Measuring the Effects of U.S. Unconventional Monetary Policy on International Financial Markets

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Abstract

I replicate the analysis of Swanson (2017) to separately identify the effects of U.S. forward guidance and large-scale asset purchases during the US zero lower bound period. I then estimate the effects of these two unconventional monetary policy tools on bond yields, stock indices, and exchange rates for the UK, Canada, Australia, Japan, and Germany. I find that these two factors have substantial effects on international bond yields, but these effects vary across countries and across maturities. I find small effects on exchange rates, and no effect on stock indices. I compute a spillover rate for each factor to facilitate cross country analysis. I extend this analysis to a larger panel of countries, and find similar results. I conclude that there are significant spillover effects on international bond yields from US monetary policy across countries and maturities. Version 0.4

Keywords: unconventional monetary policy, zero lower bound, international bonds

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1 Introduction

In an extension to work by Gürkaynak et al. (2005), Swanson (2017) proposes a new method to identify and estimate the effect of unconventional monetary policy pursued by the US Federal Reserve when the federal funds rate was set close to zero, focusing on "forward guidance" and "large scale asset purchases" (LSAPs). I replicate this analysis to identify and estimate the spillover effects of US unconventional monetary policies on foreign bond yields, exchange rates, and stocks. In particular, I look at the effects on the bond, foreign currency exchange, and stock markets of Canada, Australia, Japan, Germany, and the UK. I compute a spillover rate for each of the estimated effects, and I then extend my analysis to a larger panel of additional countries.

The paper by Gürkaynak et al. (2005) (henceforth GSS) investigates the effects of US monetary policy on asset prices using a high-frequency approach, and finds that these effects are not captured by a single factor, but rather by two: a federal funds rate factor, and a future path of policy factor. The analysis was motivated by movements of bond yields around Federal Open Market Committee (henceforth, FOMC) announcements, *including those announcements where the federal funds rate remained unchanged*. In particular, the January 24, 2004 announcement led to large reactions in bond markets despite the FOMC's decision to change the federal funds rate by exactly 0 basis points. There was more to the story than just the unanticipated component of a change (or non-change) in the federal funds target rate, namely this "future path of policy factor". Central bankers would find themselves in this exact situation a few years after the publication of this paper: the global financial crisis would lead them to reduce short-term interest rates towards the zero lower bound (ZLB). Thus, short term interest rates would essentially be unchanged during every FOMC meeting, and the efficacy of monetary policy would seem to depend solely on the second factor: the future path of policy. We know that asset prices and yields, as well as the economy, are influenced by the entire path of expected future interest rates rather than

just the current level, as implied by standard macroeconomic theory (Woodford 2003 and Clarida et al. 2002). We also know that in a world of free mobility of capital, unanticipated monetary policy decisions in the US affects yields and prices at the international level, as investors re-balance their portfolio and arbitrage away price differentials. In the zero lower bound world, we would seemingly have international agents reacting *only* to unanticipated changes in the future path of policy. We see this, for example, in the international stock and bond market response to the September 18, 2013 announcement, as international yields, stock prices, and foreign exchange rates all moved following the announcement, even though the federal funds rate remained at zero.

However, the effectiveness of monetary policy would not depend solely on forward guidance during the financial crisis. Beyond affecting the future path of rates, central bankers also turned towards large scale asset purchases (LSAPs) as their second unconventional monetary policy tool. We saw the central banks of US, the UK, and Japan all engage in some form of bond or asset purchase, which has been historically unusual. Facing deteriorating economic conditions in the middle of the crisis, the Federal Reserve moved to expand its balance sheet to unprecedented levels by purchasing large amounts of Treasury debt, and securities of medium to long term maturities. The goal here, as with forward guidance, was to put downward pressure on long-term yields, in hopes of bettering economic conditions and spurring growth.

Unconventional monetary policy can be difficult to understand, and its effects are hard to estimate. However, policy makers need to do both in order to better assess the costs of avoiding the ZLB, and to have a better understanding of the effects of their policies. There are also difficulties involved in estimating and identifying the effects of forward guidance and asset purchases separately. One of the challenges is the signaling channel of LSAPs, where expectations about the future path of interest rates is affected by a "pure" purchase announcement that lack a forward guidance component, as shown by Bauer and Neely (2014). This would imply that LSAP announcements have forward guidance signals "built" into them, making

disentangling the effect of both policies cumbersome. Work by Krishnamurthy and Vissing-Jorgensen (2011) also finds strong evidence for this signaling channel in asset responses to LSAP announcements. Other challenges are the lack of good financial expectation data on FOMC announcements, which makes determining the size of an unanticipated component difficult, and the "effect" of Central Bank inaction, which implies that even dates outside of the FOMC announcement dates could have produced movements in financial markets across the world.

In order to address these challenges, I replicate the procedures in Swanson (2017) and use a high-frequency approach. I use the data set from the aforementioned paper, look at the 30-minute response of asset prices to each FOMC announcement, then compute the first three[1] principal components of those asset price responses. I then search over all possible rotations of these principal components so as to correspond the first factor to the change in the federal funds rates, the second factor to the change in forward guidance, and the third factor to the change in LSAPs. By using a set of identifying assumptions, I can separately identify the size of each of the three components of every FOMC announcement in my sample. I then use daily regressions to estimate the response of international bond yields and asset prices to the forward guidance and LSAP component during the zero lower bound period. I find significant effects of US unconventional monetary policy on international bond yields using this procedure. I also find that the effects are different across countries, and generally smaller in magnitude than the effects found on US domestic assets, as would be expected. I compute a spillover ratio for each country across the 2-year, 5-year, and 10-year maturities to facilitate the comparison among their responses. Lastly, I extend this analysis to a panel of 32 countries to look for similar findings across a larger set of countries.

[1]See Swanson (2017) for details. Announcement effects can be well described by three dimensions over 1991-2015

2 Literature Review

A number of papers have focused on the domestic effects of unconventional monetary policy at the zero lower bound. Important contributions to this literature include Wright (2011), Gagnon et al. (2011), and Hamilton and Wu (2012), generally concluding that unconventional policy at the ZLB has effects on both yields and the real economy at large. Early work by Blinder (2000) examined the implications of the zero bound and liquidity traps on interest rates, and anticipated what central bankers, both in the US and around the world, could potentially do about it. Krishnamurthy and Vissing-Jorgensen (2011) evaluate the effects of the Federal Reserve's bond purchases on interest rates using an event-study methodology. They find these purchases lowered nominal interest rates on a number of assets, but with magnitudes that differed across bond types, maturities, and across events. Chen et al. (2011) investigate the effects of asset purchases on domestic macroeconomic variables using simulations on a medium-scale DSGE model estimated on US data. They find positive and persistent effects on GDP growth with a small marginal contribution to inflation. A more recent survey paper by Bhattarai and Neely (2016) shows that there is indeed strong evidence that unconventional policy announcements have effects on domestic and international financial markets.

At the international level, we know that one of the first countries to implement these large asset purchases as a form of unconventional policy was Japan during the early 2000s. Thus, early literature on the effects of unconventional policy at the ZLB focus on the Bank of Japan's enacting the Comprehensive Monetary Easing program, whose goal was boosting economic activity and raising inflation by purchasing government securities and corporate bonds. Berkmen (2012) finds some evidence of the impact of the BoJ's policies on output and inflation using a structural VAR, and finds relatively small effects on output and inflation, but stronger in recent times than in the past. The results may reflect a more effective credit channel as a result of improvements in the banking and corporate sectors that is generating

the stronger effect on output. Work by Bernoth et al. (2015) also summarizes the impact of asset purchases in Japanese financial markets and the domestic real economy of Japan, but extend their analysis to the US and the UK. They find asymmetries in the effectiveness of asset purchase programs, with the US and UK programs having a greater impact on bond yields than the measures taken by the Bank of Japan, in line with the findings of Berkmen, and no clear, unambiguous effect on output and inflation.

Several papers have investigated the effects of US unconventional monetary policy on international markets. Work by Berge and Cao (2014) analyzed how the response to US monetary policy changed before and after the ZLB using statistical methods. They found that foreign interest rates responded somewhat strongly to the expected path of policy during this period, while the response to the target rate factor disappeared during this period. They also find a strong effect of policy surprises on exchange rates and asset prices after 2007. Gambacorta et al. (2014) use a panel structural VAR framework with monthly data over the ZLB period to assess the effects of unconventional policies on macro variables. They exploit the cross country dimension of the financial crisis, such as output and price dynamics, central bank balance sheet policies, and dynamics of uncertainty and risk aversion in financial markets to improve the accuracy of their analysis. They find that expansionary unconventional policy shocks lead to significant but not persistent rise in output and prices, which are qualitatively similar to effects found on conventional monetary policy. Neely (2015) uses a portfolio choice model to study the effects of unconventional policy on international long-term yields and foreign exchange rates during the ZLB period. He finds that international yields indeed declined following FOMC announcements, and the expected excess bond yield declines are consistent with the predicted effects of a simple portfolio balance model estimated with historical data. The paper concludes that unconventional policy can reduce yields and depreciate the dollar even when the ZLB constraint binds. Alpanda and Kabaca (2015) evaluate international spillover effects of LSAPs using a two-country, open economy DSGE framework with nominal and real rigidities and portfolio balance effects. Their work

shows that asset purchases lower both domestic and foreign long term yields while stimulating worldwide economic activity. They also find that asset purchases in the US that generate the same effects on output as conventional policy have larger international spillover effects through a portfolio balance channel.

The literature on the effects of unconventional monetary policy on international asset prices all seem to agree that monetary policy does generate a response across international bond markets. There also seems to be consensus that these spillover effects of US unconventional policy on international assets are significant, be it foreign bonds, stocks, or exchange rates. This paper seeks to expand on this literature by separately identifying and estimating the spillover effects of each unconventional tool on these different international assets.

3 Data & Methodology

3.1 Identification of Forward Guidance, LSAPs

I estimate and identify the forward guidance and LSAP component of each FOMC announcement replicating the analysis from Swanson (2017)[2] as mentioned earlier. This data set contains the dates of each FOMC announcement from July 1991 through October 2015, along with the change in a number of asset prices in a 30-minute window bracketing each announcement. Among asset prices included are federal fund futures, eurodollar futures, Treasury bond yields, US stock market index, and exchange rates. These asset price responses are then arranged into a $T \times n$ matrix X, with rows corresponding to FOMC announcements, and columns corresponding to n different assets. Therefore, each x_{ij} element corresponds to the 30-minute response of the jth asset to the ith FOMC announcement. Both Swanson

[2]Swanson (2017) extends the original dataset used in GSS (2005) using data obtained from staff at the Federal Reserve Board. Motivation for the use of these assets can be found there. See for details on data set

(2017) and GSS describe these data with a factor model,

$$X = F\Lambda + \epsilon \tag{1}$$

where F is a $T \times k$ matrix containing $k < n$ unobserved factors, Λ is a $k \times n$ matrix of loadings of the asset prices responses on the k factors, and ϵ is a matrix of white noise residuals. The approach here is to think of the columns of F as corresponding to the surprise component of: (1) the change in the federal funds rates, (2) the change in forward guidance, (3) any LSAP announcements, and (4) any additional dimensions of news about policy or the economy that are systematically revealed during FOMC announcements. The matrix F is unobserved, and so it needs to be estimated and identified.

The approach I take in this paper is to replicate the full-sample identification strategy developed in Swanson (2017), using the entire sample from July 1991 to October 2015, and restricting X to only the first and third federal funds futures, along with the second, third, and fourth Eurodollar futures, and the 2-, 5-, 10-year Treasury bond yields[3]. Since during this period there were 213 FOMC announcements, X has a dimension of 213×8. The data can be well-explained by three dimensions underlying each announcement[4].

We can think of these three dimensions as corresponding to the aforementioned surprise components (changes in the federal funds rate, forward guidance, and large scale asset purchases). I estimate the matrix of factors F by principal components, following Gürkaynak et al. (2005), to get the three factors that explain a maximal fraction of the variation in X, ensuring that the scale of F is normalized so that each column has unit standard deviation. I then impose a structural interpretation to these three principal components following Swanson (2017), since these principal components are just a statistical decomposition, thus lacking structure. In order to do this, a $U_{3\times3}$ orthogonal matrix needs to be determined such

[3]Eurodollar futures contacts can provide information about expectations of the path of the federal funds rate, while Treasury yields provide information about market interest rate expectations and risk premia over longer horizons.

[4]This is done by investigating the rank of F following Cragg and Donald (1997). See details in Swanson (2017)

that our matrix and loadings can be represented as $\tilde{F} \equiv FU$ and $\tilde{\Lambda} \equiv U'\Lambda$ (which fits the data exactly as well as F and Λ), and some structure can be then imposed on the columns of F to represent the surprise component of the three factors. Following Swanson (2017) and Gürkaynak et al. (2005), I impose that: (1) changes in LSAPs have no effect on the current federal funds rate, (2) changes in forward guidance have no effect on the current federal funds rate, [5] and (3) the LSAP factor is as small as possible in the pre-ZLB period. This is done by imposing three restrictions on the three parameters that completely determine U so as to uniquely identify it, and hence uniquely identify $\tilde{F}$ and $\tilde{\Lambda}$. Since each principal component was normalized to have a unit standard deviation, and this rotation matrix does not change the scaling of the factors, the rotated factors have a unit standard deviation as well.

3.2 Effects on Asset Prices

Following the estimation and identification of the forward guidance and LSAP components[6] of the announcements, I then estimate their effects on asset prices using high-frequency OLS regressions. The coefficients here are in units of basis points per standard deviation surprise in the announcement. The sample period for all asset prices is from January 2009 to October 2015, which coincides with the zero-lower bound period. These tables reports estimates from a regression of the form:

$$\Delta y_t = \alpha + \beta \tilde{F}_t + \epsilon_t \tag{2}$$

where y_t refers to the various yields or prices, t indexes each FOMC announcement during this period, $\tilde{F}$ denotes the factors as estimated and identified, ϵ is a regression residual, and

[5] Recall that forward guidance is defined as the component of FOMC announcements that have information about the path of interest rates not contained in the changes to the federal funds rate itself. This definition is laid out in GSS, used in Swanson (2017), and likewise will be used here. For details on these restrictions, refer to these 2 papers

[6] These two factors correspond to the 2nd and 3rd columns of $\tilde{F}$.

α is a parameter. β is the parameter of interest and this is the estimated effect of each factor. Δ denotes the change over a daily window bracketing each announcement, done in such a way as to ensure that the FOMC announcement occurred in between the yields or prices that were reported in the data. In regards to bond markets that were closed during the FOMC meetings (all except Canada), I ensured that the timing of the announcements coincided with the time index for the yields that were quoted. That is, I took the difference between the closing yield of the date of the announcement, and the opening yield for the following day[7]. FOMC announcements throughout my sample occurred either at 12:30PM EST or 2:15PM EST, so overseas markets were closed during each announcement in my sample.

3.3 Data

British bond yield data comes from the Macro Financial Analysis division of the Bank of England, and they are the nominal zero coupon yields for government securities with 1-, 2-, 5-, 10-, and 25-year maturities. Bond yield data for Canada comes from the Bank of Canada, where daily rates are the mid-market closing yields. I examine the 6-month, and 1-, 2-, 5-, 10-year and Long Term rates. Data for Australian government bonds comes from the Reserve Bank of Australia, and reports the daily estimated yield at end of day on Australian Government Bonds of 2-, 5-, and 10-year maturities, as well as New South Wales Treasury bond yields for bonds of 3-, 5-, and 10-year maturities. Japanese government bond data comes from the Ministry of Finance of Japan, and they are the secondary market rates at market closing time. I examine the 1-, 2-, 5-, 10- and 30-year rates. German bunds yield data comes from the Deutsche Bundesbank, and I examine the 6-month, 2-, 5-, 10- and 30-year bond yields.

Data on foreign exchange rates comes from FRED, and I use the daily noon buying rates

[7]For example, if the announcement was at 2:15PM EST (7:15PM in London) on November 3rd, I'd take the difference between the November 3rd gilt closing yield and the November 4th closing yield.

in New York City for cable transfers payable in foreign currencies [8]. The dependent variable in this case is 100 times the log change of daily exchange rates. Since none of the announcements happened before noon, I use the difference between the day of the announcement and the following day. The series are in terms of dollars per foreign currency for easier comparison. Stock index data comes from Yahoo Finance and is cross referenced, when possible, with data published on the websites of each respective index.

4 Results

I will discuss some results in comparison with what Swanson (2017) estimated for US variables. Results for changes in forward guidance and LSAPs during the ZLB period are in the following tables, with a discussion of each result for each country in my analysis. Standard errors and t-statistics are heteroskedasticity-consistent [9]:

4.1 United Kingdom

Table 1 reports results for gilt yields response to FOMC announcements. These results show that British bond yields respond systematically to changes in forward guidance and LSAPs. The effects of forward guidance all have some level of significance across every maturity I analyzed. These effects are largest and most significant for the maturities between 2-years and 10-years, peaking at the 5-year maturity. The estimated effects of LSAPs are all negative, even for the shortest maturities. The t-statistics for these estimated effects are relatively small, but there is some level of significance to these findings. Regression R^2 values indicate that these two factors explain about a third of the variation in British bond yields around FOMC announcements.

I estimated similar effects of forward guidance on British bond yields when compared

[8] I omit analysis of the effect on USD/Yen, USD/Euro as this is done in Swanson (2017)

[9] Stars around coefficients can be read as follows: * = significant at the 10% level, ** = significant at the 5% level, *** = significant at the 1% level

Table 1: *Estimated Effects of Changes in U.S. Forward Guidance, and LSAPs on British Bond Yields*

	1Y	2Y	5Y	10Y	20Y
Change in forward guidance	1.18**	2.62**	4.04***	3.34**	2.26*
(Std. err)	(.482)	(.984)	(1.43)	(1.47)	(1.20)
[t-stat]	[2.45]	[2.664]	[2.83]	[2.26]	[1.87]
P>|t|	0.018	0.010	0.007	0.028	0.066
Change in LSAPs	-0.515**	-0.96*	-1.88	-2.39*	-1.45
(Std. err)	(.222)	(.551)	(1.31)	(1.34)	(1.18)
[t-stat]	[-2.32]	[-1.74]	[-1.44]	[-1.78]	[-1.22]
P>|t|	0.024	0.086	0.156	0.081	0.227
Regression R^2	0.269	0.337	0.353	0.303	0.206
# of Observations	55	55	55	55	55

with the US, but in contrast to those results, the t-statistics are not large, which is to be expected. I find a larger but less significant estimated effect on the 10-year gilt yield, and smaller, less significant estimated effects on the 2-year and 5-year yields. In contrast with US response, I find that LSAPs had a relatively larger negative effect on the shorter end of the yield curve at the 1-year and 2-year maturities. I find no significant effect on either the 5-year or 20-year bond, which is in stark contrast to the effects found in the US yields of longer maturities (t-stats between 10 and 20), and only a slightly significant effect on the 10-year yield of about half the magnitude estimated for the US 10-year bond. British bonds seems to react more strongly to unanticipated changes in forward guidance, with the short end of the curve responding to LSAPs.

4.2 Canada

Table 2 reports results for the estimated effects of changes in forward guidance and LSAPs on Canadian Bond yields. Again, the results show these bonds respond systematically to FOMC announcements, with the exception of the 6-month yield. In particular, unanticipated changes in LSAPs have extraordinarily statistically significant negative effects on bond yields,

Table 2: *Estimated Effects of Changes in U.S. Forward Guidance, and LSAPs on Canadian Bond Yields*

	6mo	1Y	2Y	5Y	10Y	LT
Change in forward guidance	0.04	0.36	1.17**	1.49**	0.74	0.34
(Std. err)	(.198)	(.384)	(.558)	(.601)	(.624)	(.638)
[t-stat]	[0.24]	[0.95]	[2.09]	[2.48]	[1.19]	[0.53]
P>|t|	0.806	0.345	0.041	0.016	0.236	0.592
Change in LSAPs	-0.28	-0.66***	-1.18***	-3.36***	-4.03***	-2.56***
(std. err)	(.194)	(.220)	(.320)	(.354)	(.382)	(.548)
[t-stat]	[-1.47]	[-2.99]	[-3.71]	[-9.51]	[-10.57]	[-4.68]
P>|t|	0.147	0.004	0.000	0	0	0
Regression R^2	0.042	0.164	0.256	0.539	0.582	0.425
# of observations	55	55	55	55	55	55

particularly for bonds of longer maturities, with t-statistics around 10 for the 5-year and 10-year bonds. These effects are humped shaped, starting out at around a half basis point negative effect, with a peak at the 10-year rate of around 4 basis points, and then a taper to a smaller effect for long term bonds. I find that Canadian bond yields respond strongly to changes in LSAPs for all yields except for the 6-month yield. The estimated effects are comparable in magnitude for the 5-year and 10-year yield, with the effect on the 5-year yield being even larger than what was estimated for the US, but smaller for the long term yield. Also, in contrast to the US response to these factors, I find a highly significant negative effect on the 1-year and 2-year yields of -0.6bp and -1.2bp per standard deviation change, respectively.

Forward guidance, on the other hand, only has significant effects on 2-year and 5-year bond yields, of about 1-1.5 basis point per standard deviation change. Canadian bond yields did not respond to forward guidance across all maturities, with only significant effects at the 2-year and 5-year yield. The estimated effects of forward guidance are about a fifth of what was estimated for the US.

Canadian bond yields seem to react more strongly to unanticipated changes in LSAPs,

especially around maturities that the Federal Reserve targeted during their bond buying program. The estimated response to forward guidance reveals small effects on medium term maturities, but no significant effect on longer term maturities. The regression R^2 shows that these two factors explain very little of the variation in the short end of the yield curve, but about half of the variation of medium and long term assets.

4.3 Australia

Table 3: *Estimated Effects of Changes in U.S. Forward Guidance, and LSAPs on Australian Bond Yields*

	2Y	5Y	10Y	NSW3Y	NSW5Y	NSW10Y
Change in fwd. guidance	1.44	1.85**	2.35**	1.31	1.65**	1.85**
(Std. err)	(.876)	(.862)	(.904)	(0.829)	(.786)	(.773)
[t-stat]	[1.65]	[2.14]	[2.60]	[1.59]	[2.09]	[2.40]
P>|t|	0.106	0.037	0.012	0.119	0.041	0.020
Change in LSAPs	-3.62***	-4.64***	-5.48***	-4.22***	-4.21***	-5.19***
(Std. err)	(.868)	(1.03)	(.997)	(.728)	(.757)	(.706)
[t-stat]	[-4.17]	[-4.50]	[-5.49]	[-5.80]	[-5.56]	[-7.35]
P>|t|	0	0	0	0	0	0
Regression R^2	0.427	0.525	0.575	0.445	0.494	0.561
# of observations	55	55	55	55	55	55

Table 3 reports results for the estimated effects of forward guidance and LSAPs on Australian Bond yields. Note that the bonds reported are for similar maturities but issued by the Reserve Bank of Australia and the New South Wales Treasury Corporation (NSW), respectively. These results also show that Australian Bond yields respond systematically to FOMC announcements during this period. In particular, the effects of unanticipated changes in LSAPs are all highly statistically significant, with t-statistics between 4 and 8. The estimated effects are also relatively large, with about a 4-5 basis point decrease per unanticipated standard deviation change. In particular, the effect of LSAP on the 5-year yield is larger than what was estimated for the US by over a basis point. More data is needed

on longer term bond yields for Australia to be able to ascertain whether longer term yields respond systematically to FOMC announcements, and to see if the overall response of yields is decreasing at longer maturities.

Furthermore, I find that the estimated effect of forward guidance is statistically significant at medium to long term maturities. I find no significant effect for the 2-year and NSW 3-year bond. These effects are smaller, and less statistically significant than the effects of changes in LSAPs. The R^2 for these regressions is between 40 and 60 percent, indicating that these two factors explain about half of the variation in Australian bond yields around FOMC announcements in the ZLB period.

I find that Australian bond yields had a strong response to LSAPs across all the maturities I analyzed, and a significant response to forward guidance for the 5-year and 10-year yields. When analyzing the response of Australian bond yields, I find a highly statistically significant response to unanticipated changes in LSAPs that, when compared with the US response, is higher in magnitude for the 5-year bond but around the same for the 10-year bond. I also find a strong, significant *negative* effect on the 2-year yield of about 3.6 basis points, in stark contrast with the small, statistically insignificant effect found for the US 2-year bond. I should also note that Australian bonds had the strongest response to these factors around maturities that the Federal Reserve targeted during their bond buying program.

4.4 Japan

Table 4 reports results for the estimated effects of changes in forward guidance and LSAPs on Japanese bond yields. I find that most Japanese bond yields respond systematically to FOMC announcements, with the exception of the 2-year bond. I find that forward guidance has a highly significant effect on medium to long term bonds, with a magnitude ranging from 0.5 to 1.25 basis points per unit standard deviation change. I find that the effect increases with maturity, with the largest effect found on the 30-year yield. In contrast, the estimated effects on short term maturities are small in magnitude, with small t-statistics.

Table 4: *Estimated Effects of Changes in U.S. Forward Guidance, and LSAPs on Japanese Bond Yields*

	1Y	2Y	5Y	10Y	30Y
Change in forward guidance	-0.003	0.02	0.54***	0.75***	1.26***
(Std. error)	(.087)	(.111)	(.139)	(.200)	(.448)
[t-stat]	[-.038]	[0.24]	[3.93]	[3.75]	[2.83]
P>|t|	0.970	0.807	0.000	0.000	0.007
Change in LSAP	-0.11*	-0.06	-0.58***	-0.62***	-0.26
(Std. error)	(.060)	(.066)	(.083)	(.202)	(.367)
[t-stat]	[-1.92]	[0.393]	[-7.10]	[-3.07]	[-0.72]
P>|t|	0.060	0.393	0.000	0.003	0.475
Regression R^2	0.070	0.018	0.521	0.327	0.269
# of Observations	55	55	55	55	55

The estimated effect of LSAPs is highly significant for bonds of 5-year and 10-year maturities and similar in magnitude. The t-statistics for these two results are high, particularly for the 5-year yield. I also find a small but significant negative effect on the 1-year yield, of about 0.1 basis points per standard deviation change, which stands in contrast with what was found for the US short maturities The R^2 of these regressions vary wildly, due to some of these effects not being significant. However, for the 5-year and 10-year yield I find that these two factors can explain between 30 to 50 percent of the variation around FOMC announcements.

While Japanese bond yields showed a strong, statistically significant response to forward guidance at longer maturities, the magnitudes were much smaller when compared with US responses. Japanese bond yields throughout my sample period are quite low, with the shorter maturities being essentially zero during this period (Figure 1. of Appendix B.), so the lack of significant coefficients for the short yields is not surprising. I estimate that the Japanese 30-year yield had a positive, significant response to forward guidance, and no response to unanticipated changes in LSAPs. In contrast, US 30-year yields were estimated to have a strong, significant negative response to changes in LSAPs for these long term maturities. Additionally, when comparing the Japanese bond yield response with estimated

US responses, I find that changes in LSAPs had much smaller negative effects, of about a half basis point for the 5-year and 10-year bond. The same argument applies here, as Japanese yields for these maturities are very low in comparison, so the estimated effects are significant, but small. Perhaps a better explanation is that the long period of low yields that Japan has experienced in recent times attenuates the response to news of longer yields, as shown in a paper by Swanson and Williams (2014). Their theoretical results shows that when short term rates are constrained by the ZLB, yields of all maturities are less sensitive to news than if the bound was not present, and that is perhaps the case here as we see statistically significant estimated effects, with relatively large regression R^2, but small in magnitude.

4.5 Germany

Table 5: *Estimated Effects of Changes in U.S. Forward Guidance, and LSAPs on German Bond Yields*

	6 Mo.	2Y	5Y	10Y	30Y
Change in fwd guidance	-0.69	0.21	0.79	1.18	0.23
(Std. err)	(.612)	(.710)	(.764)	(.869)	(1.11)
[t-stat]	[-1.14]	[0.29]	[1.04]	[1.36]	[0.207]
P>|t|	0.261	0.768	0.303	0.180	0.837
Change in LSAPs	-0.64*	-1.25***	-2.37***	-3.19***	-3.10***
(Std. err)	(.345)	(.329)	(.625)	(.804)	(.979)
[t-stat]	[-1.851]	[-3.79]	[-3.79]	[-3.97]	[-3.17]
P>|t|	0.07	0.000	0.000	0.000	0.003
Regression R^2	0.062	0.159	0.297	0.354	0.217
# of Observations	55	55	55	55	55

Table 5 reports the estimated effects of changes in forward guidance and LSAPs on German bunds yields. Here, I find that these yields respond systematically to FOMC announcements, but only to the LSAP component of each announcement, as I find no significant effect of the forward guidance factor. The effect of LSAPs, on the other hand, all have some level of significance, with relatively large t-statistics for all except for the bond of 6-month

maturity. The effect is slightly hump shaped, with a peak of -3.2 basis points at bonds of 10-year maturity. However, note that the estimated effect on the 30-year bond is -3.1, so the drop off is not large. The regression R^2 varies from 0.06 to 0.35, and thus our two factors only explain up to one third of the variation of these yields around FOMC announcement. Note that the largest R^2 is for the 10 year bond in this case.

The magnitude of the estimated response to LSAPs is similar to the US response for the 5-year yield, but about half of what was estimated for the US 10-year and 30-year yields. German 6-month and 2-year yields had statistically significant negative responses, of -0.6 and -1.25 basis points respectively, in contrast with the small positive effect found for the US short end of the curve. The lack of response to forward guidance would stand against what previous literature has found for the effect of "surprises" in monetary policy on German yields. For example, Berge and Cao (2014) find that the 10-year German yield had an average movement of -0.2 basis point on announcement days. However, the sample that they used for their analysis included announcements that had both forward guidance and asset purchases in them. The analysis in this paper disentangles these two, and I can attribute all of the response to unanticipated changes in LSAPs.

4.6 Exchange Rates

Table 6 reports the estimated effects on 3 exchange rates to the US dollar: Australian dollars, Canadian dollars, and British pounds. Estimated effects for the Japanese yen, Euro to US dollar with the asset price change over a 30 minute window can be found in Swanson (2017).

As mentioned above, the data for this analysis is over a 24-hour window bracketing FOMC announcements. I find, with a small level of significance, that the USD/AUD and USD/GBP exchange rates react to unconventional monetary policy. The effect of changes in forward guidance on the Australian dollar is intuitive, as increases in US interest rates make US investments more attractive relative to Australian investments, and tends to depreciate

Table 6: *Estimated Effects of Changes in U.S. Forward Guidance, and LSAPs on Exchange Rates*

	\$/AUS	\$/£	\$/CAN
Change in forward guidance	-0.55*	-0.16	-0.30
(Std. err)	(.296)	(.215)	(.227)
[t-stat]	[-1.88]	[-0.78]	[-1.32]
P>|t|	0.065	0.436	0.190
Change in LSAPs	0.43	0.43**	0.26
(Std. err)	(.289)	(.214)	(.198)
[t-stat]	[1.51]	[2.031]	[1.35]
P>|t|	0.136	0.047	0.182
Regression R^2	0.268	0.305	0.222
# of Observations	55	55	55

the Australian dollar against the US dollar. I also find that changes in LSAPs depreciate the USD/GBP exchange rate, with a one-standard-deviation increase causing a depreciation of the dollar against the pound of about 0.4 percent. The R^2 for these regressions is relatively small, and I found no significant results for the USD/CAN exchange rate. I find no effect of either factor on the Canadian exchange rate, which leads me to strongly believe that better data is needed for this analysis, as Canada is the US 2$^{\text{nd}}$ largest trading partner and should show *some* level of response to US monetary policy in its exchange rate. To get more precise estimates, a minute-by-minute data set would be needed in order to employ a 30-minute or 1-hour window around the announcements due to the high volatility of exchange rates.

The effects I find for exchange rates are much less significant than those found in Swanson (2017), but with similar point estimates and signs. I find that the magnitude of the effect of changes in LSAPs on the USD/GBP rate is larger, but less significant, than what was estimated for USD/EUR and USD/YEN. The USD/AUD exchange rate seems to react to changes in forward guidance only, with an effect that is about double from what was estimated for the euro and yen. These two estimated effects were statistically significant but with relatively small t-stats, in stark contrast to what was found for the euro and yen.

4.7 Stock Markets

I collected data for a number of stock market indices from Yahoo Finance and conducted my analysis using regressions of the same form as in (2). The dependent variable in this case was 100 times either the overnight or open-to-close change in the (log) price of the index. The data obtained lacked a good degree of granularity for a number of countries, so the report on Table 7 only has the effect on Japanese, Canadian, and German stock indices. Nevertheless, none of the results were significant as the t-statistics found were particularly small. Similarly, the magnitude of the estimated coefficients was small across the three regressions, with none of them larger than 0.31, and the regression R^2 for all three showed that the factors explained very little of the variation in stock index prices.

Table 7: *Estimated Effects of Changes in U.S. Forward Guidance, and LSAPs on Japanese, Canadian, German stock indices*

	Nikkei	TSX	DAX
Change in forward guidance	0.10	0.29	0.31
(Std. error)	(.164)	(.238)	(.230)
[t-stat]	[0.64]	[1.23]	[1.35]
P>$\|t\|$	0.527	0.221	0.183
Change in LSAP	0.08	-0.04	0.10
(Std. error)	(.123)	(.165)	(.154)
[t-stat]	[0.72]	[-0.25]	[0.65]
P>$\|t\|$	0.475	0.801	0.517
Regression R^2	0.011	0.074	0.067
# of Observations	55	55	55

When estimating the effects of forward guidance and LSAPs on the S&P 500, Swanson (2017) finds that the effects of forward guidance led to a drop in stock prices of about 0.25 percent during the ZLB period. The estimated effect of LSAPs was a rise in stock prices of about 0.12 percent during the same period, with a relatively lower R^2 for the regressions due to the high volatility of stock prices after FOMC announcements. My estimates are

close to those point estimates, but lack statistical significance. This result makes sense for two reasons: First, I am using day to day data as opposed to a 30 minute window, which would be much better for assets of high volatility such as stocks. Second, the estimated effect on US stocks is small in comparison with some of the other results, and thus we would expect the effect on international stocks to be smaller in comparison, as these indices are comprised of the asset prices of foreign companies, and thus are much more dependent on their corresponding domestic variables rather than US variables. If I extended this analysis using a minute-by-minute data set, I would expect the estimated effects to be small if they are found to be statistically significant.

5 Discussion

I find significant results for bond yields for all the countries in my analysis, with a good deal of variation in magnitude of the estimated effect, and in the types of yields affected. For the most part, the effects I find are less significant, have smaller t-statistics, and have smaller regression R^2 in comparison to the tables found in Swanson (2017)[10] and the estimated effects of forward guidance and LSAPs on US assets found therein. This is to be expected due to the fact that US assets respond most strongly to US monetary policy, and likewise international bond yields will respond most strongly to their respective countries' economic circumstances. I find that the 5-year and 10-year yield for all the countries in my sample responded systematically to FOMC announcements. This is also the case for all 2-year bond yields in my analysis except for Japan.

An important difference to note with the estimated effects on this paper is that, in contrast with what was found for the US, unanticipated changes in LSAPs had small, negative effects on the short end of the yield curve. One explanation for this could be that international market participants didn't sell off short-term bonds to finance the purchase of longer maturity bonds when re-balancing their portfolios. It could also be that demand for inter-

[10]Table included in the Appendix

national short term bonds responds differently than demand for US short term bonds due to differences in safety premiums. Another difference worth noting is the estimated effects of forward guidance on some of the long term bonds, such as British and Japanese yields. For these two, not only is the factor affecting the yield different than what we see for the US, but also the magnitude of the estimated effects.

These estimated results show that unconventional policy does have spillover effects on international bond yields; the main difference between other literature and this paper is that I am able to disentangle the forward guidance and the asset purchase component of each announcement, whereas most of the literature looks at either surprise components as a whole (by doing event studies), or just asset purchases (by analyzing the size and composition of each purchase). I will present a simple, intuitive way to examine these cross country effects in the following section.

5.1 Spillover Rate

In order to better compare this effect across my analysis, I compute estimated Spillover Rates of each factor for the 2-year, 5-year, and 10-year yields for each country. I compute these rates by taking the ratio of estimated effect for the US and each corresponding country, and report them on Table 8. Spillover rates that are in italics refer to those estimated effect on international bond yields that were found to not be statistically significant at any level. [11].

Spillover rates greater than 1 mean that the estimated effect was larger in the foreign country than in the US for that particular maturity. Negative spillover rates means yields of that particular maturity responded in an opposite manner than what was estimated for the US (if US yield rose, foreign yield fell). Overall, it seems that the estimated effects of LSAPs have the largest spillover rates across the 3 maturities for Canada, Australia, and Germany. The spillover rates for Japan are small due to their bond yields being low for the

[11] I omit analysis of a spillover rate of the effect of LSAPs on 2-year yields as the estimated coefficient for US bond yields was not found to be statistically significant

Table 8: *Spillover Rate*

	United Kingdom	Canada	Australia	Japan	Germany
Forward Guidance					
2-Year	0.509	0.227	*0.280*	*0.003*	*0.040*
5-Year	0.649	0.239	0.297	0.086	*0.127*
10-Year	1.091	*0.241*	0.767	0.245	*0.385*
LSAP					
5-Year	*0.643*	1.151	1.589	0.198	0.811
10-Year	0.368	0.621	0.844	0.095	0.491

entirety of the sample. The UK has large spillover rates for both factors, in particular for the 10-year yield indicating a high degree of pass-through of US unconventional monetary policy for that particular maturity. In order to see whether these rates are similar across the world, I extend my analysis in the following section.

5.2 Extended analysis of Spillover Rates

I extend my analysis to a larger panel of countries in order to determine whether other countries experienced large spillover rates or rates larger than 1. The results of this analysis are reported on table 9. The data in this case is the close-to-close change in yields for sovereign government bonds around FOMC announcements, and it was obtained from Global Financial Data, with the exception of Switzerland which came directly from the the Swiss National Bank website. In a few rare occasions, data was complemented from corresponding central bank data if there was a single or a couple missing observations. The estimated effects of US forward guidance and large scale asset purchases were estimated[12] using the same procedure (Swanson (2017)), and their rates were calculated accordingly. As above, spillover rates that are in italics indicate that the estimated effect was not found to be statistically significant.

[12]For a cross country table of the estimated effect of each factor on these 3 yields, see Appendix C.

Table 9: Spillover Rates, Extended Analysis

	Forward Guidance			**LSAP**	
Country	2 Year	5 Year	10 Year	5 Year	10 Year
Austria	0.318	0.423	0.709	0.661	0.432
Belgium	*0.14*	0.283	0.592	1.049	0.549
Switzerland	0.242	*0.111*	*0.243*	0.297	*0.164*
China	*-0.077*	*0.069*	*0.266*	*0.212*	-0.174
Czech Rep.		*0.074*	0.815	*0.197*	*0.138*
Denmark	0.288	0.364	0.618	0.717	0.426
Spain	*0.047*	0.348	1.122	1.198	0.455
Euro	0.371	0.413	*0.311*	*0.573*	0.406
Finland	*0.244*	0.340	0.734	*0.444*	0.412
France			0.693		0.422
Greece			*2.208*		*0.817*
Hong Kong			0.619		0.633
Hungary		0.5377	1.707	*-1.714*	*-0.665*
India		*0.107*	0.481	*-0.531*	0.262
Ireland	*0.827*	*1.140*	*0.533*	*0.279*	0.376
Iceland		*0.166*	*0.236*	-1.258	*-0.377*
Italy	*0.203*	0.333	1.117	1.003	0.485
Korea		0.272	0.891	0.991	0.403
Luxembourg			*0.602*		0.441
Mexico		*0.878*		*0.363*	
Malta			0.567		*0.042*
Netherlands	*0.171*	0.369	0.703	0.680	0.474

Continued on next page

Table 9 – *Continued from previous page*

	Forward Guidance			**LSAP**	
Country	2 Year	5 Year	10 Year	5 Year	10 Year
Norway	*-0.229*	*-0.096*		0.846	
New Zealand		*0.150*	*0.130*	0.480	0.433
Poland	0.383	0.660	1.79	*-0.059*	*0.151*
Portugal	*1.341*	*0.981*	*0.853*	*-0.108*	*0.336*
Romania		*-0.053*		*-0.2615*	
Singapore	*0.121*	*0.186*	0.839	0.714	0.501
Slovenia			*0.742*		*0.202*
Sweden	*0.264*	0.360	*0.609*	*0.662*	0.426
Turkey	1.997	1.138		*0.041*	
S. Africa			2.108		*0.225*

The spillover rates are comparable to what was found for the initial set of countries. For the most part, the lie between 0 and 1 across all maturities, with a fair degree of cross country variation. I compute the average spillover rates for all countries in my analysis (including the earlier set of 5 countries) where the estimated effects of forward guidance and LSAPs was significant at any level ($p < 0.10$). For the 2-, 5-, and 10-year yields the average spillover rates for forward guidance are 0.542, 0.418, and 0.910 respectively. [13] For the 5- and 10-year yields, the average spillover rates for the LSAP component are 0.695 and 0.425, respectively. This signals a strong pass through effect of the Feds unconventional policy to international sovereign bond yields during the zero lower bound period, especially for forward guidance on the 10-year yield which is nearly one to one.

A few interesting results stand out from this analysis. Several countries had spillover

[13]It is worth nothing that for the 2-year yield, a number of the spillover rates were either not significant, or not available. If Turkey is excluded, the average spillover rate is 0.334

rates that were both significant and larger than 1. This is the case across the 3 maturities, and for both components. A couple of rates were near or larger than 2, as is the case for Turkey, Poland, and South Africa. To reiterate, a spillover rate larger than 1 indicates that their bond yields had a stronger reaction that what was estimated for the US. Surprisingly, for Iceland I find a significant, negative spillover rate that's also larger than 1 in absolute value, signaling that yields of that maturity moved in the opposite direction than for the US at a larger magnitude in response to the LSAP component of Fed announcements.

Table 10: S&P Sovereign Rating

Country	S&P April 2010 Rating	S&P January 2013 Rating
Australia	AAA	AAA
Belgium	AAA	AA+
Canada	AAA	AAA
Spain	AA	BBB-
Greece	BB+	BB-
Hungary	BBB-	BB
Ireland	BBB+	BBB+
Italy	A+	BBB+
Poland	A-	A-
Portugal	A-	BB
Turkey	BB	BB
South Africa	BB+	BBB

In an effort to find a preliminary explanation for these large effects, I collected the Standard & Poor's Sovereign Ratings for April 2010 and January 2013 for each country that reported a spillover rate larger than 1, and report them on Table 10. Eight out of the twelve countries in this short sample had a rating of BBB or BB by 2013. The majority of these countries saw their sovereign ratings downgraded during this period, with only South Africa receiving an improvement in their rating, while Canada and Australia stayed put. On the other hand, a few countries had large spillover rates even though they were not subject to a credit downgrade. While this is not a complete analysis, it suggests that a good avenue for further research would be to study the role of sovereign credit ratings in the magnitude of pass through of unconventional monetary policy in large economies to international financial

markets. It would be interesting to study whether countries with poor ratings or who've been recently subjected to a downgrade are more susceptible to the effects of monetary policy in large economies during the ZLB period.

6 Conclusion

I replicate the analysis of Swanson (2017) and use the separately identified forward guidance and LSAP announcements factors to estimate the effects of both types of unconventional policies on international bond yields, stock indices, and exchange rates. Both types of policies had significant effects on bond yields, but weak effects on exchange rates, and no significant effects on stock market indices. The magnitudes of the effects found on bond yields were smaller than the US response with a few exceptions, as would be expected. The effectiveness of each type of unconventional policy varied across countries. British bond yields reacted more strongly to changes in forward guidance. Canadian, Australian, and German bond yields were estimated to react more strongly to changes in LSAPs. Japanese bond yields reacted to both factors, but only bonds of long maturities showed significant responses. Unlike the estimated effects for the US, unconventional policy seemed to have a negative effect on the short end of the yield curve rather than a positive effect. Yields of maturities that the Federal Reserve targeted during their asset buying program responded to unconventional policy across all countries analyzed in this paper.

I find that there are significant spillover effects on international bond yields from US unconventional monetary policy. I also find that countries react differently to these two estimated factors. I compute a spillover rate for each factor to better compare the effects across countries and maturities. I then extend this analysis to a larger panel of countries, and find that the spillover rates are similar across the countries studied. The pass through effect of the Fed's forward guidance is largest for the yields on 10-year bonds. Some interesting results also come from this extended analysis, providing avenues for further research.

Central bankers in other countries can use these results to better anticipate the effects of Federal Reserve unconventional monetary policy on their own economies and financial markets, and their peers'. Understanding the effects of policy tools is important, and we should seek to understand these effects both at the domestic and the international level. There is still work to be done in this framework, namely the issue of persistence and the effect of these factors on international private-sector rates. An analysis of the spillover effects of unconventional policy on emerging economies vs. developed economies could also prove fruitful as all the countries in my sample have developed economies. The spillover rates also give some avenues for future research, as it would be interesting to see what drives the difference between the levels of spillover for each factor. We are also nearly 3 years away from the end of the ZLB period, so an analysis of monetary policy now that we are back in the conventional world could prove fruitful, in particular to assess whether spillovers rates are different when outside of the ZLB.

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Appendix A.

Corresponds to Table 4 in Swanson (2017).

Table 11: *Estimated Effects of Changes in Forward Guidance, LSAPs on U.S. Treasury Yields, Jan. 2009 - Oct. 2015*

	6-month	2-year	5-year	10-year	30-year
Change in forward guidance	1.19***	5.14***	6.22***	3.06***	0.14
(Std. error)	(.322)	(.323)	(.363)	(.299)	(.886)
[t-stat]	[3.69]	[15.91]	[17.13]	[10.24]	[0.16]
Change in LSAP	0.19**	0.20	-2.92***	-6.49***	-5.77***
(Std. error)	(.094)	(.118)	(.514)	(.343)	(.554)
[t-stat]	[2.07]	[1.66]	[-5.69]	[-18.91]	[-10.42]
Regression R^2	0.40	0.93	0.95	0.98	0.81
# of Observations	55	55	55	55	55

Table 12: *Estimated Effects of Changes in U.S. Forward Guidance, and LSAPs on Stock Prices and Exchange Rates, Jan. 2009-Oct. 2015*

	S&P500	$/euro	$/yen
Change in forward guidance	-0.26**	-0.37**	-0.24***
(Std. error)	(.100)	(.057)	(.050)
[t-stat]	[-2.61]	[-6.46]	[-4.86]
Change in LSAP	0.12*	0.21***	0.29***
(Std. error)	(.059)	(.053)	(.048)
[t-stat]	[1.99]	[4.00]	[6.08]
Regression R^2	0.28	0.68	0.79
# of Observations	55	55	55

Appendix B.

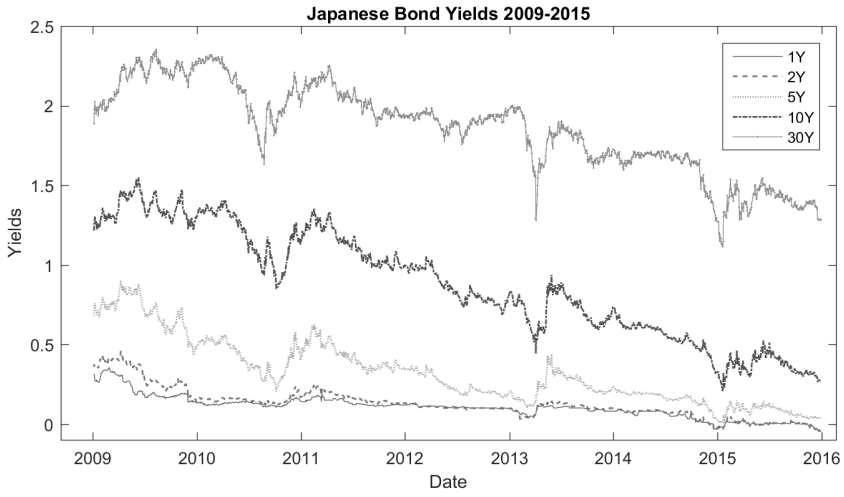

Figure 1: Japanese Yields

Appendix C.

Table 13: Estimated Effect of Forward Guidance, LSAP: Extended Analysis

	Forward Guidance			**LSAP**		
Country	2 Year	5 Year	10 Year	2 Year	5 Year	10 Year
Austria	1.64	2.63**	2.17*	-0.23	-1.93*	-2.80**
	(0.907)	(1.154)	(1.099)	(0.725)	(0.970)	(1.165)
Belgium	0.72	1.76*	1.81*	-1.061	-3.07**	-3.56***
	(0.845)	(0.916)	(1.007)	(0.685)	(1.264)	(0.855)
Switzerland	1.24*	0.69	0.74	0.81	-0.87**	-1.07
	(0.669)	(0.522)	(0.571)	(0.242)	(0.365)	(0.696)
China	-0.39	0.43	0.82	-1.61***	-0.62	1.13
	(0.818)	(1.026)	(0.995)	(0.456)	(0.412)	(0.652)
Czech Rep.		0.46	2.50***		-0.58	-0.90
		(0.508)	(0.755)		(1.287)	(1.231)
Denmark	1.48*	2.26*	1.89*	-0.89	-2.09*	-2.76***
	(0.869)	(1.253)	(1.117)	(1.227)	(1.247)	(1.020)
Spain	0.25	2.17*	3.43**	-2.60	-3.50*	-2.95*
	(1.168)	(1.129)	(1.339)	(1.929)	(2.063)	(1.491)
Euro	1.91**	2.57**	0.95	-0.77	-3.50	-2.64***
	(0.936)	(1.160)	(1.102)	(0.779)	(1.030)	(0.694)
Finland	1.25	2.12*	2.24*	-0.51	-1.93	-2.67**
	(0.839)	(1.116)	(1.132)	(0.641)	(1.062)	(1.082)
France			2.12*		-2.74***	
			(1.123)		(0.840)	
Greece			6.75			-5.30
			(15.42)			(11.02)
Hong Kong			1.89**			-4.11***
			(0.796)			(0.978)
Hungary		3.34**	5.22***		5.01	4.31
		(1.605)	(1.711)		(3.110)	(4.400)
India		0.67	1.47**		1.55	-1.71**
		(2.639)	(0.553)		(4.285)	(0.771)
Ireland	4.25	7.10	1.63	-0.47	-0.82	-2.44**
	(5.033)	(4.477)	(1.009)	(2.093)	(2.076)	(1.065)
Iceland		1.04	0.72		3.67	2.44
		(1.593)	(1.569)		(1.661)	(1.462)
Italy	1.04	2.08*	3.41***	-2.06	-2.93*	-3.14**
	(1.038)	(1.218)	(1.142)	(1.506)	(1.576)	(1.280)
Korea		1.70*	2.73***		-2.89***	-2.62***
		(0.875)	(0.642)		(0.574)	(0.513)
Luxembourg			1.84			-2.87***

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Table 13 – *Continued from previous page*

	Forward Guidance			LSAP		
Country	2 Year	5 Year	10 Year	2 Year	5 Year	10 Year
			(1.165)			(0.839)
Mexico		5.46			-1.06	
		(3.842)			(2.917)	
Malta			1.74**		-0.28	
			(0.725)		(0.625)	
Netherlands	0.88	2.30*	2.15*	-0.35	-1.99*	-3.08***
	(0.790)	(1.163)	(1.133)	(0.627)	(0.697)	(1.032)
Norway	-1.18	-0.60		-1.39**	-2.47***	
	(1.457)	(1.389)		(0.548)	(0.697)	
New Zealand		0.94	0.40		-1.40**	-2.81***
		(1.176)	(1.077)		(0.630)	(0.629)
Poland	1.97**	4.11***	5.48***	-2.78***	0.17	-0.98
	(0.818)	(0.849)	(1.007)	(1.027)	(0.686)	(1.505)
Portugal	6.90	6.10	2.61	2.95	0.31	-2.18
	(5.478)	(4.693)	(1.857)	(2.445)	(2.114)	(1.560)
Romania		-0.33			0.76	
		(1.851)			(1.194)	
Singapore	0.62	1.16	2.57**	-0.55*	-2.08**	-3.25*
	(0.553)	(1.014)	(1.244)	(0.307)	(0.831)	(1.674)
Slovenia			2.27			-1.32
			(1.412)			(0.929)
Sweden	1.36	2.24*	1.87	-0.97	-1.93	-2.77**
	(0.924)	(1.211)	(1.142)	(1.031)	(1.438)	(1.103)
Turkey	10.26***	7.08**		-3.14	-0.12	
	(3.447)	(3.059)		(2.432)	(4.073)	
South Africa			6.45***			-1.46
			(1.827)			(2.108)