THE RISE AND FALL OF THE PRE-FOMC ANNOUNCEMENT DRIFT

A STUDY OF EXCESS RETURNS IN SWEDEN AND THE UNITED STATES

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Abstract:

This thesis builds upon the influential paper "The Pre-FOMC Announcement Drift" by Lucca and Moench that was published in the Journal of Finance in 2015. The authors found that the periods leading up to FOMC announcements were accompanied by large excess returns. We replicate their methodology and employ it study the potential existence of a pre-FOMC announcement drift on the S&P 500 and the OMX30 prior to and following their publication. This study finds empirical evidence of strong pre-FOMC excess returns for both indices over the years 1994-2015. However, this effect is absent for the years 2015-2019. These findings indicate that the drift has been eroded following the publication by Lucca & Moench, possibly following the logic of the efficient market hypothesis.

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1.   Introduction

In 2015 the Journal of Finance published an influential article by David O. Lucca and Emanuel Moench. The paper, which was awarded the *2015 Amundi Smith Breeden Prize, best paper in the Journal of Finance,* explored a phenomenon they styled as "The pre-FOMC announcement drift".

The FOMC (Federal Open Market Committee) is a committee within the US Federal Reserve System tasked with overseeing the open market operations (OMO) of the United States. As such, the FOMC is the key decision-making organ on monetary policy in regard to rates and the growth of money supply in this major economy. The committee convenes regularly for publicly scheduled meetings eight times per year and following these meetings they release the policy decisions taken during that specific meeting. These announcements are important releases of information for the economy and investors, as such these meetings are anticipated and closely followed.

Lucca & Moench studied the returns of the S&P 500 (SPX) index and remarkably found that in the 24-hour window leading up to the FOMC meetings release of information (these windows are henceforth referred to as pre-FOMC windows) the index experienced unproportioned large positive excess return, namely 49 basis points higher than during non-pre-FOMC 24-hour windows. Their study examined the SPX in relation to the FOMC meetings during a period ranging from September 1994 to March 2011 and was published in February of 2015. The paper also featured a wide range of additional aspects and further time periods. However, as the FOMC first started to systematically release statements at around 2:15 pm (local time, New York U.S.) in 1994, the time period from that point up until 2011 serves as the backbone of the article.

In this paper we are going to replicate this study of the SPX and also extend it to include all meetings up until April 2019, i.e. roughly an additional eight years, the last of which have taken place after the publication of the original article. Furthermore, we will extend it further by applying the same methodology to conduct the corresponding analysis of the OMX Stockholm 30 (OMX30), an index consisting of the 30 most traded stocks on the Stockholm Stock Exchange, for the entire period of 1994-2019. These

extensions will then allow us to continue by both comparing the features and findings of the SPX to the OMX30, and also by examining whether the existence of the pre-FOMC announcement drift has been affected by the publication in 2015. These stipulated extensions thus entail new and relevant knowledge on the subject.

Through our empirical findings, we first confirm the findings of Lucca & Moench regarding the existence of a pre-FOMC announcement drift for the SPX prior to the publication. For the sample period of 1994-2015 we document a mean excess return in pre-FOMC windows of 0,323% (compared to 0,016% for the other windows). Additionally, we find that the same conclusion holds true for the OMX30 through a mean excess return in pre-FOMC windows of 0,536% (compared to 0,022% for the other windows).

Furthermore, we find that this strong effect of pre-FOMC announcement drift is absent for both indices in the period following Lucca & Moench's publication. As such, the excess returns seem to have been eroded following the release of the study and its inherent information, much like the efficient market hypothesis would suggest. Consequently, Lucca & Moench's illumination of the pre-FOMC announcement drift may also have served to eliminate it.

2.   Previous Literature

This study rests heavily upon the work and suggestions of Lucca & Moench (2015). Their famous article first identified and coined the phenomenon of the pre-FOMC announcement drift. Furthermore, their study provides important facts and ample theoretical background that enables us to take the work forward.

Other works of literature that have been important for our work include Karolyi & Stulz (1996) who study the comovements of stock returns between different markets on the global scene. Their conclusions entail the plausibility behind the assumption that the OMX30, an index traded in another market, is also affected by the FOMC and their policy announcements.

Bernanke & Kuttner (2005) study the impact of monetary policy changes on equity price. Their study incorporated the aspect regarding expected versus unanticipated changes by the Federal Reserve. The study finds that the largest part of the response of prices is accountable to the effects of unanticipated changes on the expected excess return. These conclusions provide insights and a valuable piece of the puzzle for studies of stock return and FOMC announcements.

The nature of the pre-FOMC announcement drift can be seen as closely related to the earnings announcement premium as studied by Frazzini & Lamont (2007). They showed that both stock prices and volume surged at around the scheduled announcement dates.

The efficient market hypothesis as stipulated by Fama (1970, 1991) predicts that all that investors will rationally utilize all available information in order to determine the value and price of a security. The conclusion is that all new information will immediately be incorporated in and thereby affect the stock prices. The bearing of this theorem is strong on our thesis as we, based on this logic, aspect the pre-FOMC announcement drift to have been majorly impacted by Lucca & Moench's study.

3.   Hypotheses

This study puts forward four hypotheses to be studied and either confirmed or rejected. We expect our findings to confirm the existence of a pre-FOMC announcement drift for both SPX and OMX30 prior to 2015. However, based on the reasoning of the efficient market hypothesis we expect these excess returns to have been eroded for both indices at the latest following the publication of Lucca & Moench in February of 2015.

H1: The S&P 500 will exhibit greater positive excess return during pre-FOMC windows for 1994-2015, i.e. an existence of a pre-FOMC announcement drift.

H2: The pre-FOMC announcement drift of the S&P 500 will have diminished in the period following the publication of Lucca & Moench in February 2015, i.e. 2015-2019.

H3: The OMX30 will exhibit greater positive excess return during pre-FOMC windows for 1994-2015, i.e. an existence of a pre-FOMC announcement drift.

H4: The pre-FOMC announcement drift of the OMX30 will have diminished in the period following the publication of Lucca & Moench in February 2015, i.e. 2015-2019.

4.   Data and Methodology

The analysis conducted in this thesis is centered on the movements of returns of the SPX and OMX30 in the time window ranging from September 1994 to April 2019. We employ data on prices, collected via Thomson Reuter Eikon, and a measurement of the risk-free rate defined as the one-month US Treasury bill with daily rate locked as of the beginning of each month, this data is collected from the website of Professor Kenneth R. French. Data on all historical FOMC meetings and the time of the corresponding announcements are retrieved from the website of the Federal Reserve System.

The log excess return (ER) for each 24-hour period is calculated by subtracting the log realized total return (R) by the log risk-free rate (R$_f$):

$$ER_t \ = \ \ln{(R_t)} - \ \ln{(R_{f,t})} \qquad\qquad (1)$$

The total return is the cum dividend return, i.e. the index price is adjusted to account for dividends.

Lucca & Moench (2015) employed intraday data to isolate the exact 24-hour window prior to the FOMC announcements. As this data is unavailable to us our calculations of returns are based on close-to-close prices for both the SPX and the OMX30. For the latter of these, this represents a perfect 24-hour window, yet for the SPX this is somewhat imperfect. However, as Lucca & Moench state in their article, we can still expect to find relevant results for the windows that we study and this specific close-to-close measurement is also implemented by the authors alongside their main 2pm-2pm 24-hour windows.

5.   Empirical Results

Within this segment the empirical findings of this thesis are presented. In Section A the return of the SPX are studied, Section B details the corresponding analysis for the OMX30 and Section C depicts the development over time for both indices.

A: Study of the S&P 500 during September 1994 - April 2019

The following analysis is conducted for three variations of the data sample. Firstly, we illustrate the period of 1994-2011 (September 1994 to March 2011) which is the same period studied by Lucca & Moench in order to, as closely as possible, replicate their findings via the data available to us. Secondly, we depict the period of 1994-2015 (September 1994 to January 2015), extending the study to include all years up until their publication. Thirdly, we further extend the study with the period of 2015-2019 (February 2015 to April 2019) which is the time that has transpired since the publication of Lucca & Moench. This last period is isolated in order to illustrate potential differences in the pre-FOMC announcement drift following the release of their influential article. Table 1 depicts summary statistics for the excess return of the three periods.

Table 1. S&P 500 Summary Statistics of Excess Return
This table depicts summary statistics for the cum-dividend log excess return of the S&P 500 for the 24-hour Pre-FOMC windows as well as the other 24-hour windows. The parentheses entail robust standard errors for the mean. Obs are the number of observations, i.e. number of 24-hour periods for each sample.
1994-2011 covers 01/09/1994-31/03/2011.
1994-2015 covers 01/09/1994-04/02/2015.
2015-2019 covers 05/02/2015-30/04/2019.

	1994-2011		1994-2015		2015-2019	
	Pre-FOMC	**Other**	**Pre-FOMC**	**Other**	**Pre-FOMC**	**Other**
Mean	0,338	0,009	0,323	0,016	0,055	0,039
	(0,1)	(0,02)	(0,093)	(0,017)	(0,123)	(0,027)
St. Dev.	1,144	1,261	1,188	1,212	0,707	0,855
Skew	0,705	-0,214	0,694	-0,267	0,321	-0,511
Kurtosis	5,432	11,201	5,4	11,332	3,036	7,251
Max	5,009	10,954	5,009	10,954	1,544	4,832
Min	-2,573	-9,464	-2,979	-9,464	-1,552	-4,19
Obs.	132	4043	163	4979	33	1032

Table 1 clearly depicts a positive average excess return for Pre-FOMC up until 2015, i.e. the existence of a pre-FOMC announcement drift both for the period studied by Lucca & Moench and for the period extended up until the time of the publication. The periods entail a positive average excess return of 0,345% and 0,326% respectively. This average excess return is remarkably greater than the other days. However, the period following their publication displays an average excess return close to zero and thereby suggest that an erosion of the pre-FOMC announcement drift has occurred following the publication. Furthermore, the results for 1994-2011 are near identical to those found by Lucca & Moench.

The analysis above has illustrated the fact that the pre-FOMC announcement drift has accounted for a significant portion of the total excess return of the SPX up until 2015. In order to determine if the effect of the pre-FOMC announcement is offset or compensated by strong systematic movements in the days prior or following the pre-FOMC-window we run dummy variable regressions for the excess return of these relative days. The results are shown in Table 2.

Table 2. S&P 500 Excess Return before, on and after Pre-FOMC Windows
This table depicts the findings from dummy variable regressions for average cum-dividend log excess
return on the S&P 500 on days relative to the FOMC announcements that are studied. 0 represents the day
of the announcement (i.e. for our close-to-close analysis, the pre-FOMC window), +1 is the day prior and
-1 represents the day following the announcement. The bottom two rows respectively report the sum of
the five days prior and 5 days following. The first column of each time period is the coefficient and the
second column with parentheses entail robust standard errors.
1994-2011 covers 01/09/1994-31/03/2011.
1994-2015 covers 01/09/1994-04/02/2015.
2015-2019 covers 05/02/2015-30/04/2019.

	1994-2011		1994-2015		2015-2019	
+5	-0,0935	(0,108)	-0,101	(0,0933)	0,200*	(0,0994)
+4	0,0449	(0,0874)	0,125	(0,0782)	0,159*	(0,0894)
+3	-0,0503	(0,108)	-0,093	(0,097)	0,0662	(0,149)
+2	-0,0237	(0,0864)	-0,0155	(0,0739)	-0,234*	(0,122)
+1	0,205*	(0,122)	0,132	(0,112)	0,220**	(0,106)
0 (Pre-FOMC)	0,338***	(0,0996)	0,323***	(0,0931)	0,0549	(0,123)
-1	0,031	(0,121)	-0,0206	(0,11)	-0,169	(0,142)
-2	-0,0236	(0,0921)	0,0346	(0,083)	-0,171	(0,186)
-3	0,109	(0,111)	0,0909	(0,0945)	0,0543	(0,206)
-4	-0,0709	(0,102)	0,0072	(0,0878)	0,00701	(0,198)
-5	-0,166*	(0,0998)	-0,141	(0,089)	0,0536	(0,103)
$\sum_{i=1}^{5}$	-0,1226		0,0475		0,0662	
$\sum_{i=-1}^{-5}$	0,0455		-0,0289		-0,22509	

*** denotes a significance level of 1%
** denotes a significance level of 5%
* denotes a significance level of 10%
Robust standard errors in parentheses

For the first two periods (1994-2011 and 1994-2015), the table clearly shows the pre-
FOMC announcement drift via strong and statistically significant excess returns in the
pre-FOMC window. Furthermore, the table shows that there are no counteracting
movements in the five days prior or following this window. The cumulative windows of
five days before and after the pre-FOMC window display no strong impact and are also
statistically insignificant. For the third period, 2015-2019, no pattern of excess returns
arises.

The results for 1994-2015 indicate that a large fraction of the excess return on the SPX
was earned during the pre-FOMC windows. As shown in Table 3, a trading approach
consisting of the simple strategy to buy SPX at the start of each pre-FOMC window,
selling at the close of the same window and holding cash during the rest of the year

would have entailed an annualized excess return of ~2,6% and a Sharpe ratio of ~0,77. Comparing this to the annualized return of non-FOMC days which is ~3,8% we find that the pre-FOMC windows account for approximately 40%. Comparing with the 1994-2011 sample, the average excess return accounted for 57% and would have entailed a Sharpe ratio of ~84%.

Table 3: Excess Return on the S&P 500
This table depicts the results dummy variable regressions for the different periods examined. The dependent variable is the cum-dividend log excess return, the dummy variable pre-FOMC denotes pre-FOMC windows by 1 and others by 0. Other refers to all 24-hour windows that are not pre-FOMC. Sharpe ratio entails the annualized Sharpe ratio on pre-FOMC excess returns computed as $\sqrt{8}$ times the Sharpe ratio per pre-FOMC window (average pre-FOMC excess return divided the sample standard deviation).
1994-2011 covers 01/09/1994-31/03/2011.
1994-2015 covers 01/09/1994-04/02/2015.
2015-2019 covers 05/02/2015-30/04/2019.

	1994-2011	1994-2015	2015-2019
Pre-FOMC Dummy	0,330***	0,307***	0,0161
	(0,101)	(0,0944)	(0,124)
Constant	0,00851	0,0156	0,0388
	(0,0198)	(0,0172)	(0,0266)
Annual Ex-Return Pre-FOMC	2,707	2,581	0,439
Annual Ex-Return Other	2,076	3,814	9,456
Sharpe Ratio	0,837	0,768	0,219
Obs	4175	5142	1065
Number of FOMC Meetings	132	163	33

*** denotes a significance level of 1%
** denotes a significance level of 5%
* denotes a significance level of 10%
Robust standard errors in parentheses

After concluding that the pre-FOMC announcement drift was present for the SPX during the period prior to the publication we study the correlation of these pre-FOMC excess returns to two measurements of the state of the US economy. The first one is a NBER (National Bureau of Economic Research) recession dummy which takes the form of 1 in the case of a recession. The second one is the VIX index (measured as the close value two days before the FOMC meeting), this variable is used to assess whether the pre-FOMC excess returns are correlated to the level of equity market uncertainty. Additionally, we examine whether these excess returns show signs of time-series predictability by regressing them on the average of the past eight FOMC meetings. This variable is named MA8. The explanatory variables, with the exception of the NBER

dummy, are standardized to have zero mean and unit variance. This is done in order to expedite the interpretation of the coefficients. All of these three measurements are suggested and investigated by Lucca & Moench (2015). The results of these regressions are found in Table 4. As the pre-FOMC announcement drift has been proven to be non-existent for the SPX during the 2015-2019 period, this time span is omitted from this analysis. The corresponding analysis for the period of 1994-2011 can be found in the appendix (Table B).

Table 4. Regressions of SPX Pre-FOMC Excess Returns 1994-2015
This table depicts the results of regressions of the pre-FOMC returns on three explanatory variables. The dependent variable is the pre-FOMC excess return. The NBER dummy is a dummy variable collected from the National Bureau of Economic Research which takes the form of 1 in case of a US recession and 0 otherwise. VIX is the VIX index, measured as the closing value two days prior to the specific FOMC meeting. Pre-FOMC(MA8) is a moving average of the pre-FOMC excess returns of the eight meetings prior. In order to facilitate the interpretation of the coefficients, VIX and Pre-FOMC(MA8) are standardized so as to have zero mean and unit variance.
2015-2019 covers 05/02/2015-30/04/2019.

	1994-2015		
	(1)	(2)	(3)
NBER dummy	0,615		
	(0,479)		
VIX		0,173	
		(0,16)	
Pre-FOMC(MA8)			0,0804
			(0,0914)
Constant	0,251***	0,295***	0,316***
	(0,0842)	(0,0822)	(0,0927)
R-Squared	0,0278	0,025	0,00507
Observations	162	162	162

*** denotes a significance level of 1%
** denotes a significance level of 5%
* denotes a significance level of 10%
Robust standard errors in parentheses

As shown in column one, the regression investigating the potential relation between the pre-FOMC excess returns and the NBER dummy, denoting whether or not the US economy was in a state of recession, yields a strong positive coefficient yet lacks

statistical significance. The same hold true for the other two explanatory variables found in column two and three respectively. As such no definitive conclusions can be drawn.

B: Study of the OMX30 during September 1994 - April 2019

Throughout this section, we will employ the same methodology as in Section A to investigate the excess return of the OMX30. We will investigate two periods. The first is 1994-2015 (September 1994 to January 2015), i.e. up until the publication of Lucca & Moench. The second period is 2015-2019 (February 2015 to April 2019), i.e. the period following their publication, again isolated in order to enable comparison between the findings from before and after they made their findings public knowledge. These analyses allow us to examine whether the pre-FOMC announcement drift has been noticeable on the Swedish index OMX30 and also if there has been a difference in that potential drift before vs after February 2015. The notion that the Swedish index would be affected by the FOMC is in line with the suggestions of Lucca & Moench (2015) as well as Karolyi & Stulz (1996) who report international comovement of stock returns.

The difference in local times between New York and Stockholm entails that the pre-FOMC announcements take place after the closing of trading hours in Stockholm. As such, the close-to-close returns that we employ in our study perfectly catches the 24 hours leading up to each FOMC announcement. Table 5 illustrates the summary statistics of the excess return for the OMX30.

Table 5. OMX30 Summary Statistics of Excess Return
This table depicts summary statistics for the excess return of the OMX30 for the 24 hour Pre-FOMC windows as well as the other 24-hour windows. The parentheses entail robust standard error for the mean. Obs are the number of observations, i.e. number of 24 hour periods for each sample.
1994-2015 covers 01/09/1994-04/02/2015.
2015-2019 covers 05/02/2015-30/04/2019.

	1994-2015		2015-2019	
	Pre-FOMC	**Other**	**Pre-FOMC**	**Other**
Mean	0,536	0,015	0,023	0,022
	(0,096)	(0,021)	(0,151)	(0,032)
St. Dev.	1,222	1,456	0,866	1,023
Skew	0,837	0,081	-0,055	-0,689
Kurtosis	5,077	7,22	5,226	9,413
Max	5,552	12,117	2,351	3,81
Min	-3,19	-7,742	-2,602	-8,771
Obs.	162	4960	33	1032

As evident by Table 5, the results for the OMX30 are in line with those for the SPX. For the 1994-2015, i.e. prior to the publication of Lucca & Moench, we document a strong positive mean excess return for pre-FOMC return, 0,565% compared to 0,016% for non-FOMC. Furthermore, in the period following the publication 2015-2019 this effect is absent. These findings would suggest that there was indeed a pre-FOMC announcement drift on the OMX30 prior to February 2015, a drift that has since disappeared for the following period.

The analysis above has illustrated the fact that the pre-FOMC announcement drift has accounted for a significant portion of the total excess return of the OMX30 up until 2015. In order to determine if the effect of the pre-FOMC announcement is offset or compensated by strong systematic movements in the days prior or following the pre-FOMC-window we run dummy variable regressions for the excess return of these relative days. The results are shown in Table 6.

Table 6. OMX30 Excess Return before, on and after Pre-FOMC Windows
This table depicts the findings from dummy variable regressions for average excess return on the OMX30 on days relative to the FOMC announcements that are studied. 0 represents the day of the announcement (i.e. for our close-to-close analysis, the pre-FOMC window), +1 is the day prior and -1 represents the day following the announcement. The bottom two rows respectively report the sum of the five days prior and 5 days following. The first column of each time period is the coefficient and the second column with parentheses entail robust standard errors.
1994-2015 covers 01/09/1994-04/02/2015.
2015-2019 covers 05/02/2015-30/04/2019.

	1994-2015		2015-2019	
+5	-0,00791	(0,0983)	0,0973	(0,137)
+4	0,00778	(0,109)	0,0496	(0,148)
+3	-0,139	(0,111)	0,0065	(0,159)
+2	-0,0436	(0,103)	-0,153	(0,155)
+1	-0,0636	(0,112)	0,021	(0,16)
0 (Pre-FOMC)	0,536***	(0,096)	0,0231	(0,151)
-1	0,139	(0,126)	-0,214	(0,166)
-2	0,137	(0,102)	-0,00059	(0,176)
-3	0,0647	(0,116)	-0,284	(0,179)
-4	0,0394	(0,126)	-0,0411	(0,144)
-5	-0,0935	(0,105)	0,0193	(0,18)
$\sum_{i=1}^{5}$	-0,25411		0,0214	
$\sum_{i=-1}^{-5}$	0,2866		-0,52039	

*** denotes a significance level of 1%
** denotes a significance level of 5%
* denotes a significance level of 10%
Robust standard errors in parentheses

For the first period examined, Table 6 depicts the existence of the pre-FOMC announcement drift via strong and statistically significant excess returns in the pre-FOMC window. Furthermore, the table shows that there are no counteracting movements in the five days prior or following this window. The cumulative windows of five days before and after the pre-FOMC window display no strong impact and are also statistically insignificant. In regard to the latter period, 2015-2019, there are no statistically significant excess returns.

Similarly to the SPX, the results for the OMX indicate that a large fraction of the excess return on the OMX30 during 1994-2015 was accounted for by pre-FOMC windows. As shown in Table 7, a trading approach consisting of the simple strategy to buy OMX30 at the start of each pre-FOMC window, selling at the close of the same window and

holding cash during the rest of the year would have entailed an annualized excess return of ~4,3% and a Sharpe ratio of 1,24. Comparing this to the annualized return of non-FOMC days which is ~3,76% we find that the pre-FOMC windows account for approximately 53%.

Table 7: Excess Returns on the OMX30

This table depicts the results dummy variable regressions for the different periods examined. The dependent variable is the excess return, the dummy variable pre-FOMC denotes pre-FOMC windows by 1 and others by 0. Other refers to all 24-hour windows that are not pre-FOMC.

Sharpe ratio entails the annualized Sharpe ratio on pre-FOMC excess returns computed as √8 times the Sharpe ratio per pre-FOMC window (average pre-FOMC excess return divided the sample standard deviation).

1994-2015 covers 01/09/1994-04/02/2015.
2015-2019 covers 05/02/2015-30/04/2019.

	1994-2015	2015-2019
Pre-FOMC Dummy	0,520***	0,0011
	(0,098)	(0,152)
Constant	0,0154	0,022
	(0,0207)	(0,0319)
Annual Ex-Return Pre-FOMC	4,286	0,185
Annual Ex-Return Other	3,762	5,365
Sharpe Ratio	1,24	0,0754
Obs	5122	1065
Number of FOMC Meetings	162	33

*** denotes a significance level of 1%
** denotes a significance level of 5%
* denotes a significance level of 10%
Robust standard errors in parentheses

After concluding that the pre-FOMC announcement drift did exist for the OMX30 during the before Lucca & Moench's publication, we examine the potential correlation of these pre-FOMC excess returns to the same explanatory variables as in the analysis of the SPX. The first two being measurements of the state of the US economy. We opt to utilize these measurements in the analysis of this Swedish index as the nature of the pre-FOMC drift rests upon the notion of international comovement (Karolyi & Stulz 1996) and the American FOMC meetings (Lucca & Moench 2015). The first one of these explanatory variables is therefore the NBER (National Bureau of Economic Research) recession dummy which takes the form of 1 in the case of a US recession and 0 otherwise. The second one is the VIX index (measured as the close value two days before the FOMC meeting), this variable is used to assess whether the pre-FOMC excess returns are correlated to the level of equity market uncertainty in the United

States. Additionally, we examine whether the pre-FOMC excess returns show signs of time-series predictability by regressing them on the average of the past eight FOMC meetings. This variable is named MA8. In order to expedite the analysis of the coefficients, the explanatory variables, with the exception of the NBER dummy, are standardized to have zero mean and unit variance. All of these three measurements were originally suggested and investigated by Lucca & Moench (2015). The results of the regressions are found in Table 8. As the pre-FOMC announcement drift has been proven to be non-existent for the OMX30 during the 2015-2019 period, this time span is omitted from this analysis.

Table 8. Regressions of OMX30 Pre-FOMC Excess Returns 1994-2015
This table depicts the results of regressions of the pre-FOMC returns on three explanatory variables. The dependent variable is the pre-FOMC excess return. The NBER dummy is a dummy variable collected from the National Bureau of Economic Research which takes the form of 1 in case of a US recession and 0 otherwise. VIX is the VIX index, measured as the closing value two days prior to the specific FOMC meeting. Pre-FOMC(MA8) is a moving average of the pre-FOMC excess returns of the eight meetings prior. In order to facilitate the interpretation of the coefficients, VIX and Pre-FOMC(MA8) are standardized so as to have zero mean and unit variance.
2015-2019 covers 05/02/2015-30/04/2019.

	1994-2015		
	(1)	**(2)**	**(3)**
NBER dummy	0,953**		
	(0,425)		
VIX		0,420***	
		(0,111)	
Pre-FOMC(MA8)			0,219**
			(0,087)
Constant	0,426***	0,469***	0,508***
	(0,0907)	(0,0845)	(0,0942)
R-Squared	0,0633	0,139	0,0342
Observations	161	161	161

*** denotes a significance level of 1%
** denotes a significance level of 5%
* denotes a significance level of 10%
Robust standard errors in parentheses

As shown in column one, the regression investigating the potential relation between the pre-FOMC excess returns and the NBER dummy, denoting whether or not the US

economy was in a state pf recession, yields a positive coefficient which is statistically significant at the 5% level. This indicates that the pre-FOMC announcement drift of the period was contra cyclical based on the NBER definition of US recessions. The second column depicts a positive coefficient for the regression on the explanatory variable VIX which is statistically significant at the 1% level. As such, we can conclude that a higher level of the VIX index (two days prior to the specific meeting) entails a greater excess return. In the third column we find a positive coefficient of 0,219 that is statistically significant at the 5% level. This entails that the backward-looking moving average, covering the past eight FOMC meetings, is a strong explanatory variable for the pre-FOMC excess returns of the coming meeting.

C: Time-series of Pre-FOMC Announcement Drift

The analysis above has concluded that the pre-FOMC announcement drift is present for both indices in the tim e period of 1994-2015. However, the drift is non-existent for both indices in the period following the publication of Lucca & Moench.

In order to study the development of pre-FOMC excess returns over time we plot time-series of these returns for both indices and also incorporate a moving average, see Figure 1 and Figure 2. This moving average is defined by a window covering the specific meeting examined as well as the three meetings prior and the four following. The idea is to calculate an average based of eight meetings as that is the number of scheduled meetings per year. We are primarily interested in assessing the development of the pre-FOMC announcement drift following the publication of Lucca & Moench. However, as we can not reasonably assume that the publication entails completely new information that did not reach the market in other ways earlier, we can not employ strong statistical analysis of the pre-period versus the post-period.
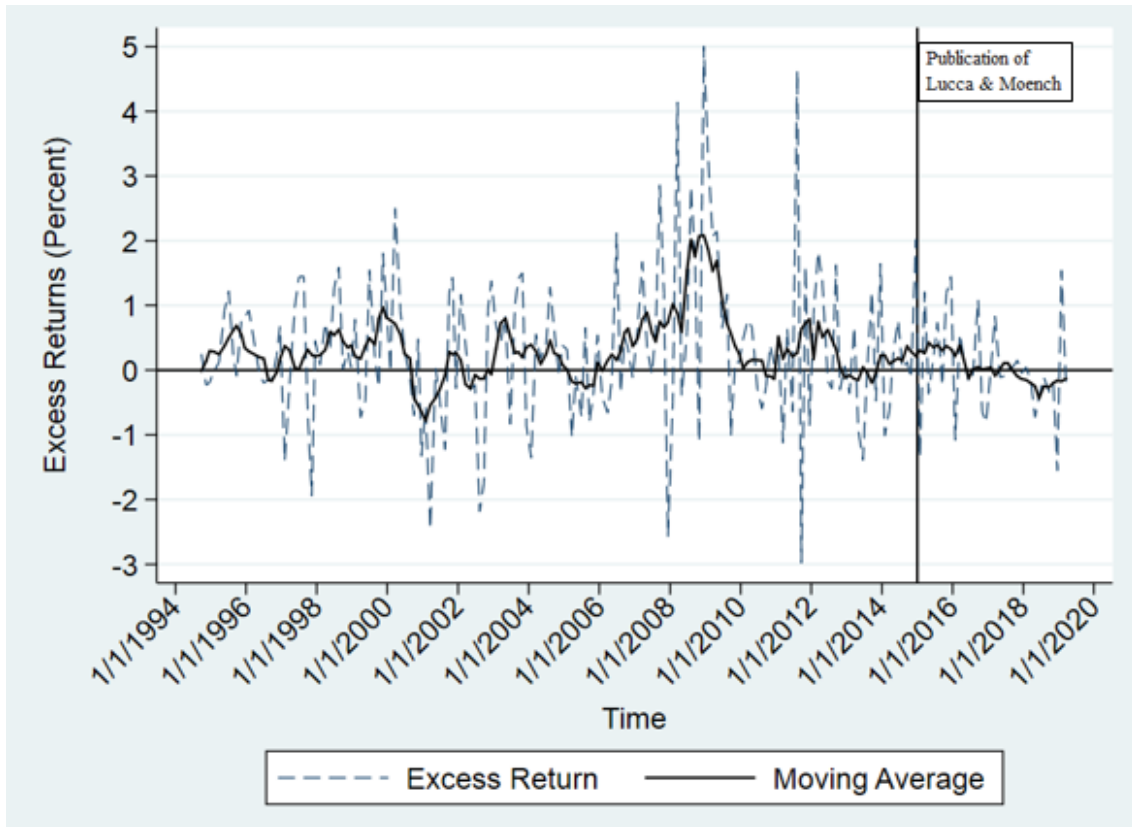
Figure 1: Time-Series of Pre-FOMC Announcement Excess Returns on the S&P 500 1994-2019

The dashed line in this figure represents the excess return of pre-FOMC windows from September 1994 to April 2019. The pre-FOMC windows are defined as the trading day on which announcements were made. The solid line represents a moving average of these excess returns, with a window incorporating the specific meeting, the three prior and the four following. The solid vertical line illustrates the time of publication for the article by Lucca & Moench in 2015.

Figure 2: Time-Series of Pre-FOMC Announcement Excess Returns on the OMX30 1994-2019

The dashed line in this figure represents the excess return of pre-FOMC windows from September 1994 to April 2019. The pre-FOMC windows are defined as the trading day on which announcements were made. The solid line represents a moving average of these excess returns, with a window incorporating the specific meeting, the three prior and the four following. The solid vertical line illustrates the time of publication for the article by Lucca & Moench in 2015.
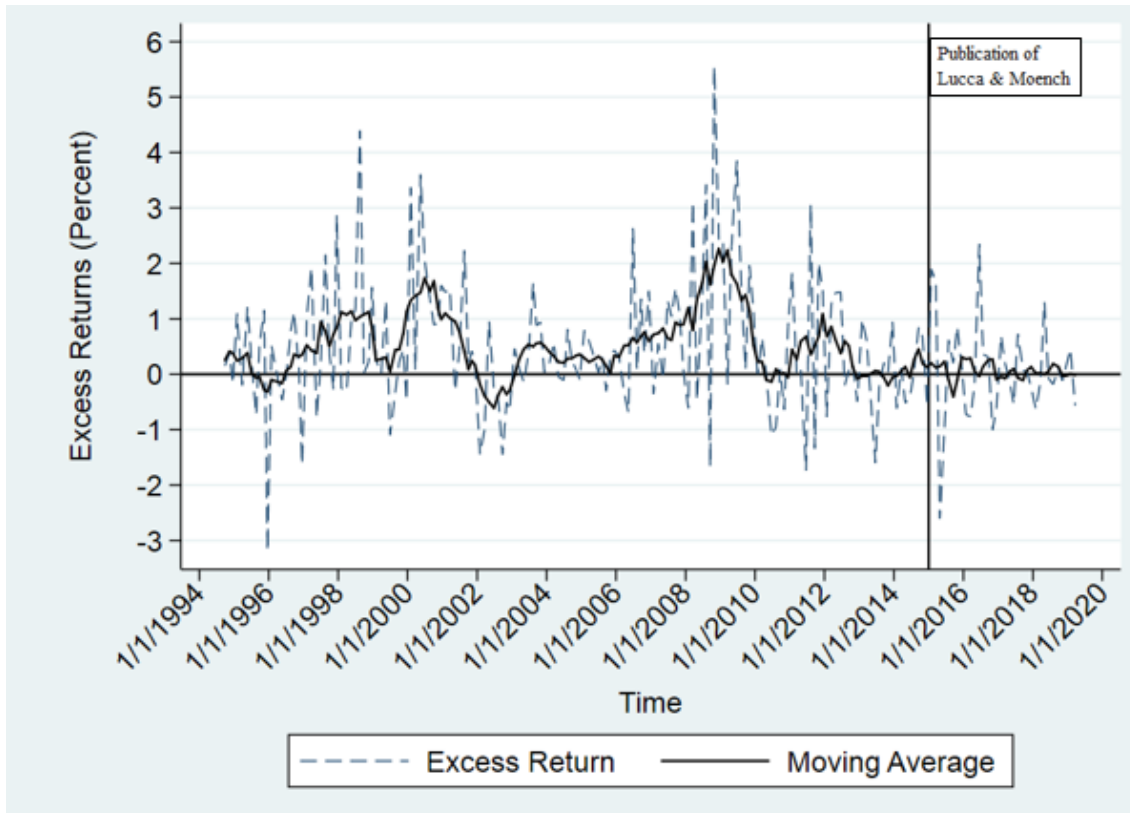
Studying the graphs in Figure 1 and Figure 2, we find that the pre-FOMC announcement drift has been fluctuating in the entire time span examined. Even for the period 1994-2015, that exhibit strong mean pre-FOMC excess returns, we can observe an inconsistent pattern of both positive and negative values. This hold true for both the SPX and the OMX30. However, in the period following the publication of Lucca & Moench in February of 2015 there is a declining pattern for the pre-FOMC effect, albeit not barring incidental positive excess returns. This, combined with the findings of Section B and Section C, would suggest that the pre-FOMC announcement drift was negatively shocked by the publication in 2015. However, as the effect has been varying in persistence over the period of 1994-2011 this might simply entail a temporary decline. In order to fully assess whether the pre-FOMC announcement drift has been fully eliminated a sample of more years following 2015 is needed.

Additionally, we run an analysis of potential structural breaks for the pre-FOMC excess returns of both indices (Bai & Perron 2003). For the SPX, this statistical analysis estimates a potential structure break around the meeting on the 24th of October 2012. However, the analysis is unable to reject the null hypothesis that there is no structural break and as such no clear conclusion can be drawn. For the OMX30, we can reject the null hypothesis on a significance level of 1% and thereby conclude that there is indeed a structural break in the data. This break is estimated at the meeting on the 1st of August 2012. Interestingly, Lucca & Moench published an entry on the subject on the 11th of July 2012 which might have instigated investors to take advantage of their findings as early as during the summer of 2012 and thereby initiate the elimination of the pre-FOMC announcement drift.

6.   Implications and Conclusions

	Hypothesis	**Conclusion**
H1:	The S&P 500 will exhibit greater positive excess return during pre-FOMC windows for 1994-2015, i.e. an existence of a pre-FOMC announcement drift.	Confirmed
H2:	The pre-FOMC announcement drift of the S&P 500 will have diminished in the period following the publication of Lucca & Moench in February 2015, i.e. 2015-2019.	Confirmed
H3:	The OMX30 will exhibit greater positive excess return during pre-FOMC windows for 1994-2015, i.e. an existence of a pre-FOMC announcement drift.	Confirmed
H4:	The pre-FOMC announcement drift of the OMX30 will have diminished in the period following the publication of Lucca & Moench in February 2015, i.e. 2015-2019.	Confirmed

Our empirical results confirm the findings of Lucca & Moench (2015), during the time period spanning from September 1994 to January 2015 the SPX experienced positive significant average excess returns in the pre-FOMC windows. This confirms the existence of the so called pre-FOMC announcement drift for this index during these years. Our findings would suggest that the significance of the drift has lessened to some degree in the span 2011-2015. A reasonable implication for this could be that the knowledge gathered by Lucca & Moench reached the market to in the years prior to the publication, which is also evident by postings made online by the authors. However, it is impossible to perfectly establish at what time this information was first made available.

Our findings regarding the OMX30 are in line with those of the SPX. For the period of September 1994 to January 2015 the OMX30 displays a strong and statistically significant excess return during the pre-FOMC windows. These results confirm the existence of the pre-FOMC announcement on the OMX30 during these years. The same conclusion holds true for both SPX and OMX30, indicating an international comovement in line with the suggestions of Karolyi & Stulz (1996). The results for the OMX30 are even stronger than those for the SPX in our study, we believe this might be due to the fact that the close-to-close returns studied are better fitted to the 24 hours leading up to FOMC announcements as the announcements take place after the closing

of the trading hours in Stockholm. This means that the data on the OMX30 better catches the relevant 24-hour periods.

Furthermore, it should be noted that the results for the OMX30 1994-2015 are remarkably strong compared to other international indices studied by Lucca & Moench in their original article (such as the German DAX, the British FTSE 100, the French CAC40, the Spanish IBEX and the Swiss SMI). This could seem to indicate that the Swedish index is particularly prone to comovement with the US economy. Possibly the small economy of Sweden might entail more non-diversifiable risk and hence larger premiums are required by equity investors.

The analyses of both indices over the period following the publication of Lucca & Moench, i.e. February 2015 to April 2019, produce results that exhibit no signs of the pre-FOMC announcement drift. Comparing the period of 1994-2015 to the period of 2015-2019, the mean excess return of Pre-FOMC windows has dropped from 0,323 to 0,055 for the SPX and from 0,536 to 0,023 for the OMX30. This could suggest that the excess returns of these windows have been eroded and thereby that the pre-FOMC drift has been virtually eliminated for both indices. This is in line with the efficient market hypothesis that predicts that the market will incorporate all available information (Fama 1970 & Fama 1991). As such, investors should have taken advantage of the information made available by Lucca & Moench leading to the excess return to be diminished which could be a potential explanation behind our findings.

The time-series of both indices depict the recent decline in pre-FOMC excess returns. However, these returns have been volatile in the period ranging from 1994-2015 as well, and as such it might be too early to definitively declare the pre-FOMC announcement drift to be eliminated. For future research, we would suggest these studies to be conducted with a greater sample when more time has passed since the publication in February of 2015 as the timespan currently available may be too slim to allow for definitive conclusions. However, the structural break analyses would seem to indicate that a negative shift in the effect of the pre-FOMC announcement drift occurred as early as during the summer of 2012.

The analysis of explanatory variables for the pre-FOMC excess returns on both indices covering the period up until the publication of Lucca & Moench in 2015, i.e. the period with an existing pre-FOMC announcement drift, is highly interesting. We find no strong correlation between the pre-FOMC excess returns of the American S&P 500 index and the different measurements of the US economy that are studied. However, these variables exhibit strong explanatory power for the Swedish OMX30 index. As such, the pre-FOMC announcement drift of the OMX30 seems to have been even more related to the recent development of the financial market in the US than the pre-FOMC announcement drift of the SPX.

The findings of this paper add knowledge to the existing literature by reviewing the continued development of the pre-FOMC announcement drift as well as by examining the phenomenon on a new domestic market, via the Swedish index OMX30.

7.   References

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8. Appendix

Table A. FOMC Meeting Dates in the Period Studied
This table depicts the dates of all meetings in the period covered by this paper. The meeting on March 26th 1996 is marked with an asterisk as it is excluded from the sample following the suggestions of Lucca & Moench (2015).

Year	1st	2nd	3rd	4th	5th	6th	7th	8th
1994						27-09-1994	15-11-1994	20-12-1994
1995	01-02-1995	28-03-1995	23-05-1995	06-07-1995	22-08-1995	26-09-1995	15-11-1995	19-12-1995
1996	31-01-1996	1996-03-26*	21-05-1996	03-07-1996	20-08-1996	24-09-1996	13-11-1996	17-12-1996
1997	05-02-1997	25-03-1997	20-05-1997	02-07-1997	19-08-1997	30-09-1997	12-11-1997	16-12-1997
1998	04-02-1998	31-03-1998	19-05-1998	01-07-1998	18-08-1998	29-09-1998	17-11-1998	22-12-1998
1999	03-02-1999	30-03-1999	18-05-1999	30-06-1999	24-08-1999	05-10-1999	16-11-1999	21-12-1999
2000	02-02-2000	21-03-2000	16-05-2000	28-06-2000	22-08-2000	03-10-2000	15-11-2000	19-12-2000
2001	31-01-2001	20-03-2001	15-05-2001	27-06-2001	21-08-2001	02-10-2001	06-11-2001	11-12-2001
2002	30-01-2002	19-03-2002	07-05-2002	26-06-2002	13-08-2002	24-09-2002	06-11-2002	10-12-2002
2003	29-01-2003	18-03-2003	06-05-2003	25-06-2003	12-08-2003	16-09-2003	28-10-2003	09-12-2003
2004	28-01-2004	16-03-2004	04-05-2004	30-06-2004	10-08-2004	21-09-2004	10-11-2004	14-12-2004
2005	02-02-2005	22-03-2005	03-05-2005	30-06-2005	09-08-2005	20-09-2005	01-11-2005	13-12-2005
2006	31-01-2006	28-03-2006	10-05-2006	29-06-2006	08-08-2006	20-09-2006	25-10-2006	12-12-2006
2007	31-01-2007	21-03-2007	09-05-2007	28-06-2007	07-08-2007	18-09-2007	31-10-2007	11-12-2007
2008	30-01-2008	18-03-2008	30-04-2008	25-06-2008	05-08-2008	16-09-2008	29-10-2008	16-12-2008
2009	28-01-2009	18-03-2009	29-04-2009	24-06-2009	12-08-2009	23-09-2009	04-11-2009	16-12-2009
2010	27-01-2010	16-03-2010	28-04-2010	23-06-2010	10-08-2010	21-09-2010	03-11-2010	14-12-2010
2011	26-01-2011	15-03-2011	27-04-2011	22-06-2011	09-08-2011	21-09-2011	02-11-2011	13-12-2011
2012	25-01-2012	13-03-2012	25-04-2012	20-06-2012	01-08-2012	13-09-2012	24-10-2012	12-12-2012
2013	30-01-2013	20-03-2013	01-05-2013	19-06-2013	31-07-2013	18-09-2013	30-10-2013	18-12-2013
2014	29-01-2014	19-03-2014	30-04-2014	18-06-2014	30-07-2014	17-09-2014	29-10-2014	17-12-2014
2015	28-01-2015	18-03-2015	29-04-2015	17-06-2015	29-07-2015	17-09-2015	28-10-2015	16-12-2015
2016	27-01-2016	16-03-2016	27-04-2016	15-06-2016	27-07-2016	21-09-2016	02-11-2016	14-12-2016
2017	01-02-2017	15-03-2017	03-05-2017	14-06-2017	26-07-2017	20-09-2017	01-11-2017	13-12-2017
2018	31-01-2018	21-03-2018	02-05-2018	13-06-2018	01-08-2018	26-09-2018	08-11-2018	19-12-2018
2019	30-01-2019	20-03-2019						

Table B. Regressions of SPX Pre-FOMC Excess Returns 1994-2011
This table depicts the results of regressions of the pre-FOMC returns on three explanatory variables. The NBER dummy is a dummy variable collected from the National Bureau of Economic Research which takes the form of 1 in case of a US recession and 0 otherwise. VIX is the VIX index, measured as the closing value two days prior to the specific FOMC meeting. Pre-FOMC(MA8) is a moving average of the pre-FOMC excess returns of the eight meetings prior. In order to facilitate the interpretation of the coefficients, VIX and Pre-FOMC(MA8) are standardized so as to have zero mean and unit variance. 1994-2011 covers 01/09/1994-31/03/2011.

	1994-2011		
	(1)	**(2)**	**(3)**
NBER dummy	0,617		
	(0,479)		
VIX		0,162	
		(0,166)	
Pre-FOMC(MA8)			0,126
			(0,0909)
Constant	0,250***	0,298***	0,321***
	(0,0835)	(0,0851)	(0,0973)
R-Squared	0,036	0,0265	0,0151
Observations	131	131	131

*** denotes a significance level of 1%

** denotes a significance level of 5%

* denotes a significance level of 10%

Robust standard errors in parentheses