable. To make the restrictions, we set the values of other endogenous variables in the Risk-off equation line of the coefficient matrix A_τ to zeros while keeping the values of the Risk-off variable as it is. Confidence intervals at the 95% level are provided.

We use working days data that span from 14 January 1999 to 31 March 2021 for Japan, 13 March 2007 to 31 March 2021 for Switzerland, and 15 January 2002 to 31 March 2021 for the United States.[5] The WUI and the REER data are converted from monthly to working days frequency using the quadratic interpolation method. Data of the RGDP, Debtsec, Equity, Other, and Direct variables are converted from quarterly to working day frequency also using the interpolation method. Table 4.1 lists the endogenous variables, data, and data sources.

[5] The use of daily data is used given that the risk-off shocks occurred on a specific day. Using lower frequency such as monthly or quarterly dilutes the impact of the shock, which would be spread over a longer time dimension. Interpolating time series to higher frequencies is commonly undertaken in order to address issues related to conducting empirical work that combines financial and macroeconomic time series. In particular, interpolating from lower to higher frequencies is not regarded as being problematic given that the lower frequency variables, such as output, are slower-moving so that any errors due to the interpolation would only marginally affect the impact variables (e.g., Danielsson et al. 2018). Nonetheless, in order to allay concerns, we have also carried out the analysis using weekly and monthly frequencies. We find that the shapes of the baseline daily impulse response functions (IRFs) are generally consistent with those of the weekly and monthly IRFs. For daily compared to monthly IRFs, the wide disparity in the underlying time horizon implies that caution is needed in making comparisons based on IRF shapes, e.g. 40 periods of daily would equate to 2 months (i.e. 20 business days per month), while 40 periods of monthly would equate to over 3 years.

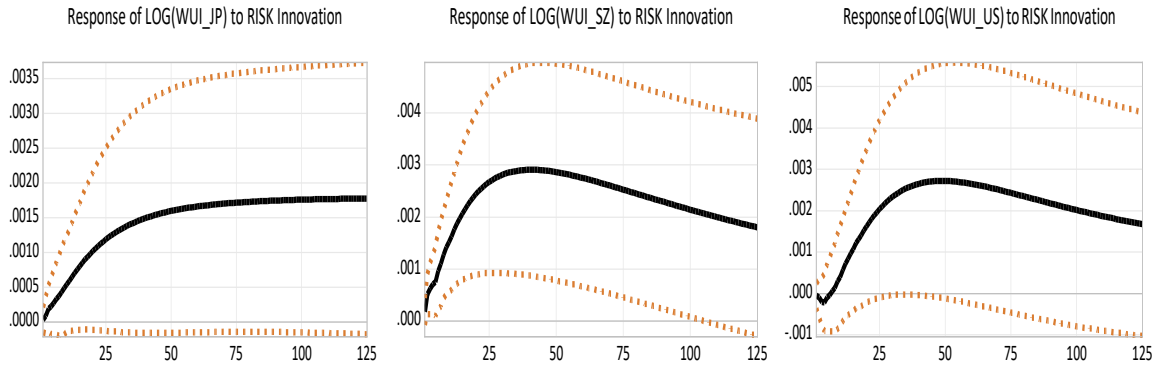
Table 4.1 Variables, Data, and Data Source

Variable	Data	Data Source
Risk-off	Risk-off event (value: 0, 1)	Authors' calculation
Log (WUI)	World Uncertainty Index (WUI) (index unit)	https://worlduncertaintyindex.com/
Spread (vis-à-vis US)	- 10-year Japanese government bond yield (%)	Bloomberg
	- 10-year Switzerland government bond yield (%)	
	- 10-year US Treasury government bond yield (%)	
Log (RGDP)	Constant price GDP	International Monetary Fund (IMF)
Log (REER)	Real effective exchange rate, broad index (2010 = 100, index unit) of:	Bank for International Settlements (BIS)
	- Japan	
	- Switzerland	
	- United States	
Log (Stock_Index)	- Nikkei-225 Index	Bloomberg
	- Swiss Market Index	
	- S&P 500 Index	
Debtsec	- Net portfolio investment inflows to debt securities (USD billion)	- International Monetary Fund (IMF)
	- GDP at current price (local currency billion)	- CEIC
	- USD/JPY and CHF/USD exchange rate	- Bloomberg
Equity	- Net portfolio investment inflows to equity (USD billion)	International Monetary Fund (IMF)
	- GDP at current price (local currency billion)	
	- USD/JPY and CHF/USD exchange rate	
Other	- Net other portfolio investment (USD billion)	- International Monetary Fund (IMF)
	- GDP at current price (local currency billion)	- CEIC
	- USD/JPY and CHF/USD exchange rate	- Bloomberg
Direct	- Net direct investment (USD billion)	- International Monetary Fund (IMF)
	- GDP at current price (local currency billion)	- CEIC
	- USD/JPY and CHF/USD exchange rate	- Bloomberg

5. Empirical results

Figs. 5.1 to 5.7 display the main impulse response function (IRF) results from the restricted VAR models for Japan, Switzerland, and the US.[6] Real and financial spillovers to Japan from risk-off shocks are evident via a number of transmission channels. While risk-off episodes are typically associated with a flight to safe havens, rising uncertainty in markets can also be broad-based, with safe haven destinations also subject to heightened uncertainty. Our impulse responses indicate that risk-off shocks lead to a rise in economic policy uncertainty in the case of Switzerland, while the responses for Japan and the US are not statistically significant (Fig. 5.1).

Fig. 5.1 Economic Policy Uncertainty Responses to Risk-off Shocks in Safe Havens



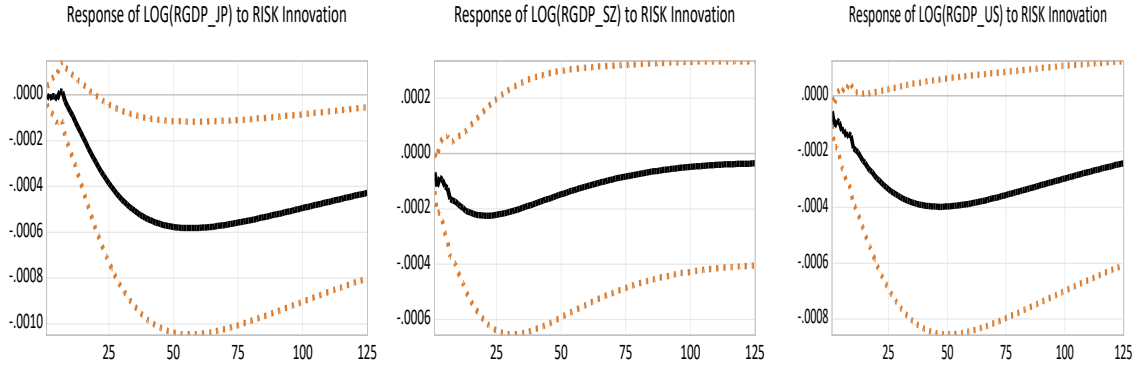
Note: Reported are the IRFs based on equation (1), using a Cholesky identification scheme and block recursive restriction; 95% confidence intervals are provided by the dotted lines; the vertical axis represents percentage points while the horizontal axis refers to the number of days.

The results for Switzerland indicate a significant rise in economic policy uncertainty due to a risk-off shock, which persists until around 100 days, with a peak impact apparent after around 40 days. In the case of Japan, the lack of significant impulse responses could be linked to the much more muted impact of risk-off episodes on the volatility of Japanese financial markets given strong expectations of overseas net portfolio holdings repatriated back to Japan priced in by market participants. Expectations priced in by markets can also help to explain the lack of significance in the US.

During risk-off episodes, it may be intuitive to expect a broad-based decline in global demand from both trade and financial channels. On real spillovers of risk-off shocks to safe havens (Fig. 5.2), there is clear evidence of a significant negative impact on GDP growth in the case of Japan. From around 25 days after the risk-off shock, a statistically significant decline in GDP growth is found, with the negative impact peaking at around 50 days. By contrast, risk-off shocks do not significantly affect the trajectory of output growth overall in Switzerland and the US, apart from some short-lived impacts at low time horizons. The findings may be linked to the stronger interconnectedness of Japan in regional trade and finance vis-à-vis emerging Asian economies that may be vulnerable to risk-off shocks. Negative spillovers to Japan via these channels can emanate due to economic downturns in these economies in crisis times.

[6] The full set of IRFs for both the restricted and unrestricted models are available from the authors upon request. We focus the discussion primarily on statistically significant IRFs at conventional levels.

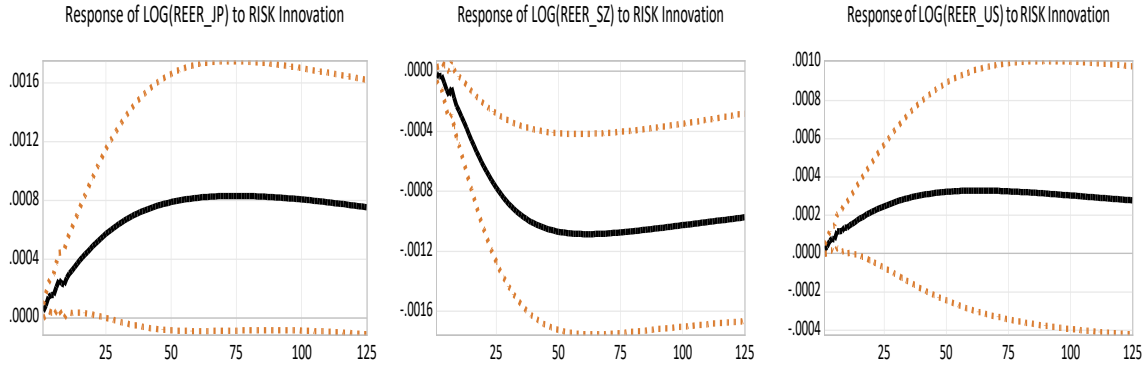
Fig. 5.2 Output Growth Responses to Risk-off Shocks in Safe Havens



Note: Reported are the IRFs based on equation (1), using a Cholesky identification scheme and block recursive restriction; 95% confidence intervals are provided by the dotted lines; the vertical axis represents percentage points while the horizontal axis refers to the number of days.

Financial flows to safe havens due to risk-off episodes can be expected to lead to real exchange rate appreciations, the competitiveness impacts of which can be important contributors to negative real effects over time. The precise effect also depends on the speed of possible policy reaction to counteract appreciating exchange rates, such as intervention by the central bank in foreign exchange markets. Our impulse response analysis shows differences in the responses of REERs for Japan, Switzerland, and the US to risk-off shocks (Fig. 5.3).

Fig. 5.3 REER Responses to Risk-off Shocks in Safe Havens



Note: Reported are the IRFs based on equation (1), using a Cholesky identification scheme and block recursive restriction. 95% confidence intervals are provided by the dotted lines. The vertical axis represents percentage points while the horizontal axis refers to the number of days.

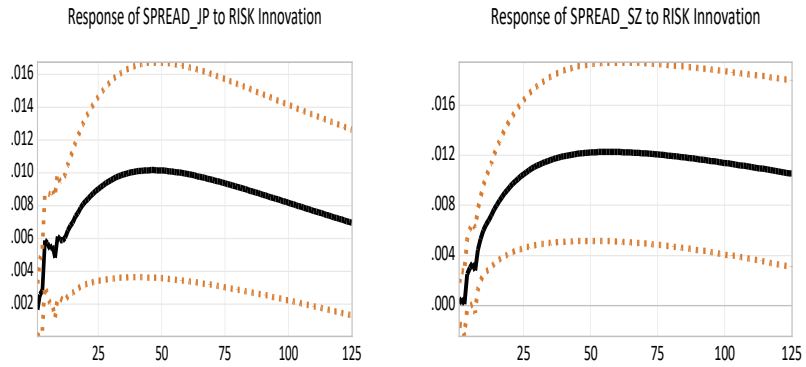
For the Japanese yen, a risk-off shock results in the expected exchange rate appreciation. This appreciating effect of the yen loses significance at around 25 days. For the US, the appreciating effect loses significance almost immediately. By contrast, we find the opposite effect for Switzerland, with the Swiss franc depreciating significantly, which may seem to be counterintuitive.[7] It is important to bear in mind, however, that the Swiss central bank actively and aggressively intervenes in foreign exchange markets to ensure the competitiveness in its export-dependent economy. The Bank of Japan, by contrast, tends not to intervene strongly in foreign exchange markets. This is underpinned by its preference to allow interest

[7] Over longer shock horizons with lower frequency data (such as weekly or monthly), we do not find a significant of the response for the Swiss franc. This can be related to its higher sensitivity to daily frequency induced shocks.

rate yield differentials vis-à-vis the US bear the adjustment, which would keep the USD–JPY bilateral exchange rate in a narrow range. In the case of Japan, the response of GDP growth given an appreciating REER suggests that exchange rate and trade channels are important contributing factors to negative real spillovers. In other words, safe haven financial flows to Japan in periods of heightened global risk aversion dampen economic growth via appreciating exchange rate effects.

On long-term yield differentials relative to the US (Fig. 5.4), also reflecting rising country-specific risk, a significant and positive response of long yield spreads for the Japanese government bond market is found. The effect peaks at around 40 days after the risk-off shock but remains persistent and statistically significant over the estimation duration. A similar effect is found in the case of Swiss bond spreads.

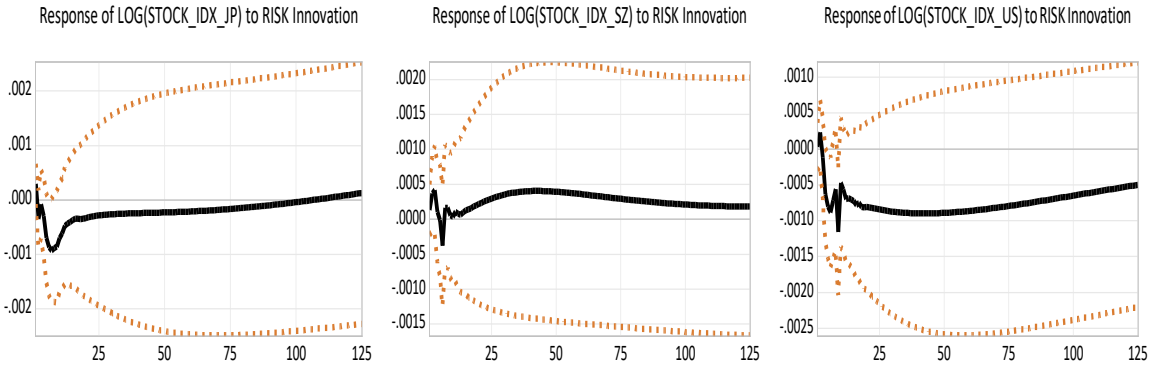
Fig. 5.4 Sovereign Bond Spread Responses to Risk-off Shocks in Safe Havens



Note: Reported are the IRFs based on equation (1), using a Cholesky identification scheme and block recursive restriction; 95% confidence intervals are provided by the dotted lines; the vertical axis represents percentage points while the horizontal axis refers to the number of days.

On sovereign bond spreads, widening spreads underscore the dominance of the US dollar as the main global safe haven currency. During risk-off episodes, flows to US Treasuries imply that even other safe haven destinations for financial flows will face some amplification in sovereign borrowing costs. This also relates to the theoretical literature pointing towards a significant role of liquidity in affecting asset pricing (e.g., Vayanos 2004; Caballero and Krishnamurthy 2008; Brunnermeier and Pederson 2009). For the stock market in safe havens (Fig. 5.5), the response to a risk-off shock is not significant for Japan and Switzerland. For the US, the results are also mostly not significant, apart from short-lived negative significant effects in the days after the shock. Time varying impacts of market volatility on equity risk premia and risk aversion across safe havens are important considerations in this regard (e.g., Bekaert, Engstrom, and Xing 2009).

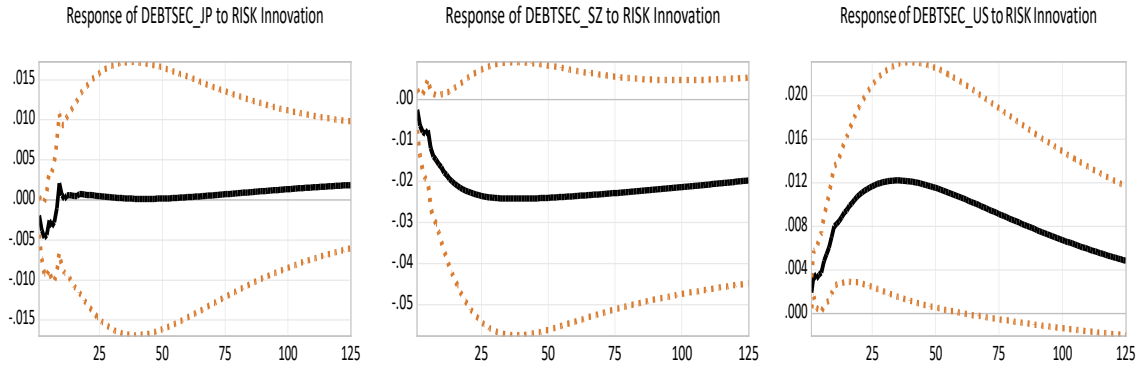
Fig. 5.5 Equity Market Responses to Risk-off Shocks in Safe Havens



Note: Reported are the IRFs based on equation (1), using a Cholesky identification scheme and block recursive restriction; 95% confidence intervals are provided by the dotted lines; the vertical axis represents percentage points while the horizontal axis refers to the number of days.

Turning to capital flows, Figs. 5.6 and 5.7 show the responses in portfolio debt and portfolio equity flows to safe havens. Overall, and contrary to expectations, we do not find a significant effect in the response of portfolio flows to Japan to a risk-off shock. That said, this finding is in line with Botman, De Carvalho Filho, and Lam (2013), who suggest that Japan may be subject to portfolio rebalancing triggered by risk-off episodes via offshore trading in derivatives markets that are not captured in official balance of payments transactions.

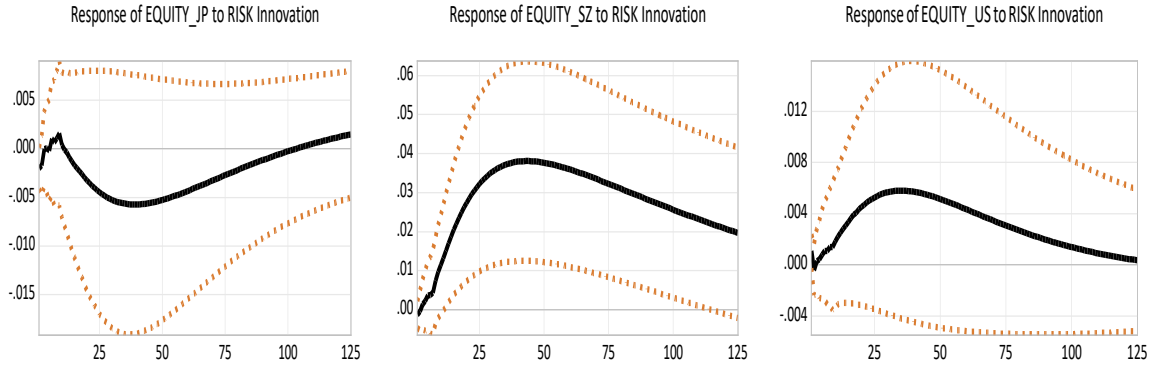
Fig. 5.6 Portfolio Debt Flow Responses to Risk-off Shocks in Safe Havens



Note: Reported are the IRFs based on equation (1), using a Cholesky identification scheme and block recursive restriction; 95% confidence intervals are provided by the dotted lines; the vertical axis represents percentage points while the horizontal axis refers to the number of days.

While no significant effect is found for portfolio debt responses to risk-off in the case of Japan (similar to Switzerland), the response in the US is positive and statistically significant a few days after the shock up until around 50 days. This is in line with conventional expectations that in times of heightened financial stress, US debt securities are the preferred destination for financial flows by investors. As described by Caballero and Krishnamurthy (2009), these flows of primarily nonspeculative capital can lead to excessive leverage by financial institutions as risk-free assets are sold to foreigners during these periods. On portfolio equity responses (Fig. 5.7), we find some evidence of a statistically significance positive response for equity flows to Switzerland after around 10 days, but no significance for Japan or the US.

Fig. 5.7 Portfolio Equity Flow Responses to Risk-off Shocks in Safe Havens



Note: Reported are the IRFs based on equation (1), using a Cholesky identification scheme and block recursive restriction; 95% confidence intervals are provided by the dotted lines; the vertical axis represents percentage points while the horizontal axis refers to the number of days.

Comparing real and financial spillovers from risk-off shocks in Japan to the case of the US and Switzerland suggests an idiosyncrasy to the dynamics at play in Japan. On real spillovers, the effect of risk-off shocks has only a marginal and short-lived significant effect on GDP growth in the US or Switzerland, while a statistically significant negative effect of greater magnitude is found for Japan after around 25 days, remaining persistent thereafter. Japan's protracted lower relative GDP growth may make it more susceptible to shocks. On financial spillovers, the exchange rate effect is specific to Japan, weighing on competitiveness and growth.

6. Conclusions

This paper examines real and financial spillovers of risk-off episodes in safe haven destinations over the period 1990 to 2021. The empirical findings are summarized in Table 6.1.

Table 6.1 Summary of empirical findings

	Japan	Switzerland	US
Economic policy uncertainty	Insignificant	Significant (+)	Insignificant
Output growth	Significant (-)	Insignificant	Insignificant
REER	Significant (+)	Significant (-)	Insignificant
Sovereign bond spread	Significant (+)	Significant (+)	n/a
Equity market	Insignificant	Insignificant	Significant (-)
Portfolio debt flow	Insignificant	Insignificant	Significant (+)
Portfolio equity flow	Insignificant	Significant (+)	Insignificant

We show that dynamics for Japan appear to be different to those of Switzerland and the US in three main ways. First, in response to risk-off episodes, the yen REER appreciates significantly, with the effect exhibiting signs of persistence. Second, no significant effect on portfolio flows to Japan are found, in spite of the appreciating exchange rate effect, suggesting a rapid adjustment of financial markets to shifts in equilibrium exchange rates. Third, negative real spillovers from risk-off shocks appear to only apply to Japan.

Our findings have several implications for policymakers. Effective exchange rate management would appear to be particularly important in the case of Japan, also related to its transmission to the real economy. Policy makers should be vigilant to

potential volatility in currency markets and ensure that appropriate countercyclical adjustment mechanisms are available from the suite of fiscal, monetary, and macroprudential policy tools. In addition, persistence identified in bond spreads and portfolio debt securities may contribute to a buildup of financial vulnerabilities and risks to financial stability over the longer term, underscoring the need for careful monitoring by policymakers, in particular by central banks and financial supervisors.

Acknowledgments

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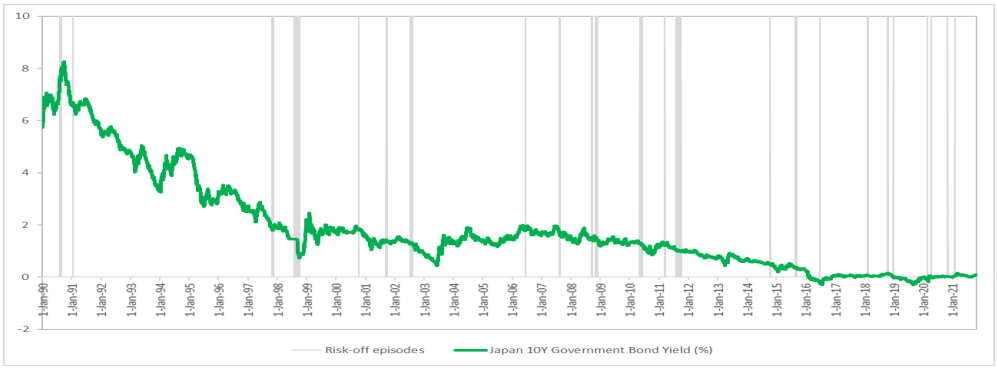
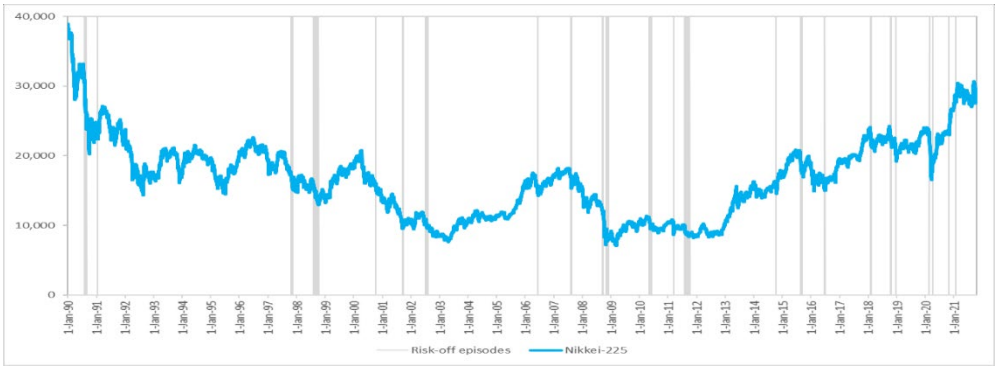
Appendix 1. Financial Markets and Risk-off Events in Japan

Fig. A1.1 The 10-Year JGB Yields (%) and the Risk-off Episodes



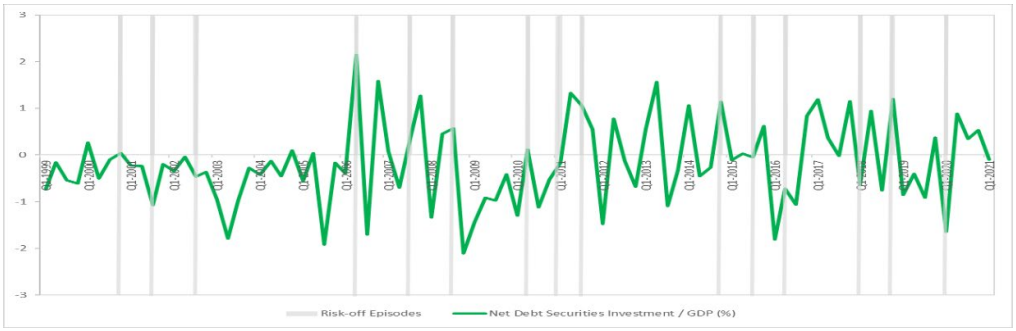
Source: Bloomberg, Authors' calculation.

Fig. A1.2 Nikkei-225 Index and Risk-off Episodes



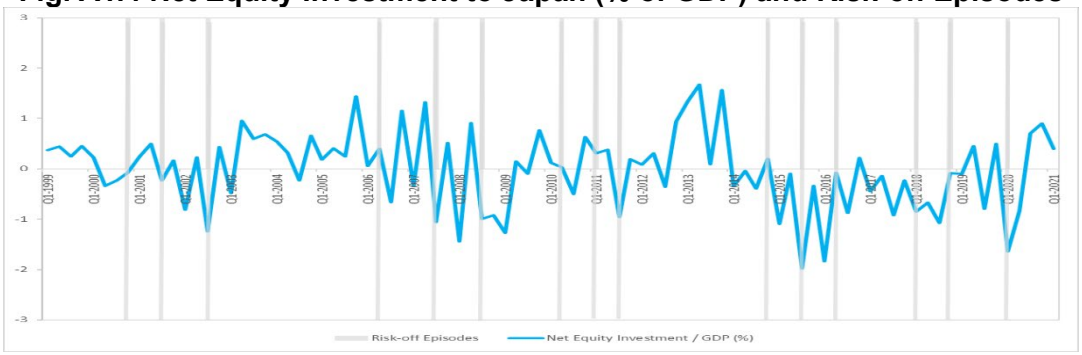
Source: Bloomberg, Authors' calculation.

Fig. A1.3 Net Debt Securities Investment to Japan (% of GDP) and Risk-off Episodes



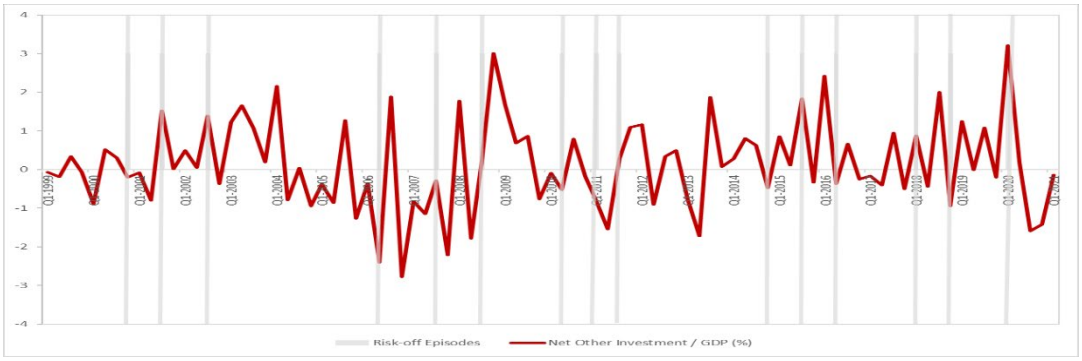
Source: Bloomberg, Authors' calculation.

Fig. A1.4 Net Equity Investment to Japan (% of GDP) and Risk-off Episodes



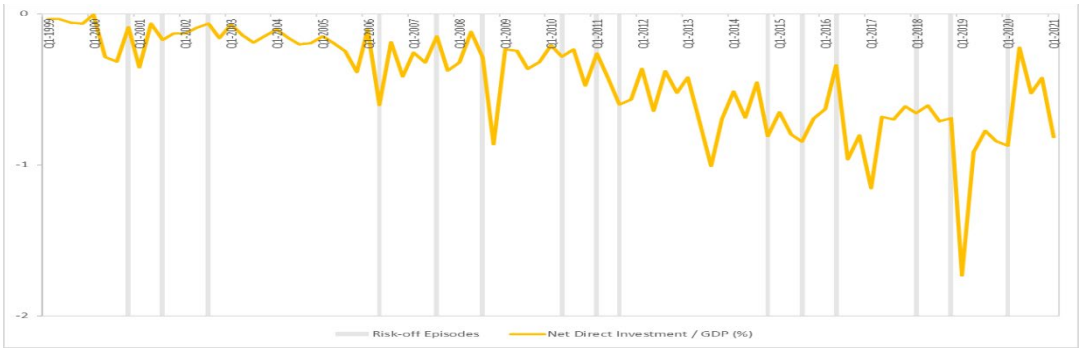
Source: Bloomberg, Authors' calculation.

Fig. A1.5 Net Other Investment to Japan (% of GDP) and Risk-off Episodes



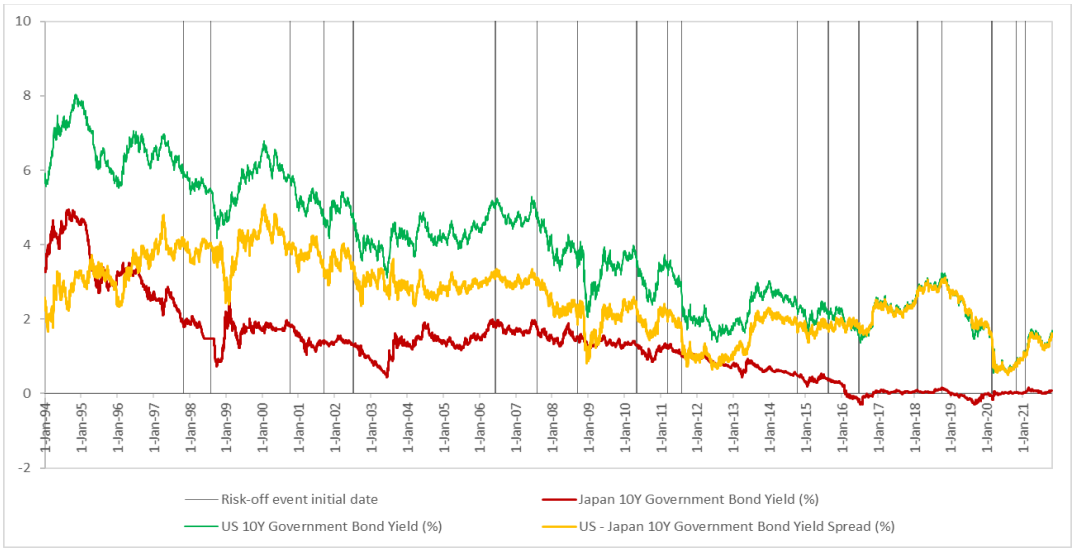
Source: Bloomberg, Authors' calculation.

Fig. A1.6 Net Direct Investment to Japan (% of GDP) and Risk-off Episodes



Source: Bloomberg, Authors' calculation.

Fig. A1.7 Yield Spread Between the 10Y US and Japan Government Bonds



Source: Bloomberg, Authors' calculation.