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Master Thesis Master in Business Economics (BE)

The Impact of Monetary Policy Shocks on Risk across Markets

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Abstract

This master thesis investigates the impact of monetary policy shocks on risk, before and after the introduction of the so-called unconventional monetary policies, such as the quantitative easing programs, that have been implemented in recent years. The magnitude of those programs and the extra attention given to central banks in the aftermath of the financial crisis of 2008 require the research community to investigate whether there is any difference in the response to monetary policy shocks. To do so, large cap stock indices, small cap stock indices, long-term government bond indices, investment grade corporate indices, and high yield corporate indices from different markets were analysed. The markets are the United States, the European Union, the United Kingdom, Japan, Switzerland, Australia and Brazil. Risk was measured by both the dynamic betas and the risk premia, as estimated by an ARCH-M model, for all the indices. The data samples of the different markets were split in two using a Markov-switching model, and Impulse Response Functions were performed on the two halves of the indices samples for both measures of risk. The responses on the two periods were then compared. A variance ratio test showed that the impact of monetary policy shocks on the risk of stock and bond indices changes significantly after the implementation of the unconventional monetary policies for most markets.

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Introduction

The financial crisis that occurred in 2008 caused a lot of concerns, not only for the investors of the financial markets, but also for the central banks as the magnitude of the crisis reached levels comparable to the Great Depression in the 1930s. While facing these challenging times, central bankers felt short of options when trying to contain the effect of the financial crisis. As the traditional tools had been used without succeeding in resolving the crisis, central banks turn to more obscure technics. So-called unconventional monetary policies were then put to use in an effort to re-establish calm on the financial markets. In this context, this paper wants to investigates the impact of these unconventional monetary policies on the risk of stocks and bonds. Given the magnitude of the quantitative easing programs and the overall increase of the central bank's activity, it is reasonable to expect changes in the response of the markets to monetary policy shocks. This changes could occur if for example the attention or credibility of central banks have changed since both the financial crisis and the implantation of the unconventional monetary policies. More precisely, the research question of this research is:

Has the impact of monetary policy shocks on the risk of stocks and bonds changed since the introduction of the so-called unconventional monetary policies across markets?

The monetary policies referred to as unconventional have been relatively widely used in the aftermath of the 2008 financial crisis. Policies such as quantitative easing, or in case of Switzerland a fixed exchange rate long after the dissolution of the Bretton Woods agreements, have been used by central banks in the developed world. These policies have been controversial, some arguing that only increasing the money supply, in the case of quantitative easing, would not have a real impact on the financial markets.

Although many papers have written on the subject, none has taken the approach of single out the period when the unconventional monetary policies have been active across different markets. This research fills this gap in the literature, provide a cross-sectional approach that was missing.

In order to answer the research question, data on the following markets has been gathered: The United States, the European Union, the United Kingdom, Japan, Switzerland, Australia, and Brazil. The dataset includes the returns of stock and bond indices, as well as macroeconomic data. Two different measures of risk were computed, the risk premia modelled by an ARCH-M model, and dynamic betas. The dataset was then split in different states of monetary policy, and Impulse Response Functions on the risk measures were used to model monetary policy shocks on risk. A variance test ratio was then performed on the variances of the Impulse Response Functions. This research founds that the markets which have experienced so-called unconventional monetary policies tend to have more statistically significant differences in the variances of the risk measures impacted by monetary policy shocks before and after the implementation of the unconventional monetary policies, than markets that did not implement any unconventional monetary policies.

This paper is structured as such: first a short review of the literature upon which this research is based is presented, the data and methodology used in this paper are then described and explained, the results of the research are finally displayed, followed by the conclusion and limitations of the research. An appendix is displayed at the end of this paper where additional information can be found.

Literature review

This paper builds upon the existing literature on monetary policy and risk. The transmission of monetary policy has been researched in many papers. Among them, Taylor (1995) wrote in his research that the main instrument of central banks for conducting their monetary policies is to actively guide the short-term interest rates through influencing the money market rates. This influences in turn the nominal long-term and exchanges rates, and due to price stickiness the real interest and exchange rates. Taylor (1995) also explored the question of how the monetary policy transmission mechanisms have changed over time. He found that the interest rate elasticities of investment and consumption as well as the response of real GDP to monetary policy shocks have changed over time, following the business cycle.

Bernanke & Kuttner (2005) found in their research that financial markets react significantly to surprise changes in policy rate. They argue that the change in stock prices after a monetary policy shock can be predominantly attributed to a change in expected excess return. Their paper is constructed as an event-study analysis, finding significant stock price changes on the day of the announcement of policy rate changes. They also found that the impact of monetary policy shocks on financial markets are perceived to be long-lasting. Finally, Bernanke & Kuttner (2005) argue that tightening monetary policies tend to both increase the risk of stocks, and reduce the incentives of market participants to bear risk. Finally, they found that different stocks are impacted in different ways by monetary policy shocks, depending on their idiosyncratic characteristics, these findings are also found by Ehrmann & Fratzscher (2004).

Other research in the likes of Borio & Zhu (2012) as well as Drechsel, Savov & Schnabl (2018) have investigated the relationship between monetary policy and risk. They have come to the conclusion that the current monetary policy regime has increased the overall risk-taking behaviour of the market participant. Borio & Zhu (2012) wrote about the transmission of monetary policy to the financial markets. Their research first stated that monetary policies are transmitted, among others, through the "risk-taking channel" which can be operative in the three following ways. First, through the impact of interest rates, which boost asset and collateral values when low, and increase incomes and profit. This phenomenon reduces risk perceptions, and increases risk tolerance. This effect is positively correlated to the magnitude of the reduction as well as the duration of low interest rates. The second way monetary policies are transmitted through the risk-taking channel, operates through the relationship between market rates and target rates of return. The target rates of return being "stickier" than policy rates, thus pushing market participants to increase their risk tolerance in order to meet their target returns. Borio & Zhu (2012) states that this effect is particularly powerful when the interest rates are close to zero. Finally, the third way of risk-taking transmission operates through the central bank's communication policies and reaction function. Increasing the transparency and the perceived degree of commitment might trigger what Borio & Zhu (2012) called an "insurance effect". This effect would reassure the market participants that the central bank commits to remove some of the uncertainties about the future. A good example of this would be the "whatever-it-takes" speech by Mario Dragui. Borio & Zhu (2012) also stated that the risk-taking channel seems to have grown in relevance, and that the central banks have adopted more active monetary policies in the aftermath of the 2008 financial crisis.

Campbell, Pflueger and Viceira (2014) investigated what are the macroeconomic forces that determine the risk properties of US Treasury bonds, and whether they change over time. They divide monetary policy into three subperiods using a QLR test, which correspond to the changes of CAPM betas of bonds. They found that the CAPM betas experienced important changes over time, from being close to zero between 1960 and 1977, to positive until 2000, and finally to negative up until the end of the sample in 2011. They attribute these changes to the differences in the focus of the monetary policies that occurred over time. Campbell, Pflueger and Viceira (2014) also made use of the dynamic betas when analysing the impact of the monetary policy shocks on the risk of stocks and bonds.

Hamilton (1989) first proposed a model that allows for the identification of so-called turning points in time series. Based on the assumptions that time series do not follow a linear stationary process, but rather a nonlinear stationary process, Hamilton (1989) introduced a model that separate the data in regimes. This model is based on the Markov-switching regression as proposed by Goldfeld & Quandt (1973). The so-called Markov-switching model is used by Campbell, Pflueger and Viceira (2014) when determining the different regimes in the US monetary policy.

The autoregressive conditional heteroscedasticity (ARCH) model was first developed by Engle (1982) in order to build models allowing for time-varying conditional variance. The ability of the ARCH model to model volatility make it a useful tool to estimate time-varying systematic risk. Built on the ARCH theory, the ARCH-M, or ARCH in mean, models were first introduced by Engle, Lilien and Robins (1987), and are constructed in a way that allows the conditional variance to affect the mean, or the expected return of a portfolio. In their paper, Engle, Lilien and Robins (1987) investigated the risk premium in the term structure.

Many different papers have used the impulse response function (IRF) in order to investigate the impact of monetary policy shocks on, among others, stock returns (Thorbecke (1997), Bredin et al. (2007)), or exchange rates (Eichenbaum & Evans (1995)). However, the literature lacks a research on the impact of monetary policy shocks on the risk premium. In order to fill this gap in the literature, this paper will use a vector autoregressive (VAR) model, which was first introduced by Sims (1980).

Data

The dataset can be separated in two sections. The first part contains quarterly data in order to determine the date of the monetary policy breaks, and was used as control variables. The data used for determining the monetary policy breaks includes the real GDP, the CPI, and the central bank's policy rate. For all the markets, the Year-on-Year real GDP growth data was retrieved from the OECD. For the CPIs and the central bank's policy rates, the data was retrieved from DataStream. The Selic interest rate was used for Brazil for the policy rate. The dataset includes data from 2000Q1 until 2018Q1.

The second part of the data set includes daily data on the policy rate, the short term interest rates, 3-month Treasury Bill or equivalent, and includes total return indices on major stocks, small cap stocks, government bonds, investment grade corporate bonds, and high yield corporate bonds. For the total return on large and small stocks, the MSCI Large Cap and Small Cap where used. Germany was used as a proxy for the EU for both the Large and Small Cap indices. The MSCI World Index is also used in daily term. The daily dataset includes daily observations form the 1st of January 2000 to the 1st of January 2018.

The long-term government bond indices have different maturities depending on the market. For the US, Japan, Brazil, and Switzerland the 10-year bond index is used except for Brazil as only the yield was available, whereas for the UK the 15-year bond index, and for the EU and Australia the 7-10y bond index are used. Finally, the corporate bonds indices are rated either investment grade and high yield or AAA and BBB respectively. For the US the Barclays U.S. Corporate Investment Grade and Barclays U.S. Corporate High Yield were used. For the UK the indices FTSE Sterling Corp. AA Rated and BBB Rated were found. For the EU the TR CV Europe Focus Investment Grade and the IBOXX Euro High Yield Fixed Rate indices were used. For Japan only the TR CV Japan Investment Grade index was available, and no high yield bond index could be found with sufficient data. The Australian bond indices are the S&P 500 AAA Investment Grade and the S&P 500 High Yield Corporate Bond. For Switzerland, the Swiss SBI Dom Non-Governmental AAA-AA 1-3y and the Swiss BI Dom Non-Governmental AAA-BBB 1-3y price indices were used. Finally, as no bond index was available with sufficient data for the Brazilian corporate bonds, the performance of the Signature Emerging Markets Corp CI mutual fund was used. This mutual fund invests in corporate bonds from emerging markets, Brazil included. Thus, it was used as a proxy for the Brazilian corporate bond index.

The 3-month government bill was replaced by the 3-month German deposit rate for the EU and the 3-month deposit rate for Australia. For Brazil, the CDI rate was used to obtain the risk-free rate.
The size of the daily sample for Switzerland was reduced for the ARCH-M model as well as for the Impulse Response Function with the daily data, the sample starts in the 1st of January 2007. For the Markov-switching model, the full sample size was used.
An explanation on the dates plotted with the results of the Markov-switching model is provided at the beginning of the Appendix.

Methodology

The methodology of this paper can be separated in two parts. The first part consists of finding the break dates where the samples can be split in two part using a Markov-switching model and the quarterly data. The second part of the methodology uses daily data and consists of obtaining time-varying betas and risk premia for all indices and then performs impulse response functions on the two parts of each sample.

Monetary Policy Regimes

In order to split the sample in two periods, a break date from which the change in monetary policy regime happens must be determined. The preferred method is to use a Markov-switching model as in Campbell et al. (2014). In addition to the Markov-switching model, several key dates when the monetary policies have been announced will be plotted in order to see if the breaks found by the Markov-switching model correspond to those of the announcement. The Markov-switching model as described in Hamilton (1989) uses a dynamic regression, and the independent variables are used as non-switching variables. More precisely, as described in Kole (2010), it is assumed that the policy rate I_t follows a distribution that depends on S_t, a latent process. The S_t process can be in say two states at each point in time, $S_t = 0$ and $S_t = 1$. Thus, the policy rate has the following distributions, both normal, only with different means and variances.

$$I_t \sim \begin{cases} N(\mu_0, \sigma_0^2) \text{ if } S_t = 0 \\ N(\mu_1, \sigma_1^2) \text{ if } S_t = 1 \end{cases}$$

The probability density function f is then computed as such:

$$f(i; \mu, \sigma^2) = \frac{1}{\sqrt{2\pi}\sigma} \exp\left(-\frac{(i-\mu)^2}{2\sigma^2}\right)$$

The probability that i_t is in one or the other state is then computed using Baye's rule:

$$Pr[S_1 = 0 | I_1 = i_1] = \frac{f(i_1; \mu_0, \sigma_0^2) * Pr[S_1 = 0]}{f(i_1; \mu_0, \sigma_0^2) * Pr[S_1 = 0] + f(i_1; \mu_1, \sigma_1^2) * (1 - Pr[S_1 = 0])}$$

As seen in Campbell et al. (2014), a break in the following relation is a sign of a monetary policy break. All the data are denominated in quarterly frequency.

$$i_t = b_0 + b_1 x_t + b_2 \pi_t + b_3 i_{t-1} + \varepsilon_t$$

Where t denotes the quarter, i is the central bank's policy rate, x is the Year-on-Year output gap, π is the annual inflation, and ε is the error term.

As shown in the Appendix, different equations were used for the Markov-switching model for the US, the most fitted one appears to be the relationship as described in Campbell et al. (2014). Moreover, the Markov-switching model with the equation of Campbell et al. (2014) was run again, using a shorter sample period beginning at 2007Q4. The shorter sample size does not retrieve any significant difference, see Appendix. The same formula was thus used for all markets.

In addition to the results of the Markov-switching model, certain dates where important events have taken place, such as the announcement of a quantitative easing program, have been plotted on the graphs. More information on the dates can be found in the Appendix. Once the regimes have been determined, the results of the Markov-switching model were plotted together with the standard deviations, variances, dynamic betas, and the ARCH-M risk premia of all indices across markets. After this point in the methodology, only daily data are used.

Dynamic Betas

For both the dynamic betas and the ARCH-M model, the daily returns of the indices were calculated using the first difference of the natural logarithm. The betas are said to be dynamic as they vary over time. First, the monthly standard deviations and variances of the indices are plotted together will the results of the Markov-switching model as well as with the monetary policy dates as reported in the Appendix. Then, the dynamic betas are computed. The following formula was used in order to obtain the dynamic betas:

$$\beta_{it} = correlation(i, m) * \frac{\sigma_{it}}{\sigma_{mt}}$$

where i stands for the index, and m for the MSCI World Index. The standard deviations are obtained using one month of data that is rolled over the entire sample. The dynamic betas are then plotted with the results of the Markov-switching model.

Time-Varying Risk Premia with the ARCH-M model

The ARCH-M model allows to retrieve the dynamic risk premium of a security. This paper investigates the risk premium in addition to the dynamic beta for the sake of completion. This paper followed the same methodology as Engle, Lilien and Robins (1987). The ARCH-M can be written as:

$$r_t = \mu_t + \varepsilon_t$$

where r_t is the return at time t, μ_t is the risk premium, and ε_t the residual. The risk premium is itself a function of volatility as shown on the formula below:

$$\mu_t = const + \theta\sqrt{h_t},$$

and

$$h_t = \alpha\varepsilon_{t-1}^2$$

where h is the variance σ^2, θ is the ARCH-M coefficient, and α is the ARCH coefficient. The ARCH-M model states that μ_t is proportional to the square root of volatility, $\sqrt{h}$, but not to volatility h.

In order to perform an ARCH-type model, the following steps were executed in order to ensure that the indices returns have an ARCH-effect. A Dickey-Fuller test was first performed on the first differences of the natural logarithms of all the indices. They were all found to be stationary at the 5% confidence level. Then, a Portmanteau test for white noise were performed on both the indices returns and their squared returns in order to test for independence and volatility clustering, both null hypotheses were rejected for all the indices. It is therefore appropriate to use an ARCH-M model. An ARCH-M(1) was then performed on all the indices.

Once the break dates were known and that the dynamic betas and ARCH-M risk premia were obtained, the monetary shocks could be investigated using the Impulse Response Fucntions.

Impulse response function

In order to see the impact of a monetary policy shock on risk, the Impulse Response Functions (IRFs) of the policy rate over the different dynamic betas and risk premia of all the indices were computed. The IRFs were then performed on both part of the sample in order to be able to compare the impact of the monetary policy shocks before and after the implementation of the unconventional monetary policies.

Following the methodology of Thorbecke (1997), this paper uses a simple formula only including the central bank's policy rate, replacing the price as in Thorbecke (1997) by the risk premia. Furthermore, following Bernanke, Boivin & Eliasz (2005) this paper considers the risk premia to be fast-moving variables, therefore are allowed to respond at the same time as the policy shock. Therefore, there is no need for a lag in the formula.

$$dynamic\ beta/risk\ premium_{i,t} = \alpha_0 + \alpha_1 d\_PolicyRate_t + \varepsilon_t$$

Using a simple formula with only one explanatory variables, here the first difference of the central bank's policy rate allows for the Cholesky ordering to be ignored. The impulse function is then estimated with a VAR model including two lags. The models were set as such: the first difference of the policy rate is set as the impulse variable, whereas the indices returns are set as the response variables.

Variance Test Ratio

The results of the IRFs are then compared between the first and second period samples with a variance test ratio in order to determine whether the magnitude of the impact of monetary policy shocks has changed since the implementation of the unconventional monetary policies. The variance test ratio for $\sigma_x^2 = \sigma_y^2$ is given by the F-value with $n_x - 1$ and $n_y - 1$ degrees of freedom computed as such:

$$F = \frac{s_x^2}{s_y^2}$$

Empirical Results

In this section, the empirical results obtained for the different markets are reported. For the sake of convenience, all the respective indices will be given the same name across all the markets. *Large* and *Small* denote the Large and Small Cap MSCI Total Return indices, *10y* the long-term government bonds, *IG* and *HY* the investment grade (or AAA/AA-rated) and the high yield (or BBB-rated) bond indices. Only Brazil has a *MF* variable, which denotes the mutual fund on emerging markets corporate bonds. When the results of the Markov-switching model are plotted on a graph, the right axis has been used to measure the two states.

Monetary Breaks

US

The results of the Markov-switching model together with the date of the announcement of the QE program are plotted on Figure 1 below. The model retrieves a mean of -0.0005 for the "low" state, and a mean of 0.0096 for the "high" state. All the Stata outputs are displayed in the Appendix. On Figure 1 it appears that the monetary policy breaks occurred before the announcement of the first quantitative easing program. At the beginning of 2008, the Markov-switching model indicates that the US fed funds are in the "high" state, and do not change regime thereafter.

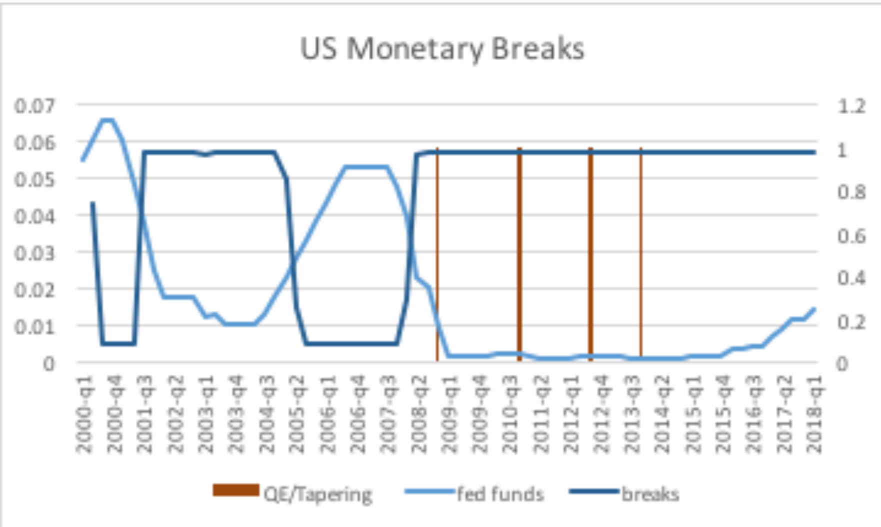

Figure 1: US monetary breaks and policy rates

EU

The EU is a particular case as it regroups several countries, that have different types of economies. On one hand, countries like Germany or the Netherlands have strong economies, and have managed to go through the 2008 financial crisis, and recover from it relatively quickly. On the other hand, European countries such as Greece or Spain experienced a sovereign debt crisis following the financial crisis. Thus, there are some limitations when using Germany as a proxy for the EU, as it was done for the stock indices.

Figure 2 below reports the monetary breaks as obtained by the Markov-switching model. Unlike for the US, the Markov-switching model does not report clear monetary breaks. The entire period between the end of 2008 and the end of 2013 seems to be split between two states. The economic reason behind the particular results of the Markov-switching model could be that the EU experienced a sovereign debt crisis after the 2008 financial crisis. It seems therefore that allowing for three states in the Markov-switching model would be the preferred option. This makes sense when taking into account both the financial and the sovereign debt crises. However, due to the relative short size of the sample, Stata cannot compute a three-state model. Thus, in order to have a clear break in monetary policy regime that separates the so-called unconventional monetary policy regime, the date of the first announcement of the European quantitative easing program has been used as the break in monetary policy regime. The announcement happened in May 2010, therefore the break date was defined to be the 1st of May 2010.

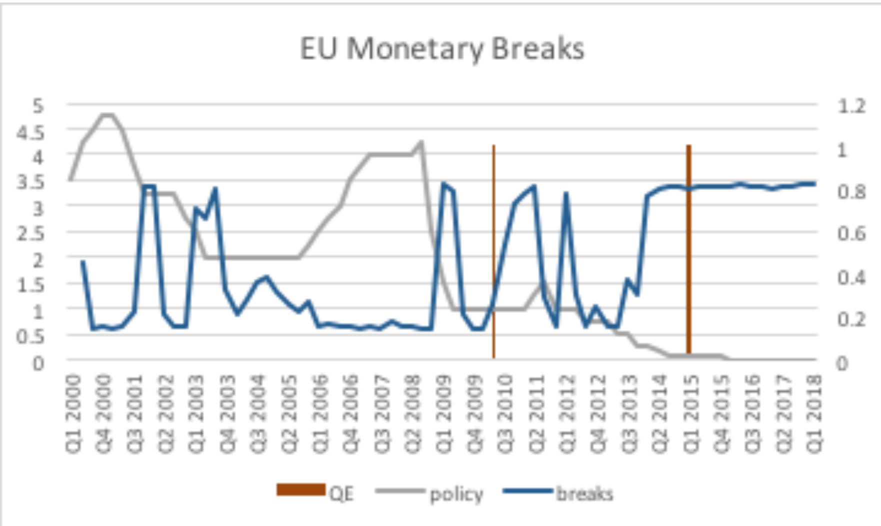

Figure 2: EU Monetary breaks and policy rates

UK

Plotted on Figure 3 are the results of the Markov-switching model and the policy rates. The Markov-switching model indicates that the switch in regime actually occurred after the first two QE announcements. The first clear quarter of the high state is Q3 2010, which has served as the break point for the switch in regime.

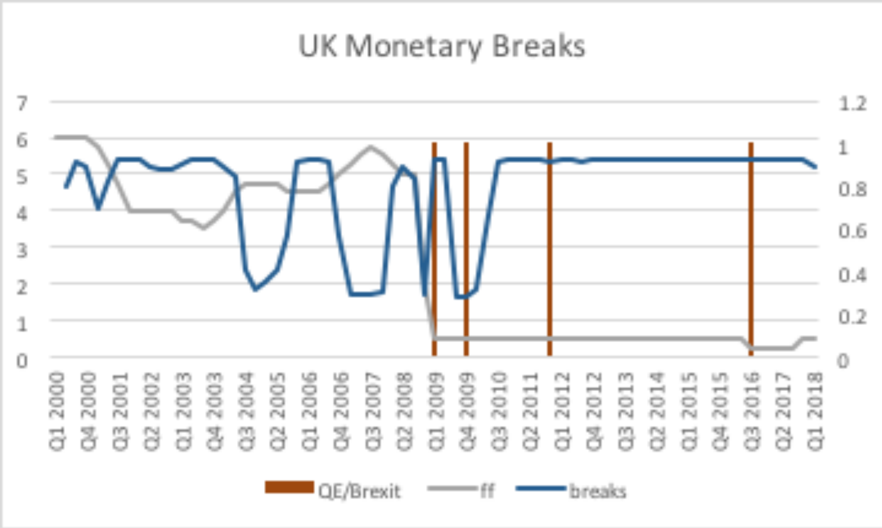

Figure 3: UK Monetary breaks and policy rates

Japan

The particularity of the monetary policy in Japan is that the quantitative easing program has started before the 2008 crisis. Therefore, the monetary policies after and before 2008 are similar. In Japan, the monetary break as found by the Markov-switching regime happens in 2008 Q3. However, Figure 4 below reports that the policy rate had reached zero before the 2008 crisis. The policy rate increased up to 0.5 for a short period before diving and even reach a negative value at -0.1.

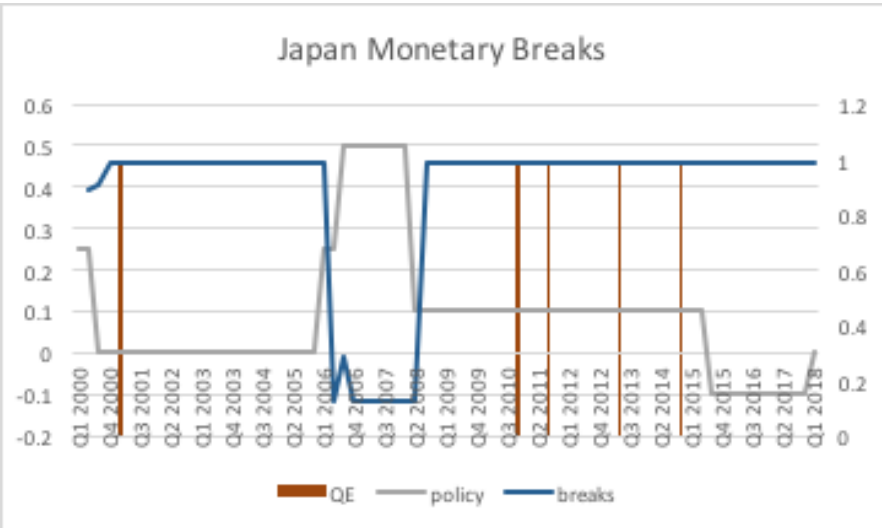

Figure 4: Japan Monetary breaks and policy rates

Switzerland

Switzerland has been in a different situation as the markets mentioned above as its main concern was the overvaluation of the Swiss Franc. Switzerland did not experience any quantitative easing program, instead, the extraordinary measure taken was to introduce a fixed exchange rate to the Euro between September of 2011 and January of 2015.

For Switzerland the break in monetary policy regime as computed by the Markov-switching regime happened in Q2 of 2011, shortly before the fixed exchange rate to the Euro was introduced. These results are logical as the fixed exchange rate with the Euro was the only unconventional, at least for Switzerland, monetary policy used, together with the introduction of negative policy rates, which happened during the fixed exchange rate period, represented by the second column on the graph on Figure 5 below.

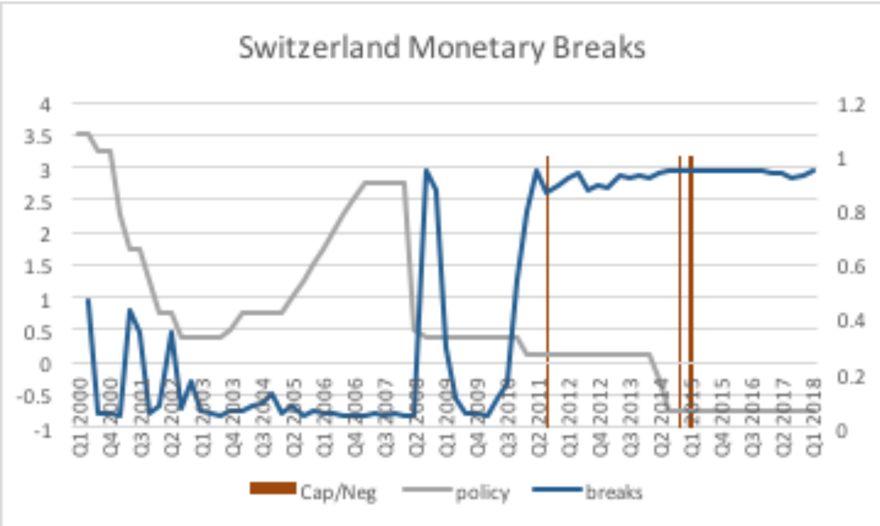

Figure 5: Switzerland monetary breaks and policy rates

Australia

As opposed to the markets that are reported on above, Australia has a role of a counterfactual in this paper. Australia has not experienced in the past 20 years the same sort of unconventional monetary policies as the above-mentioned markets. As reported on Figure 6 below, Australia has also entered into a new monetary policy regime following the financial crisis. No key date has been plotted as Australia did not experience any extraordinary monetary policy.

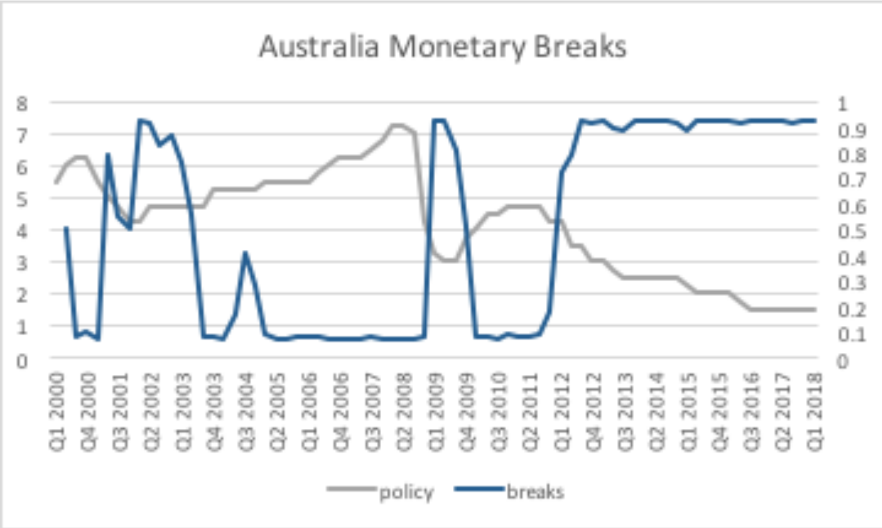

Figure 6: Australia monetary breaks and policy rates

Brazil

The last country to be investigated is Brazil. Just as Australia, Brazil did not experience the same sort of unconventional monetary policies, instead it will serve for investigating whether there also was a change in monetary policy regime in a country from an emerging market.

As seen on the graph reported on Figure 7 below, the results of the Markov-switching model are significantly different from the other markets. Where all the other markets experienced a high state for the last few years without interruption, Brazil saw a switch to a low state between 2015 and 2017. Overall, there seems to be no particular trend in the monetary policy regime. Plotted together with the results of the Markov-switching model are some key dates during which political events happened, more information can be found in the Appendix.

Figure 7: Brazil monetary breaks and policy rates

Dynamic Betas

US

Figure 4 below reports the dynamic betas. On Figure 8, it seems that the betas have not been impacted significantly by the switch in monetary policy as indicated by the Markov model. However, a small upward trend for the Large Stocks, Small Stocks, and downward trend for the 10-year government bond indices can be noticed. These trends seem to have stated around 2016, which was a politically charged year that saw the beginning of the Trump presidency and Brexit.

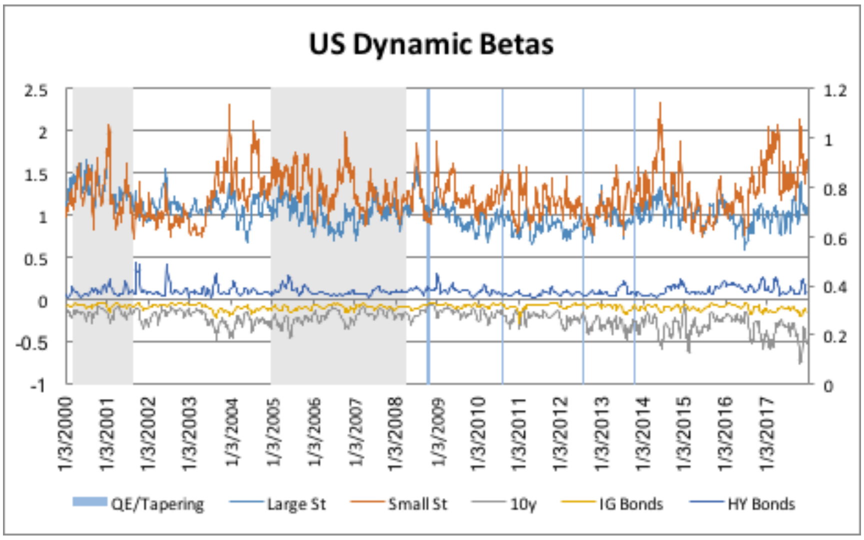

Figure 8: US dynamic betas, the grey area indicates the high policy rate state

EU

Figure 9 below reports the dynamic betas for the EU. As seen in graph of the standard deviations in the Appendix, the dynamic beta of the large stock index experienced an increase in value between 2001 and 2003. The dynamic beta of the small stock index appears to be more stable over time. Both stock indices also show an increase since 2016. The bond indices seem to have had very stable dynamic betas. Only the dynamic beta of the investment grade bond index appears to have fluctuated more, reporting a low dynamic beta in 2009, and a higher one at the end of the sample period.

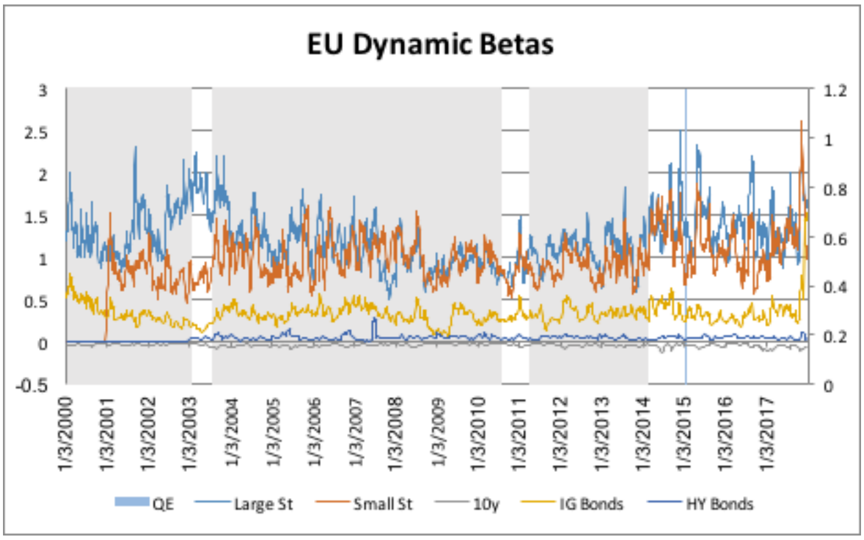

Figure 9: EU dynamic betas, the grey area indicates the high policy rate state

UK

Figure 10 reports the dynamic betas of the British indices. The dynamic betas are mostly stable over the sample period. The high yield bond index has an increase in dynamic beta around 2013, at the time the United Kingdom was going through the debate of the referendum for the Scottish independence held in 2014, but overall all the indices have little movement in their dynamic betas. Only as from 2016, the year of the Brexit vote, all the indices see an increase in the magnitude of the dynamic betas. The QE announcements do not seem to have an impact on the dynamic betas.

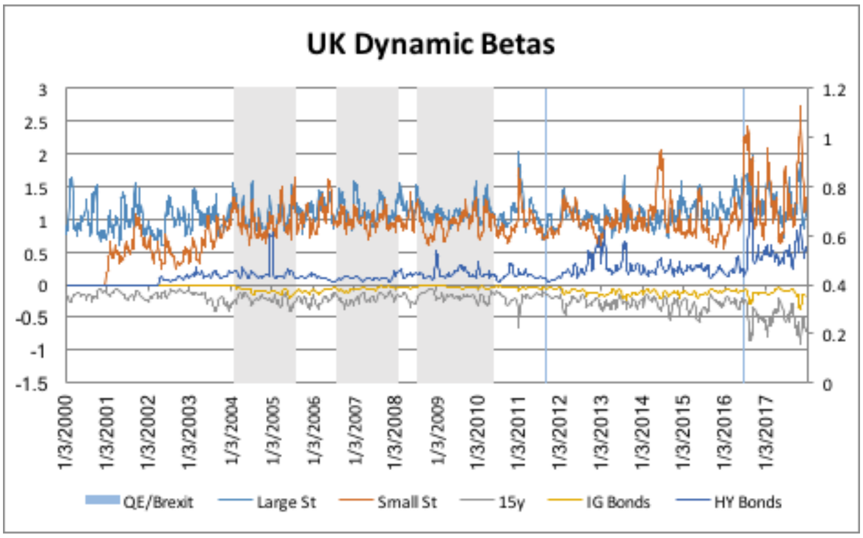

Figure 10: UK dynamic betas, the grey area indicates the high policy rate state

Japan

The dynamic betas for both stock indices appear to have a similar pattern. They seem to be impacted by the switch in regime. The beta of the large and small stock indices, which have an average dynamic beta of respectively 0.59 and 0.46 over the entire sample, both experience a peak at the regime switch, reaching values of 1.24 and 1.84 respectively. Both of the peak values were found statistically significantly different from their average values. Moreover, they became more volatile toward the beginning of 2013, peaking closely after the second to last QE announcement. The corporate investment grade bond index also peaked at the same period. Only the government bond index seems to be completely unaffected as it experienced a very stable dynamic beta over the entire sample. The second to last QE announcement was an expansion of the BoJ's QE program that would increase the QE up to ¥70 trillion a year.

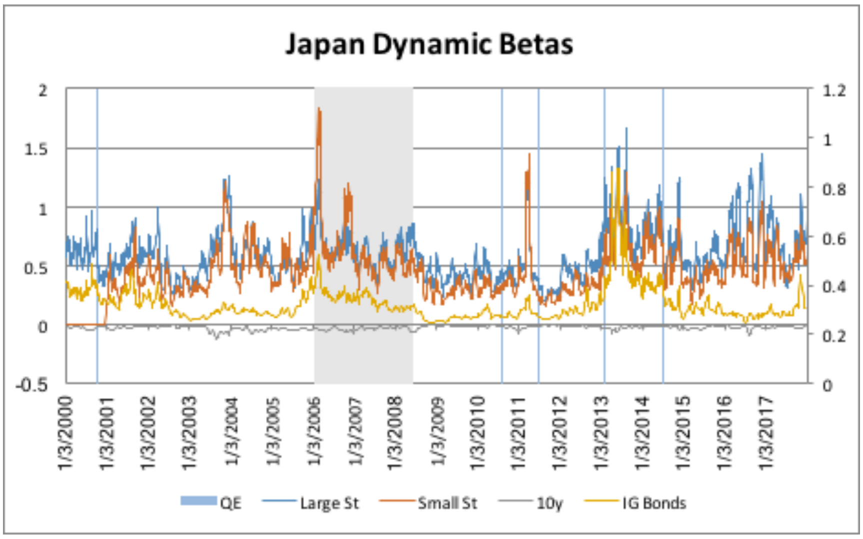

Figure 11: Japanese dynamic betas, the grey area indicates the high policy rate state

Switzerland

Plotted below on Figure 12 are the dynamic betas of all the indices for Switzerland. It can be seen that the dynamic betas for the stock indices appear to be relatively stable over the period of the sample, peaking at the lift of the fixed exchange rate, and moving upward as from mid-2016, where spike in the dynamic betas for all indices occurred, the other major spikes happened at the introduction and lift of the fixed exchange rate, confirming the results of the Markov-switching model, and designating the fixed exchange rate as the most important monetary policy in recent years in Switzerland.

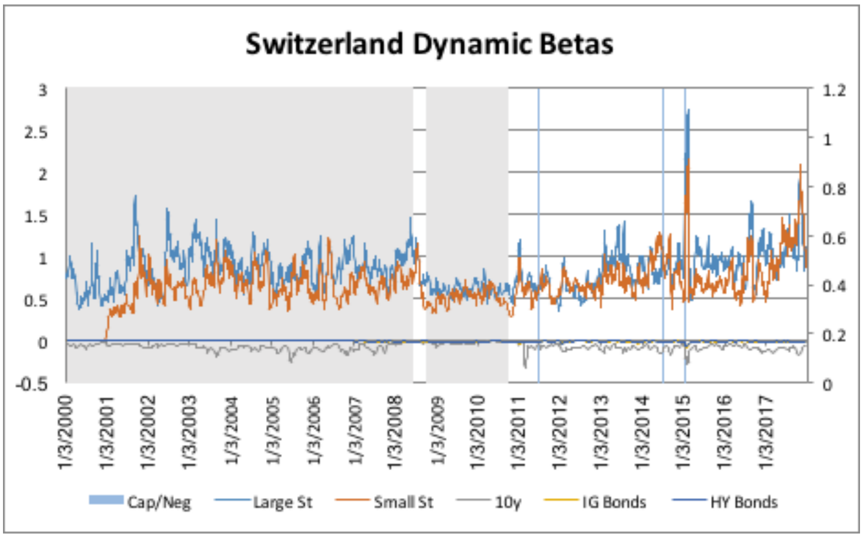

Figure 12: Swiss dynamic betas, the grey area indicates the high policy rate state

Figure 13 below reports the dynamic betas of the bond indices. On the graph it is possible to see that the dynamic betas of the government bond index appear to be affected by the regime switch. There is a large spike soon after the last regime switch and close to the introduction of the fixed exchange rate, and another at the end of the fixed exchange rate period. Corporate bond indices seem to have been mostly impacted by the lift of the fixed exchange rate.

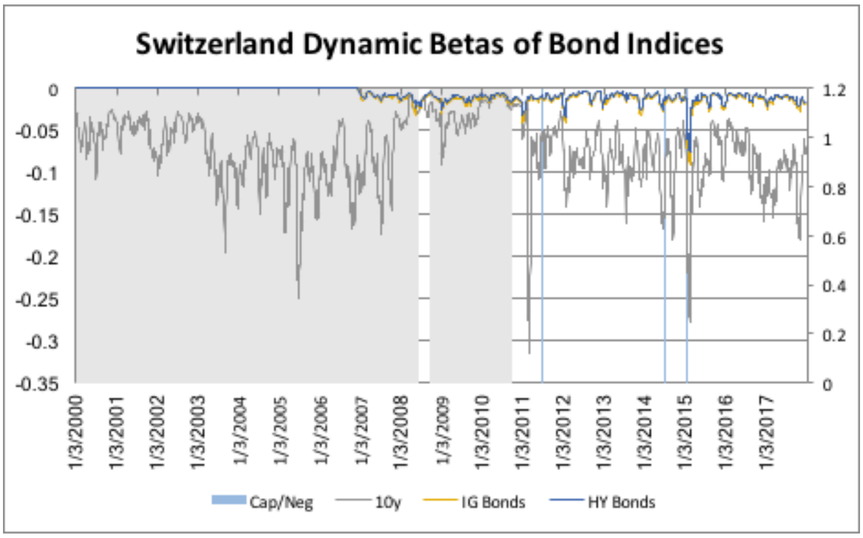

Figure 13: Swiss dynamic betas of corporate bonds, the grey area indicates the high policy rate state

Australia

As reported below, the dynamic betas of the Australian stock indices have seemed to increase over the period of the sample, apart from a slump around 2006. The dynamic betas of the bond indices have remained stable over the entire sample, showing little sign of any particular behaviour. However, it seems that once again, an increasing trend of the absolute values of the dynamic appears around 2016.

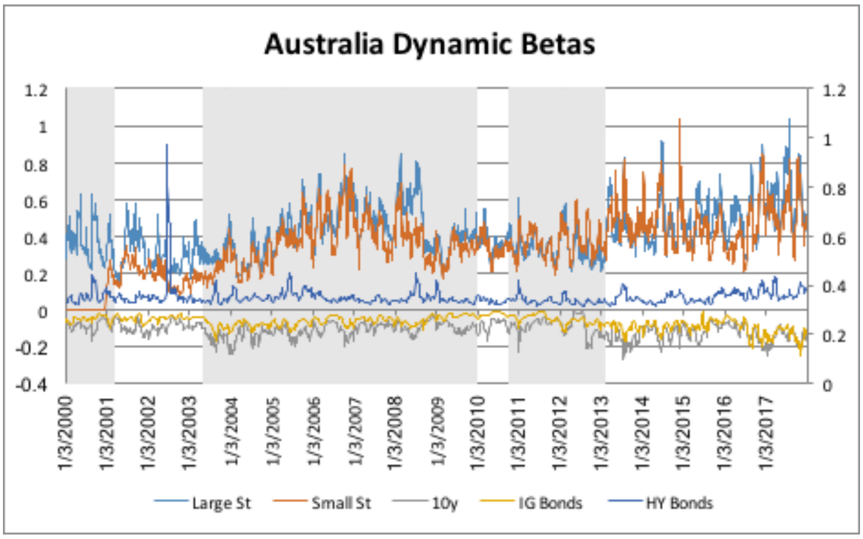

Figure 14: Australian dynamic betas, the grey area indicates the high policy rate state

Brazil

Plotted below on Figure 15 are the dynamic betas of the Brazilian indices. The first notable thing is that the average values seem to be higher than for the other markets. It also appears that there is a cyclical pattern for all the dynamic betas in the sample period, reaching a low point up until the beginning of the Dilma Rousseff presidency. Three spikes of the dynamic betas of the government bond yield stand out. The first one appears in 2002, the year where Luiz Inácio Lula da Silva gain momentum in the presidential run-up. The second spike happened in 2013, around the time of the of protest initiated by the Free Fare Movement that shook Brazil for a few months. The last one occurred at the end of 2017, happened at the time of developments regarding the "Car Wash" scandal. There is also a spike, especially for the large stock index, around the date of the Petrobras scandal. Finally, as for other markets, the dynamic betas seem to be on an upwards trend since 2016.

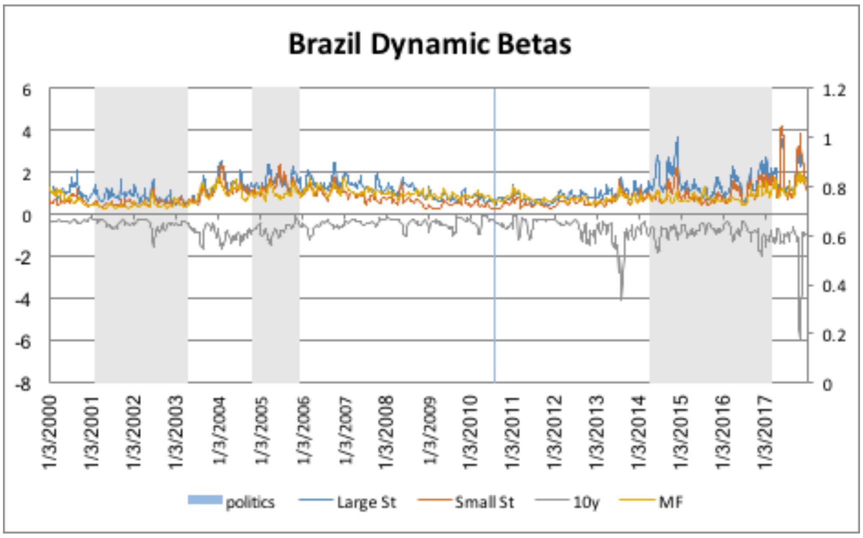

Figure 15: Brazilian dynamic betas, the grey area indicates the high policy rate state

ARCH-M Risk Premia

US

Figure 16 below reports the risk premia extracted by the ARCH-M model. On Figure 16, it seems that the risk premia is impacted more significantly by the change of monetary policy regime. In order to see if the if the impact of monetary policy shocks on risk has changed since the implementation of the so-called unconventional monetary policies. The risk premia can be negative as for the government and investment grade bond indices, for either tax reasons, reduced capital gain taxes makes holding long-term assets, such as bonds, reasonable (Bollerslev et al., 1988).

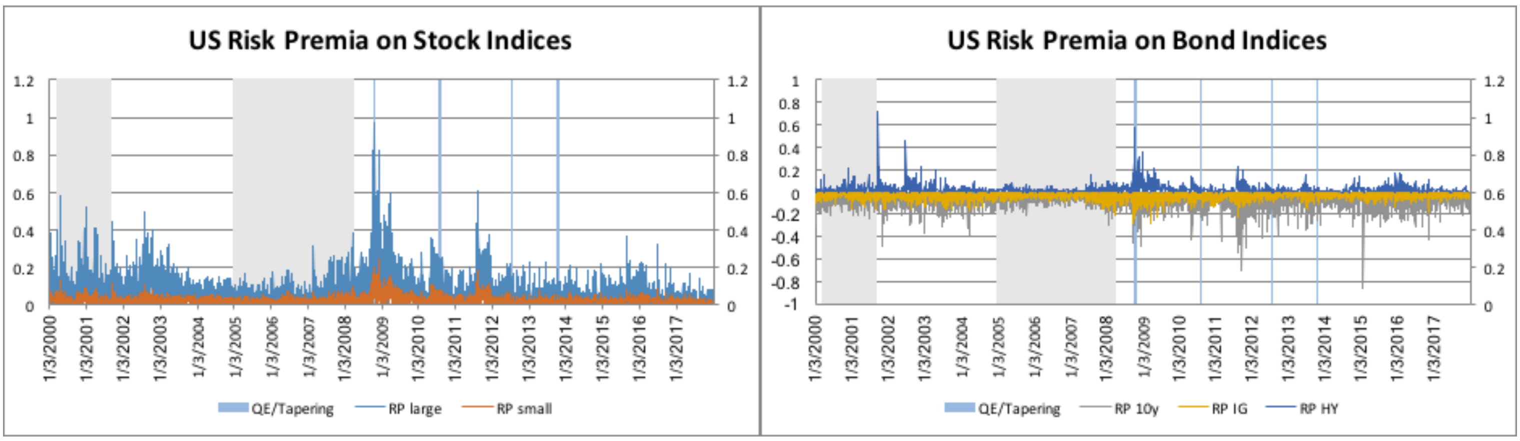

Figure 16: US risk premia, the grey area indicates the high policy rate state

EU

Plotted below on Figure 17 are the risk premia of the European indices. It can be seen that for the large stock index, there are three main periods with an increase in the risk premia. The first one is at the beginning of the sample over the 2002-2003 period. The second one happened at the end of 2008, and was probably caused by the financial crisis. The third and last spike occurred at the end of 2011. Although Germany was not directly hit by the sovereign debt crisis, it appears the large stock index was affected. The small stock index appears to have a similar pattern, only with a much lower magnitude. On Figure 17, it is also possible to see that the risk premia on the European bond indices have a similar behaviour as the stock indices. However, it seems that the 2011 sovereign crisis was more impactful for the bond indices than the 2008 crisis while the opposite holds true for the stock indices. Moreover, there seems to be some greater volatility in the risk premia after the second QE announcement for the bond indices than for the stock indices.

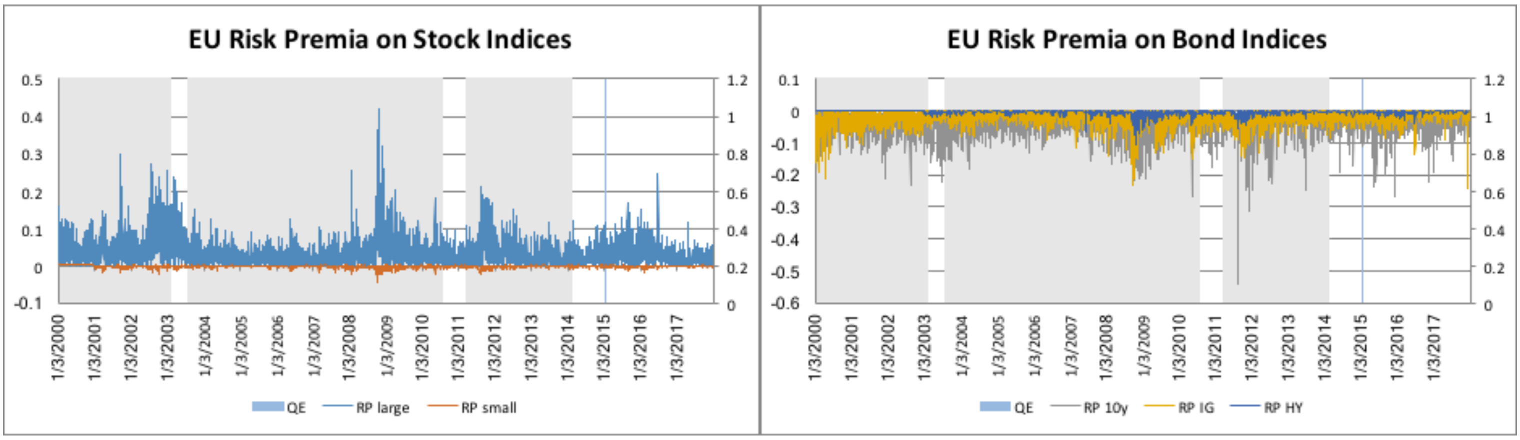

Figure 17: EU risk premia, the grey area indicates the high policy rate state

UK

Figure 18 below reports the risk premia on the British indices. For technical reasons, the risk premium of the large stock index is not visible on the graph, thus it was plotted alone on a graph displayed in the Appendix. However, both the large and small stock indices have similar risk premium behaviours. Both of them show negative risk premia, which can be a sign that their returns have a negative correlation to increases in long-term rates over short-term rates (Chen et al., 1986). Figure 19 shows that the risk premia of the stock indices experienced spikes in 2008, at the third QE announcements, while the largest one occurred on the date of the Brexit vote. The risk premium on the small stock index reaches a value of -0.45, down from the

-0.021 average value. The peak value was found significantly different from the average value. Figure 18 below also shows the risk premia of the British bond indices. As for the graph with the stock indices, the risk premium on the 15-year government bond index is plotted separately and displayed in the Appendix. As the behaviour of the government bond index is similar to the behaviour of the risk premium of the high yield bond index, the graph is displayed only in the Appendix. Just like the stock indices, the bond indices see their risk premia mostly affected by the 2008 financial crisis and the Brexit vote. The investment grade bond index also seems to have been impacted by the third QE announcement. The average risk premium value for this index appears to have increased significantly after the announcement was made.

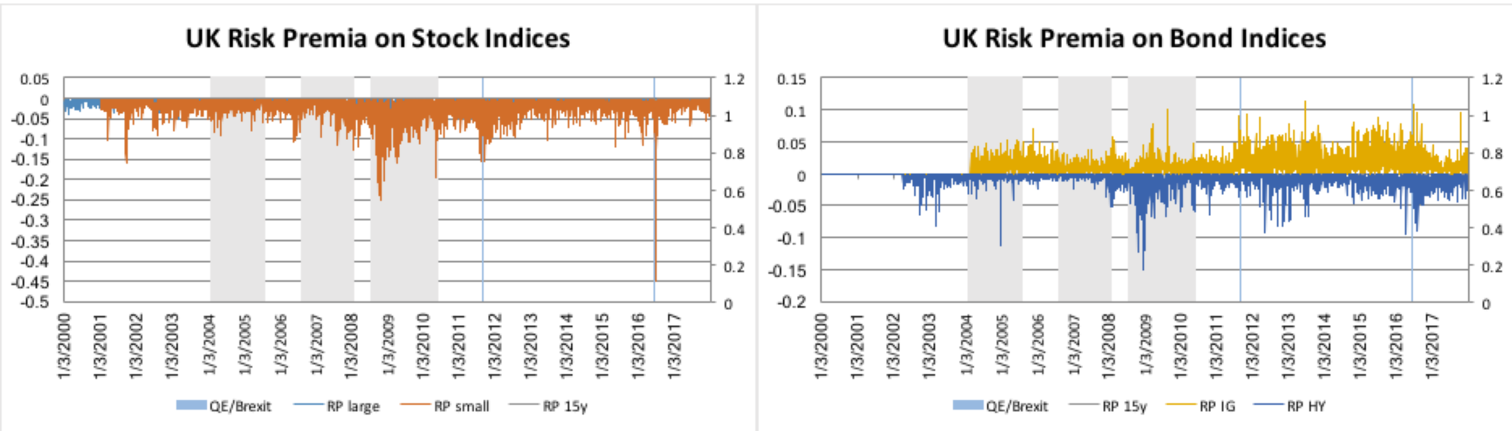

Figure 18: UK risk premia, the grey area indicates the high policy rate state

Japan

Figure 19 reports the risk premia retrieved by the ARCH-M(1) model. For the stock indices, there appear to be spikes around some of the QE announcement dates as well as the following quarters after the regime switch. For the corporate investment grade bond index, the risk premium experienced a significant spike after the second to last QE announcement, whereas the government bond index seems to have had virtually no risk premium over the entire sample.

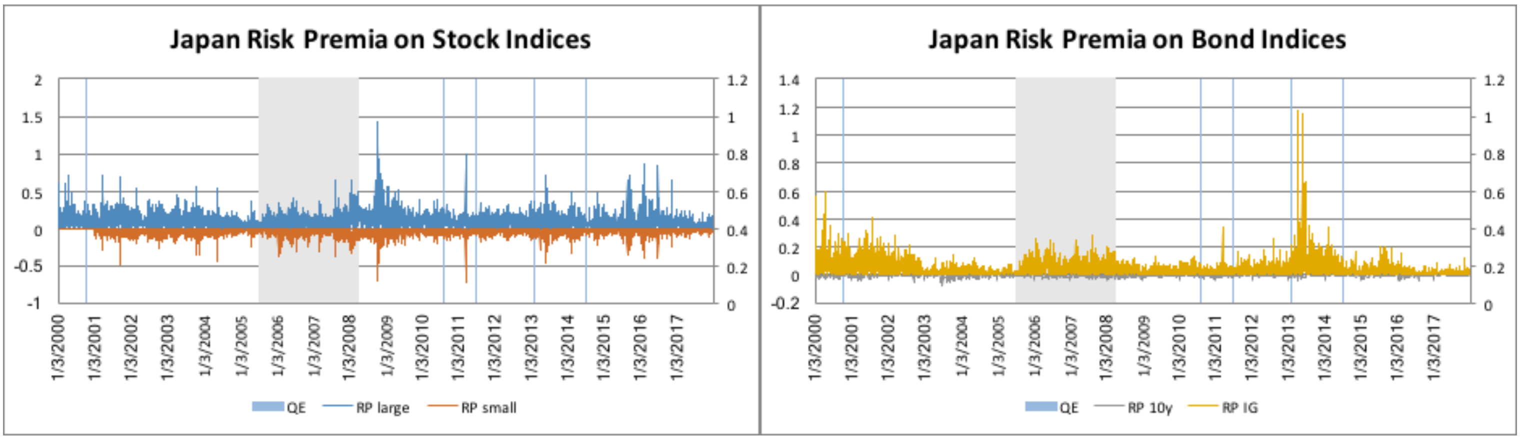

Figure 19: Japan risk premia, the grey area indicates the high policy rate state

Switzerland

For the following graph, a shorter sample has been used. Plotted below on Figure 20 are both the risk premia of the stock and bond indices. The two graphs show a very similar patter, only the magnitude seems to differ, the risk premium on the large stock index being around twice as high as for the corporate bond indices. Two major movements appeared, once at the end of 2008, probably caused by the financial crisis, and one in 2011 after the introduction of the fixed exchange rate. The risk premium on the small stock index is reported to be virtually inexistent, the ARCH-M coefficient being found statistically insignificant could be an explanation for these results.

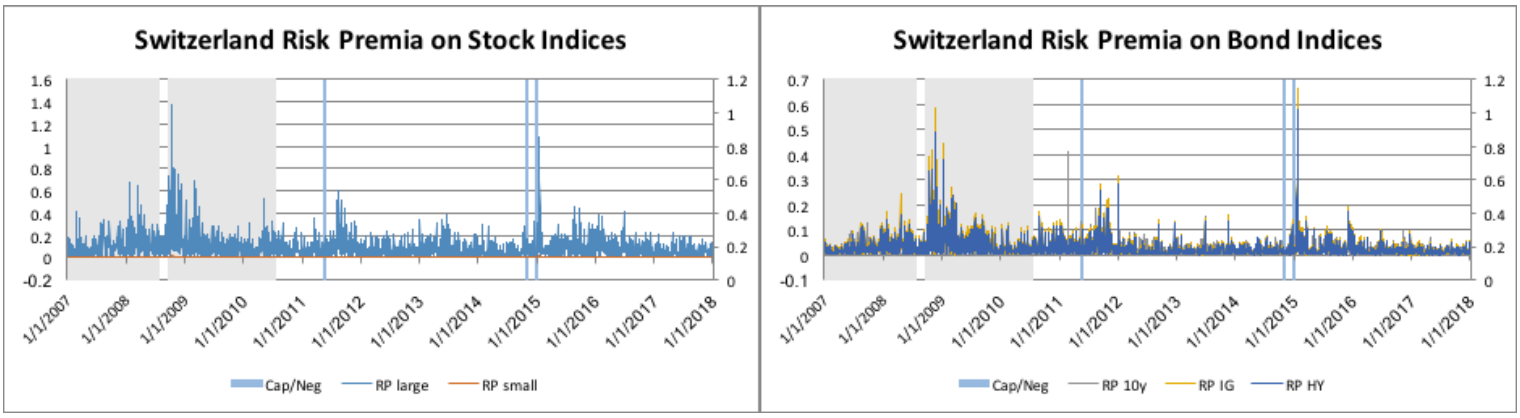

Figure 20: Switzerland risk premia, the grey area indicates the high policy rate state

The risk premium of the government bond index was plotted separately as it appears to have a different behaviour from the other indices. The graph below reports that the introduction of the fixed exchange rate triggered a long lasting impact on the risk premium up until the end of the sample.

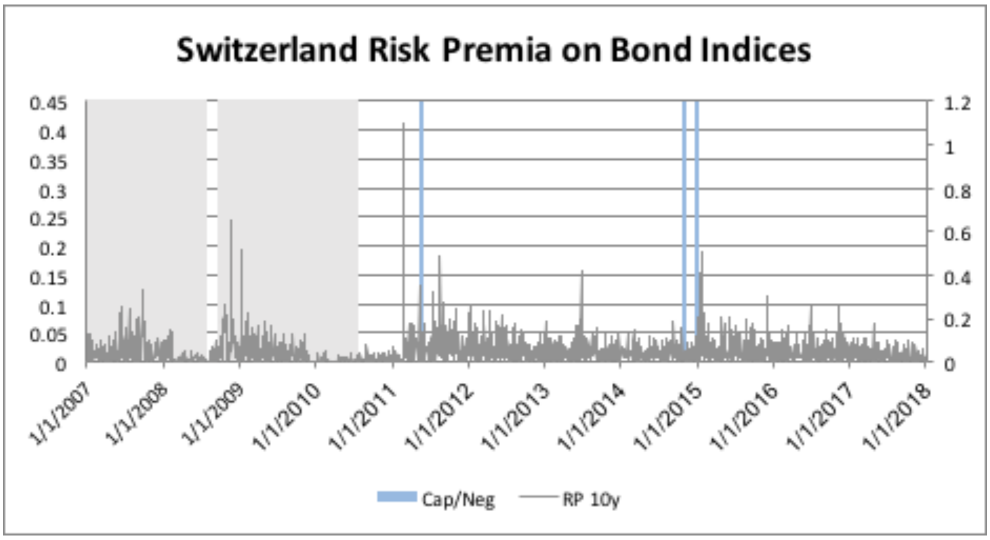

Figure 21: Switzerland Government Bond Index risk premium, the grey area indicates the high policy rate state

Australia

The risk premia of the stock indices appear to be stable over the period over the sample. Only a spike around 2009 as seen on previous graphs seems to break that stable behaviour. The levels of the risk premia after the 2008 financial crisis seem to revert back to the pre-crisis levels. Figure 22 below seems to report that the risk premia of the bond indices appear to be impacted by the change in regime. It seems that the spike around 2009 is followed by a short period of low risk premia, up until the switch in regime, when the risk premia rose back to higher levels. The high yield corporate bond index reports a very low risk premium compared to the other bond indices.

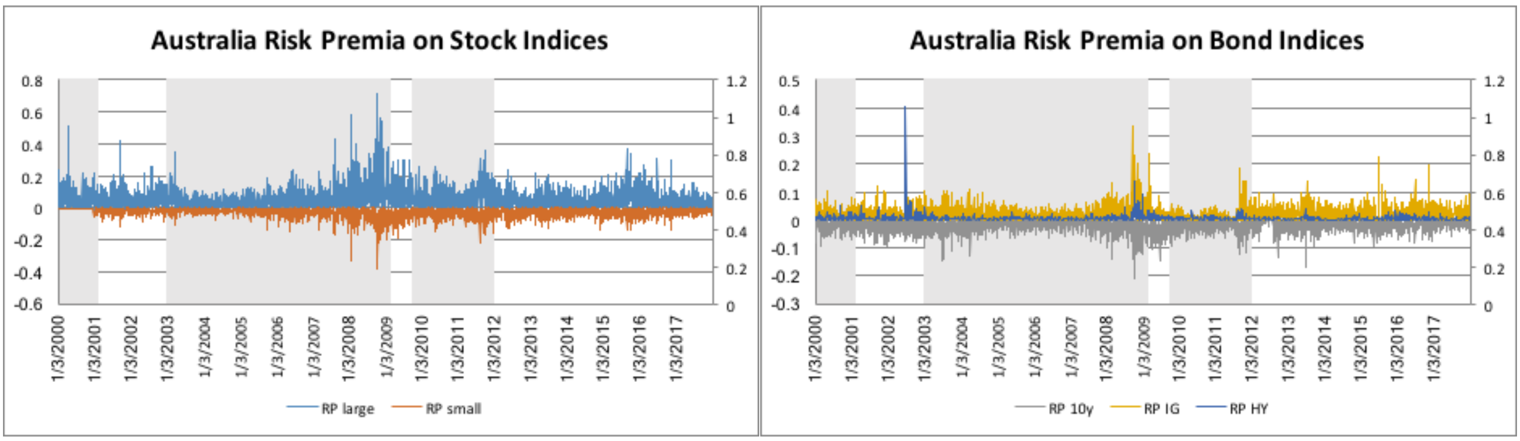

Figure 22: Australia risk premia, the grey area indicates the high policy rate state

Brazil

Figure 23 below reports the risk premia of the Brazilian stock and bond indices. At a first glance, there does not seems to be any impact of regime switches on the risk premia of the stock indices. Only a spike stands out at the end of 2008. At the time of the two last political events plotted on the graph, the Petrobras scandal and the impeachment of Dilma Rousseff, two other smaller spikes occurred, more so for the large stock index. Apart from the 2008 spike not much can be said about the risk premium of the mutual fund, which was to be expect as its constituents are not exclusively Brazilian securities. For the government bond index, the same pattern as the standard deviation can be observed with the same spikes in 2002, 2008, and 2013.

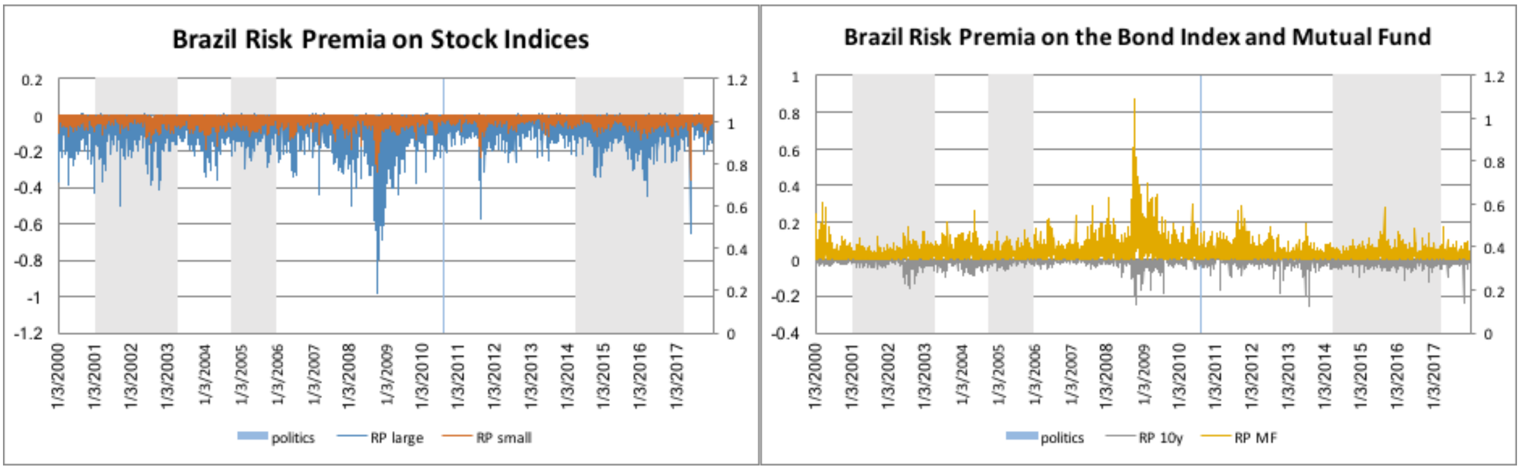

Figure 23: Brazilian risk premia, the grey area indicates the high policy rate state

Impulse Response Functions on the Risk Premia

US

The graphs below on Figure 24 report the results of the IRFs on the risk premia of the indices. Overall, the impact of the monetary policy shocks appears to be similar for both sample. In both cases, the shocks are mostly negative except for the investment grade corporate bonds.

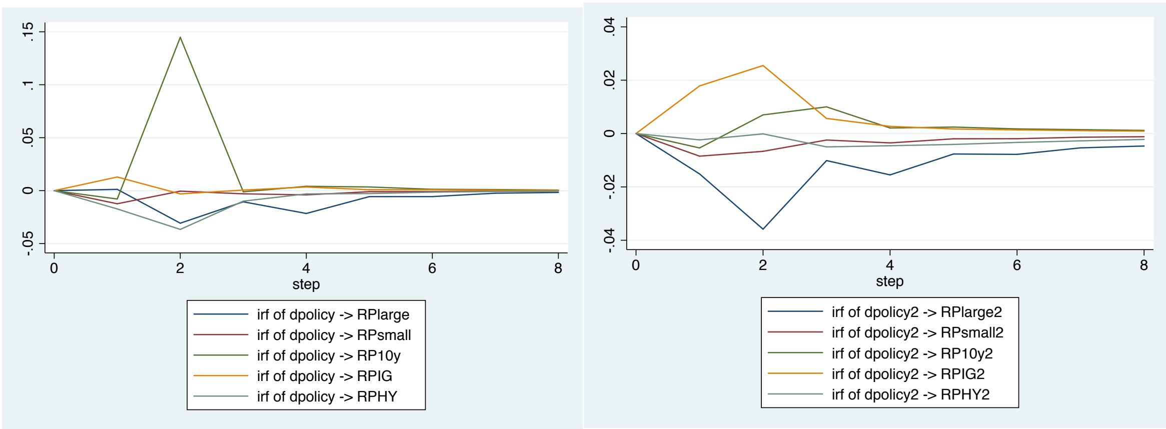

Figure 24: IRFs on the risk premia of all US indices

On both graphs, it can be seen that the shocks eventually return to zero, meaning that there is no permanent impact of monetary policy shocks on the risk premia. Based on the results reported on Figure 7, it seems that there is no change in the impact of monetary policy shocks on the risk premia of bonds and stocks since the unconventional monetary policies have been implemented.

EU

On Figure 25 below, the IRFs on the risk premia for all the European indices are plotted. Both the large and small stock indices seem to show no significant difference between the two samples. The government bond index seems to be the most affected by the change in monetary policy regime. On the first sample period, the results of the IRF shows a positive response, the largest in magnitude for all indices. On the second sample period, is shows a strong negative response. The investment grade bond index also seems to have inverted its IRF between the two sample periods. The high yield bond index seems to be unaffected in the change of monetary policy regime.

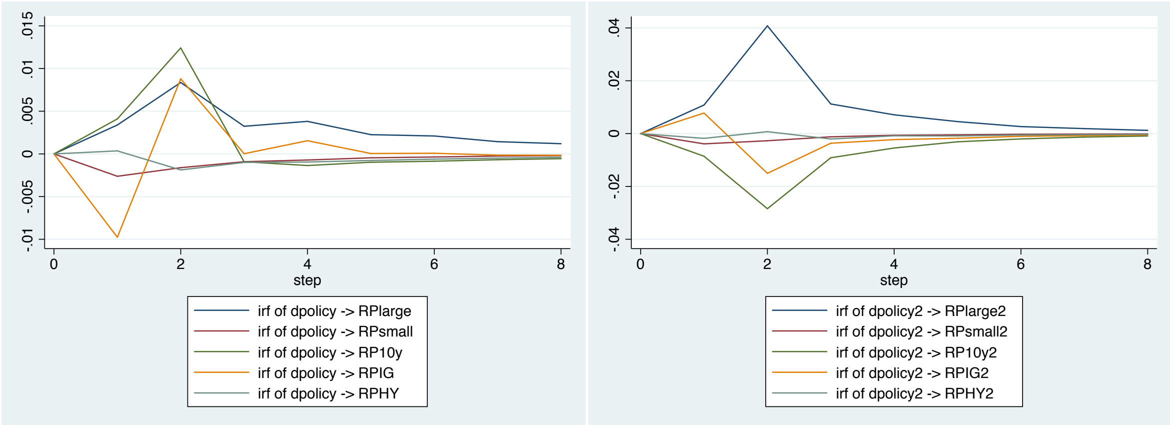

Figure 25: IRFs on the risk premia of all EU indices

UK

Plotted on Figure 26 are the IRFs on the risk premia of the British indices. The first thing to be noticed is that the government bond does not seem to be affected at all by monetary policy shocks on both sample periods. The two corporate bond indices seem to be impacted by monetary policy shocks in a similar way in both sample periods. Only the high yield bond index changes its IRF, it being first negative, then positive in the first sample period, and strictly negative in the second. The stock indices have inverted their IRFs in the two sample periods. The difference in the overall magnitude of the IRFs between both sample periods also seems to be relevant.

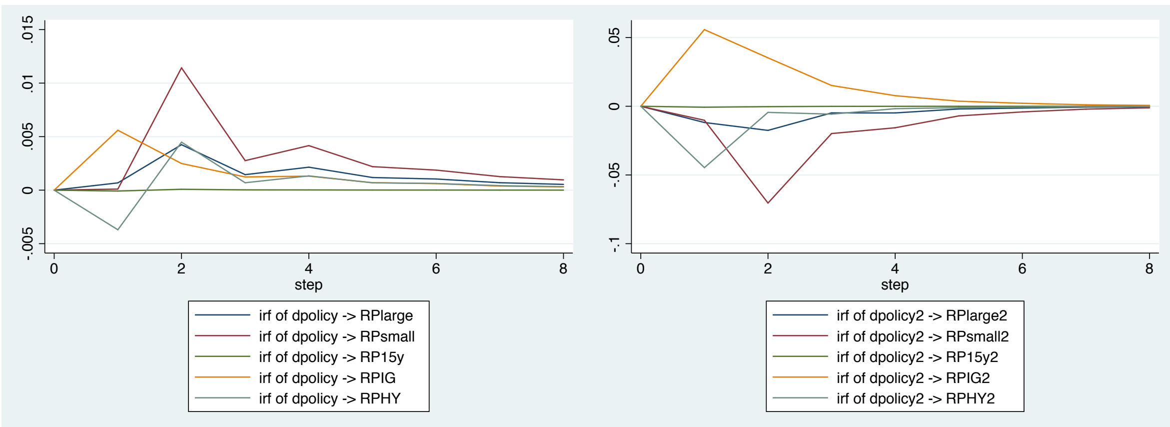

Figure 26: IRFs on the risk premia of all British indices

Japan

Figure 27 below report the IRFs on the two samples for all the indices. Overall, it seems that there is no significant difference between the two samples as no distinctive behaviour can be observed for both samples. However, a slower mean-reverting process on the second sample can be observed. As for the other graphs, the government bond index appears to be almost unaffected by the monetary policy shocks.

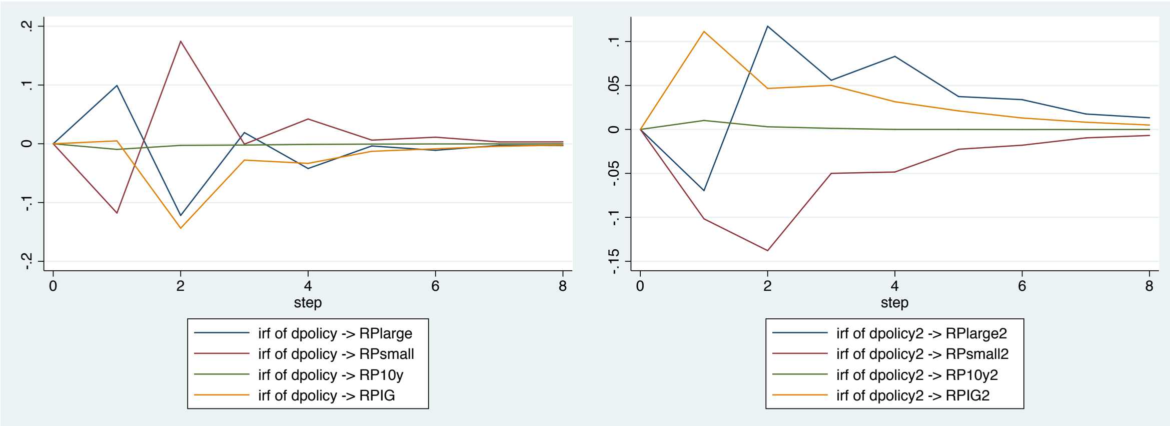

Figure 27: IRFs on the risk premia of all Japanese indices

Switzerland

The two graphs plotted on Figure 28 below reports the IRFs on the risk premia of the Swiss indices. It has to be remembered that the IRFs have been performed on the shorter sample. It appears that the impact of monetary policy shocks has been inverted since the switch in monetary policy regime for the large stock index, which is the index with both the largest IRFs and the most significant change. The impact on corporate bond indices has also moderately changed. Only the government bond index seems to be unaffected by the switch in monetary policy regime. The small stock index is also unaffected, however, the coefficient of the ARCH-M model was found statistically insignificant.

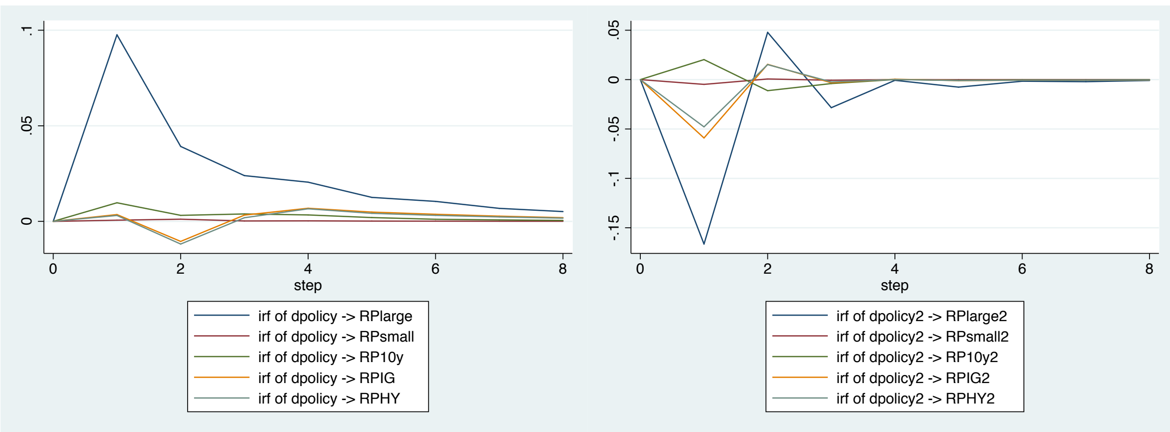

Figure 28: IRFs on the risk premia of all Swiss indices

Australia

As seen of Figure 29 below, it seems that there is no particular pattern on the impact of the monetary policy shocks over the risk premia for both sample. It should be noted that the magnitude of the IRFs is much lower that for the other markets. The shocks on the risk premia seem to revert back to zero after the same number of days.

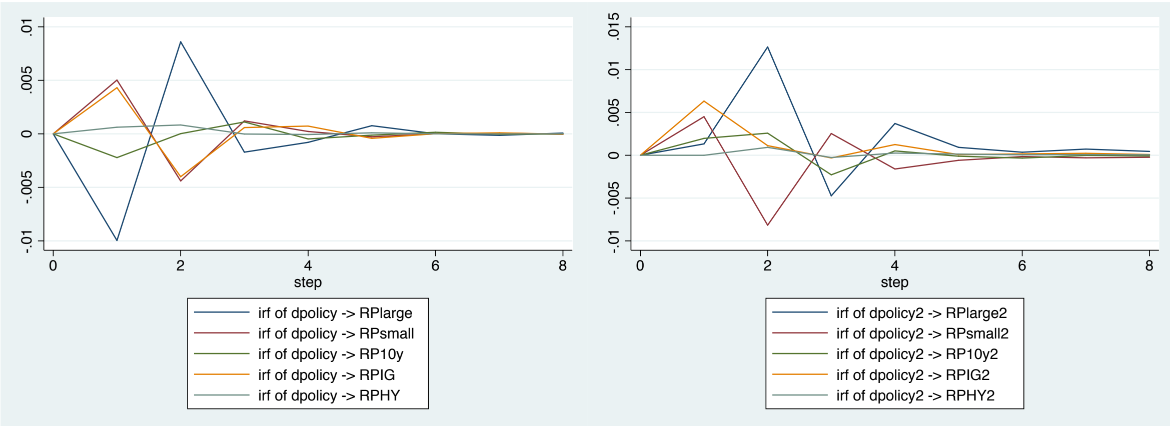

Figure 29: IRFs on the risk premia of all Australian indices

Brazil

Plotted below on Figure 30 are the IRFs on the Brazilian risk premia. The first notable characteristic of the two graphs is the relatively low magnitude of the IRFs. The stock indices report an opposite pattern, being positive in the first sample, then negative in the second. For the government bond yield, the IRF is virtually flat in the first sample, but shows some level of impact in the second. The risk premium of the mutual fund is left unchanged between the two sample periods.

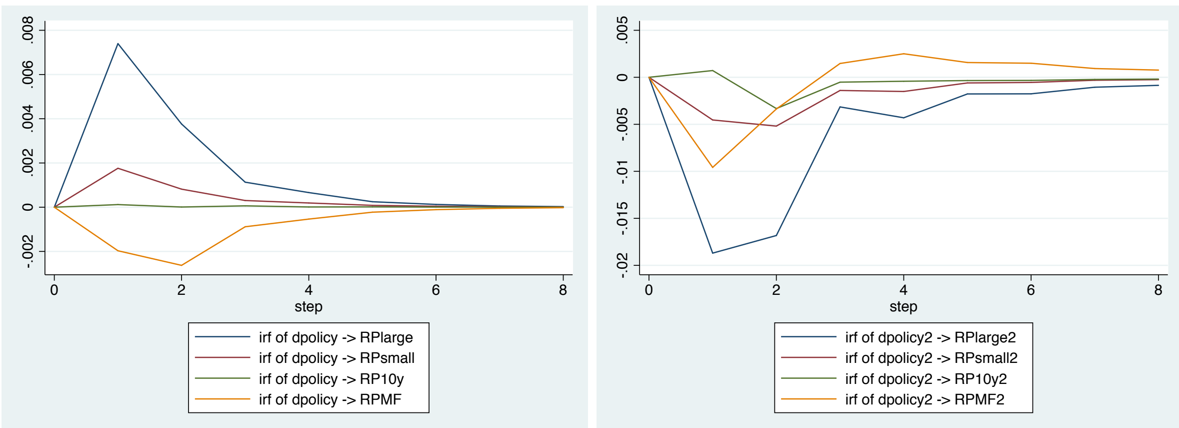

Figure 30: IRFs on the risk premia of all Brazilian indices

Impulse Response Functions on the Dynamic Betas

US

The same methodology as for the risk premia was performed on the dynamic betas. As reported on Figure 31 below, the results show a significant change in the impact of the monetary policy shocks. The shocks on the first part of the sample show no clear trend, whereas the shocks on second part of the sample have a clear positive impact. Only the dynamic betas of the high yield corporate bond index are impacted negatively, however, the results show that the IRF are extremely close to zero.

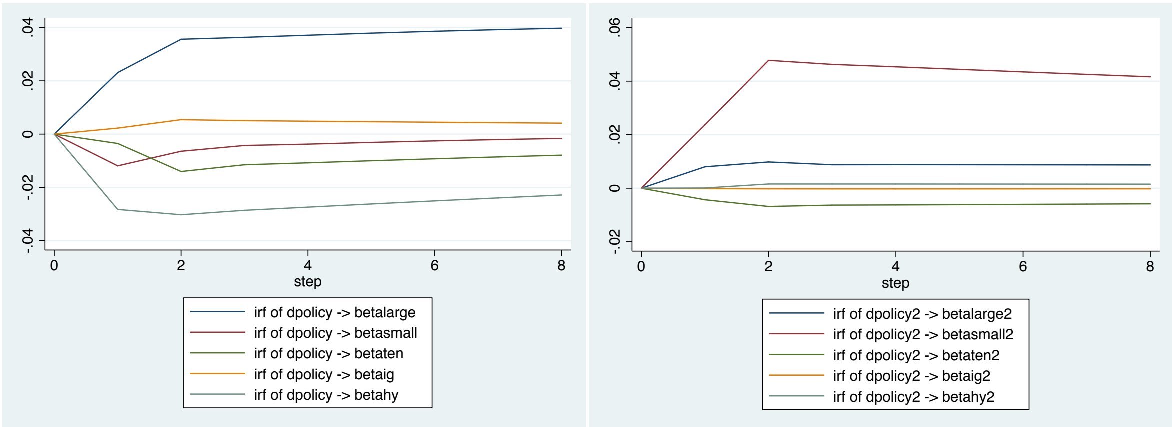

Figure 31: IRFs on the dynamic betas of all US indices

As seen on Figure 8, it seems that the new regime put in place with the unconventional monetary policies have systematically changed the impact of monetary policy shocks on risk in the US as measure by the dynamic betas.

EU

The results of the IRFs on the dynamic betas for the European indices are plotted on Figure 32 below. Figure 32 reports interesting results as all the indices seem to be affected in the same way by monetary policy shocks for both sample periods. Only the investment grade bond index reports a significant difference between the two sample periods. In the first sample period, the dynamic beta of the investment grade bond index shows a positive response, while in the second sample period, it shows a strong negative response.

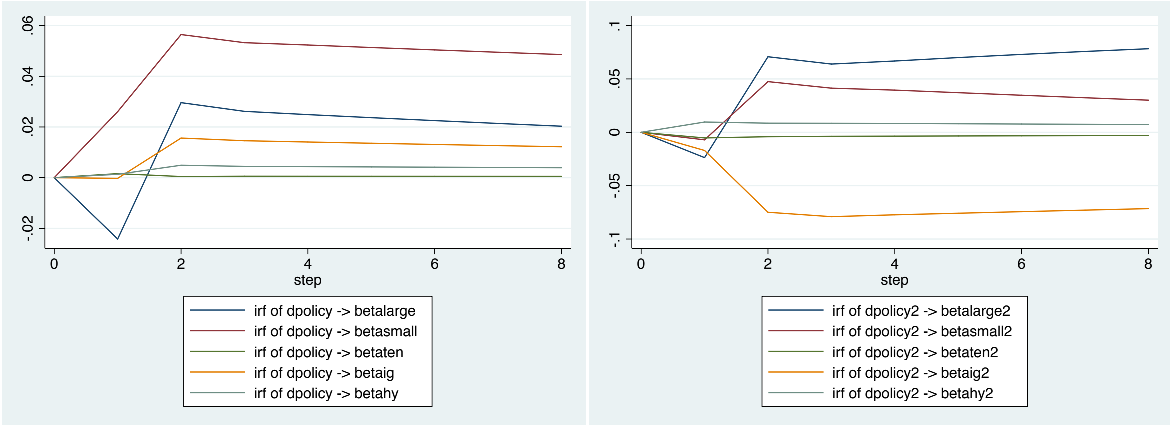

Figure 32: IRFs on the dynamic betas of all EU indices

UK

Figure 33 below reports the IRFs on the dynamic betas of the British indices. The stock indices appeared to have inverted the impact of monetary policy shocks between sample periods, as they are found to be mostly negative in the first sample period, and clearly positive in the second. The bond indices also inverted their IRFs, the investment grade index appears to be first slightly negatively impacted, then slightly positively, whereas the high yield bond index has the opposite behaviour with a greater magnitude. The government bond index is first positively impacted in the first sample period, then negatively impacted, the magnitude is also greater in the second sample.

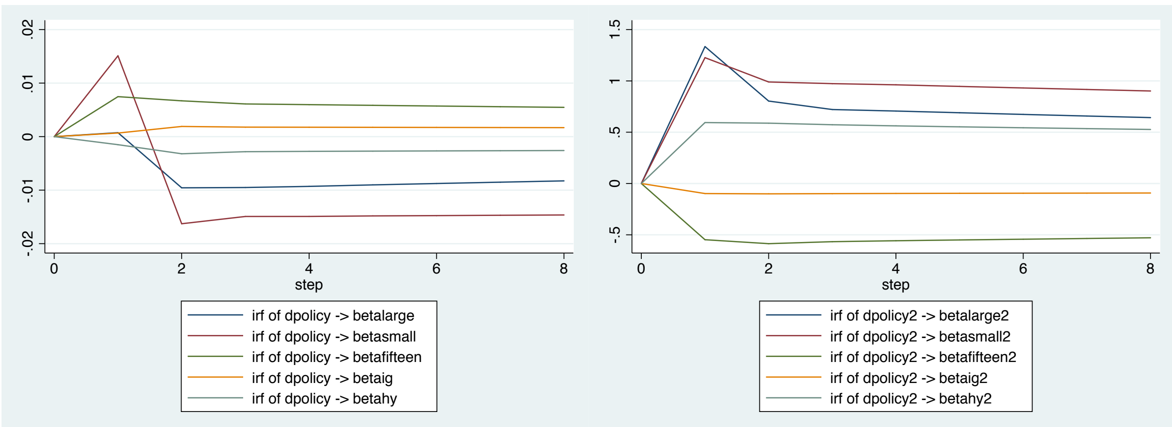

Figure 33: IRFs on the dynamic betas of all British indices

Japan

The IRFs on the dynamic betas report a clear shift in the behaviour of indices when experiencing a monetary policy shock. On Figure 34 below, it can be seen that all the indices, except for the government bond index, show the opposite pattern between the two samples. It appears that the switch in regime has inverted the impact of monetary policy shocks on the dynamic betas. Moreover, it seems that the magnitude of the shocks as decreased significantly for the second sample.

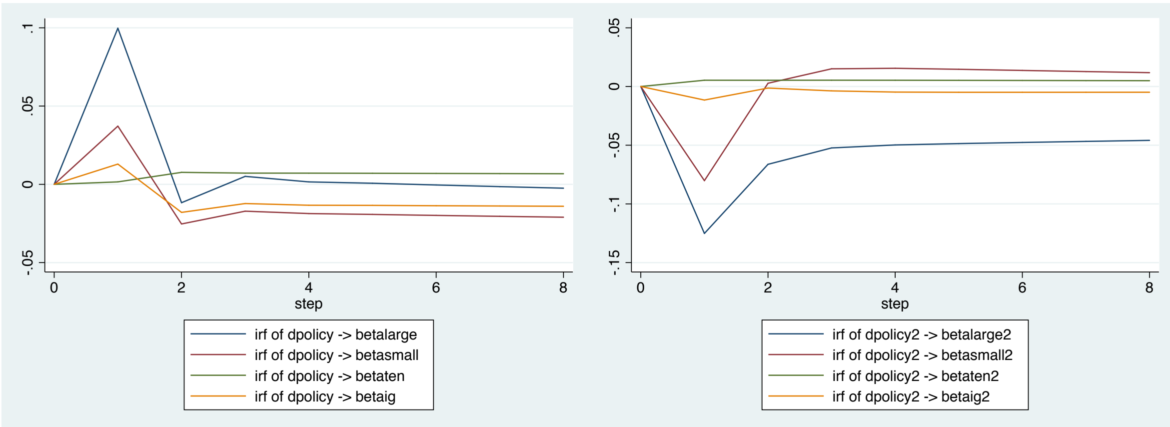

Figure 34: IRFs on the dynamic betas of all Japanese indices

Switzerland

Figure 35 reports below the impact of monetary policy shocks on the dynamic betas of the Swiss indices. As for the risk premia, the government bond index seems unaffected by the regime switch, the corporate bond indices also show little to no change between the two sample. The large stock index is the most affected, changing direction and indicating a long lasting impact. The small stock index appears to be unaffected in the first sample, but reports a similar IRF to the large stock index in the second sample.

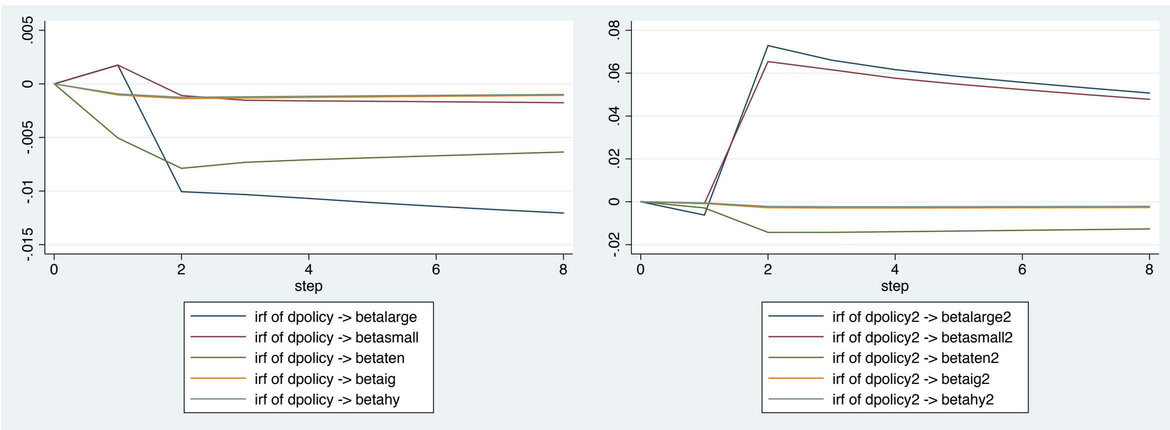

Figure 35: IRFs on the dynamic betas of all Swiss indices

Australia

The IRFs on the dynamic betas appear to show an inverted pattern as for Japan. In the first sample, the stock indices are impacted positively while the bond indices are impacted negatively. In the second sample, in appears to be the opposite, the stock indices being impacted positively whereas the bond indices, apart from the government bond index, seem to have been impacted positively.

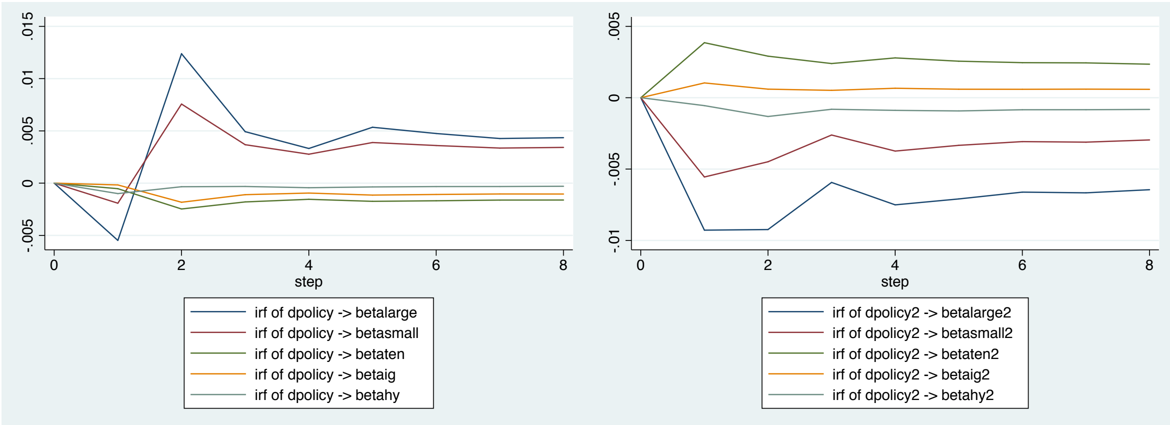

Figure 36: IRFs on the dynamic betas of all Australian indices

These results on Australia are interesting as they seem to indicate that in spite of not having had an unconventional monetary policy program there still appears to be a switch in monetary policy regime.

Brazil

Figure 37 below report the IRFs on the Brazilian dynamic betas. On the left hand side graph, it can be seen that the dynamic betas, except for the mutual fund, are virtually unaffected by monetary policy shocks. However, on the second sample period, the graph show greater variations. The large stock index reports a relatively large positive impact, compared to a small negative impact in the first sample period. The IFR of the small stock index' dynamic beta shows a negative shock, while the government bond yield reports a positive shock. The mutual fund does not seem to show any significant difference betweent the two sample periods.

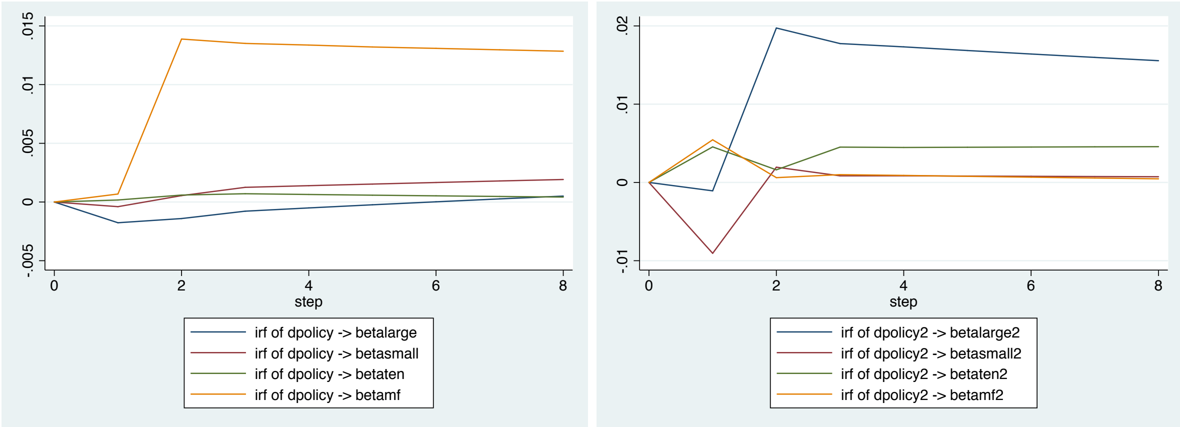

Figure 37: IRFs on the dynamic betas of all Brazilian indices

Variance Test Ratios

In order to see whether any difference in the magnitude of the IRFs of policy monetary shocks on risk can be observed on an aggregated level, variance test ratios have been performed on the results of the IRFs. The data was sorted by market and by type of risk measure, risk premium and beta. Figure 38 below reports the results of the variance test ratio. The column in the middle, Ratio=1, indicates whether the null hypothesis that the variances are equals for both sample periods can be rejected. The other ratio columns retrieve the one-sided p-values evaluating the hypotheses that the ratios are smaller or greater than one. The ratios are obtained by dividing the variances of the first sample period over the second.

It can be seen that the European markets – EU, UK, and Switzerland – all have p-values of zero, meaning that the variances of the IRFs have statistically changed since the implementation of the unconventional monetary policies. For the US, the change in the IRFs on the risk premia seems to have change significantly. However, the null hypothesis cannot be rejected for the dynamic betas. Japan, which had experience unconventional monetary policies in both sample period, reports a p-value below 5% for the beta, but not for the risk premia. The two markets that did not experience any sort of unconventional monetary policy – Brazil and Australia – reports higher p-values on average. Only the null hypothesis that the variances have not changed between the two sample periods of the Brazilian risk premia can be rejected.

		Ratios	Ratio < 1	Ratio = 1	Ratio > 1
Australia	Beta	0.9247	0.303	0.6059	0.697
Australia	Risk Premia	0.8811	0.2021	0.4042	0.7979
Brazil	Beta	0.7713	0.0646	0.1292	0.9354
Brazil	Risk Premia	0.3431	0	0	1
Switzerland	Beta	0.1364	0	0	1
Switzerland	Risk Premia	0.5592	0	0	1
EU	Beta	0.5548	0	0	1
EU	Risk Premia	0.3771	0	0	1
Japan	Beta	0.6723	0.0106	0.0213	0.9894
Japan	Risk Premia	1.0601	0.6341	0.7317	0.3659
UK	Beta	0.0133	0	0	1
UK	Risk Premia	0.1280	0	0	1
US	Beta	0.9223	0.2969	0.5939	0.7031
US	Risk Premia	2.7226	1	0	0
Average	Beta	0.1104	0.0964	0.1929	0.9036
Average	Risk Premia	0.8475	0.2623	0.1623	0.7377

Figure 38: Table of the P-values of the variance test ratio

These results as shown on Figure 38 are in line with the expectations of this paper. Markets in which the so-called unconventional monetary policies tend to have more significant changes in the variance of the monetary policy shocks on the risk measures than countries that did not implement unconventional monetary policies. More information can be found in the Appendix.

Limitations and Conclusion

In conclusion, it can be said that the unconventional monetary policies did have a real impact on the risk of stocks and bonds. The results of the variance test ratio indicate that markets where those unconventional monetary policies have been implemented tend to be more responsive to monetary policy shocks. The research question this paper tried to answer was the following:

Has the impact of monetary policy shocks on the risk of stocks and bonds changed since the introduction of the so-called unconventional monetary policies across markets?

The results found by this research state that the impact of monetary policy shocks on the risk premia and dynamic betas of stock and bond indices has changed indeed since the introduction of the unconventional monetary policies. Overall, the variances of the responses to the monetary policy shocks seem to have increase since the introduction of the unconventional monetary policies. This means that the indices are more sensitive to monetary policy shocks. In some cases, the response to the monetary policy shocks are inverted before and after the unconventional monetary policies. In some other the magnitude changes. This research also indicates that there might be a visible distinction between markets that experienced the unconventional monetary policies and those that did not. The IRFs on the dynamic betas also seem to have a distinctive shift between the two sample periods. It seems that the markets where unconventional monetary policies were introduced only in the second sample period – US, EU, UK, Switzerland – have more positive IRFs for the second than for the first sample period. These results indicate that the increase in risk induced by the monetary policy shocks has grown since the implementation of the unconventional monetary policies. This could be interpreted as a sign that the central banks are more scrutinised since then, thus the financial markets react with greater magnitude to monetary policy shocks. The impact of the monetary policy shocks seems to produce more risk for stocks and bonds.

There are however some limitations to this research. The Markov-switching model of some markets could perform better with more data, for the EU for example. The EU being relatively young, the available data is not long enough to allow for a three-state Markov-switching model which might be more appropriate than a two-state Markov-switching model. The EU is also a particular case in the sense that it is composed of different countries which are in different economic situation. Investigating the EU countries separately might lead to different results.

The data available for Brazil was also insufficient in this research. Researcher with better access to data on emerging markets could expand this paper by using more data coming from the emerging markets. A greater attention could also be given to the monetary policy shocks as described in the impulse response functions. This research only looks at the change in the policy rates without considering any other variable, more sophisticated formulas might be more accurate. Moreover, the impulse response functions treat increases and decreases in policy rates in the same way, asymmetric impulse response functions might be more appropriate. Impulse response functions over longer period could also shed a light on a longer-term impact of monetary policy shocks. Finally, one of the issues with the variance test ratios is that it is sensitive to the assumption of normality.

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Appendix

A1. Descriptive statistics of the US data. Q denotes quarterly data, D daily data.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Policy Q	74	1.82	2.05	0.07	6.54
GDP Q	74	14738.47	1376.50	12323.34	17385.83
CPI Q	74	90.90	11.58	72.76	108.90
Large Caps D	4,718	1787.94	724.37	828.17	4159.93
Small Caps D	4,718	2346.78	1180.06	813.76	5573.17
10y D	4,718	225.33	81.36	98.14	392.90
IG D	4,718	1787.81	561.26	883.91	2803.16
HY D	4,718	976.57	447.15	390.43	1867.27
World D	4,718	1326.93	313.27	688.64	2248.93
Policy D	4,718	1.76	2.01	0.13	6.50
3m D	4,718	1.59	1.86	-0.02	6.24

A2. Descriptive statistics of the EU data. Q denotes quarterly data, D daily data.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Policy Q	77	1.86	1.49	0.00	4.75
GDP YoY Q	77	1.43	1.93	-5.52	4.47
CPI Q	77	89.92	8.99	74.07	102.41
Large Caps D	4,718	885.57	318.92	288.50	1692.09
Small Caps D	4,459	165.95	95.05	43.50	481.40
7-10y D	4,718	190.91	57.25	103.72	299.03
IG D	4,718	164.09	27.67	117.58	215.93
HY D	3,936	114.51	10.92	67.85	125.53
World D	4,718	1326.93	313.27	688.64	2248.93
Policy D	4,718	1.85	1.49	0.00	4.75
3m D	4,718	1.88	1.73	-0.41	5.35

A3. Descriptive statistics of the UK data. Q denotes quarterly data, D daily data.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Policy Q	77	2.69	2.24	0.25	6.00
GDP YoY Q	77	1.92	1.90	-5.92	4.91
CPI Q	77	86.42	11.00	71.58	104.75
Large Caps D	4,718	778.08	201.80	373.55	1200.30
Small Caps D	4,459	233.05	106.71	68.03	490.10
15y D	4,718	2835.68	1076.45	1546.17	5658.36
IG D	3,633	118.28	16.16	96.06	153.84
HY D	4,126	4.68	1.55	1.56	8.14
World D	4,718	1326.93	313.27	688.64	2248.93

Policy D	4,718	2.60	2.20	0.25	6.00
3m D	4,718	3.56	1.43	0.52	6.00

A4. Descriptive statistics of the Japan data. Q denotes quarterly data, D daily data.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Policy Q	76	0.09	0.16	-0.10	0.50
GDP YoY Q	77	0.90	2.16	-8.69	5.48
CPI Q	77	98.00	1.45	95.80	101.20
Large Caps D	4,718	708.61	198.86	392.56	1230.10
Small Caps D	4,459	153.45	57.77	73.47	335.18
10y D	4,718	145.98	13.74	124.47	176.23
IG D	4,718	144.67	31.68	99.40	212.61
HY D (yield)	3,345	1.90	1.16	0.44	5.63
World D	4,718	1326.93	313.27	688.64	2248.93
Policy D	4,718	0.13	0.15	-0.10	0.50
3m D	4,718	0.10	0.21	-0.47	0.73

A5. Descriptive statistics of the Switzerland data. Q denotes quarterly data, D daily data.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Policy Q	77	0.74	1.24	-0.75	3.50
GDP YoY Q	76	1.83	1.67	-3.19	4.63
CPI Q	77	99.17	3.14	92.15	103.48
Large Caps D	4,718	815.40	230.29	363.34	1336.22
Small Caps D	4,459	178.52	83.59	50.29	452.20
10y D	4,718	170.23	47.05	96.55	255.38
IG D	2,894	97.29	3.61	90.03	102.55
HY D	2,894	96.19	3.57	88.95	101.01
World D	4,718	1326.93	313.27	688.64	2248.93
Policy D	4,718	0.80	1.22	-0.75	3.50
3m D	4,718	0.68	1.27	-2.59	3.63

A6. Descriptive statistics of the Australia data. Q denotes quarterly data, D daily data.

Variable	Obs	Mean	Std. Dev.	Min	Max
Policy Q	77	4.23	1.62	1.50	7.25
GDP YoY Q	77	2.99	0.97	1.13	5.18
CPI Q	77	91.17	13.44	67.80	112.60
Large Caps D	4,718	884.69	340.81	384.11	1605.97
Small Caps D	4,459	239.41	79.06	95.71	403.05
7-10y D	4,718	191.61	57.64	98.35	298.23
IG D	4,718	244.53	47.46	143.23	327.14

HY D	4,718	441.55	198.00	173.09	830.12
World D	4,718	1326.93	313.27	688.64	2248.93
Policy D	4,718	2.58	2.22	0.00	7.25
3m D	4,718	4.47	1.53	1.87	8.03

A7. Descriptive statistics of the Brazil data. Q denotes quarterly data, D daily data.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Policy Q	77	14.33	5.50	6.50	42.00
GDP Q	77	2.38	3.19	-5.48	9.10
CPI Q	77	2987.78	1007.85	1484.13	4942.72
Large Caps D	4,718	904.08	483.19	159.53	2065.93
Small Caps D	4,718	969.23	636.17	113.53	2450.20
10y D	4,718	7.35	4.45	2.24	30.78
Mutual Fund D	4,718	11.02	3.99	4.11	18.81
World D	4,718	1326.93	313.27	688.64	2248.93
Policy D	4,718	13.89	4.35	7.00	26.50
CDI D	4,718	13.74	4.36	6.84	26.32

A8. Key dates plotted together with the results of the Markov-switching model.

US: QE1 was announced in November 2008, QE2 in November 2010, QE3 in September 2012, and the Tapering was first announced in December 2013.

EU: QE announcements in May 2010 and January 2015.

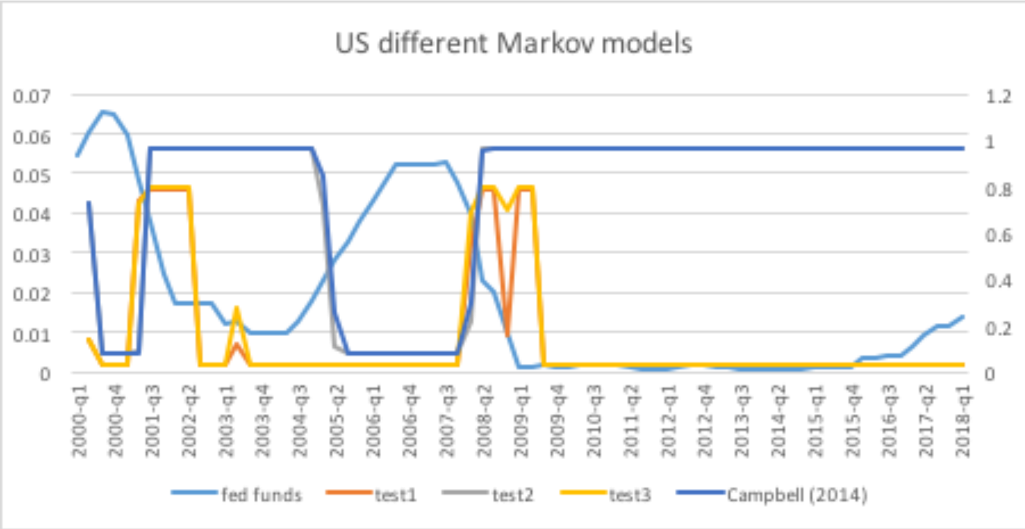
UK: QE announcements in March 2009, November 2009, October 2011, and Brexit in August 2016.

Japan: QE program announcements in March 2001, October 2010 August 2011 April 2013 October 2014.

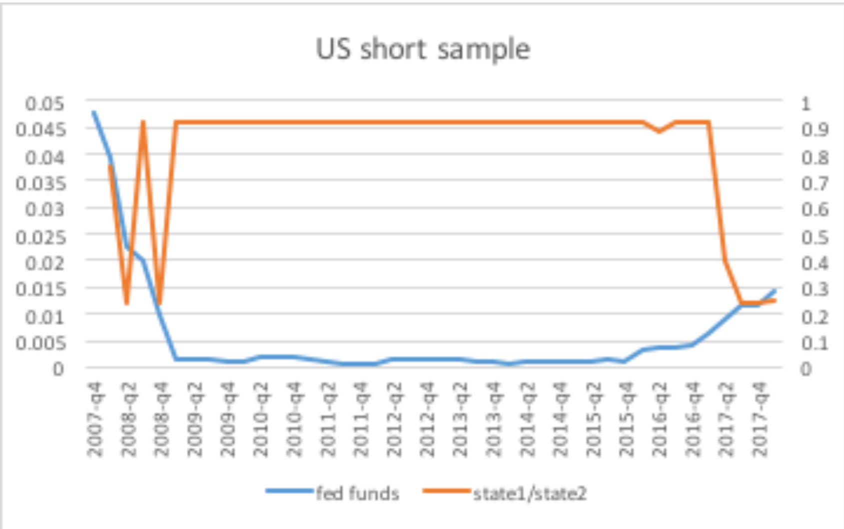
Switzerland: Beginning of the fixed exchange rate in September 2011, negative interest rate started in December 2014, end of the fixed exchange rate in January 2015.

Brazil: Lula da Silva elected in January 2003, Dilma Rousseff elected in October 2010, Petrobras scandal in March 2015, impeachment of Dilma Rousseff in August 2016

A9. Different US Markov-switching models. Test1 only uses the the lagged fed funds and the output gap, whereas Test2 only includes the lagged fed funds. Finally, Test3 includes both the lagged fed funds and the inflation.



A9. US Markov-switching model on the shorter sample (2007Q4 to 2018Q1).



A10. Stata output of the Markov-switching model for the US.

	Markov	Coefficients	Std. Err.	z	P>|z|	[95% Conf. Interval]	
policy	L1.	0.8098782	0.0246908	32.8	0	0.7614851	0.8582712
	output gap	0.1524555	0.0519592	2.93	0.003	0.0506173	0.2542937
	inflation	0.0166758	0.0308731	0.54	0.589	-0.0438343	0.0771859
State1	_cons	-0.0005035	0.0006469	-0.78	0.436	-0.0017714	0.0007644
State2	_cons	0.0095958	0.0013447	7.14	0	0.0069602	0.0122315
	sigma	0.0024872	0.0002116			0.0021052	0.0029385
	p11	0.9688465	0.0222776			0.8798025	0.9924886
	p21	0.0831154	0.0664967			0.0161275	0.3339148

A11. Stata output of the Markov-switching model for the EU.

	Markov	Coefficients	Std. Err.	z	P>|z|	[95% Conf. Interval]	
policy	L1.	0.8971511	0.0226885	39.54	0	0.8526825	0.9416197
	output gap	0.1155656	0.0137679	8.39	0	0.0885811	0.1425502
	inflation	-2.831644	3.48633	-0.81	0.417	-9.664725	4.001438
State1	_cons	-0.2124141	0.049174	-4.32	0	-0.3087934	-0.1160348
State2	_cons	0.2164959	0.074068	2.92	0.003	0.0713253	0.3616666
	sigma	0.18373	0.0210871			0.1467187	0.2300776
	p11	0.820824	0.0734372			0.6325738	0.9241843
	p21	0.1468171	0.067701			0.0563007	0.3317073

A12. Stata output of the Markov-switching model for the UK.

	Markov	Coefficients	Std. Err.	z	P>|z|	[95% Conf. Interval]	
policy	L1.	0.8956981	0.0310376	28.86	0	0.8348656	0.9565306
	output gap	0.1684011	0.0265088	6.35	0	0.1164447	0.2203575
	inflation	-2.367297	4.00565	-0.59	0.555	-10.21823	5.483633
State1	_cons	-0.2209455	0.1088686	-2.03	0.042	-0.434324	-0.0075669
State2	_cons	0.4216972	0.1414927	2.98	0.003	0.1443765	0.6990178
	sigma	0.2757079	0.0283498			0.2253844	0.3372675
	p11	0.9284668	0.0384			0.8069287	0.9757921
	p21	0.2640147	0.207135			0.0425122	0.7434755

A13. Stata output of the Markov-switching model for Japan.

	Markov	Coefficients	Std. Err.	z	P>|z|	[95% Conf. Interval]	
policy	L1.	0.5571527	0.0547068	10.18	0	0.4499294	0.664376
	output gap	-0.0031188	0.0028056	-1.11	0.266	-0.0086176	0.00238
	inflation	0.1466666	0.6916469	0.21	0.832	-1.208936	1.50227
State1	_cons	0.0111053	0.0073983	1.5	0.133	-0.003395	0.0256056
State2	_cons	0.2317389	0.0277671	8.35	0	0.1773164	0.2861613
	sigma	0.0510721	0.004258			0.0433728	0.0601382
	p11	0.9853104	0.0147324			0.9012188	0.9979763
	p21	0.1220882	0.1052649			0.0198851	0.4880255

A14. Stata output of the Markov-switching model for Switzerland.

	Markov	Coefficients	Std. Err.	z	P>|z|	[95% Conf. Interval]	
policy	L1.	0.7639783	0.0449411	17	0	0.6758954	0.8520613
	output gap	0.1136333	0.0236518	4.8	0	0.0672765	0.1599901
	inflation	-13.67251	3.89563	-3.51	0	-21.3078	-6.037211
State1	_cons	-0.3238561	0.0613116	-5.28	0	-0.4440247	-0.2036875
State2	_cons	0.1825872	0.0622465	2.93	0.003	0.0605862	0.3045882
	sigma	0.2423968	0.0208611			0.2047722	0.2869345
	p11	0.9502194	0.0382669			0.7963264	0.9893832
	p21	0.0443571	0.0338164			0.0096254	0.1814516

A15. Stata output of the Markov-switching model for Australia.

	Markov	Coefficients	Std. Err.	z	P>|z|	[95% Conf. Interval]	
policy	L1.	0.7481943	0.0366628	20.41	0	0.6763365	0.8200521
	output gap	0.2148026	0.0636728	3.37	0.001	0.0900063	0.339599
	inflation	17.05487	5.6572	3.01	0.003	5.966958	28.14278
State1	_cons	-0.3095844	0.1927639	-1.61	0.108	-0.6873948	0.068226
State2	_cons	0.3954911	0.2281367	1.73	0.083	-0.0516486	0.8426309
	sigma	0.2817177	0.0249647			0.2368013	0.3351539
	p11	0.9247293	0.0445334			0.7780645	0.9772993
	p21	0.0751773	0.0453317			0.0221466	0.2258617

A16. Stata output of the Markov-switching model for Brazil.

	Markov	Coefficients	Std. Err.	z	P>|z|	[95% Conf. Interval]	
policy	L1.	0.7860115	0.044368	17.72	0	0.6990518	0.8729712
	output gap	0.2771054	0.0459415	6.03	0	0.1870617	0.3671492
	inflation	35.99814	9.289282	3.88	0	17.79148	54.20479
State1	_cons	-0.2908757	0.548657	-0.53	0.596	-1.366224	0.7844724
State2	_cons	1.847754	0.7350305	2.51	0.012	0.4071211	3.288388
	sigma	0.975726	0.0901465			0.8141156	1.169418
	p11	0.9384923	0.0358811			0.8185886	0.9809865
	p21	0.1460474	0.0753895			0.0497031	0.3586606

A17. Correlation table between the indices and the MSCI World.

Correlation	Large Caps	Small Caps	Govt	IG/MF	HY
US	0.8836	0.8258	-0.2704	-0.1912	0.3589
EU	0.7623	0.7180	-0.1035	0.6487	0.2221
UK	0.7785	0.6675	-0.2632	-0.1769	0.1083
Japan	0.3585	0.3162	-0.0953	0.2112	0.0361
Switzerland	0.6819	0.6238	-0.1837	-0.1297	-0.1104
Australia	0.3458	0.3135	-0.2204	-0.1770	0.2412
Brazil	0.5871	0.5445	-0.2706	0.7325	

A18. Output of the US ARCH-M(1) model.

ARCH-M(1)		Large St	Small St	Govt	IG	HY
	const	-0.0013	0.0000	0.0021	0.0006	0.0007
	archm	14.8938	3.5180	-44.4073	-31.5486	10.3536
arch	arch L1	0.3552	0.3178	0.1061	0.1645	1.0664
	const	0.0001	0.0001	0.0000	0.0000	0.0000

A19. Output of the EU ARCH-M(1) model.

ARCH-M(1)		Large St	Small St	Govt	IG	HY
	const	-0.0006	0.0010	0.0006	0.0004	0.0002

	archm	6.0207	-0.5611	-51.0869	-14.5880	-2.6143
arch	arch L1	0.3390	0.4215	0.1382	0.2485	1.2242
	const	0.0002	0.0001	0.0000	0.0000	0.0000

A20. Output of the UK ARCH-M(1) model.

ARCH-M(1)		Large St	Small St	Govt	IG	HY
	const	0.00046	0.00102	0.00031	0.00007	0.00004
	archm	-1.35889	-4.11397	-0.11266	8.01271	-1.69723
arch	arch L1	0.50462	0.43589	0.16394	0.52319	0.30764
	const	0.00011	0.00010	0.00004	0.00001	0.00016

A21. Output of the Japan ARCH-M(1) model.

ARCH-M(1)		Large St	Small St	Govt	IG	HY
	const	-0.0032	0.0019	0.0002	-0.0002	-0.0041
	archm	20.0091	-10.9078	-6.7088	12.2691	1.7514
arch	arch L1	0.2854	0.3166	0.2842	0.7648	0.2378
	const	0.0001	0.0001	0.0000	0.0000	0.0015

A22. Output of the Switzerland ARCH-M(1) model. The coefficient in red was found statistically insignificant.

ARCH-M(1)		Large St	Small St	Govt	IG	HY
	const	-0.0010	0.0008	0.0001	-0.0001	-0.0001
	archm	17.8538	0.4282	13.4300	69.5249	56.3515
arch	arch L1	0.4721	0.2722	0.3617	0.5467	0.6330
	const	0.0001	0.0001	0.0000	0.0000	0.0000

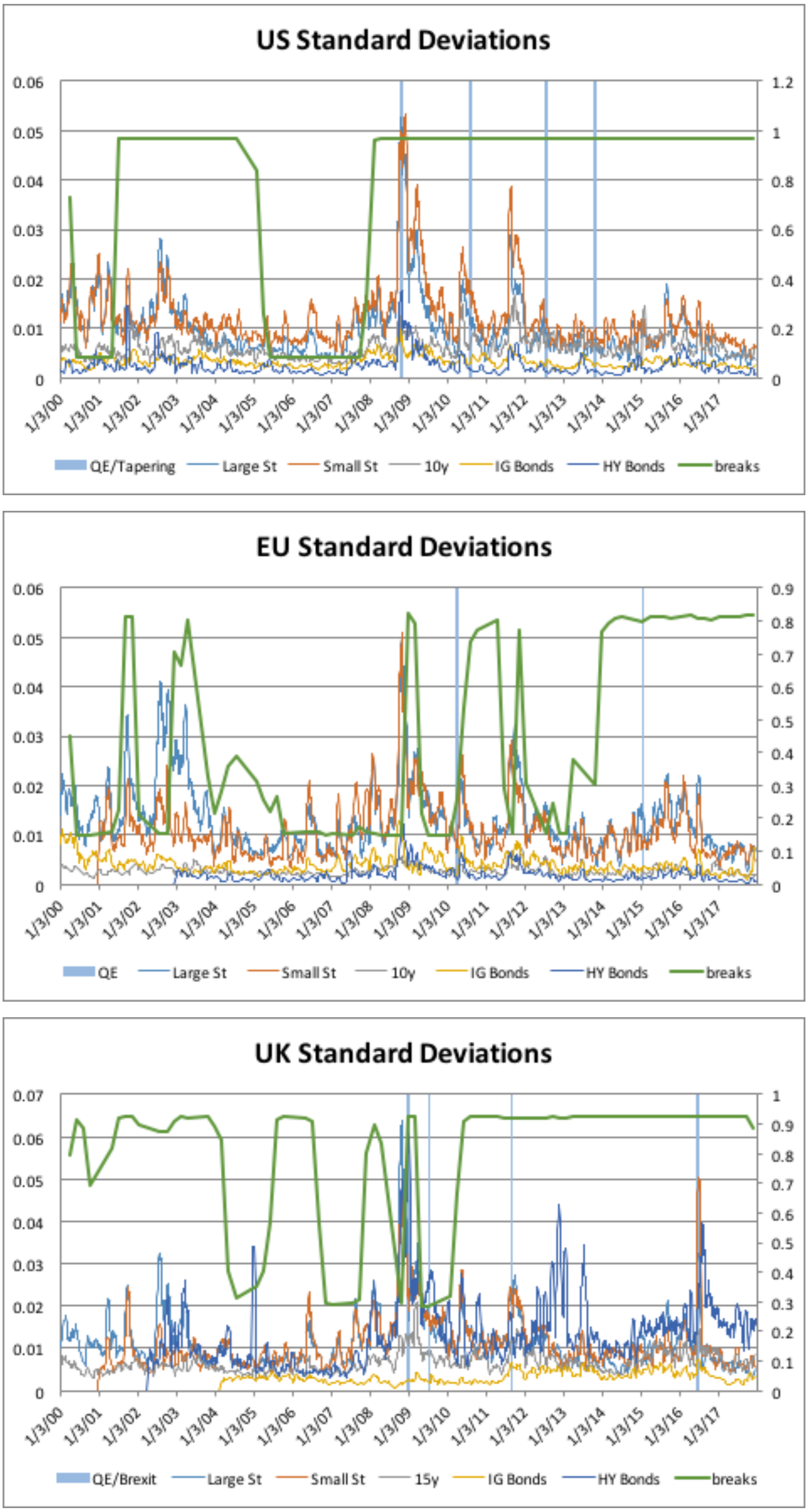
A23. Output of the Australia ARCH-M(1) model.

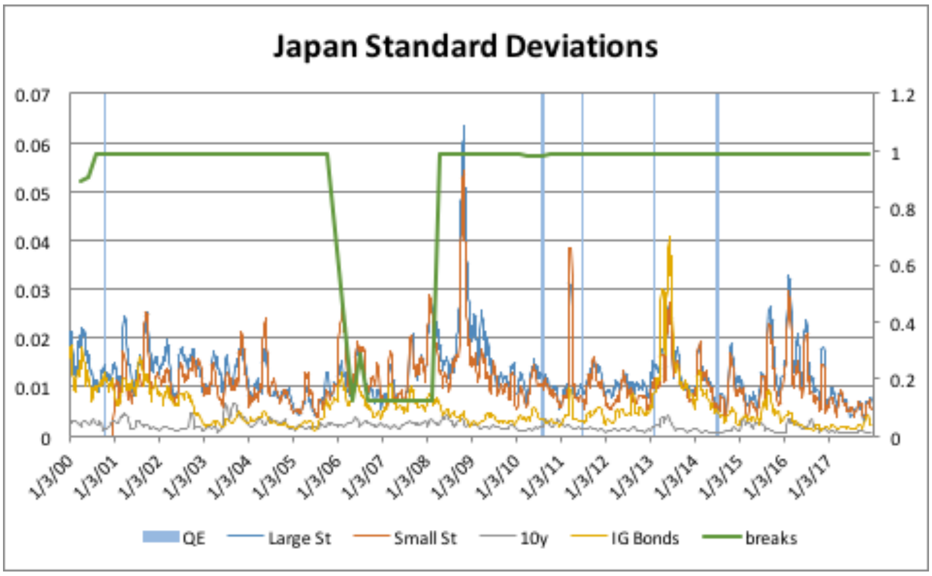
ARCH-M(1)		Large St	Small St	Govt	IG	HY
	const	-0.0010	0.0010	0.0005	0.0000	0.0005
	archm	14.6923	-5.9664	-19.7829	22.0171	2.6866
arch	arch L1	0.3181	0.4889	0.1419	0.2268	1.2260
	const	0.0001	0.0001	0.0000	0.0000	0.0000

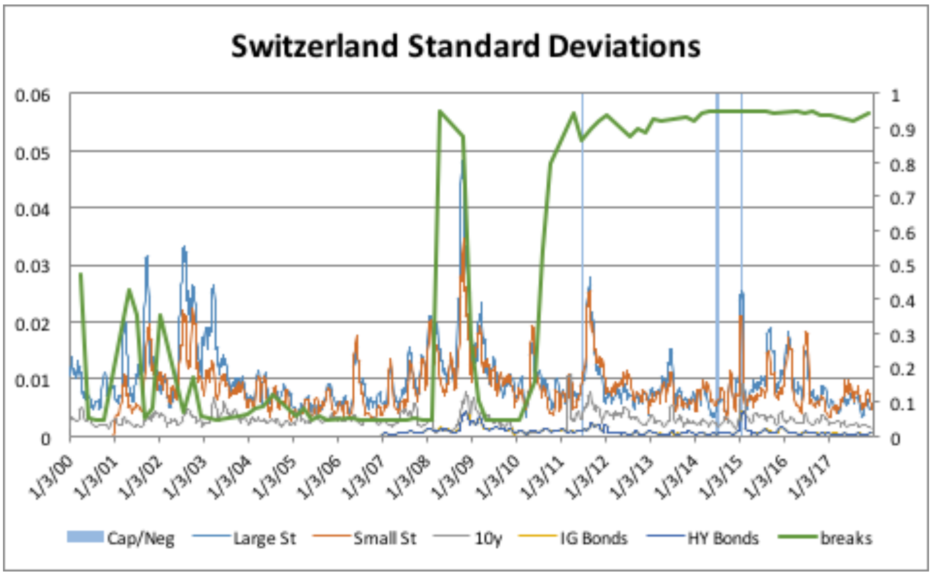
A24. Output of the Brazil ARCH-M(1) model.

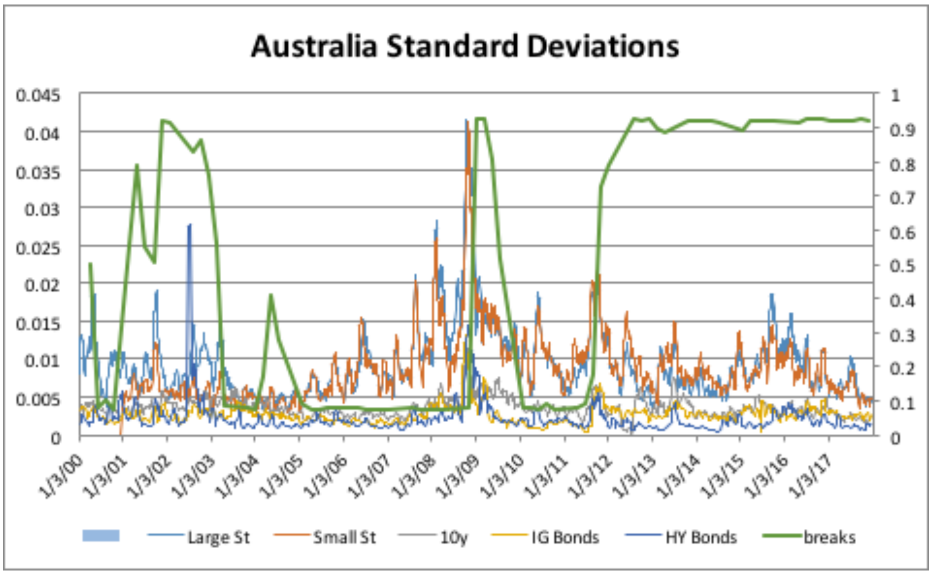
ARCH-M(1)		Large St	Small St	Govt	MF
	const	0.0045	0.0019	0.0003	-0.0003
	archm	-15.2697	-6.4844	-1.8915	7.9651
arch	arch L1	0.1971	0.2222	0.4275	0.5346
	const	0.0002	0.0001	0.0003	0.0001

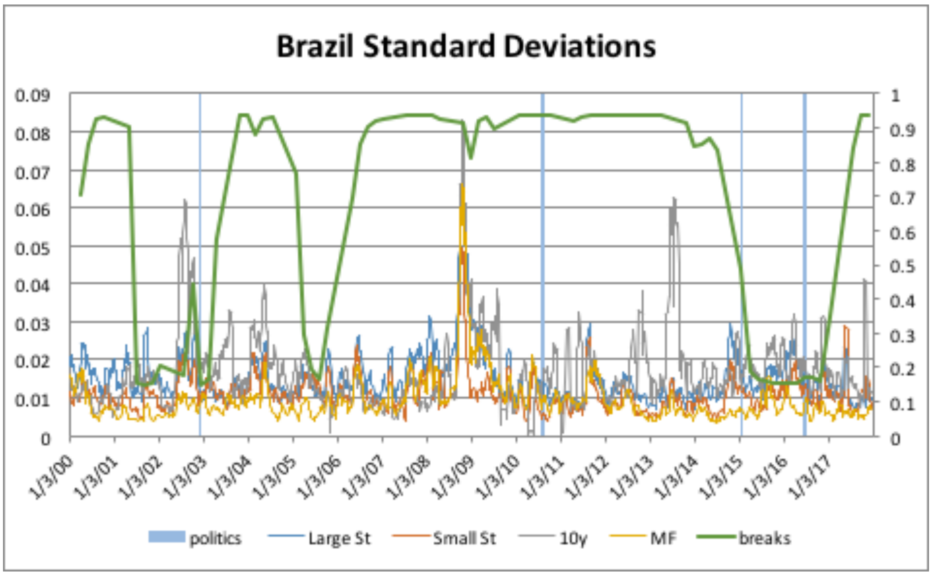
A25. Standard deviations of all the indices.



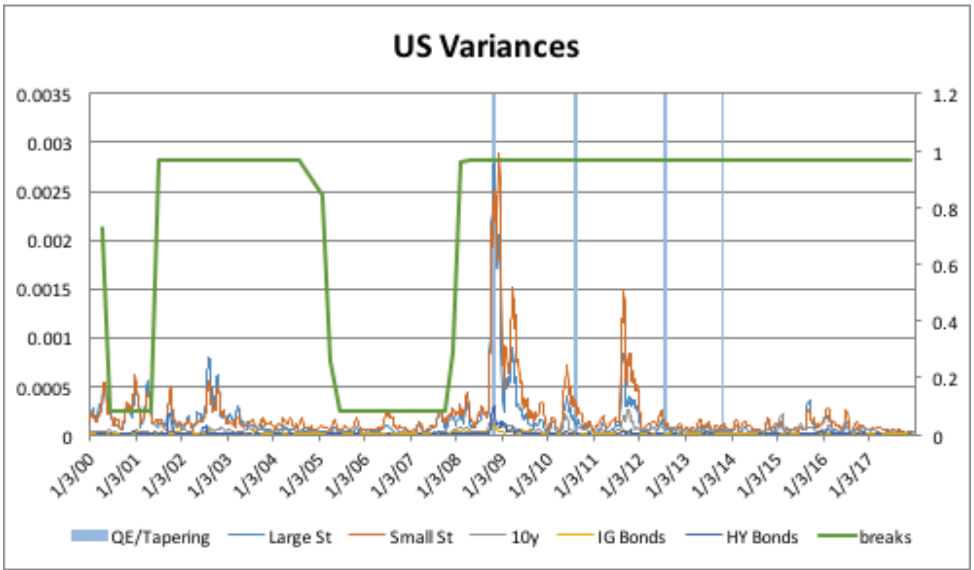

Japan Standard Deviations
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1.2
1
0.8
0.6
0.4
0.2
0
1/3/00
1/3/01
1/3/02
1/3/03
1/3/04
1/3/05
1/3/06
1/3/07
1/3/08
1/3/09
1/3/10
1/3/11
1/3/12
1/3/13
1/3/14
1/3/15
1/3/16
1/3/17
QE
Large St
Small St
10y
IG Bonds
breaks

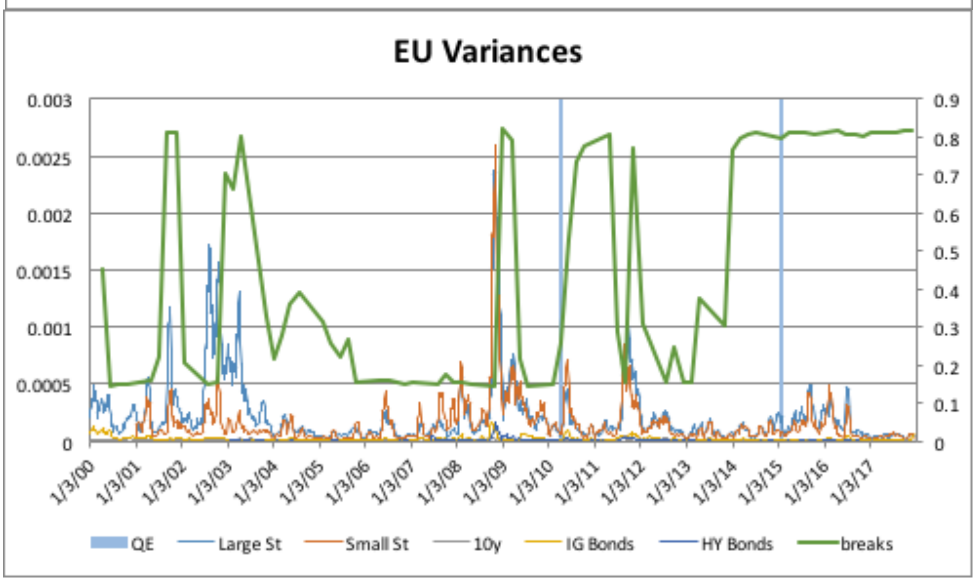

Switzerland Standard Deviations
0.06
0.05
0.04
0.03
0.02
0.01
0
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1/3/00
1/3/01
1/3/02
1/3/03
1/3/04
1/3/05
1/3/06
1/3/07
1/3/08
1/3/09
1/3/10
1/3/11
1/3/12
1/3/13
1/3/14
1/3/15
1/3/16
1/3/17
Cap/Neg
Large St
Small St
10y
IG Bonds
HY Bonds
breaks

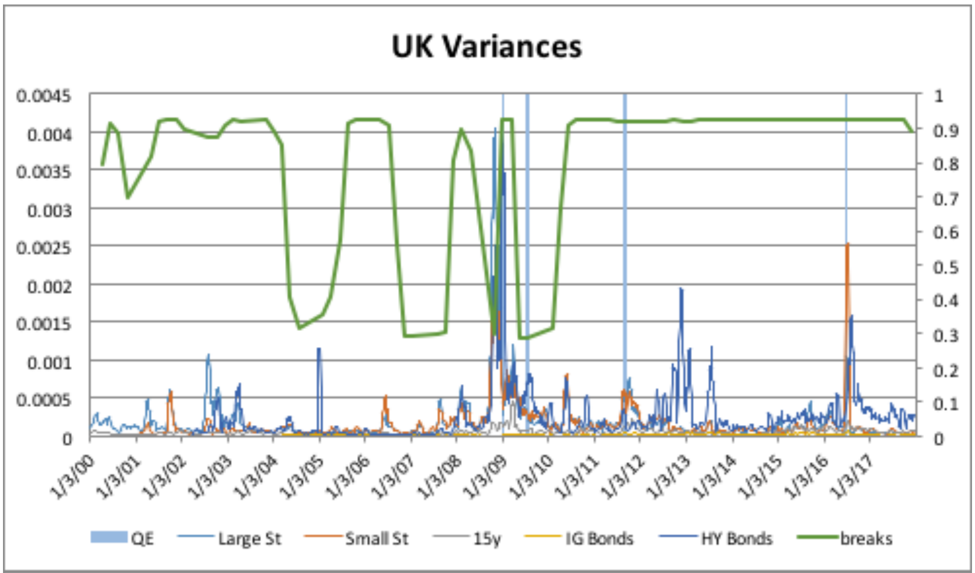

Australia Standard Deviations
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1/3/00
1/3/01
1/3/02
1/3/03
1/3/04
1/3/05
1/3/06
1/3/07
1/3/08
1/3/09
1/3/10
1/3/11
1/3/12
1/3/13
1/3/14
1/3/15
1/3/16
1/3/17
Large St
Small St
10y
IG Bonds
HY Bonds
breaks

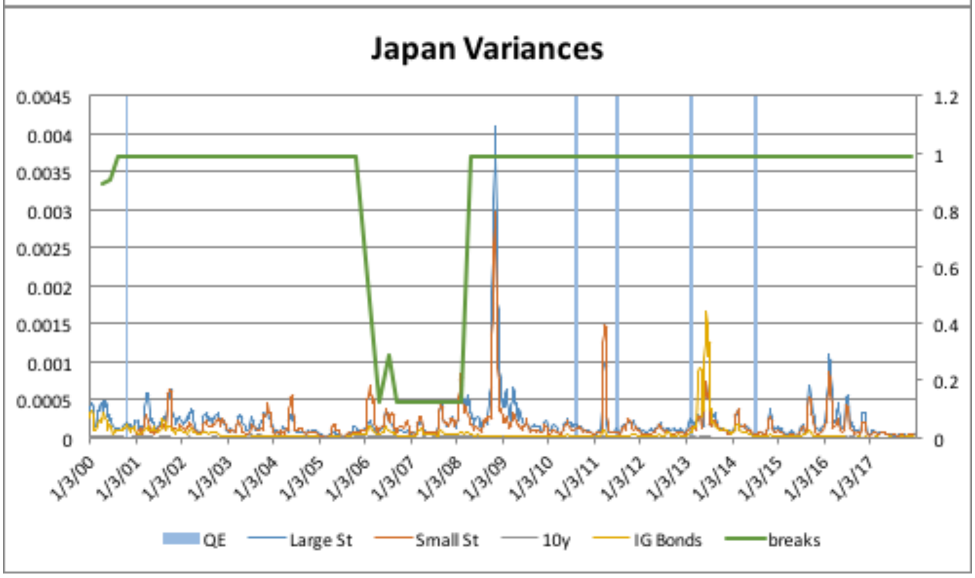


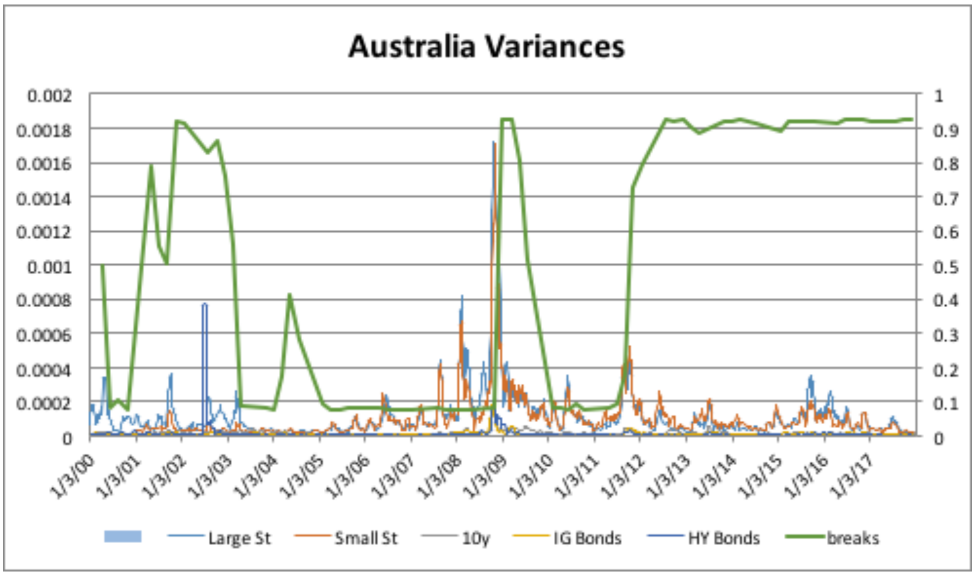
A26. Variances of all the indices.

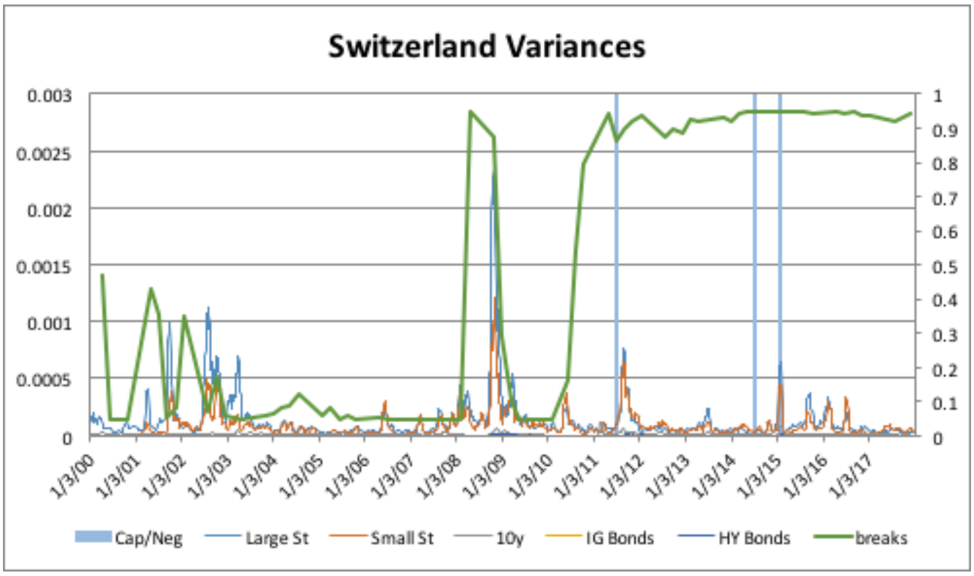


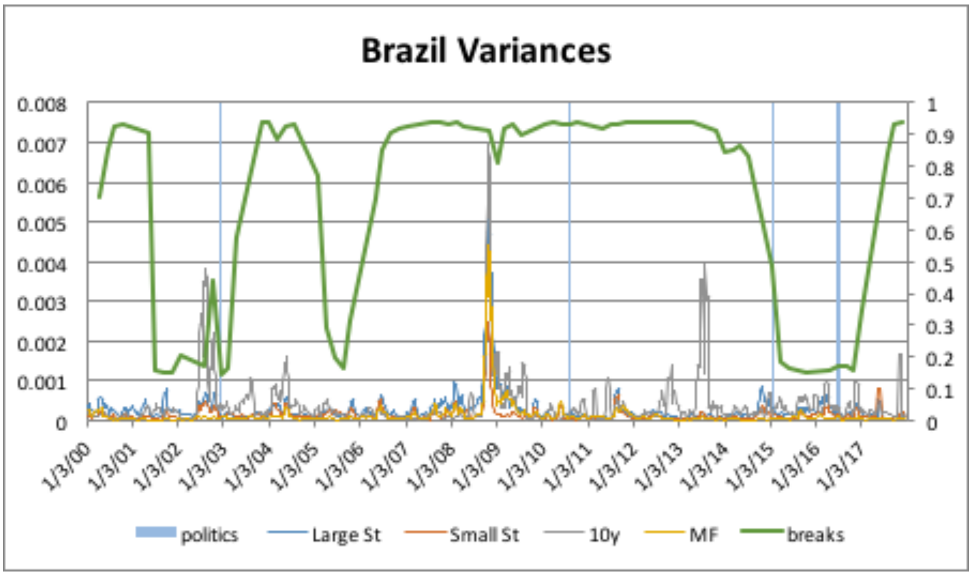



UK Variances
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1/3/00
1/3/01
1/3/02
1/3/03
1/3/04
1/3/05
1/3/06
1/3/07
1/3/08
1/3/09
1/3/10
1/3/11
1/3/12
1/3/13
1/3/14
1/3/15
1/3/16
1/3/17
QE
Large St
Small St
15y
IG Bonds
HY Bonds
breaks

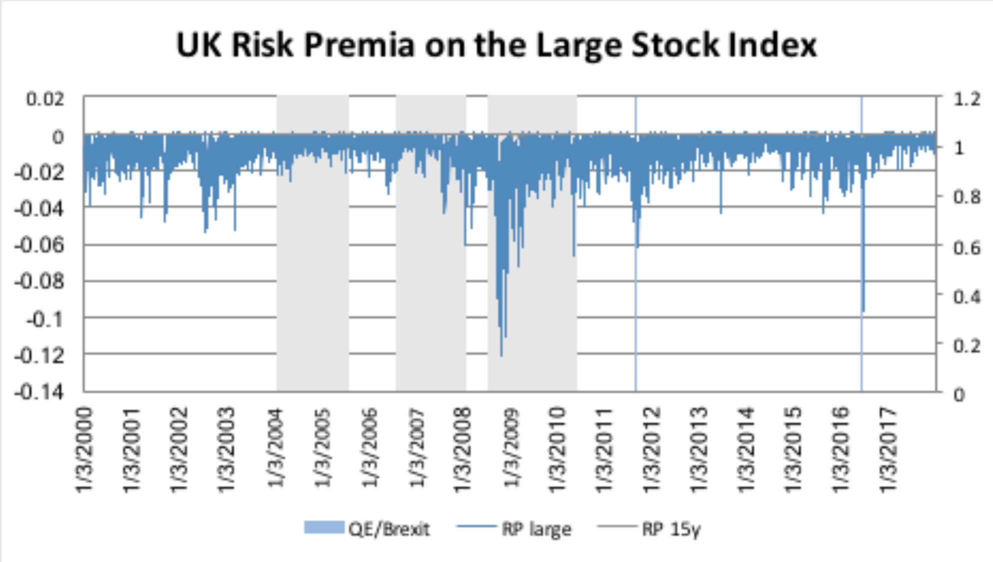

Japan Variances
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
1.2
1
0.8
0.6
0.4
0.2
0
1/3/00
1/3/01
1/3/02
1/3/03
1/3/04
1/3/05
1/3/06
1/3/07
1/3/08
1/3/09
1/3/10
1/3/11
1/3/12
1/3/13
1/3/14
1/3/15
1/3/16
1/3/17
QE
Large St
Small St
10y
IG Bonds
breaks

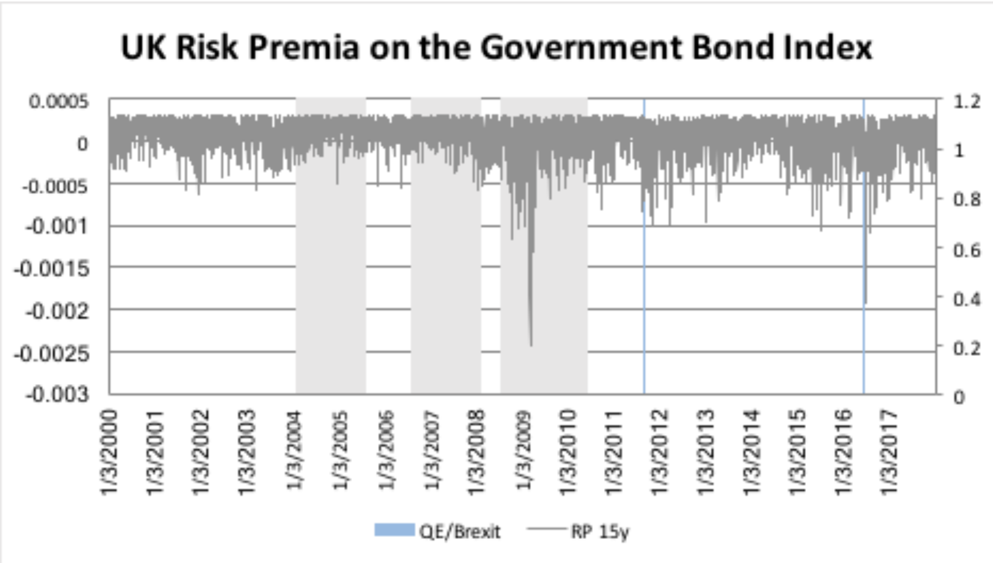

Australia Variances
0.002
0.0018
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1/3/00
1/3/01
1/3/02
1/3/03
1/3/04
1/3/05
1/3/06
1/3/07
1/3/08
1/3/09
1/3/10
1/3/11
1/3/12
1/3/13
1/3/14
1/3/15
1/3/16
1/3/17
Large St
Small St
10y
IG Bonds
HY Bonds
breaks


Switzerland Variances
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1/3/00
1/3/01
1/3/02
1/3/03
1/3/04
1/3/05
1/3/06
1/3/07
1/3/08
1/3/09
1/3/10
1/3/11
1/3/12
1/3/13
1/3/14
1/3/15
1/3/16
1/3/17
Cap/Neg
Large St
Small St
10y
IG Bonds
HY Bonds
breaks

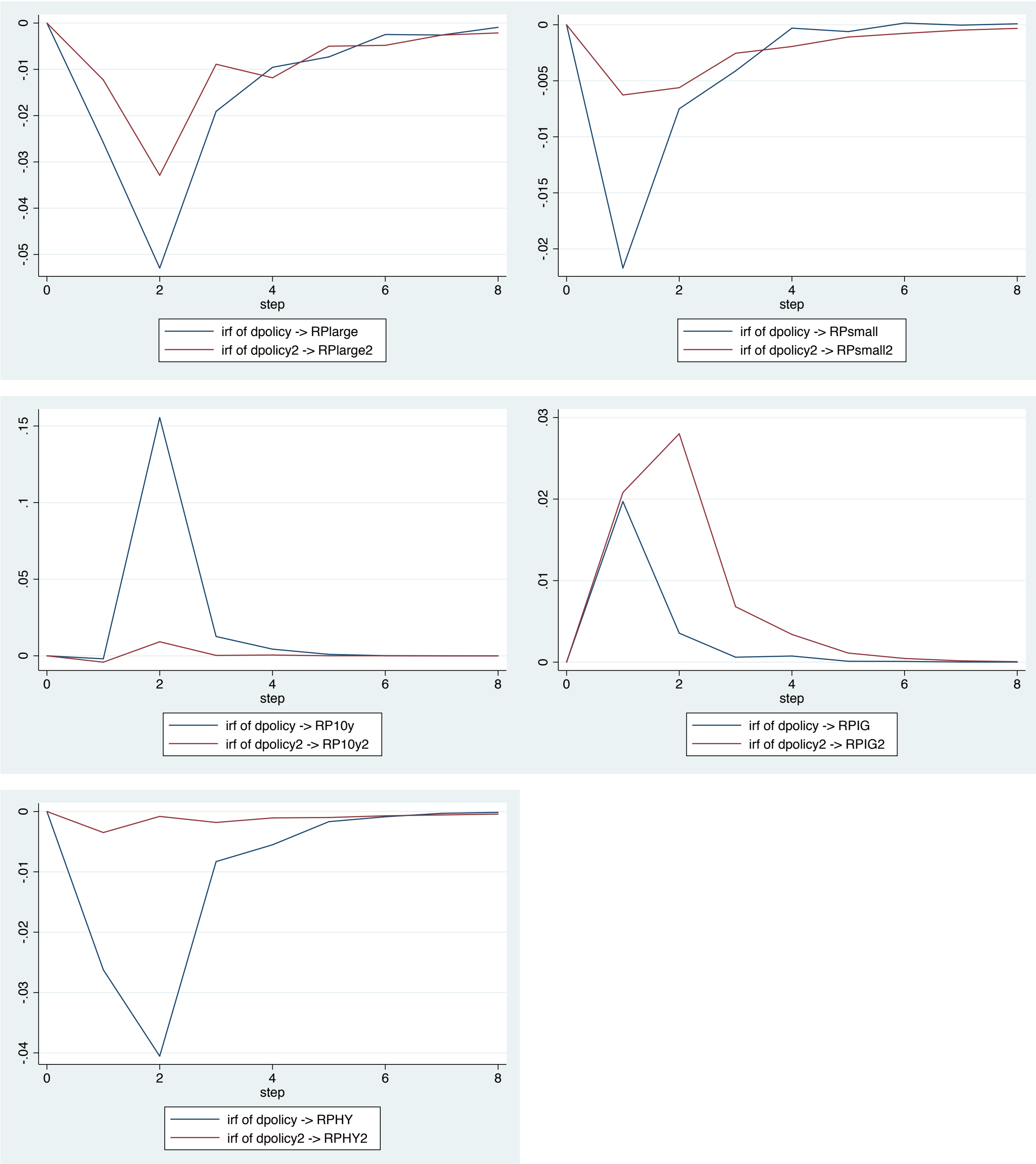

Brazil Variances
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1/3/00
1/3/01
1/3/02
1/3/03
1/3/04
1/3/05
1/3/06
1/3/07
1/3/08
1/3/09
1/3/10
1/3/11
1/3/12
1/3/13
1/3/14
1/3/15
1/3/16
1/3/17
politics
Large St
Small St
10y
MF
breaks

A27. UK Risk Premia for all the Large Stock and Government Bond indices.

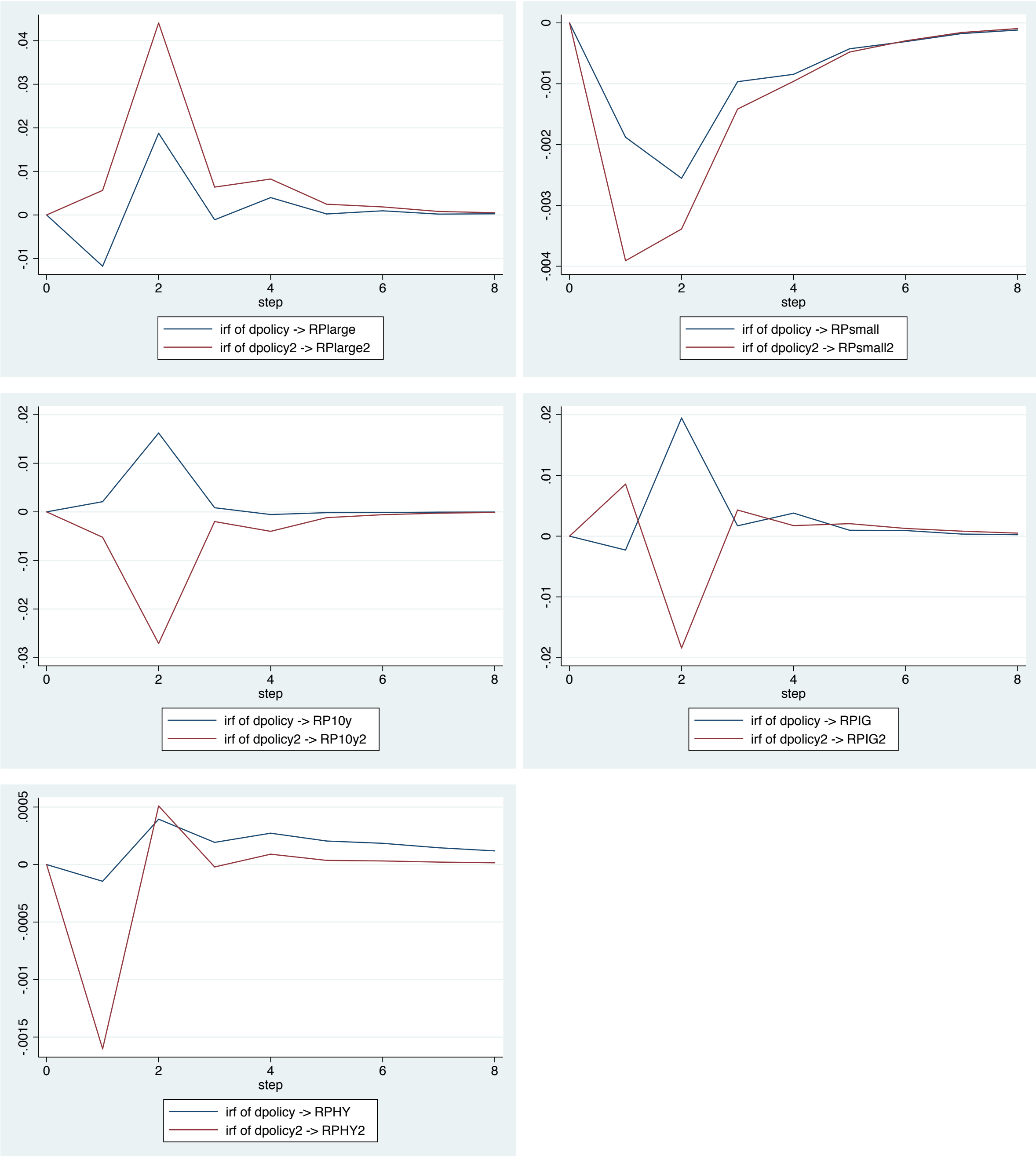




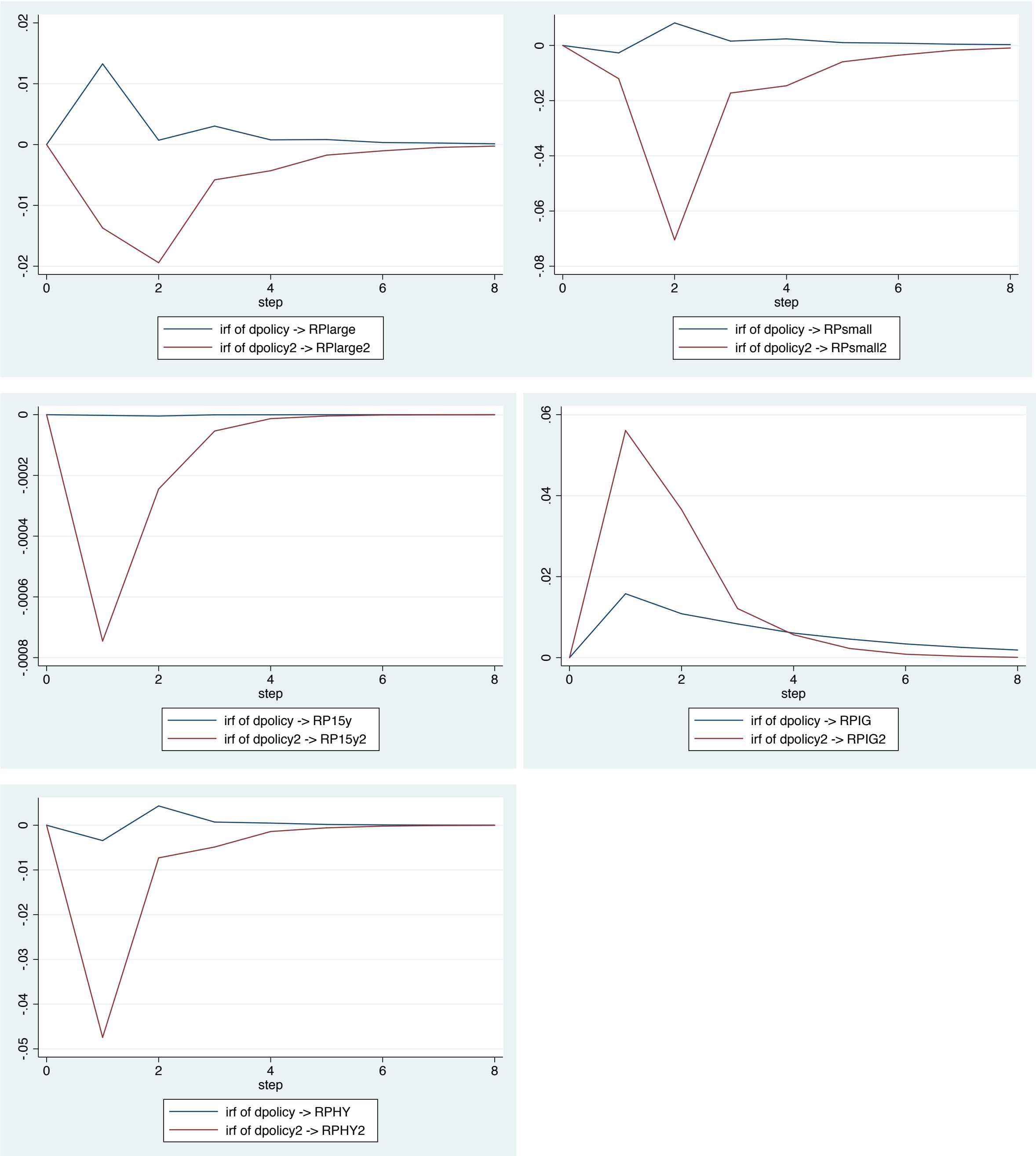
A28. Graphs of the IRFs on the US Risk Premia.



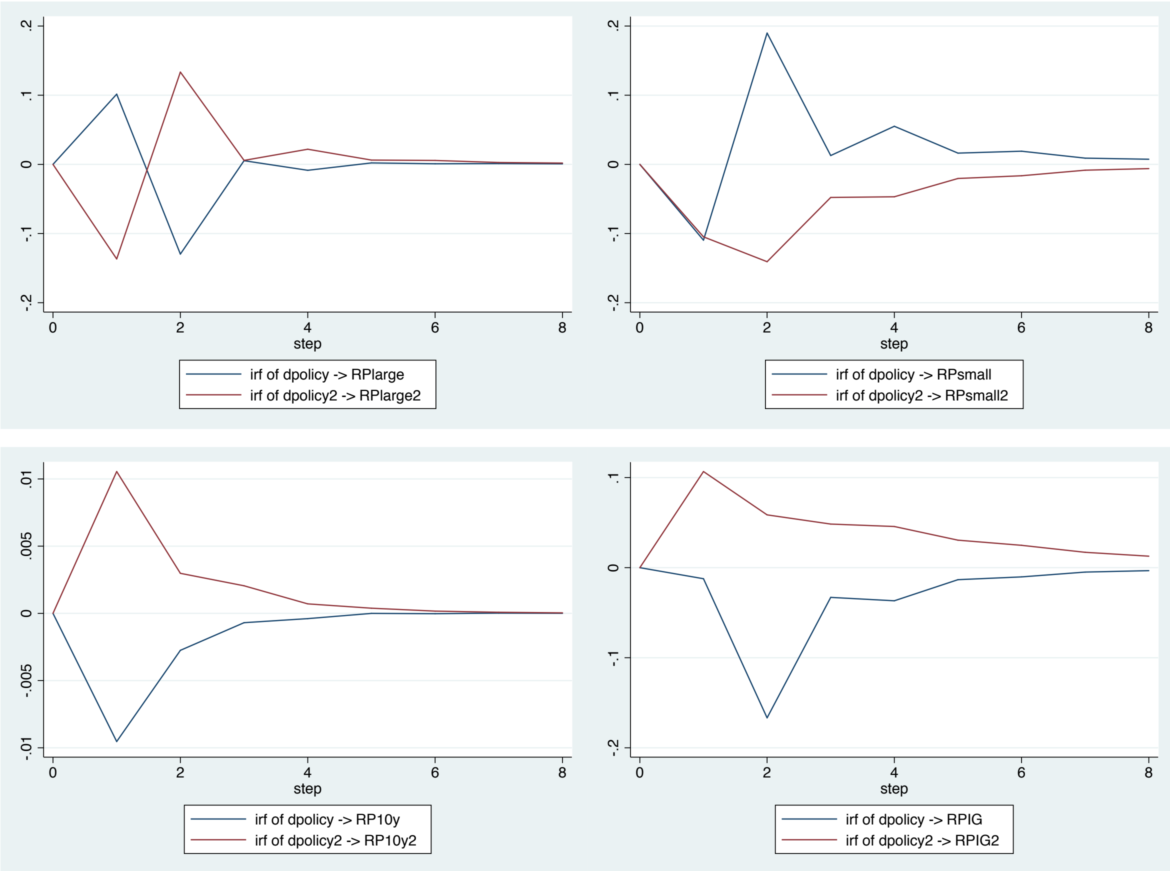
A29. Graphs of the IRFs on the EU Risk Premia.



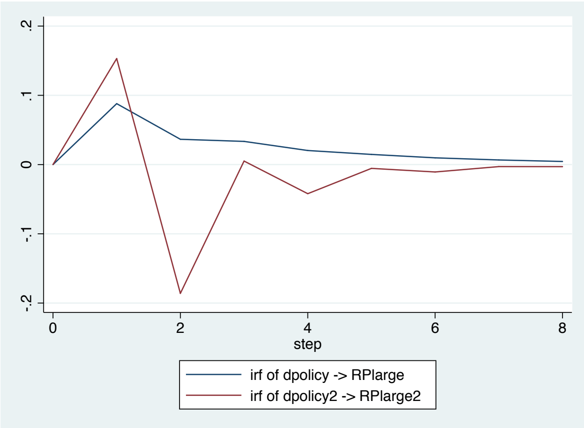
A30. Graphs of the IRFs on the UK Risk Premia.

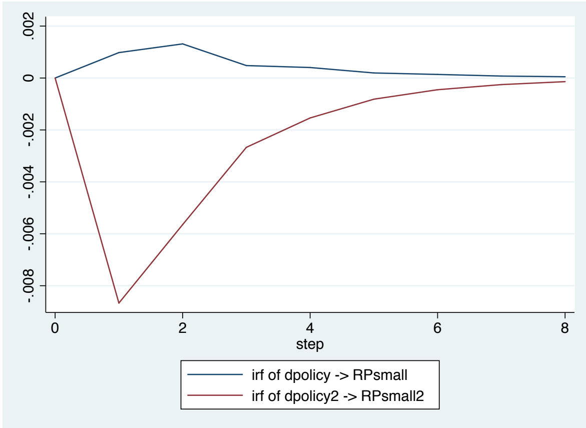


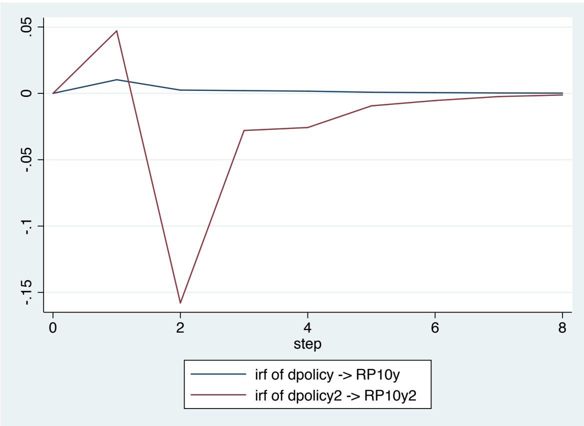
A31. Graphs of the IRFs on the Japan Risk Premia.

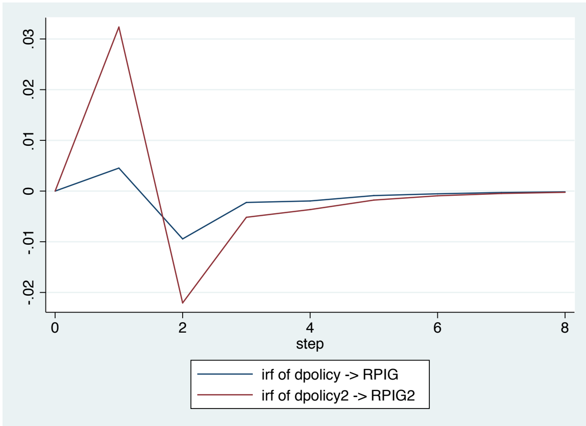


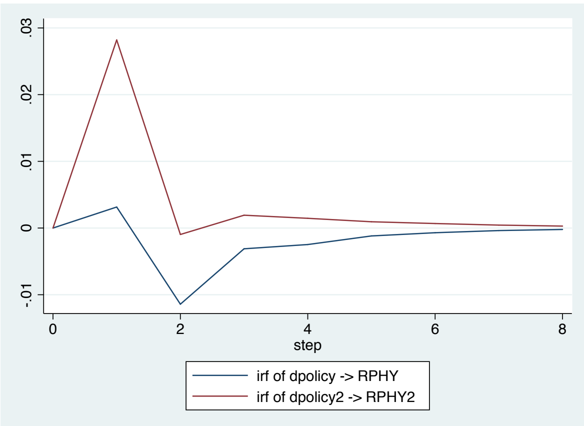
A32. Graphs of the IRFs on the Switzerland Risk Premia.



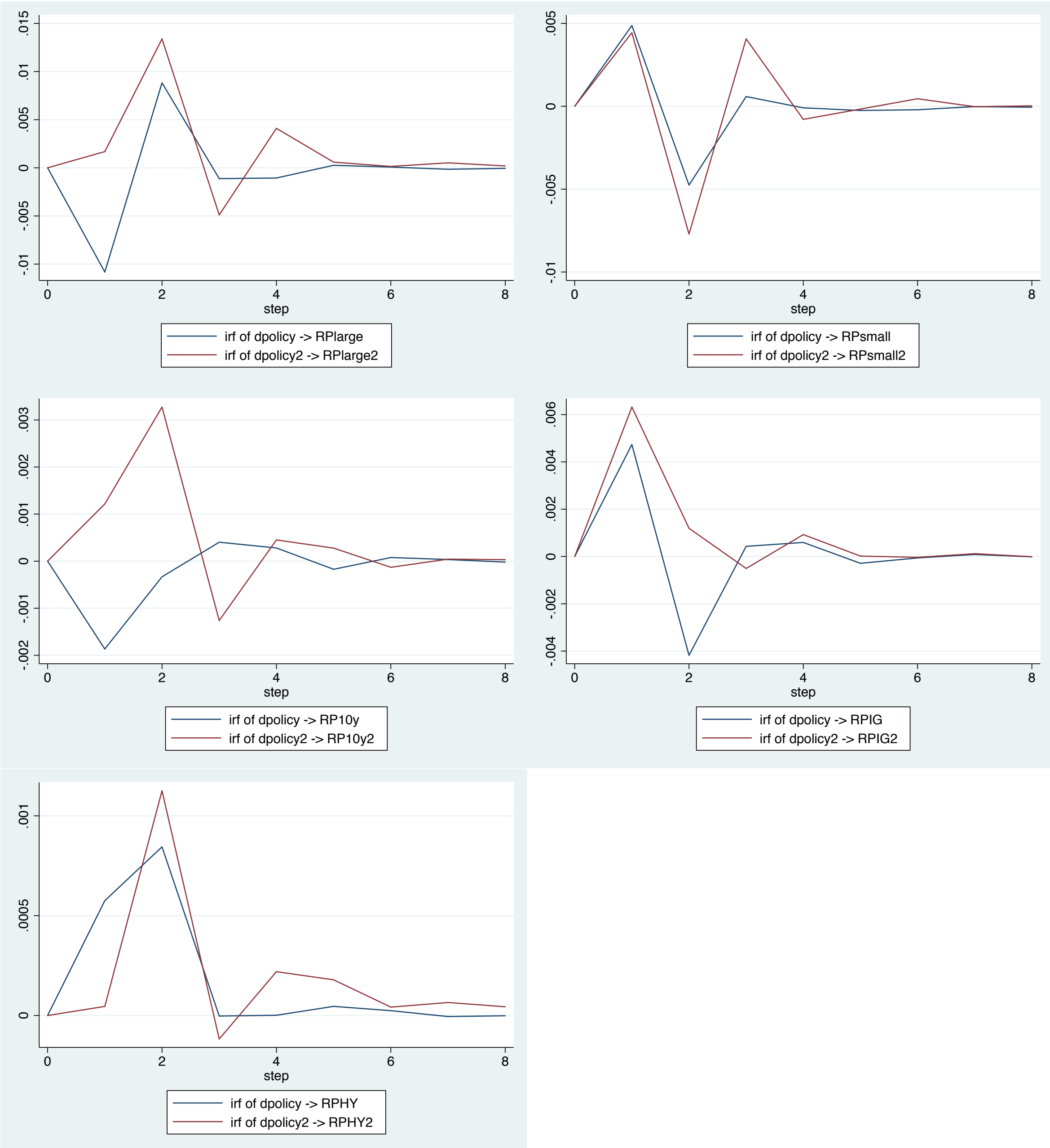




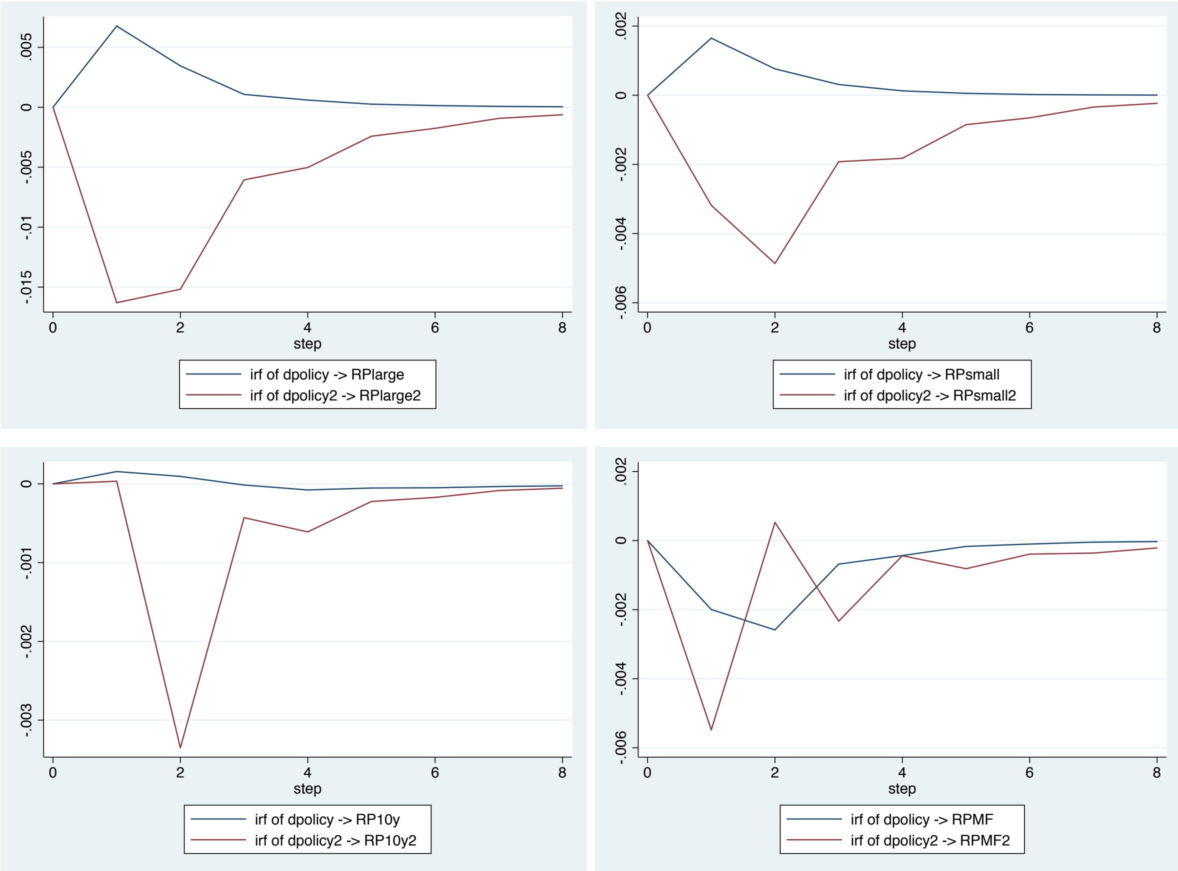




A33. Graphs of the IRFs on the Australian Risk Premia.



A34. Graphs of the IRFs on the Brazil Risk Premia.



A35. Results of the IRFs on the US Risk Premia with the 95% confidence interval.

Steps	RPlarge	Lower	Upper	RPsmall	Lower	Upper
0	0	0	0	0	0	0
1	-0.007902	-0.141816	0.126011	0.012883	-0.060787	0.086553
2	0.144777	0.007433	0.282121	-0.003077	-0.076832	0.070678
3	-0.001097	-0.034901	0.032707	0.000539	-0.009183	0.01026
4	0.004101	-0.009818	0.01802	0.003424	-0.004651	0.011498
5	0.003469	-0.004001	0.01094	0.000875	-0.001975	0.003725
6	0.001317	-0.002624	0.005258	0.000907	-0.001114	0.002929
7	0.001019	-0.001372	0.003411	0.000377	-0.00063	0.001384
8	0.000531	-0.000838	0.001901	0.000267	-0.000387	0.000922
Steps	RP10y	Lower	Upper	RPIG	Lower	Upper
0	0	0	0	0	0	0
1	-0.007902	-0.141816	0.126011	0.012883	-0.060787	0.086553
2	0.144777	0.007433	0.282121	-0.003077	-0.076832	0.070678
3	-0.001097	-0.034901	0.032707	0.000539	-0.009183	0.01026
4	0.004101	-0.009818	0.01802	0.003424	-0.004651	0.011498
5	0.003469	-0.004001	0.01094	0.000875	-0.001975	0.003725
6	0.001317	-0.002624	0.005258	0.000907	-0.001114	0.002929
7	0.001019	-0.001372	0.003411	0.000377	-0.00063	0.001384

8	0.000531	-0.000838	0.001901	0.000267	-0.000387	0.000922
Steps	RP HY	Lower	Upper			
0	0	0	0			
1	-0.017256	-0.08801	0.053498			
2	-0.036602	-0.108506	0.035302			
3	-0.009905	-0.027515	0.007706			
4	-0.003065	-0.015294	0.009165			
5	-0.002744	-0.008371	0.002883			
6	-0.001449	-0.004983	0.002085			
7	-0.000805	-0.002737	0.001127			
8	-0.000488	-0.001665	0.00069			

Steps	RPlarge2	Lower	Upper	RPsmall2	Lower	Upper
0	0	0	0	0	0	0
1	-0.015125	-0.078082	0.047831	-0.008479	-0.025178	0.008221
2	-0.035839	-0.100698	0.02902	-0.006669	-0.023968	0.010631
3	-0.010127	-0.037536	0.017281	-0.002421	-0.00954	0.004698
4	-0.015496	-0.041458	0.010465	-0.003504	-0.009958	0.00295
5	-0.007661	-0.025717	0.010395	-0.001967	-0.006612	0.002677
6	-0.007804	-0.023236	0.007629	-0.001929	-0.00585	0.001992
7	-0.005362	-0.0174	0.006676	-0.001378	-0.004462	0.001706
8	-0.004668	-0.014566	0.00523	-0.001183	-0.00371	0.001344
Steps	RP10y2	Lower	Upper	RPIG2	Lower	Upper
0	0	0	0	0	0	0
1	-0.005393	-0.061923	0.051137	0.017857	-0.006597	0.042311
2	0.006993	-0.050283	0.064269	0.025495	0.000488	0.050502
3	0.010001	-0.001719	0.02172	0.005665	-0.001015	0.012345
4	0.002078	-0.005743	0.009898	0.002694	-0.002288	0.007676
5	0.002434	-0.002523	0.007391	0.001714	-0.002005	0.005433
6	0.001743	-0.002296	0.005783	0.00138	-0.001602	0.004363
7	0.001465	-0.001737	0.004668	0.001105	-0.001307	0.003516
8	0.001182	-0.001427	0.003791	0.000893	-0.001055	0.002841
Steps	RPHY2	Lower	Upper			
0	0	0	0			
1	-0.002379	-0.025085	0.020327			
2	-0.000124	-0.024537	0.024288			
3	-0.005005	-0.018211	0.008201			
4	-0.00456	-0.01647	0.00735			
5	-0.004084	-0.013156	0.004988			
6	-0.003327	-0.010778	0.004125			
7	-0.002738	-0.008713	0.003237			
8	-0.002206	-0.007044	0.002631			

A36. Results of the IRFs on the EU Risk Premia with the 95% confidence interval.

Steps	RPlarge	Lower	Upper	RPsmall	Lower	Upper
0	0	0	0	0	0	0
1	0.0041	-0.027293	0.035493	-0.009764	-0.031197	0.011668
2	0.012414	-0.019178	0.044007	0.008793	-0.013036	0.030623
3	-0.000923	-0.006487	0.004641	0.000021	-0.006634	0.006675
4	-0.001361	-0.005782	0.00306	0.001543	-0.003893	0.006979
5	-0.000977	-0.003901	0.001946	0.000046	-0.002645	0.002737
6	-0.000857	-0.003191	0.001476	0.000076	-0.00187	0.002021
7	-0.000681	-0.002459	0.001098	-0.000149	-0.00143	0.001131
8	-0.000557	-0.001967	0.000853	-0.000157	-0.001116	0.000801
Steps	RP10y	Lower	Upper	RPIG	Lower	Upper
0	0	0	0	0	0	0
1	0.0041	-0.027293	0.035493	-0.009764	-0.031197	0.011668
2	0.012414	-0.019178	0.044007	0.008793	-0.013036	0.030623
3	-0.000923	-0.006487	0.004641	0.000021	-0.006634	0.006675
4	-0.001361	-0.005782	0.00306	0.001543	-0.003893	0.006979
5	-0.000977	-0.003901	0.001946	0.000046	-0.002645	0.002737
6	-0.000857	-0.003191	0.001476	0.000076	-0.00187	0.002021
7	-0.000681	-0.002459	0.001098	-0.000149	-0.00143	0.001131
8	-0.000557	-0.001967	0.000853	-0.000157	-0.001116	0.000801
Steps	RP HY	Lower	Upper			
0	0	0	0			
1	0.000352	-0.004697	0.005402			
2	-0.00188	-0.007507	0.003747			
3	-0.001001	-0.004319	0.002317			
4	-0.000952	-0.003678	0.001774			
5	-0.000772	-0.002861	0.001318			
6	-0.000612	-0.002249	0.001025			
7	-0.000496	-0.001781	0.000789			
8	-0.000391	-0.001399	0.000617			

Steps	RPlarge2	Lower	Upper	RPsmall2	Lower	Upper
0	0	0	0	0	0	0
1	0.010816	-0.066638	0.08827	-0.003886	-0.01094	0.003169
2	0.040786	-0.037743	0.119315	-0.002709	-0.009901	0.004483
3	0.011213	-0.011211	0.033638	-0.001219	-0.003601	0.001163
4	0.007104	-0.012599	0.026807	-0.000632	-0.002734	0.00147
5	0.00454	-0.006484	0.015564	-0.000468	-0.001669	0.000734
6	0.002651	-0.00551	0.010812	-0.000273	-0.001162	0.000615
7	0.001884	-0.003492	0.00726	-0.000201	-0.000788	0.000387
8	0.001218	-0.00255	0.004986	-0.000131	-0.000542	0.00028
Steps	RP10y2	Lower	Upper	RPIG2	Lower	Upper
0	0	0	0	0	0	0
1	-0.008568	-0.108591	0.091456	0.007778	-0.043142	0.058698
2	-0.028437	-0.129832	0.072959	-0.015048	-0.066293	0.036197
3	-0.009148	-0.03451	0.016213	-0.00365	-0.015056	0.007756

4	-0.005457	-0.025309	0.014395	-0.002279	-0.012499	0.007942
5	-0.003104	-0.012687	0.006479	-0.001774	-0.006967	0.003419
6	-0.002026	-0.008556	0.004505	-0.001023	-0.004793	0.002748
7	-0.001319	-0.005563	0.002926	-0.000789	-0.00326	0.001682
8	-0.000908	-0.003819	0.002002	-0.000518	-0.002227	0.001191
Steps	RPHY2	Lower	Upper			
0	0	0	0			
1	-0.001812	-0.013487	0.009863			
2	0.000732	-0.011744	0.013209			
3	-0.002053	-0.007697	0.003591			
4	-0.00084	-0.005008	0.003328			
5	-0.000893	-0.00365	0.001864			
6	-0.000554	-0.002428	0.00132			
7	-0.000411	-0.001704	0.000882			
8	-0.000278	-0.00116	0.000603			

A37. Results of the IRFs on the UK Risk Premia with the 95% confidence interval.

Steps	RPlarge	Lower	Upper	RPsmall	Lower	Upper
0	0	0	0	0	0	0
1	0.000678	-0.006805	0.008161	0.000103	-0.018159	0.018364
2	0.004248	-0.003413	0.011908	0.011429	-0.007435	0.030292
3	0.001448	-0.001381	0.004277	0.00276	-0.004781	0.010302
4	0.002145	-0.000418	0.004708	0.004162	-0.002496	0.01082
5	0.001181	-0.000403	0.002765	0.002196	-0.002054	0.006446
6	0.001042	-0.000219	0.002302	0.001873	-0.001405	0.00515
7	0.000695	-0.000188	0.001579	0.001266	-0.001043	0.003575
8	0.000539	-0.000129	0.001207	0.000961	-0.000749	0.002671
Steps	RP15y	Lower	Upper	RPIG	Lower	Upper
0	0	0	0	0	0	0
1	-0.000083	-0.000229	0.000063	0.005598	-0.000926	0.012122
2	0.000084	-0.000065	0.000232	0.00249	-0.004301	0.009281
3	0.000026	-0.000013	0.000065	0.001235	-0.001622	0.004093
4	0.000021	-0.0000098	0.000051	0.001309	-0.001119	0.003738
5	0.000013	-0.0000056	0.000032	0.000692	-0.000846	0.00223
6	0.000011	-0.0000036	0.000026	0.000612	-0.000571	0.001794
7	0.0000077	-0.0000026	0.000018	0.000383	-0.00044	0.001206
8	0.0000059	-0.0000019	0.000014	0.000306	-0.000303	0.000915
Steps	RP HY	Lower	Upper			
0	0	0	0			
1	-0.003701	-0.011464	0.004061			
2	0.004486	-0.003519	0.012491			
3	0.000693	-0.002161	0.003547			
4	0.001335	-0.001007	0.003676			
5	0.00069	-0.000781	0.00216			
6	0.000626	-0.000491	0.001743			
7	0.000422	-0.00036	0.001204			
8	0.000328	-0.000251	0.000907			

Steps	RPlarge2	Lower	Upper	RPsmall2	Lower	Upper
0	0	0	0	0	0	0
1	-0.011816	-0.06946	0.045829	-0.010185	-0.188803	0.168432
2	-0.017564	-0.076157	0.041029	-0.07045	-0.253792	0.112893
3	-0.004826	-0.021099	0.011447	-0.019858	-0.075035	0.035319
4	-0.004858	-0.017938	0.008221	-0.015659	-0.054758	0.023441
5	-0.001979	-0.007526	0.003568	-0.007015	-0.024729	0.010699
6	-0.001295	-0.004745	0.002154	-0.004113	-0.014371	0.006145
7	-0.00063	-0.002343	0.001082	-0.002083	-0.007341	0.003174
8	-0.000358	-0.001321	0.000606	-0.001141	-0.004043	0.001761
Steps	RP15y2	Lower	Upper	RPIG2	Lower	Upper
0	0	0	0	0	0	0
1	-0.000709	-0.002514	0.001096	0.055791	-0.067594	0.179176
2	-0.000278	-0.002092	0.001537	0.035266	-0.089191	0.159722
3	-0.0001	-0.00038	0.00018	0.015114	-0.0113	0.041527
4	-0.000037	-0.000239	0.000166	0.007713	-0.013366	0.028792
5	-0.000013	-0.000077	0.000051	0.003698	-0.003958	0.011354
6	-0.000008	-0.00005	0.000034	0.002178	-0.003034	0.007389
7	-0.000003	-0.000021	0.000015	0.001078	-0.001329	0.003485
8	-0.0000019	-0.000012	0.0000086	0.000627	-0.000851	0.002105
Steps	RPHY2	Lower	Upper			
0	0	0	0			
1	-0.044661	-0.13314	0.043818			
2	-0.004449	-0.094075	0.085177			
3	-0.005751	-0.023304	0.011803			
4	-0.001758	-0.011946	0.008431			
5	-0.001023	-0.004612	0.002566			
6	-0.000574	-0.002388	0.001239			
7	-0.000298	-0.001155	0.00056			
8	-0.000173	-0.000645	0.000299			

A38. Results of the IRFs on the Japan Risk Premia with the 95% confidence interval.

Steps	RPlarge	Lower	Upper	RPsmall	Lower	Upper
0	0	0	0	0	0	0
1	-0.009554	-0.042332	0.023223	0.004883	-0.267374	0.277139
2	-0.002727	-0.035867	0.030413	-0.143678	-0.420539	0.133184
3	-0.002195	-0.009138	0.004748	-0.027803	-0.113235	0.05763
4	-0.001114	-0.006098	0.00387	-0.033337	-0.106838	0.040163
5	-0.000611	-0.002469	0.001246	-0.012831	-0.049505	0.023844
6	-0.000335	-0.001554	0.000884	-0.008546	-0.036395	0.019304
7	-0.000179	-0.000825	0.000467	-0.004284	-0.021331	0.012764
8	-0.000095	-0.000534	0.000345	-0.002297	-0.014655	0.010062
Steps	RP10y	Lower	Upper	RPIG	Lower	Upper
0	0	0	0	0	0	0
1	-0.009554	-0.042332	0.023223	0.004883	-0.267374	0.277139

2	-0.002727	-0.035867	0.030413	-0.143678	-0.420539	0.133184
3	-0.002195	-0.009138	0.004748	-0.027803	-0.113235	0.05763
4	-0.001114	-0.006098	0.00387	-0.033337	-0.106838	0.040163
5	-0.000611	-0.002469	0.001246	-0.012831	-0.049505	0.023844
6	-0.000335	-0.001554	0.000884	-0.008546	-0.036395	0.019304
7	-0.000179	-0.000825	0.000467	-0.004284	-0.021331	0.012764
8	-0.000095	-0.000534	0.000345	-0.002297	-0.014655	0.010062

Steps	RPlarge2	Lower	Upper	RPsmall2	Lower	Upper
0	0	0	0	0	0	0
1	-0.069593	-0.84809	0.708904	-0.101707	-0.49038	0.286966
2	0.117353	-0.66904	0.903747	-0.137855	-0.533401	0.257692
3	0.055931	-0.226834	0.338697	-0.049948	-0.197111	0.097214
4	0.083052	-0.188267	0.35437	-0.048433	-0.183159	0.086294
5	0.037373	-0.089499	0.164245	-0.022552	-0.087571	0.042467
6	0.033865	-0.070883	0.138613	-0.017953	-0.068919	0.033013
7	0.017531	-0.039863	0.074926	-0.009622	-0.037979	0.018735
8	0.013252	-0.029186	0.05569	-0.006893	-0.027152	0.013366

Steps	RP10y2	Lower	Upper	RPIG2	Lower	Upper
0	0	0	0	0	0	0
1	0.010182	-0.021672	0.042037	0.111373	-0.305906	0.528652
2	0.003012	-0.029314	0.035337	0.046607	-0.392808	0.486023
3	0.001244	-0.006621	0.009109	0.050106	-0.148507	0.24872
4	-0.000025	-0.005873	0.005823	0.031471	-0.132414	0.195356
5	-0.000044	-0.002409	0.002321	0.021047	-0.080701	0.122796
6	-0.000163	-0.00166	0.001335	0.012979	-0.060817	0.086774
7	-0.00011	-0.00091	0.00069	0.008181	-0.041664	0.058025
8	-0.000093	-0.000608	0.000421	0.004989	-0.030131	0.040108

A39. Results of the IRFs on the Switzerland Risk Premia with the 95% confidence interval.

Steps	RPlarge	Lower	Upper	RPsmall	Lower	Upper
0	0	0	0	0	0	0
1	0.009732	-0.018764	0.038228	0.003563	-0.062974	0.070101
2	0.003154	-0.025985	0.032293	-0.010477	-0.08112	0.060167
3	0.003882	-0.005108	0.012873	0.003275	-0.027178	0.033728
4	0.003374	-0.003793	0.010541	0.006868	-0.015767	0.029504
5	0.001994	-0.001797	0.005786	0.004854	-0.010682	0.02039
6	0.001104	-0.001404	0.003613	0.003713	-0.007539	0.014965
7	0.000758	-0.000953	0.00247	0.00273	-0.005462	0.010922
8	0.000495	-0.00071	0.0017	0.001947	-0.003984	0.007879

Steps	RP10y	Lower	Upper	RPIG	Lower	Upper
0	0	0	0	0	0	0
1	0.009732	-0.018764	0.038228	0.003563	-0.062974	0.070101
2	0.003154	-0.025985	0.032293	-0.010477	-0.08112	0.060167
3	0.003882	-0.005108	0.012873	0.003275	-0.027178	0.033728
4	0.003374	-0.003793	0.010541	0.006868	-0.015767	0.029504

5	0.001994	-0.001797	0.005786	0.004854	-0.010682	0.02039
6	0.001104	-0.001404	0.003613	0.003713	-0.007539	0.014965
7	0.000758	-0.000953	0.00247	0.00273	-0.005462	0.010922
8	0.000495	-0.00071	0.0017	0.001947	-0.003984	0.007879
Steps	RP HY	Lower	Upper			
0	0	0	0			
1	0.003093	-0.054347	0.060532			
2	-0.011858	-0.072605	0.048889			
3	0.001911	-0.024429	0.02825			
4	0.006574	-0.013768	0.026916			
5	0.004217	-0.009276	0.01771			
6	0.003148	-0.006658	0.012953			
7	0.002331	-0.004782	0.009443			
8	0.001689	-0.003484	0.006863			

Steps	RPlarge2	Lower	Upper	RPsmall2	Lower	Upper
0	0	0	0	0	0	0
1	-0.166466	-0.397661	0.06473	-0.004839	-0.00886	-0.000818
2	0.047858	-0.18848	0.284196	0.000643	-0.003451	0.004738
3	-0.028437	-0.110006	0.053132	-0.000648	-0.001955	0.000659
4	-0.000716	-0.068142	0.06671	0.000012	-0.001071	0.001094
5	-0.007605	-0.04239	0.027179	-0.000126	-0.000693	0.000441
6	-0.001618	-0.026656	0.02342	-0.000027	-0.000434	0.00038
7	-0.002087	-0.017611	0.013438	-0.000035	-0.000287	0.000218
8	-0.000886	-0.011511	0.009739	-0.000015	-0.000187	0.000157
Steps	RP10y2	Lower	Upper	RPIG2	Lower	Upper
0	0	0	0	0	0	0
1	0.02025	-0.031917	0.072417	-0.059091	-0.154715	0.036533
2	-0.011208	-0.064295	0.041879	0.015462	-0.086279	0.117204
3	-0.003988	-0.019805	0.011829	-0.003177	-0.048133	0.041778
4	0.000057	-0.012979	0.013093	0.000421	-0.031372	0.032214
5	-0.00075	-0.008538	0.007038	-0.001019	-0.020432	0.018394
6	-0.000243	-0.00579	0.005304	-0.000601	-0.01353	0.012328
7	-0.000303	-0.003879	0.003273	-0.000571	-0.009046	0.007903
8	-0.000164	-0.002585	0.002257	-0.000395	-0.006032	0.005243
Steps	RPHY2	Lower	Upper			
0	0	0	0			
1	-0.047843	-0.130662	0.034976			
2	0.015181	-0.073032	0.103394			
3	-0.002352	-0.041721	0.037017			
4	0.000093	-0.027852	0.028037			
5	-0.000955	-0.01803	0.016119			
6	-0.00053	-0.01193	0.010871			
7	-0.000504	-0.007978	0.006969			
8	-0.000349	-0.005323	0.004626			

A40. Results of the IRFs on the Australian Risk Premia with the 95% confidence interval.

Steps	RPlarge	Lower	Upper	RPsmall	Lower	Upper
0	0	0	0	0	0	0
1	-0.002219	-0.009845	0.005407	0.004312	-0.004136	0.012761
2	0.000019	-0.007966	0.008004	-0.004007	-0.012126	0.004112
3	0.00111	-0.003078	0.005299	0.000587	-0.002278	0.003451
4	-0.000476	-0.001817	0.000865	0.000726	-0.000362	0.001815
5	-0.000121	-0.001152	0.00091	-0.000422	-0.001401	0.000557
6	0.000147	-0.000294	0.000588	0.000015	-0.00026	0.000289
7	-0.000039	-0.000204	0.000126	0.000094	-0.000051	0.000238
8	-0.000024	-0.000136	0.000089	-0.00003	-0.000135	0.000074
Steps	RP10y	Lower	Upper	RPIG	Lower	Upper
0	0	0	0	0	0	0
1	-0.002219	-0.009845	0.005407	0.004312	-0.004136	0.012761
2	0.000019	-0.007966	0.008004	-0.004007	-0.012126	0.004112
3	0.00111	-0.003078	0.005299	0.000587	-0.002278	0.003451
4	-0.000476	-0.001817	0.000865	0.000726	-0.000362	0.001815
5	-0.000121	-0.001152	0.00091	-0.000422	-0.001401	0.000557
6	0.000147	-0.000294	0.000588	0.000015	-0.00026	0.000289
7	-0.000039	-0.000204	0.000126	0.000094	-0.000051	0.000238
8	-0.000024	-0.000136	0.000089	-0.00003	-0.000135	0.000074
Steps	RP HY	Lower	Upper			
0	0	0	0			
1	0.00062	-0.004054	0.005294			
2	0.000828	-0.003686	0.005342			
3	-0.000019	-0.000924	0.000887			
4	-0.000065	-0.000623	0.000493			
5	0.000098	-0.000373	0.000568			
6	0.00000018	-0.000079	0.000079			
7	-0.0000082	-0.00008	0.000064			
8	0.0000078	-0.000044	0.00006			

Steps	RPlarge2	Lower	Upper	RPsmall2	Lower	Upper
0	0	0	0	0	0	0
1	0.001327	-0.03025	0.032904	0.004502	-0.010829	0.019834
2	0.012646	-0.016339	0.041632	-0.008166	-0.022094	0.005761
3	-0.004737	-0.019883	0.010409	0.002535	-0.004681	0.009752
4	0.003709	-0.005439	0.012857	-0.001605	-0.00621	0.003001
5	0.000922	-0.00338	0.005224	-0.000591	-0.002474	0.001291
6	0.000355	-0.00313	0.003839	-0.000154	-0.001746	0.001438
7	0.000719	-0.001968	0.003406	-0.0003	-0.001555	0.000954
8	0.000449	-0.001457	0.002355	-0.000234	-0.001101	0.000632
Steps	RP10y2	Lower	Upper	RPIG2	Lower	Upper
0	0	0	0	0	0	0
1	0.00197	-0.008051	0.01199	0.006325	-0.006111	0.01876
2	0.002579	-0.006566	0.011725	0.001122	-0.010093	0.012337
3	-0.002284	-0.006772	0.002204	-0.000313	-0.004934	0.004309

4	0.000508	-0.001546	0.002562	0.001251	-0.001447	0.003949
5	-0.000113	-0.001356	0.00113	0.000078	-0.001346	0.001503
6	-0.000329	-0.001059	0.0004	0.000157	-0.000813	0.001127
7	-0.000023	-0.000606	0.000559	0.000228	-0.00054	0.000997
8	-0.000081	-0.000473	0.000311	0.000087	-0.000422	0.000596
Steps	RPHY2	Lower	Upper			
0	0	0	0			
1	-0.0000042	-0.003198	0.003189			
2	0.000921	-0.002102	0.003945			
3	-0.000263	-0.001038	0.000511			
4	0.000255	-0.00075	0.001261			
5	0.000139	-0.000487	0.000765			
6	0.00006	-0.000313	0.000433			
7	0.000078	-0.000273	0.000429			
8	0.000058	-0.00019	0.000306			

A41. Results of the IRFs on the Brazil Risk Premia with the 95% confidence interval.

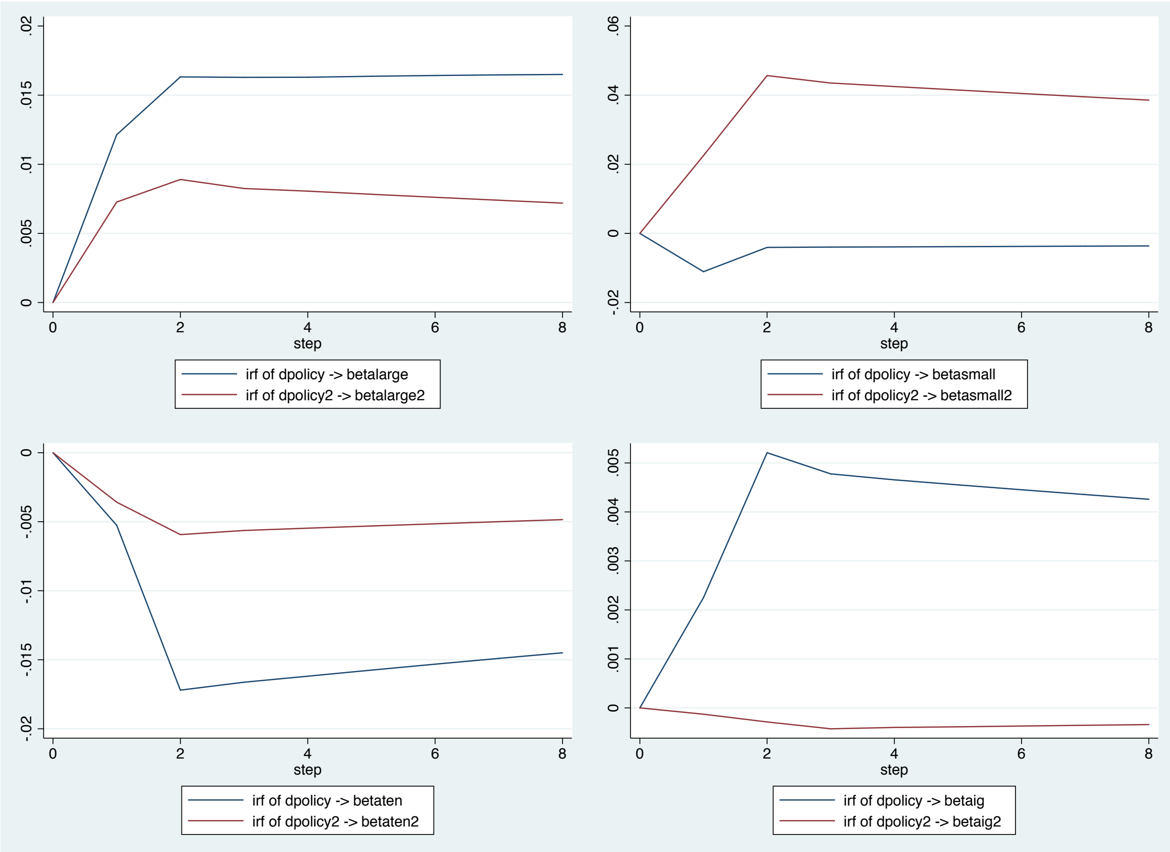
Steps	RPlarge	Lower	Upper	RPsmall	Lower	Upper
0	0	0	0	0	0	0
1	0.000118	-0.001144	0.00138	-0.00197	-0.005103	0.001163
2	0.0000086	-0.001307	0.001324	-0.00263	-0.00584	0.00058
3	0.000062	-0.000471	0.000595	-0.000885	-0.001778	0.0000086
4	0.000011	-0.000412	0.000434	-0.000537	-0.001102	0.000028
5	0.000015	-0.000223	0.000253	-0.000225	-0.000461	0.000011
6	0.0000055	-0.000155	0.000166	-0.000111	-0.00023	0.0000082
7	0.0000045	-0.000094	0.000103	-0.000049	-0.000104	0.0000063
8	0.0000024	-0.000061	0.000066	-0.000023	-0.00005	0.0000048
Steps	RP10y	Lower	Upper	RPMF	Lower	Upper
0	0	0	0	0	0	0
1	0.000118	-0.001144	0.00138	-0.00197	-0.005103	0.001163
2	0.0000086	-0.001307	0.001324	-0.00263	-0.00584	0.00058
3	0.000062	-0.000471	0.000595	-0.000885	-0.001778	0.0000086
4	0.000011	-0.000412	0.000434	-0.000537	-0.001102	0.000028
5	0.000015	-0.000223	0.000253	-0.000225	-0.000461	0.000011
6	0.0000055	-0.000155	0.000166	-0.000111	-0.00023	0.0000082
7	0.0000045	-0.000094	0.000103	-0.000049	-0.000104	0.0000063
8	0.0000024	-0.000061	0.000066	-0.000023	-0.00005	0.0000048

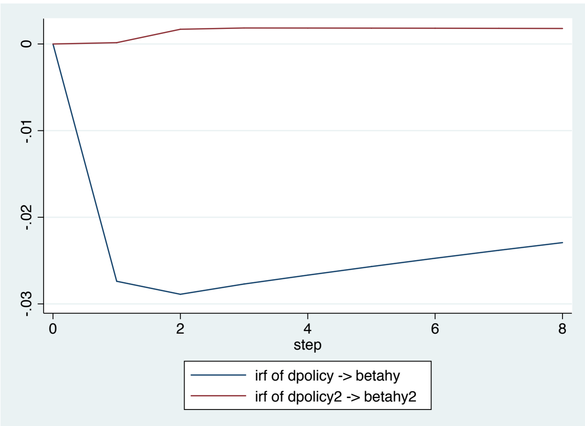
Steps	RPlarge2	Lower	Upper	RPsmall2	Lower	Upper
0	0	0	0	0	0	0
1	-0.018698	-0.059419	0.022023	-0.004539	-0.017364	0.008286
2	-0.016827	-0.058312	0.024658	-0.00519	-0.018245	0.007865
3	-0.003149	-0.017619	0.011322	-0.001399	-0.00586	0.003061
4	-0.004306	-0.017583	0.00897	-0.001509	-0.005572	0.002554
5	-0.001771	-0.009501	0.005959	-0.000599	-0.002867	0.001668
6	-0.001756	-0.007977	0.004465	-0.000547	-0.002365	0.001271

7	-0.001055	-0.005269	0.003159	-0.000314	-0.00153	0.000902
8	-0.000856	-0.004034	0.002321	-0.000251	-0.001168	0.000665

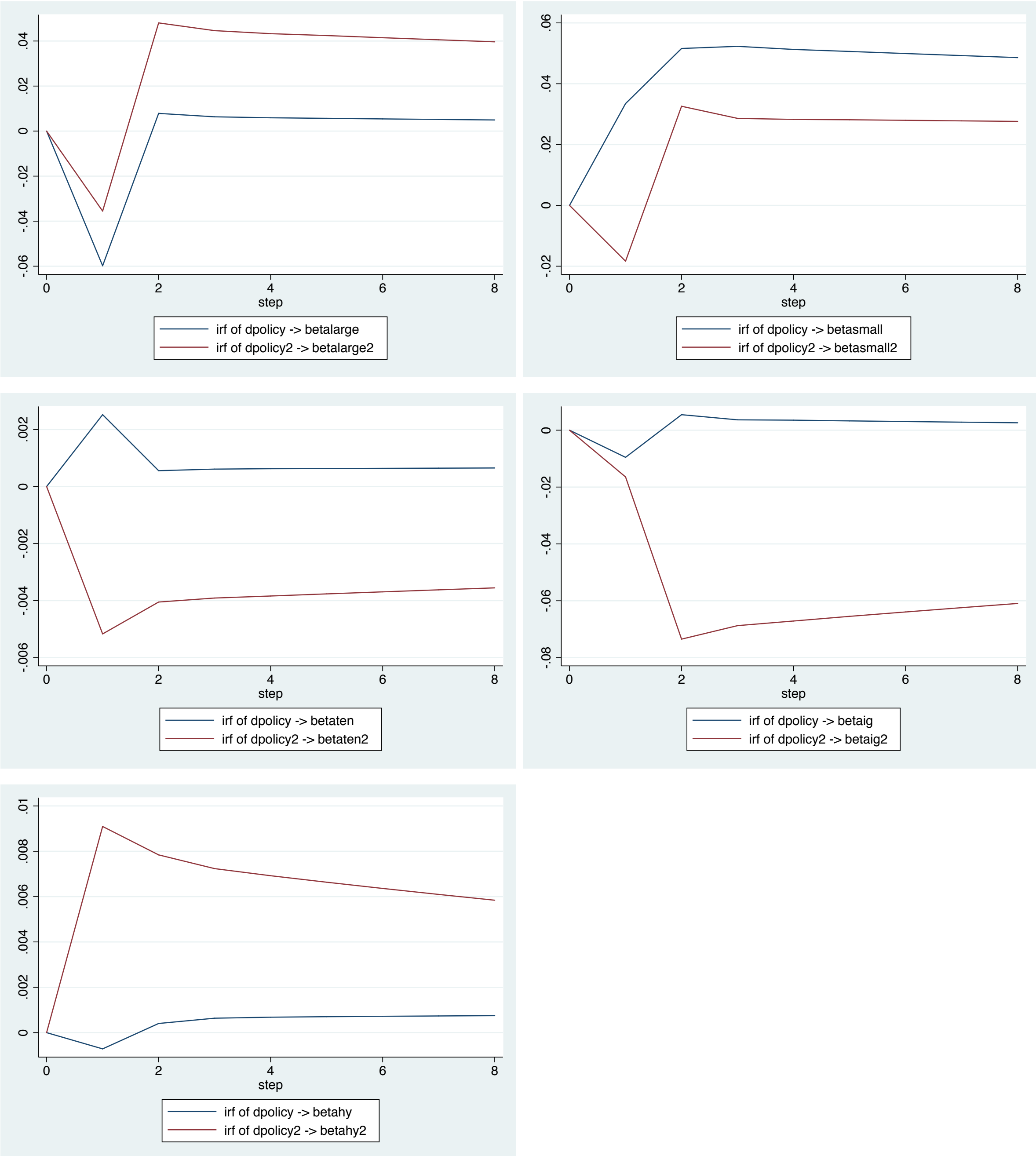
Steps	RP10y2	Lower	Upper	RPMF2	Lower	Upper
0	0	0	0	0	0	0
1	0.000718	-0.009583	0.011019	-0.009583	-0.037332	0.018167
2	-0.003324	-0.013849	0.0072	-0.003371	-0.031751	0.025009
3	-0.000517	-0.003982	0.002949	0.001469	-0.010851	0.013789
4	-0.000421	-0.003345	0.002503	0.002504	-0.009179	0.014187
5	-0.000346	-0.002025	0.001332	0.001572	-0.005133	0.008276
6	-0.00033	-0.001745	0.001085	0.001498	-0.004144	0.00714
7	-0.000227	-0.001151	0.000697	0.000931	-0.002746	0.004608
8	-0.000189	-0.000911	0.000533	0.000767	-0.002088	0.003621

A42. Graphs of the IRFs on the US dynamic betas.

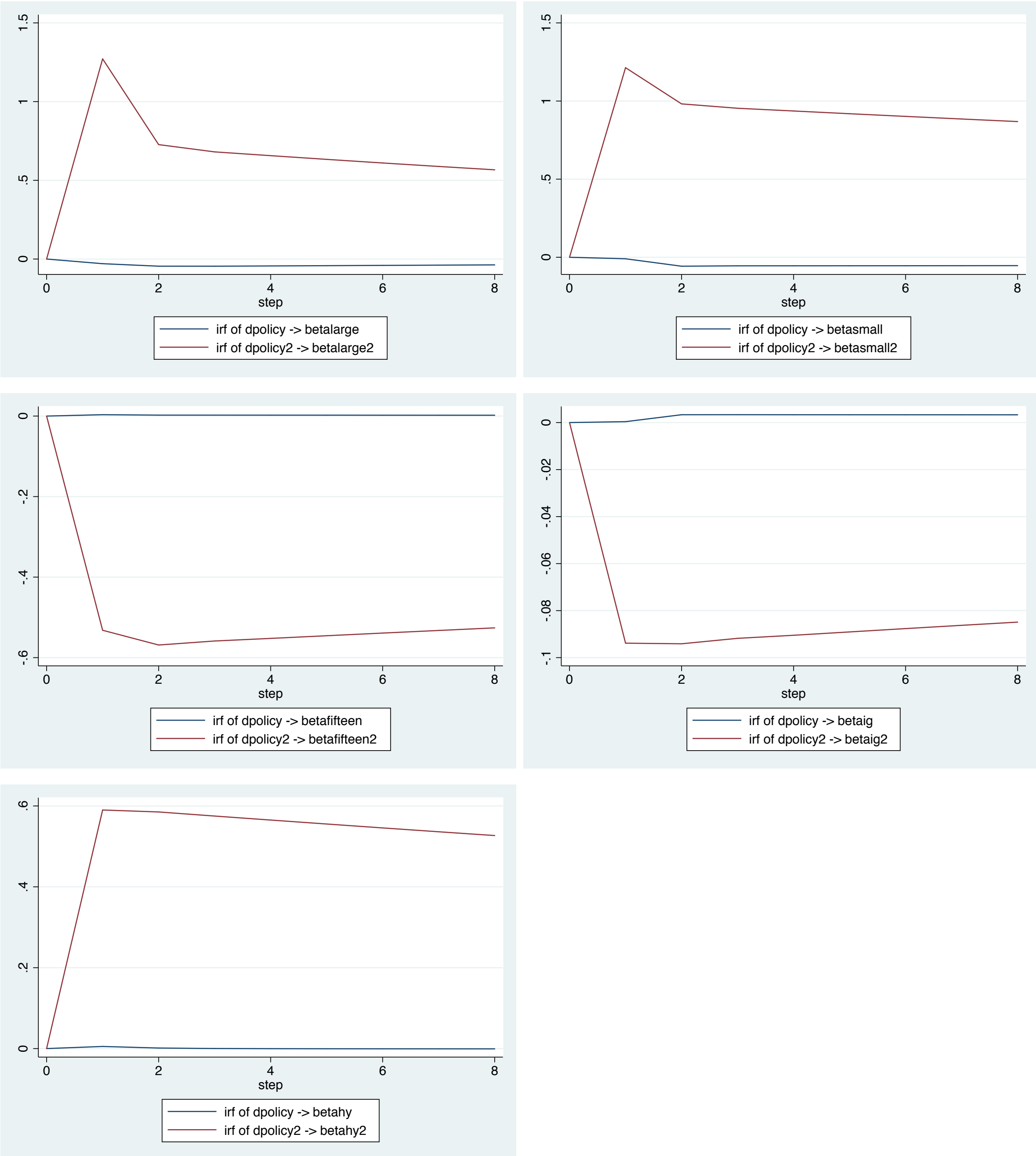




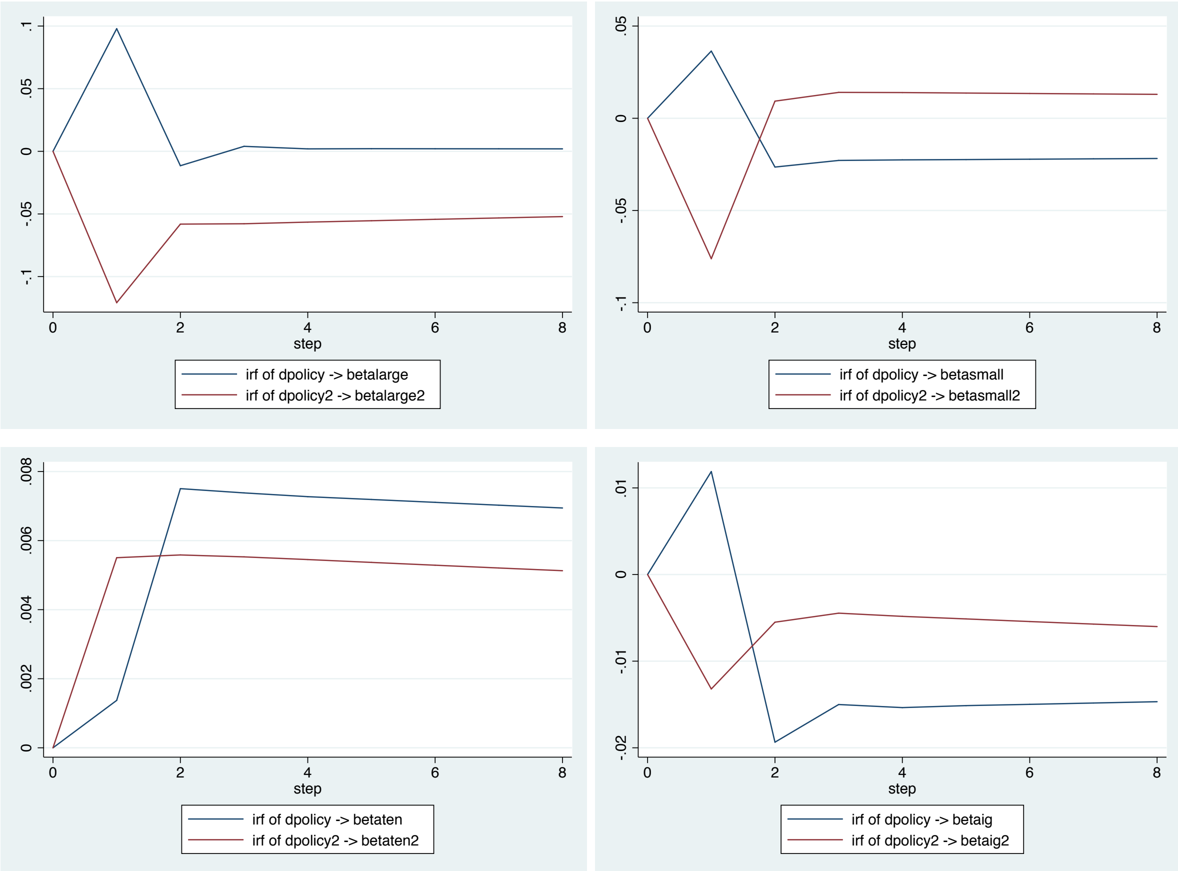
A43. Graphs of the IRFs on the EU dynamic betas.



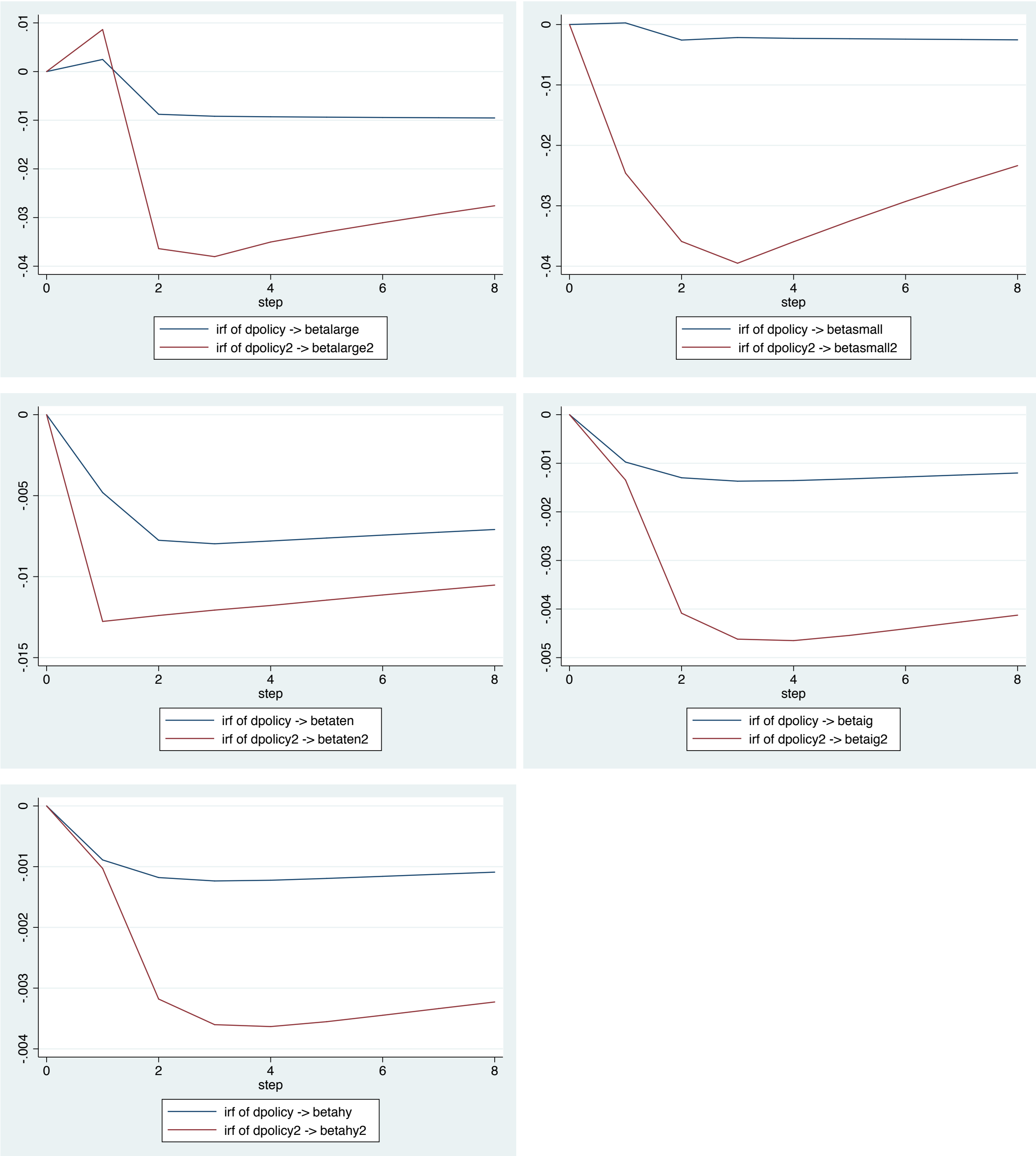
A44. Graphs of the IRFs on the UK dynamic betas.



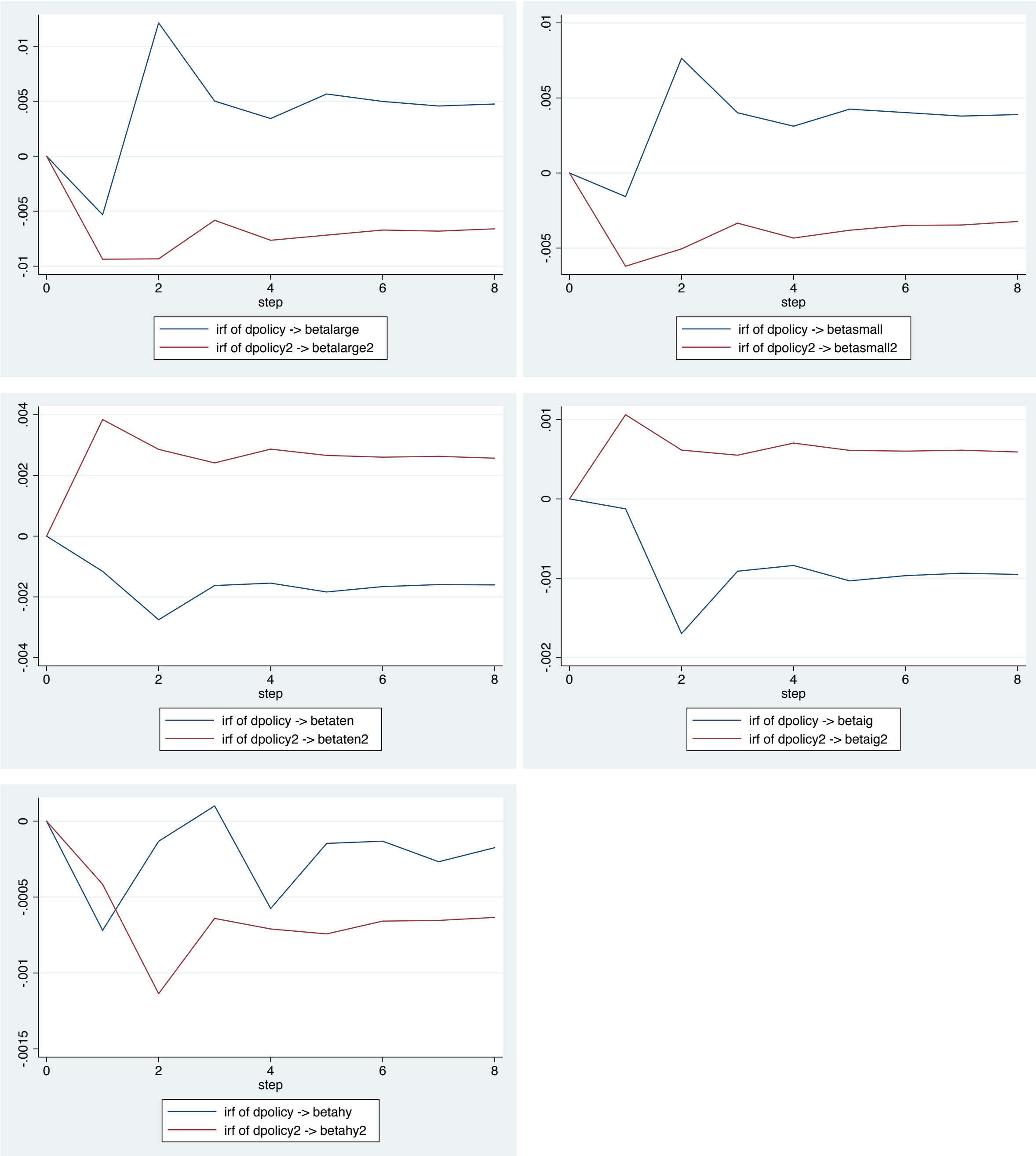
A45. Graphs of the IRFs on the Japan dynamic betas.



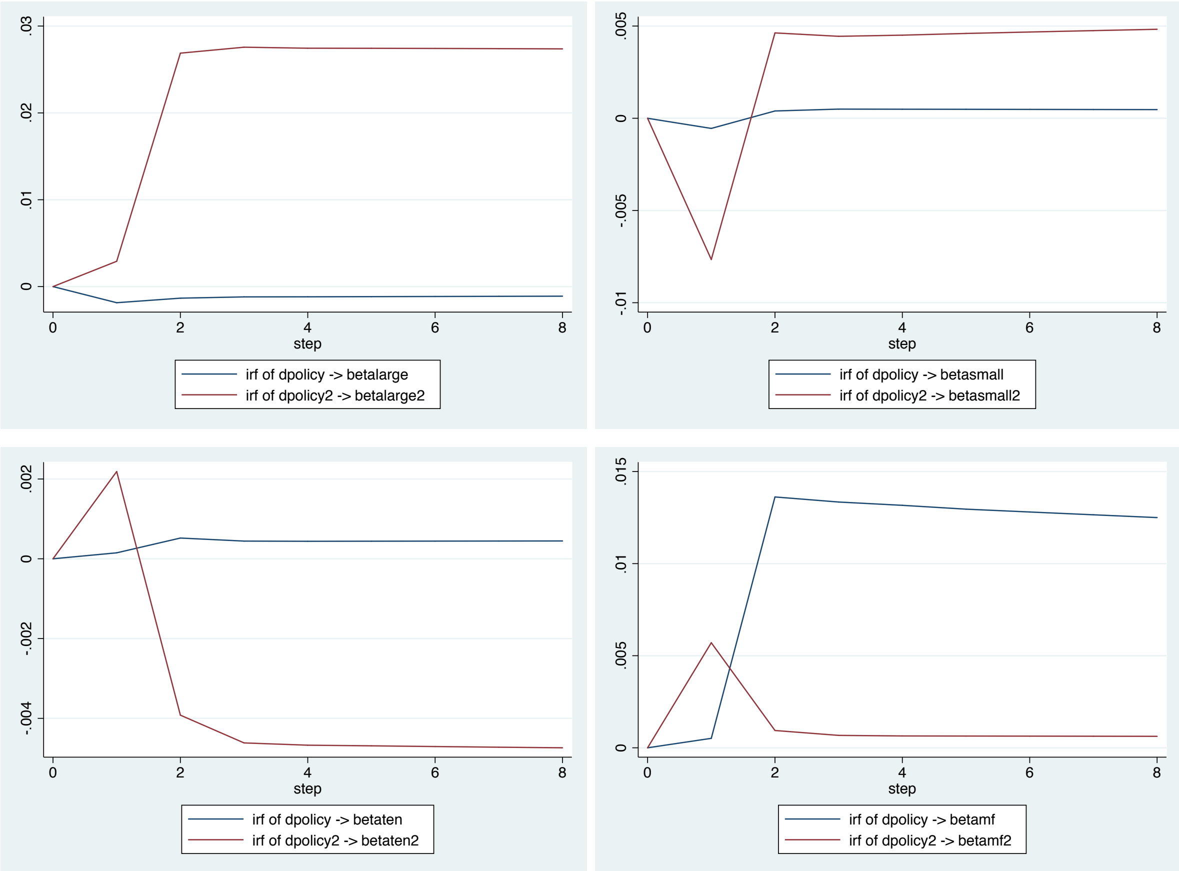
A46. Graphs of the IRFs on the Switzerland dynamic betas.



A47. Graphs of the IRFs on the Australian dynamic betas.



A48. Graphs of the IRFs on the Brazil dynamic betas.



A49. Results of the IRFs on the US dynamic betas with the 95% confidence interval.

Steps	Beta Large	Lower	Upper	Beta Small	Lower	Upper
0	0	0	0	0	0	0
1	0.023084	-0.079275	0.125443	-0.011914	-0.147174	0.123347
2	0.035609	-0.105165	0.176383	-0.006438	-0.195155	0.18228
3	0.03633	-0.098825	0.171485	-0.004266	-0.187834	0.179303
4	0.037115	-0.095228	0.169458	-0.003757	-0.182836	0.175321
5	0.037907	-0.09167	0.167483	-0.003105	-0.178087	0.171877
6	0.038601	-0.08827	0.165473	-0.002542	-0.173544	0.168461
7	0.039217	-0.085012	0.163446	-0.002046	-0.169191	0.1651
8	0.039755	-0.081889	0.161399	-0.001614	-0.165015	0.161788
Steps	Beta 10y	Lower	Upper	Beta IG	Lower	Upper
0	0	0	0	0	0	0
1	-0.00351	-0.04154	0.034521	0.002248	-0.013164	0.017659
2	-0.014037	-0.066717	0.038643	0.005424	-0.015537	0.026385
3	-0.011499	-0.062163	0.039165	0.005054	-0.014833	0.024942
4	-0.010773	-0.059996	0.038451	0.00485	-0.014668	0.024368
5	-0.009995	-0.058047	0.038058	0.004653	-0.014509	0.023816
6	-0.009257	-0.056158	0.037644	0.004465	-0.014354	0.023284
7	-0.00856	-0.054364	0.037244	0.004285	-0.014201	0.022771

8	-0.007898	-0.052652	0.036855	0.004113	-0.014049	0.022275
Steps	Beta HY	Lower	Upper			
0	0	0	0			
1	-0.028274	-0.068998	0.01245			
2	-0.030268	-0.084263	0.023727			
3	-0.028603	-0.077859	0.020654			
4	-0.027413	-0.074828	0.020001			
5	-0.026219	-0.071693	0.019255			
6	-0.025065	-0.068703	0.018574			
7	-0.023944	-0.065834	0.017946			
8	-0.022857	-0.063082	0.017368			

Steps	Beta Large2	Lower	Upper	Beta Small2	Lower	Upper
0	0	0	0	0	0	0
1	0.008015	-0.018147	0.034177	0.023688	-0.017082	0.064458
2	0.009811	-0.025458	0.045079	0.047784	-0.008069	0.103636
3	0.008779	-0.02427	0.041828	0.046275	-0.007087	0.099636
4	0.008815	-0.023486	0.041116	0.04537	-0.006817	0.097558
5	0.008791	-0.022709	0.040291	0.044418	-0.0065	0.095335
6	0.008765	-0.021954	0.039485	0.043473	-0.006194	0.09314
7	0.008736	-0.021226	0.038699	0.042546	-0.005907	0.091
8	0.008704	-0.020525	0.037932	0.041638	-0.005639	0.088914
Steps	Beta 10y2	Lower	Upper	Beta IG2	Lower	Upper
0	0	0	0	0	0	0
1	-0.00431	-0.0212	0.01258	-0.00015	-0.005481	0.005181
2	-0.00682	-0.030639	0.016999	-0.00022	-0.007725	0.007285
3	-0.00631	-0.029741	0.017121	-0.000243	-0.007591	0.007105
4	-0.006238	-0.029135	0.016658	-0.00025	-0.007396	0.006896
5	-0.006135	-0.028531	0.016262	-0.000243	-0.00721	0.006724
6	-0.006029	-0.027926	0.015868	-0.000236	-0.007027	0.006554
7	-0.005925	-0.027334	0.015485	-0.00023	-0.00685	0.00639
8	-0.005822	-0.026756	0.015112	-0.000224	-0.006679	0.006231
Steps	Beta HY2	Lower	Upper			
0	0	0	0			
1	0.000095	-0.006731	0.00692			
2	0.001587	-0.008337	0.011512			
3	0.001581	-0.008531	0.011693			
4	0.001578	-0.008378	0.011533			
5	0.001564	-0.0082	0.011328			
6	0.001549	-0.00802	0.011117			
7	0.001535	-0.007843	0.010912			
8	0.001521	-0.007671	0.010712			

A50. Results of the IRFs on the EU dynamic betas with the 95% confidence interval.

Steps	Beta Large	Lower	Upper	Beta Small	Lower	Upper
0	0	0	0	0	0	0
1	-0.024207	-0.079139	0.030724	0.026047	-0.020743	0.072837
2	0.029597	-0.046487	0.10568	0.056458	-0.0082	0.121117
3	0.026159	-0.047393	0.099712	0.053253	-0.009588	0.116095
4	0.024879	-0.046838	0.096597	0.052341	-0.009711	0.114393
5	0.023677	-0.046294	0.093648	0.051355	-0.00972	0.11243
6	0.022514	-0.045786	0.090814	0.050406	-0.009709	0.11052
7	0.021391	-0.045295	0.088077	0.049479	-0.009705	0.108663
8	0.020305	-0.044822	0.085433	0.048575	-0.009708	0.106857
Steps	Beta 10y	Lower	Upper	Beta IG	Lower	Upper
0	0	0	0	0	0	0
1	0.001583	-0.000682	0.003849	-0.000277	-0.016988	0.016435
2	0.000445	-0.002706	0.003596	0.015627	-0.007248	0.038502
3	0.000566	-0.002514	0.003645	0.014573	-0.007361	0.036507
4	0.00055	-0.002483	0.003583	0.014068	-0.007493	0.035629
5	0.000544	-0.002435	0.003524	0.013577	-0.007587	0.03474
6	0.000538	-0.002388	0.003465	0.013103	-0.00768	0.033886
7	0.000532	-0.002343	0.003407	0.012643	-0.007775	0.033061
8	0.000526	-0.002299	0.00335	0.012197	-0.00787	0.032264
Steps	Beta HY	Lower	Upper			
0	0	0	0			
1	0.001331	-0.004535	0.007196			
2	0.004903	-0.003263	0.013068			
3	0.004448	-0.003518	0.012414			
4	0.004349	-0.003474	0.012173			
5	0.004238	-0.003449	0.011925			
6	0.004131	-0.003423	0.011685			
7	0.004028	-0.003398	0.011453			
8	0.003927	-0.003373	0.011227			

Steps	Beta Large2	Lower	Upper	Beta Small2	Lower	Upper
0	0	0	0	0	0	0
1	-0.023715	-0.1969	0.14947	-0.007044	-0.156006	0.141918
2	0.070796	-0.1657	0.307291	0.047487	-0.152601	0.247576
3	0.063951	-0.16078	0.288682	0.041358	-0.145186	0.227903
4	0.066808	-0.15241	0.286026	0.039527	-0.142626	0.221679
5	0.070032	-0.14419	0.284255	0.037142	-0.141004	0.215288
6	0.072997	-0.136299	0.282293	0.034721	-0.139396	0.208838
7	0.075763	-0.128869	0.280394	0.032386	-0.137886	0.202659
8	0.078321	-0.121876	0.278518	0.030127	-0.136455	0.196709
Steps	Beta 10y2	Lower	Upper	Beta IG2	Lower	Upper
0	0	0	0	0	0	0
1	-0.005264	-0.014017	0.003489	-0.01703	-0.063456	0.029397
2	-0.004127	-0.016705	0.008451	-0.074923	-0.138181	-0.011664
3	-0.003757	-0.016395	0.008881	-0.079059	-0.139354	-0.018764

4	-0.00359	-0.015974	0.008794	-0.077302	-0.136503	-0.0181
5	-0.003427	-0.01556	0.008706	-0.075842	-0.13378	-0.017903
6	-0.00327	-0.015159	0.008618	-0.074371	-0.131047	-0.017695
7	-0.003118	-0.014774	0.008537	-0.072923	-0.128394	-0.017451
8	-0.002971	-0.014405	0.008463	-0.071504	-0.12582	-0.017188
Steps	Beta HY2	Lower	Upper			
0	0	0	0			
1	0.009629	-0.001069	0.020327			
2	0.008565	-0.006005	0.023135			
3	0.008463	-0.005327	0.022252			
4	0.008316	-0.005087	0.02172			
5	0.008031	-0.005002	0.021064			
6	0.007757	-0.004913	0.020427			
7	0.00749	-0.004833	0.019813			
8	0.007229	-0.004763	0.019221			

A51. Results of the IRFs on the UK dynamic betas with the 95% confidence interval.

Steps	Beta Large	Lower	Upper	Beta Small	Lower	Upper
0	0	0	0	0	0	0
1	0.00074	-0.039969	0.04145	0.015106	-0.01929	0.049502
2	-0.009565	-0.067412	0.048282	-0.016277	-0.063163	0.030609
3	-0.009507	-0.066357	0.047344	-0.014918	-0.059609	0.029772
4	-0.009295	-0.063717	0.045126	-0.014913	-0.058925	0.029099
5	-0.009016	-0.061071	0.043038	-0.014816	-0.058142	0.02851
6	-0.008758	-0.058568	0.041053	-0.014757	-0.057459	0.027944
7	-0.008508	-0.05617	0.039154	-0.014696	-0.056793	0.027401
8	-0.008268	-0.053874	0.037338	-0.014635	-0.056152	0.026881
Steps	Beta 15y	Lower	Upper	Beta IG	Lower	Upper
0	0	0	0	0	0	0
1	0.007472	-0.003005	0.017949	0.000671	-0.002465	0.003806
2	0.006691	-0.008046	0.021428	0.001902	-0.002533	0.006338
3	0.006106	-0.00837	0.020582	0.001777	-0.002634	0.006189
4	0.00598	-0.008159	0.020118	0.001754	-0.002617	0.006126
5	0.005848	-0.007957	0.019653	0.001735	-0.002601	0.006071
6	0.005719	-0.007772	0.01921	0.001717	-0.002586	0.00602
7	0.005593	-0.007595	0.01878	0.0017	-0.002572	0.005971
8	0.00547	-0.007423	0.018363	0.001682	-0.002558	0.005923
Steps	Beta HY	Lower	Upper			
0	0	0	0			
1	-0.001504	-0.014563	0.011555			
2	-0.003201	-0.023645	0.017242			
3	-0.00281	-0.025274	0.019654			
4	-0.002755	-0.025245	0.019735			
5	-0.002708	-0.024669	0.019252			
6	-0.002669	-0.023971	0.018634			
7	-0.00263	-0.023257	0.017996			
8	-0.002593	-0.022557	0.01737			

Steps	Beta Large2	Lower	Upper	Beta Small2	Lower	Upper
0	0	0	0	0	0	0
1	1.33448	0.875877	1.79308	1.22645	0.725066	1.72784
2	0.803559	0.154458	1.45266	0.989579	0.276473	1.70269
3	0.721069	0.087583	1.35455	0.973536	0.266218	1.68085
4	0.706277	0.101648	1.31091	0.96183	0.270139	1.65352
5	0.68981	0.111609	1.26801	0.946393	0.268332	1.62445
6	0.673444	0.119894	1.22699	0.931201	0.265806	1.5966
7	0.657595	0.127249	1.18794	0.916339	0.262981	1.5697
8	0.64229	0.133848	1.15073	0.901775	0.259942	1.54361
Steps	Beta 15y2	Lower	Upper	Beta IG2	Lower	Upper
0	0	0	0	0	0	0
1	-0.547861	-0.740009	-0.355713	-0.097936	-0.173519	-0.022354
2	-0.586355	-0.8525	-0.320211	-0.100774	-0.204565	0.003016
3	-0.566856	-0.824964	-0.308748	-0.098638	-0.198055	0.000779
4	-0.557737	-0.812123	-0.303351	-0.097006	-0.194548	0.000536
5	-0.550192	-0.800914	-0.299471	-0.09582	-0.191627	-0.000013
6	-0.542916	-0.790185	-0.295647	-0.094685	-0.188837	-0.000534
7	-0.535806	-0.779856	-0.291756	-0.093566	-0.186148	-0.000985
8	-0.52883	-0.769853	-0.287807	-0.092461	-0.183546	-0.001375
Steps	Beta HY2	Lower	Upper			
0	0	0	0			
1	0.594039	0.369689	0.81839			
2	0.588101	0.249957	0.926245			
3	0.572951	0.214308	0.931593			
4	0.561774	0.20437	0.919179			
5	0.5523	0.201036	0.903563			
6	0.543478	0.19905	0.887906			
7	0.534937	0.197178	0.872696			
8	0.526598	0.195205	0.857991			

A52. Results of the IRFs on the Japan dynamic betas with the 95% confidence interval.

Steps	Beta Large	Lower	Upper	Beta Small	Lower	Upper
0	0	0	0	0	0	0
1	0.099739	-0.096666	0.296143	0.037186	-0.144176	0.218548
2	-0.011731	-0.267541	0.24408	-0.025317	-0.276511	0.225876
3	0.005087	-0.226109	0.236284	-0.017146	-0.262266	0.227974
4	0.00155	-0.225728	0.228828	-0.01867	-0.261544	0.224204
5	0.000704	-0.220154	0.221562	-0.019217	-0.258843	0.220408
6	-0.000414	-0.215258	0.214429	-0.019846	-0.256261	0.21657
7	-0.001454	-0.210479	0.20757	-0.020436	-0.253759	0.212887
8	-0.002454	-0.205852	0.200943	-0.020997	-0.251328	0.209333
Steps	Beta 10y	Lower	Upper	Beta IG	Lower	Upper
0	0	0	0	0	0	0
1	0.00157	-0.012434	0.015573	0.012946	-0.055661	0.081553

2	0.007653	-0.011939	0.027245	-0.017917	-0.10829	0.072456
3	0.007172	-0.012156	0.026499	-0.012272	-0.095744	0.071199
4	0.007151	-0.012003	0.026305	-0.013353	-0.096372	0.069666
5	0.007055	-0.011844	0.025955	-0.013444	-0.095108	0.06822
6	0.006965	-0.011682	0.025612	-0.013655	-0.09411	0.0668
7	0.006875	-0.011524	0.025275	-0.013839	-0.093119	0.065442
8	0.006786	-0.011369	0.024942	-0.014013	-0.092162	0.064136

Steps	Beta Large2	Lower	Upper	Beta Small2	Lower	Upper
0	0	0	0	0	0	0
1	-0.125154	-0.485821	0.235514	-0.080186	-0.373369	0.212998
2	-0.066281	-0.573323	0.44076	0.002762	-0.421308	0.426832
3	-0.052336	-0.551136	0.446463	0.015073	-0.414433	0.444579
4	-0.049782	-0.537892	0.438328	0.015518	-0.405247	0.436284
5	-0.04862	-0.525024	0.427784	0.014664	-0.395562	0.424889
6	-0.04767	-0.512552	0.417211	0.013682	-0.386103	0.413468
7	-0.046766	-0.500432	0.4069	0.012721	-0.376924	0.402367
8	-0.045884	-0.48865	0.396883	0.011797	-0.368022	0.391617
Steps	Beta 10y2	Lower	Upper	Beta IG2	Lower	Upper
0	0	0	0	0	0	0
1	0.005342	-0.009543	0.020227	-0.011544	-0.189091	0.166002
2	0.005306	-0.017015	0.027626	-0.001314	-0.25879	0.256161
3	0.005372	-0.018132	0.028876	-0.003721	-0.266234	0.258792
4	0.005324	-0.017985	0.028632	-0.004745	-0.2648	0.255309
5	0.005236	-0.017667	0.028138	-0.004926	-0.262147	0.252294
6	0.005143	-0.017333	0.02762	-0.004928	-0.259419	0.249563
7	0.005052	-0.017004	0.027107	-0.004904	-0.256724	0.246917
8	0.004962	-0.016681	0.026605	-0.004878	-0.254066	0.24431

A53. Results of the IRFs on the Switzerland dynamic betas with the 95% confidence interval.

Steps	Beta Large	Lower	Upper	Beta Small	Lower	Upper
0	0	0	0	0	0	0
1	0.001748	-0.046861	0.050357	0.001755	-0.041901	0.045411
2	-0.01006	-0.076715	0.056595	-0.001089	-0.058371	0.056193
3	-0.010329	-0.074038	0.05338	-0.001528	-0.053627	0.050571
4	-0.010693	-0.073132	0.051747	-0.00159	-0.053024	0.049843
5	-0.01108	-0.072245	0.050085	-0.001626	-0.052143	0.048891
6	-0.01143	-0.071369	0.048509	-0.001666	-0.051307	0.047976
7	-0.011755	-0.070524	0.047015	-0.00171	-0.0505	0.047081
8	-0.012055	-0.069705	0.045596	-0.001758	-0.049723	0.046207
Steps	Beta 10y	Lower	Upper	Beta IG	Lower	Upper
0	0	0	0	0	0	0
1	-0.00505	-0.018904	0.008805	-0.001031	-0.002546	0.000484
2	-0.007884	-0.027349	0.01158	-0.001374	-0.003602	0.000854
3	-0.00732	-0.026285	0.011645	-0.001316	-0.003598	0.000966
4	-0.00708	-0.025457	0.011296	-0.001261	-0.003489	0.000968

5	-0.006894	-0.024749	0.010961	-0.00121	-0.003378	0.000957
6	-0.006711	-0.024057	0.010635	-0.001162	-0.003267	0.000944
7	-0.006534	-0.02339	0.010323	-0.001115	-0.00316	0.000931
8	-0.006361	-0.022746	0.010023	-0.001069	-0.003056	0.000918
Steps	Beta HY	Lower	Upper			
0	0	0	0			
1	-0.000939	-0.002192	0.000315			
2	-0.001253	-0.003087	0.00058			
3	-0.001205	-0.003073	0.000662			
4	-0.001157	-0.002982	0.000668			
5	-0.001113	-0.002892	0.000666			
6	-0.00107	-0.002802	0.000663			
7	-0.001028	-0.002715	0.000659			
8	-0.000987	-0.002631	0.000656			

Steps	Beta Large2	Lower	Upper	Beta Small2	Lower	Upper
0	0	0	0	0	0	0
1	-0.006223	-0.196745	0.184299	-0.000875	-0.164907	0.163157
2	0.072861	-0.202231	0.347953	0.065398	-0.171975	0.30277
3	0.066062	-0.210915	0.343039	0.061574	-0.177913	0.301061
4	0.061646	-0.208144	0.331435	0.057634	-0.175969	0.291237
5	0.058453	-0.203851	0.320757	0.0548	-0.173059	0.282659
6	0.055717	-0.199348	0.310782	0.052335	-0.170043	0.274713
7	0.053159	-0.194819	0.301137	0.05001	-0.166992	0.267013
8	0.050717	-0.190328	0.291762	0.04778	-0.163951	0.25951
Steps	Beta 10y2	Lower	Upper	Beta IG2	Lower	Upper
0	0	0	0	0	0	0
1	-0.002885	-0.024066	0.018297	-0.000818	-0.005671	0.004035
2	-0.014287	-0.043905	0.015331	-0.002779	-0.01039	0.004833
3	-0.014279	-0.043192	0.014634	-0.002893	-0.011271	0.005485
4	-0.013996	-0.042216	0.014223	-0.002893	-0.011285	0.0055
5	-0.013668	-0.041179	0.013843	-0.002851	-0.011044	0.005343
6	-0.013337	-0.040159	0.013485	-0.002796	-0.010742	0.00515
7	-0.013007	-0.039157	0.013143	-0.002737	-0.010432	0.004959
8	-0.012681	-0.038181	0.012819	-0.002676	-0.010131	0.004779
Steps	Beta HY2	Lower	Upper			
0	0	0	0			
1	-0.000532	-0.004682	0.003618			
2	-0.002199	-0.008741	0.004343			
3	-0.002326	-0.009552	0.004901			
4	-0.002331	-0.009566	0.004903			
5	-0.0023	-0.009355	0.004756			
6	-0.002257	-0.009091	0.004577			
7	-0.00221	-0.008821	0.004401			
8	-0.002162	-0.008559	0.004234			

A54. Results of the IRFs on the Australian dynamic betas with the 95% confidence interval.

Steps	Beta Large	Lower	Upper	Beta Small	Lower	Upper
0	0	0	0	0	0	0
1	-0.005481	-0.018564	0.007602	-0.001919	-0.012405	0.008567
2	0.012381	-0.003986	0.028748	0.007568	-0.005776	0.020913
3	0.004926	-0.005303	0.015154	0.003678	-0.005036	0.012391
4	0.003315	-0.007254	0.013885	0.002768	-0.006308	0.011844
5	0.005346	-0.005822	0.016514	0.003887	-0.005818	0.013591
6	0.004749	-0.005653	0.015151	0.0036	-0.005618	0.012818
7	0.004268	-0.005814	0.014351	0.003355	-0.005724	0.012435
8	0.004351	-0.00559	0.014292	0.003418	-0.005666	0.012502
Steps	Beta 10y	Lower	Upper	Beta IG	Lower	Upper
0	0	0	0	0	0	0
1	-0.00053	-0.004136	0.003076	-0.000172	-0.002201	0.001857
2	-0.002471	-0.007186	0.002243	-0.001828	-0.004451	0.000795
3	-0.001798	-0.005024	0.001429	-0.001104	-0.002837	0.00063
4	-0.001546	-0.004637	0.001546	-0.000949	-0.002711	0.000812
5	-0.001741	-0.005012	0.001531	-0.001144	-0.003035	0.000747
6	-0.001687	-0.00477	0.001396	-0.001084	-0.002875	0.000707
7	-0.00162	-0.004587	0.001347	-0.001036	-0.002787	0.000716
8	-0.001615	-0.004533	0.001304	-0.001041	-0.002786	0.000703
Steps	Beta HY	Lower	Upper			
0	0	0	0			
1	-0.001	-0.009677	0.007677			
2	-0.000343	-0.011484	0.010798			
3	-0.000317	-0.007409	0.006775			
4	-0.000438	-0.007354	0.006479			
5	-0.000363	-0.007589	0.006863			
6	-0.000326	-0.006896	0.006243			
7	-0.000322	-0.006501	0.005856			
8	-0.0003	-0.006248	0.005648			

Steps	Beta Large2	Lower	Upper	Beta Small2	Lower	Upper
0	0	0	0	0	0	0
1	-0.00928	-0.025157	0.006597	-0.005555	-0.020286	0.009176
2	-0.009237	-0.027872	0.009397	-0.004489	-0.021739	0.012762
3	-0.005936	-0.016152	0.00428	-0.002613	-0.01201	0.006783
4	-0.007507	-0.020262	0.005247	-0.003739	-0.015457	0.007979
5	-0.007093	-0.01956	0.005374	-0.003337	-0.014768	0.008094
6	-0.006616	-0.017941	0.004709	-0.003075	-0.013426	0.007276
7	-0.006666	-0.018055	0.004723	-0.003114	-0.013507	0.007279
8	-0.006446	-0.017466	0.004575	-0.002959	-0.012994	0.007077
Steps	Beta 10y2	Lower	Upper	Beta IG2	Lower	Upper
0	0	0	0	0	0	0
1	0.003856	-0.000345	0.008057	0.001037	-0.002238	0.004311
2	0.002912	-0.002446	0.00827	0.0006	-0.003487	0.004686
3	0.002394	-0.001059	0.005847	0.000516	-0.002013	0.003045

4	0.00279	-0.001108	0.006688	0.000663	-0.002283	0.00361
5	0.002559	-0.001369	0.006487	0.000594	-0.002381	0.003569
6	0.002458	-0.001194	0.006109	0.000589	-0.002178	0.003357
7	0.002441	-0.001212	0.006093	0.000601	-0.002189	0.003391
8	0.002349	-0.001231	0.005928	0.000587	-0.002158	0.003333
Steps	Beta HY2	Lower	Upper			
0	0	0	0			
1	-0.000555	-0.003001	0.001891			
2	-0.001317	-0.004547	0.001914			
3	-0.00081	-0.003028	0.001408			
4	-0.000887	-0.003298	0.001525			
5	-0.000926	-0.003356	0.001503			
6	-0.000843	-0.003106	0.001419			
7	-0.000839	-0.003083	0.001406			
8	-0.000821	-0.003014	0.001371			

A55. Results of the IRFs on the Brazil dynamic betas with the 95% confidence interval.

Steps	Beta Large	Lower	Upper	Beta Small	Lower	Upper
0	0	0	0	0	0	0
1	-0.001767	-0.00787	0.004336	-0.000397	-0.005364	0.004571
2	-0.001409	-0.00985	0.007031	0.000545	-0.006401	0.00749
3	-0.000782	-0.008998	0.007434	0.001249	-0.005608	0.008107
4	-0.000504	-0.008521	0.007513	0.001391	-0.005345	0.008127
5	-0.000238	-0.008077	0.007601	0.001528	-0.005107	0.008163
6	0.000018	-0.007666	0.007702	0.001662	-0.004888	0.008211
7	0.000265	-0.007272	0.007803	0.001792	-0.004676	0.00826
8	0.000504	-0.006895	0.007902	0.001918	-0.004473	0.008309
Steps	Beta 10y	Lower	Upper	Beta MF	Lower	Upper
0	0	0	0	0	0	0
1	0.000171	-0.003519	0.003861	0.000681	-0.003465	0.004827
2	0.000591	-0.00473	0.005913	0.013881	0.008102	0.01966
3	0.000705	-0.004725	0.006135	0.013508	0.007786	0.019231
4	0.000642	-0.004723	0.006006	0.013369	0.007705	0.019033
5	0.000582	-0.004716	0.005881	0.013206	0.007604	0.018808
6	0.000526	-0.004718	0.00577	0.013086	0.00753	0.018643
7	0.000473	-0.00472	0.005665	0.012966	0.007452	0.018479
8	0.000421	-0.004723	0.005564	0.012846	0.007373	0.018318

Steps	Beta Large2	Lower	Upper	Beta Small2	Lower	Upper
0	0	0	0	0	0	0
1	-0.001072	-0.039172	0.037029	-0.009054	-0.036566	0.018459
2	0.019733	-0.033526	0.072992	0.001949	-0.036762	0.04066
3	0.017744	-0.034363	0.06985	0.000845	-0.037244	0.038934
4	0.017323	-0.033902	0.068547	0.000846	-0.036537	0.038229
5	0.016856	-0.033552	0.067265	0.000812	-0.035932	0.037556
6	0.016409	-0.033223	0.066041	0.000781	-0.035347	0.036909
7	0.015976	-0.032905	0.064857	0.000754	-0.034776	0.036283

8	0.015557	-0.032595	0.063709	0.000729	-0.034216	0.035675
Steps	Beta 10y2	Lower	Upper	Beta MF2	Lower	Upper
0	0	0	0	0	0	0
1	0.004543	-0.03973	0.048817	0.005445	-0.015052	0.025943
2	0.001609	-0.062126	0.065344	0.000613	-0.028226	0.029453
3	0.004516	-0.059277	0.068309	0.000996	-0.02723	0.029222
4	0.004467	-0.057502	0.066436	0.000899	-0.026512	0.02831
5	0.004496	-0.055833	0.064826	0.000782	-0.025882	0.027446
6	0.004525	-0.054239	0.063289	0.00067	-0.025272	0.026611
7	0.00455	-0.052709	0.061808	0.000564	-0.024675	0.025803
8	0.00457	-0.051237	0.060377	0.000463	-0.024092	0.025019

A56. Results of the variance test ratios. There were 45 observations for each sub-sample.

Variance Ratio Test		Standard Deviations				P-values		
		First Sample	Second Sample	Difference	Ratios	Ratio < 1	Ratio = 1	Ratio > 1
Australia	Beta	0.0032	0.0034	0.0003	0.9247	0.303	0.6059	0.697
Australia	Risk Premia	0.0025	0.0028	0.0003	0.8811	0.2021	0.4042	0.7979
Brazil	Beta	0.0052	0.0068	0.0016	0.7713	0.0646	0.1292	0.9354
Brazil	Risk Premia	0.0015	0.0045	0.0030	0.3431	0	0	1
Switzerland	Beta	0.0041	0.0297	0.0257	0.1364	0	0	1
Switzerland	Risk Premia	0.0161	0.0287	0.0127	0.5592	0	0	1
EU	Beta	0.0189	0.0341	0.0152	0.5548	0	0	1
EU	Risk Premia	0.0033	0.0087	0.0054	0.3771	0	0	1
Japan	Beta	0.0216	0.0321	0.0105	0.6723	0.0106	0.0213	0.9894
Japan	Risk Premia	0.0521	0.0492	-0.0030	1.0601	0.6341	0.7317	0.3659
UK	Beta	0.0075	0.5650	0.5575	0.0133	0	0	1
UK	Risk Premia	0.0022	0.0170	0.0148	0.1280	0	0	1
US	Beta	0.0155	0.0168	0.0013	0.9223	0.2969	0.5939	0.7031
US	Risk Premia	0.0237	0.0087	-0.0150	2.7226	1	0	0
Average	Beta	0.0109	0.0983	0.0874	0.1104	0.0964	0.1929	0.9036
Average	Risk Premia	0.0145	0.0171	0.0026	0.8475	0.2623	0.1623	0.7377