More than 100% of the equity premium: How much is really earned on macroeconomic announcement days?*

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October 13, 2019

One can earn well over 100% of the equity risk premium on macroeconomic announcement days identified by the prior literature. This is a robust phenomenon present across many other subsets of macroeconomic variables. We show how inadvertent sample selection along with the timing of macroeconomic announcements throughout the month produces this too-much-return puzzle. Looking at the entire distribution of macroeconomic variables eliminates this sample selection bias, while including day-of-the-month fixed effects controls for the announcement timing. We find that expected macroeconomic announcements *as a whole* are responsible for about half of the equity premium. This smaller premium earned over more days means Sharpe ratios are similar on announcement and non-announcement days. We also show that the fit of the CAPM on macroeconomic announcement days is not evidence that those days are special, but only a by-product of those days' high ex-post market returns.

JEL classification: G14.

Keywords: Macroeconomic announcements, equity premium, FOMC, information, news.

*We are grateful to our colleagues at the University of Washington as well as Hank Bessembinder and David Schreindorfer for helpful comments and discussion. All errors remain our own.

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Return for bearing risk should be earned when the resolution of the risk is announced. If information revelation is uneven, for instance by being concentrated on macroeconomic announcement days, then expected returns should be high on those high expected news days. A large literature has confirmed this concentration. Savor and Wilson (2013) show that about 60% of the equity risk premium is earned on the days when unemployment, inflation and interest rates are announced. Lucca and Moench (2015) show that about 80% of the equity premium is earned during the 24 hours prior to interest rate announcements by the FOMC. Cieslak, Morse, and Vissing-Jorgensen (2019) show that the entire equity premium is earned on a bi-weekly cycle of the FOMC announcements.

Ironically, these papers confirm this return concentration too well. Table 1 shows that one can earn about 150% of the equity premium by holding the market on all of the expected news days identified by the above three prominent papers. We demonstrate the robustness of this finding by producing many combinations of macroeconomic variables that together generate more than 100% of the equity premium earned on their respective announcement days.[1] This reproducibility confirms that this too-much-return puzzle is not due to an error, an artifact of different samples across the papers, or overlapping announcements.

While all of these individual findings are correct, there is an adding-up problem. Earning more than 100% of the equity premium on a given small set of pre-scheduled announcement days implies that holding the market during the majority of the year must earn predictably negative returns. Moreover this too-much-return puzzle leaves no room for any other systematically important news events such as earnings announcements or periods of systematic uncertainty.[2] Lastly, this puzzle is complimentary to the excess Sharpe ratio found on macroeconomic announcement days (Savor and Wilson, 2013; Ai and Bansal, 2018), and it

[1] We focus on the announcement days themselves, setting aside issues of pre-announcement drift, which would make the concentrations even larger. See Kurov, Sancetta, Strasser, and Wolfe (2019) for evidence of pre-announcement drifts beyond the FOMC.

[2] Many papers document the systematic importance of earnings announcements: Frazzini and Lamont (2007); Barth and So (2014); Savor (2012); Barber, George, Lehavy, and Trueman (2013); McLean and Pontiff (2016); Gilbert, Hrdlicka, and Kamara (2018); Savor and Wilson (2016); Linnainmaa and Zhang (2019). Hu, Pan, Wang, and Zhu (2019) show that eight heightened-uncertainty days per year account for more than 30% of the equity premium.

Table 1
Equity Premium Concentration from Combining Prior Papers
The first column reports the average market excess return on the expected news days from the prior literature: inflation (PPI), employment, and FOMC days from Savor and Wilson (2013); the day prior to the FOMC days from Lucca and Moench (2015); and days -1 to 3, 9 to 13, 19 to 23, and 29 to 33 in FOMC cycle time from Cieslak et al. (2019). The second column reports the average market excess return on all other days. The third column reports the difference between the two. We also report the number of observations in each sample and the percent of the equity premium earned on the announcement days, which is calculated per Equation 1. The sample period is January 1990 to June 2018. Standard errors are in parentheses, and *, ** and *** indicate significance at the 10, 5 and 1 percent levels.

	Ann.	Non-ann.	Diff.
Average market excess return	7.7***	-1.9	9.6***
	(1.79)	(1.71)	(2.49)
N	3,820	3,615	
Percent of equity premium	149.1%		

is also tied to the finding that the cross-sectional CAPM risk premium is higher on those days (Savor and Wilson, 2014; Andrei, Cujean, and Wilson, 2018). In this paper, we propose a two-pronged solution to the puzzle: control for the fact that the previously studied macroeconomic variables are not random draws from the pool that could have been studied, and control for the day-of-the-month effects present in stock returns. We show that there is nothing unusual about macroeconomic announcement days.

The extraordinary concentration of the equity premium on these small sets of announcements can be due to inadvertent sample selection. This need not be a selection bias of individual researchers, but may well be driven by the publication process itself (Harvey, 2017; Andrews and Kasy, 2019). Indeed, there are many other combinations of macroeconomic variables that lead to an even greater concentration of the equity premium than those documented in the literature. The existence of such "better" alternative combinations suggests that researchers did not produce their results by explicitly data-mining. For example, had Savor and Wilson (2013) picked construction spending and consumer confidence, they could have claimed an even larger "success."

Focusing on macroeconomic announcements with high returns comes from theory's pre-

diction that the most important news announcements should be the ones with the highest expected returns. Unfortunately, using high returns ex-post to identify important news announcements leads to a catch-22 of trying to find macroeconomic variables that have high returns but not so high that they break the 100% barrier. One might argue that variables like unemployment, inflation and the FOMC could have been ex-ante identified as important, but even the impression that these variables are ex-ante important can be contaminated by their ex-post high returns.[3] Under similarly reasonable arguments as to the importance of housing and consumption in GDP, one could have made a case for the ex-ante importance of construction spending and consumer confidence announcements, which also yield high ex-post returns. This exemplifies that debating ex-post what is ex-ante important is unlikely to lead to satisfying conclusions.

One can avoid this problem of needing to ex-ante identify the most important macroeconomic announcements, by studying the entire distribution of macroeconomic announcements. To minimize the chance of accidentally selecting a sample made up of only ex-post important macroeconomic announcements, we analyze all U.S. monthly macroeconomic variables and the FOMC. The intuition for this solution builds on the work of Fama and French (2010) and Kelly and Jiang (2014).[4]

Using this entire distribution, macroeconomic announcements as a whole appear special. The concentration of the equity premium on these announcement days is higher on average than a sample of days randomly selected using a uniform distribution from the entire time-series. The mean concentration of the equity premium on a set of three macroeconomic variables is 31.4% versus a mean of 12.4% for randomly selected days of equal sample size.

[3]Friedman (1953) writes "The facts that serve as a test of the implications of a hypothesis might equally well have been among the raw material used to construct it [...] the process [of hypothesis construction] never begins from scratch [...] the two methodologically distinct stages [of hypothesis construction and testing] are always proceeding jointly."

[4]Fama and French (2010) show in the context of mutual fund managers that one can avoid the multiple comparison test and selection bias of looking at ex-post successful managers by looking at the entire cross-sectional distribution of managers. Kelly and Jiang (2014) show that one can help solve the problem of short time-series, by using the information in the cross-section of similar events to effectively extend the time-series sample.

However, this comparison overstates the specialness of macroeconomic announcements because the null's uniform distribution ignores the strong time-series structure of macroeconomic announcements. Each variable is announced with a high level of regularity at the beginning, middle or end of the month, and these times of the month have previously been associated with high returns, for example due to capital flows into the markets (Ogden, 1990; Meng and Pantzalis, 2018; Etula, Rinne, Suominen, and Vaittinen, 2019). We therefore construct a benchmark of pseudo-macro days that captures this timing structure by randomly selecting days following a timing distribution that matches that of actual macroeconomic announcements. The mean concentration of the equity premium on a set of three such pseudo-macro announcements is 24.9%. This mean is much closer to the 31.4% of actual macroeconomic announcements, which shows that this time-series structure matters. Importantly, this finding suggests that part of the concentration of the equity premium on the announcement days is due to their timing within the month.

To control for this timing effect, we exploit the variation across months in the timing of announcements within the month for each macroeconomic variable. If the higher equity premium associated with a variable's announcement days is due to the expected news content of those days, then we should expect the higher equity premium to move across days as the announcement day changes within the month. Regressing the market's daily excess returns on fixed effects for macroeconomic announcement days along with fixed effects for the day-of-the-month, we confirm that the announcement timing is important.

Without the day-of-month fixed effects, the macroeconomic announcement fixed effects continue to deliver more than 100% of the equity premium. Including the day-of-the-month fixed effects lowers the average macroeconomic announcement fixed effect. Though the announcement fixed effects' point estimates remain economically meaningful on average, they lose their joint statistical significance in the presence of the day-of-the-month fixed effects.[5] However, the day-of-the-month fixed effects themselves remain both economically

[5]Only the FOMC fixed effects are routinely statistically significant.

and statistically significant in virtually all specifications. The lack of statistical significance of the macroeconomic fixed effects in the presence of the day-of-the-month fixed effects suggests that macroeconomic announcements happen to occur on days with high average market returns, and may not in and of themselves be special.

Controlling for the day-of-the-month fixed effects, the macroeconomic announcement fixed effects show that macroeconomic variables *as a whole* account for 56% of the equity premium. This confirms the concentration hypothesis, while showing that the timing of macroeconomic announcements contributes to the too-much-return puzzle. Importantly, that macroeconomic announcements explain significantly less of the equity premium than previously thought leaves room for the many other plausibly important sources of information in the economy.

That this premium is earned over 62% of days helps solve the puzzle of excessively high Sharpe ratios, which prior work found to be an order of magnitude higher on "selected" macroeconomic announcement days compared to non-announcement days (Savor and Wilson, 2013; Ai and Bansal, 2018). The small premium we find earned over many days, means the small increases in risk observed on macroeconomic announcement days can explain this observed premium. The Sharpe ratio on all macroeconomic announcement days after controlling for the day-of-the-month effect is 0.027, virtually the same as the Sharpe ratio on all days of 0.029.

Finally, we show that the CAPM fitting "better" on macroeconomic announcement days as measured by a higher risk premium on those days is a mechanical consequence of these announcement days having higher ex-post returns (Savor and Wilson, 2014). The intuition is that cross-sectional regression coefficients on estimated CAPM betas are the realized market return attenuated by the amount of estimation noise in the betas. We illustrate this point by showing there is a similar distribution of CAPM premia across different combinations of macroeconomic announcement variables as there is in these variables' realized market returns. Even more directly, sorting days into deciles based on the realized market

return gives a monotonically increasing market risk premium. Thus these high premia do not reflect a better fit of the CAPM or a fundamentally different risk return trade-off on macroeconomic announcement days. These high premia reflect the higher realized market returns on these days regardless of whether these returns are from higher expected returns or chance realizations.

Our paper is related to a growing literature on the multiple comparisons problem or p-hacking in asset pricing (see Harvey, Liu, and Zhu (2015); Harvey and Liu (2018); Chordia, Goyal, and Saretto (2019), among others). As researchers search for statistically significant anomalies in the same CRSP dataset, one cannot consider each hypothesis test as fully independent of the previous test. Eventually, significance will be obtained due to random sampling error. Our paper follows the same idea in the context of macroeconomic announcements and the percentage of the equity premium earned on a given set of days. In this vein, the premium earned on FOMC announcement days (or even weeks in FOMC cycle time) may not be special either since one would expect to find such significance for one variable, just by luck.[6]

The more general point of our paper is that it is unclear that macroeconomic announcement days are as special as the prior literature may suggest. After carefully controlling for sample selection and day-of-the-month return patterns, these days look relatively normal. A large body of literature has developed with new models built to explain such high premia (and even pre-announcement drifts) using different preferences or learning processes (Ai and Bansal, 2018; Ai, Bansal, Im, and Ying, 2018; Wachter and Zhu, 2018; Andrei et al., 2018). Our message is that maybe there is no puzzle to solve once things are measured correctly, and hence no need for new asset pricing theories.

[6]In the context of return predictability regressions, Cochrane (2007) makes the related point that the economic significance of a point estimate is different from its statistical significance.

1. Data

To capture the distribution of an entire set of ex-ante hypothesized important macroeconomic announcements, we construct a panel of the announcement dates from January 1990 to June 2018 for all major U.S. macroeconomic series that are released at the monthly frequency. Because of its near-monthly frequency and common inclusion in the literature, we also include the FOMC announcement dates. Table 2 lists the included series, the announcing agency, the start and end date of the series in our sample and the number of announcements for the series. This data set of macroeconomic variables mirrors the prior literature (Andersen, Bollerslev, Diebold, and Vega, 2003, 2007; Gilbert, Scotti, Strasser, and Vega, 2017) but excludes weekly jobless claims and quarterly GDP announcements.

Many economic statistics are released on the same day, e.g., the release of the unemployment rate by the Bureau of Labor Statistics on the first Friday of every month at 8:30am ET includes non-farm payroll and hourly earnings. We list the announcement by only one of the series announced on that day. Hence one set of announcement dates in our analysis can cover multiple macroeconomic variables released at the same time by the same (or another) agency. Since our objective is to capture the information for all major macroeconomic announcements, this inability to separately identify the effect of a given variable announced on a given day is not relevant for this study.

For each macroeconomic announcement series, we calculate the percent of the equity premium that each macroeconomic variable accounts for over the sample period. This is computed as the annualized return to a portfolio that invests in the market on the announcement days and invests in the risk-free asset on all other days:

$$\frac{\left(\prod_{t=1}^{N_i}(1+r_{m,t}^{e,i})\right)^{\frac{252}{T}}-1}{\left(\prod_{t=1}^{T}(1+r_{m,t}^{e})\right)^{\frac{252}{T}}-1} \tag{1}$$

where T is the total number of days in the sample and $r_{m,t}^{e,i}$ represents the market's excess

Table 2
Monthly Macroeconomic Announcements
This table lists the 21 macroeconomic variables, the agencies that release them, the start and end dates of the series within the sample, and the number of announcements for each series. The variables are listed in descending order of the percent of the annualized equity premium earned on a portfolio that invests in the CRSP value-weighted market index on the announcement day and in the risk-free asset on all other days (see Equation 1). All series are monthly except for the FOMC.

Variable	Agency	Start Date	End Date	N	Percent of EP
Construction Spending	Census Bureau	1/2/1990	6/1/2018	340	36.2%
FOMC	Federal Reserve	2/8/1990	6/13/2018	228	31.9%
NAPM	Institute for Supply Management	2/1/1990	6/1/2018	341	29.2%
Consumer Confidence	The Conference Board	7/30/1991	6/26/2018	324	18.8%
New Home Sales	Census Bureau	1/3/1990	6/25/2018	339	16.6%
Housing Starts	Census Bureau	1/18/1990	6/19/2018	339	16.0%
Unemployment Rate	Bureau of Labor Statistics	1/5/1990	6/1/2018	335	14.3%
UM Consumer Confidence F	University of Michigan	2/1/1991	6/29/2018	327	13.3%
Producer Price Index	Bureau of Labor Statistics	1/12/1990	6/13/2018	340	12.9%
Advance Retail Sales	Census Bureau	1/12/1990	6/14/2018	340	12.4%
Durable Goods Orders	Census Bureau	1/26/1990	6/27/2018	341	12.1%
Personal Consumption	Bureau of Economic Analysis	1/29/1990	6/29/2018	337	11.2%
Capacity Utilization	Federal Reserve	1/17/1990	6/15/2018	339	10.1%
Factory Orders	Census Bureau	1/5/1990	6/4/2018	341	6.5%
Consumer Price Index	Bureau of Labor Statistics	1/18/1990	6/12/2018	340	6.3%
Trade Balance	Census Bureau	1/17/1990	6/6/2018	341	6.1%
Business Inventories	Census Bureau	1/16/1990	6/14/2018	338	-0.2%
Leading Indicators	The Conference Board	1/31/1990	6/21/2018	341	-0.4%
UM Consumer Confidence P	University of Michigan	1/18/1991	6/15/2018	327	-5.7%
Monthly Budget Statement	Bureau of the Fiscal Service	2/22/1990	6/12/2018	334	-7.7%
Consumer Credit	Federal Reserve	1/8/1990	6/7/2018	339	-7.9%

return on days when variable i is released.[7] The daily market return $r_{m,t}$ is the CRSP value-weighted return including distributions, the risk-free rate $r_{f,t}$ is the one-month Treasury bill rate from Kenneth French's website, and hence the market's excess return is $r^e_{m,t} = r_{m,t} - r_{f,t}$. Over our sample period, the market's average daily excess return is 3.2 basis points and its daily volatility is 109 basis points.

The macroeconomic announcements in Table 2 are sorted in descending order of their ex-post "importance" as measured by this concentration of the equity premium. We see that there is a wide heterogeneity across macroeconomic variables. Construction spending and the

[7]The ratio of the total cumulative returns over the entire sample period without anualizing is

$$\left(\left(\prod_{t=1}^{N_i}(1+r^{e,i}_{m,t})\right)-1\right) / \left(\left(\prod_{t=1}^{T}(1+r^{e}_{m,t})\right)-1\right).$$

FOMC each account for more than 30% of the equity premium.[8] Others, like consumer credit and the monthly budget statement, earn negative returns and hence represent a negative percentage of the equity premium. Taken at face value, without adjusting for their ex-post nature, these negative returns would say this subset of macroeconomic announcements earn negative expected returns and therefore provide a hedge for the risk in the economy. Obviously, this conclusion is problematic, and negative returns can more easily be reconciled with standard models of risk and return by recognizing that these realized returns are only a noisy proxy for the expected returns of these macroeconomic announcements.

Out of 21 variables, 13 account for more than 10% of the equity premium on their own. Individually, these positive average returns are less problematic than the negative returns. However, combined these 13 account for well over 100% of the equity premium, presenting a complementary puzzle to the negative returns just discussed. If these macroeconomic variables account for more than 100% of the equity premium in expectation, then other days must have negative expected returns. The overlap in announcement days between the 13 variables lessens the problem only slightly. Again, the simplest reconciliation of the importance of macroeconomic announcements with standard risk and return models is that ex-post average returns are only proxies for the ex-ante average returns. In the remainder of the paper, we show how better measures of expected returns accomplish this reconciliation.

2. Returns on Sets of Announcement Days

The high concentration of the equity premium on many macroeconomic announcement days shown in Table 2 is consistent with the joint hypothesis that expected returns should be earned when risk is expected to be resolved and that macroeconomic announcements are a source of such expected risk resolution. A reasonable goal is to try to narrow down the set of macroeconomic variables to the most important ones. The prior literature has done this

[8]Note that this percentage only includes the announcement day, and not the day before as in Lucca and Moench (2015) or the entire week as in Cieslak et al. (2019).

implicitly by focusing on small subsets of them.

It is not clear ex-ante which of these major macroeconomic variables are most important. Thankfully theory provides clear guidance on how to identify them: the most important announcements are those accompanied by the highest expected returns. However, as Table 2 suggests using realized returns as a proxy for expected returns can be problematic. Realized returns can diverge substantially above expected returns leading to concentrations of more than a 100% of the equity premium or realized returns can diverge substantially below expected returns leading to implausible negative estimates of expected returns. Thus in using realized returns to identify the subset of the most important variables, one faces the catch-22 of trying to find macroeconomic announcements with large returns, but if the returns are too large they must be thrown out as non-representative.

The too-much-return findings of Table 2 is not due to an oddity of the sample period we select. This problem of too-much-return is apparent as soon as one jointly considers the finding of Cieslak et al. (2019) that "the equity premium is earned entirely in weeks zero, two, four and six in FOMC cycle time" with the finding of Savor and Wilson (2013) that "60% of the cumulative annual equity risk premium is earned on announcement days" of inflation, unemployment and FOMC. One way of reconciling these would be to show that Savor and Wilson (2013) is due entirely to the FOMC. Table 3 shows this is not the case and that our sample period is comparable to that of previous studies. We do so by replicating the results of Savor and Wilson (2013) in our sample and decomposing it into the contribution from inflation and unemployment and that from the FOMC.

The first row of Table 3 shows the fraction of the equity premium earned on a portfolio that invests in the market index on days that inflation (PPI), unemployment or FOMC data are announced and invests in the risk-free asset on all other days. This portfolio earns 57.3% of the equity premium during our 1990 to 2018 sample. This concentration is nearly identical to the 60% Savor and Wilson find in their sample from 1958 to 2009. The difference between the average return on announcement days and all other days is economically and statistically

Table 3
Replicating and Decomposing Savor and Wilson (2013)
This table reports the average market excess return on inflation (PPI), employment, and FOMC days (Ann.) versus all other days (Non-ann.), as well as the difference between the two (Diff.). We also report the percent of the equity premium earned on those days in the last column (see Equation 1). The first row replicates the main result from Savor and Wilson (2013) during our sample period (January 1990 - June 2018). The second row excludes the FOMC and the third row includes only the FOMC. The non-announcement day columns are kept constant across all rows. Standard errors are in parentheses, and *, ** and *** indicate significance at the 10, 5 and 1 percent levels.

	Average return			
	Ann.	Non-ann.	Diff.	Percent of EP
Updated Savor and Wilson (2013)	12.5***	1.8	10.7***	57.3%
	(3.71)	(1.34)	(3.96)	
Only unemployment and inflation	8.1*	1.8	6.3	26.5%
	(4.33)	(1.34)	(4.42)	
Only FOMC	27.0***	1.8	25.2***	31.9%
	(7.22)	(1.34)	(7.33)	

significant.

The remainder of the table shows that this concentration of the equity premiums is split roughly in half between that due to the inflation and unemployment announcements (26.5%) and that due to the FOMC announcements (31.9%). Though the point estimates indicate an economically significant concentration of the equity premium on both subsets, only the concentration on FOMC announcements is statistically different from non-announcement days.

Having confirmed that our sample period is similar to those previously studied, Table 4 shows that the concentration of over 100% of the equity premium on a handful of macroeconomic announcement days is not due to the overlap in announcement days between variables and is not unique to the set of variables chosen by the prior literature. More precisely, Table 4 shows the concentration of the equity premium using the top 1 through 5 macroeconomic variables.[9] Panel A shows these combinations including the FOMC. Panel B omits the FOMC to highlight that we are not simply finding a repeat of the FOMC explaining all of

[9]Days with two announcements are not counted twice and we create the exact distribution of (all) combinations of 1 through 5 macroeconomic variables chosen from the full set of 21.

Table 4
Combinations of Macroeconomic Variables with Largest Concentration of the Equity Premium
This table reports the top combinations of 1 through 5 macroeconomic variables that jointly achieve the highest percent of the cumulative annual equity premium. Panel A includes the FOMC, and Panel B excludes the FOMC.

Panel A: With FOMC

Variable 1	Variable 2	Variable 3	Variable 4	Variable 5	Percent of EP
Const Spend					36.2%
Const Spend	FOMC				69.2%
Const Spend	Consumer Conf	FOMC			89.1%
Const Spend	Consumer Conf	New Home Sales	FOMC		106.2%
Unemploy Rate	Const Spend	Consumer Conf	New Home Sales	FOMC	124.2%

Panel B: Without FOMC

Variable 1	Variable 2	Variable 3	Variable 4	Variable 5	Percent of EP
Const Spend					36.2%
Const Spend	Consumer Conf				55.4%
Housing Starts	Const Spend	Consumer Conf			71.3%
Unemploy Rate	Const Spend	Consumer Conf	New Home Sales		86.3%
Unemploy Rate	Housing Starts	Const Spend	Consumer Conf	New Home Sales	102.5%

the equity premium.

Panel A shows the top 5 announcement days earn 125% of the equity premium and Panel B shows the top 5 excluding the FOMC earn 103% of the equity premium. That the unemployment rate, featured in Savor and Wilson (2013), only enters when we consider combinations of 5 or more announcements shows that one could have picked many other combinations of two or three variables and found similar or stronger results. Consumer confidence and real-estate related variables seem just as "important" ex-post, and one could plausibly argue these are ex-ante just as important as unemployment and inflation given the role consumption and housing play in the economy.

That one can earn about 125% of the equity premium by holding the market on FOMC, consumer confidence, construction spending, unemployment, and new home sales announcement days means that 56 days per year generate 125% of the equity premium. If this represents the true expected return, it implies that there is a predictably large negative expected return earned on all other days. While the FOMC is important, Panel B shows that one can generate similarly puzzling results without it. These results motivate our looking at

the entire distribution of macroeconomic variables to eliminate the noise of realized returns and better estimate the expected returns on these announcement days.

3. Distribution of Equity Premium Concentration on Sets of Announcement Days

In this section, we show that the large concentration of the equity premium on macroeconomic announcement days is pervasive in the sense that many combinations of two, three, four or five macroeconomic variables generate 100% or more of the equity premium on their announcement days. As a result, the absolute importance (in terms of percentage of the equity premium) of a set of macroeconomic variables must be measured relative to all other possible sets of variables. We generate distributions of the concentration of the equity premium for all combinations of two or three variables and benchmark those against bootstrapped baselines of random days.

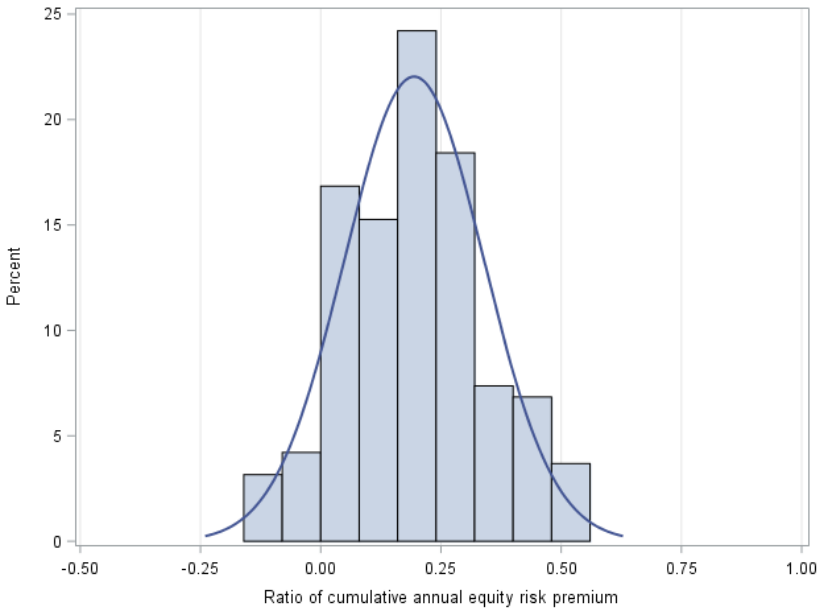
3.1. Distributions using two or three variables

We demonstrate this by showing the histogram of the fraction of the equity premium earned on all combinations of two and three macroeconomic variables. Panel A of Figure 1 shows the sets of two variables excluding the FOMC and Panel B shows the sets of three variables including the FOMC.

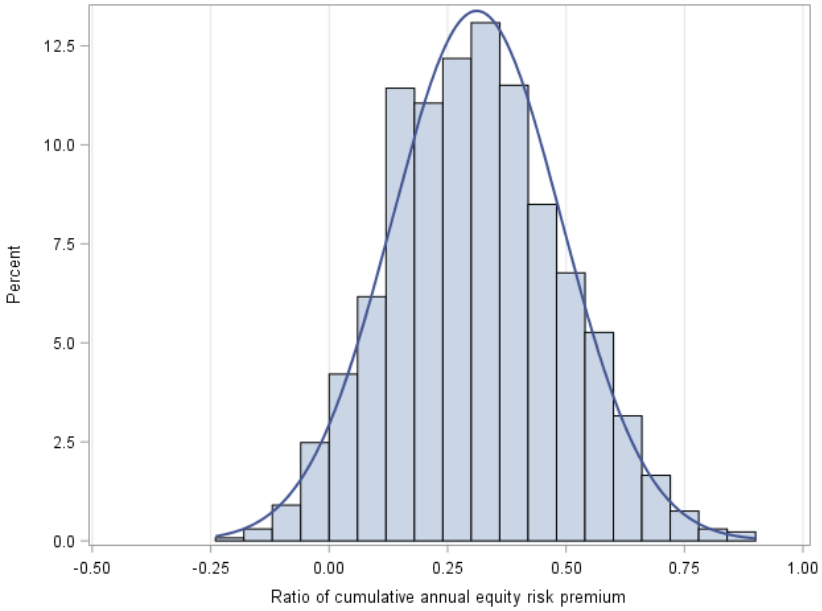
Panel A shows that the combination of unemployment and inflation announcements considered by Savor and Wilson (2013), which has 26.5% of the equity premium, falls in middle of the distribution (70th percentile) of all possible combinations of macroeconomic variables. Including the FOMC as well in Panel B raises the concentration to 57.3% but this combination still only falls at the 91st percentile. Thus while the combinations of macroeconomic announcement days previously considered seem special relative to non-announcement days, these macroeconomic variables do not seem special relative to other macroeconomic

Fig. 1. Distributions of the Percentage of the Equity Premium for all Combinations of Two or Three Macroeconomic Variables

This figure shows histograms of the concentration of equity premium earned for every combination of two or three macroeconomic variables. Panel A is the distribution from selecting 2 variables, excluding the FOMC. Panel B is the distribution from selecting 3 variables, including the FOMC. The x-axis shows the percentage of the equity premium earned and the solid line is a normal distribution best fit.



Panel A: Two macroeconomic variables, excluding FOMC



Panel B: Three macroeconomic variables, including FOMC

variables.

The fact that these are relatively "ordinary" macroeconomic variables suggests that the existing literature did not report the variables with the highest ex-post concentration of the equity premium. However, the fact that combining the variables chosen by the literature produces a concentration of more than 100% of the equity premium makes the too-much-return puzzle even more puzzling. It is further exacerbated with the inclusion of the most extreme equity-premium-earning macroeconomic variables documented in Table 4. Moreover, this makes the excess Sharpe ratio puzzle documented by the literature more puzzling as well.[10]

3.2. Baselines

Our proposed solution of looking at the entire distribution of macroeconomic variables rather than only pre-selected ones requires a different statistical benchmark. We first propose comparing the distributions of concentration in Figure 1 with the distributions of concentration obtained from randomly sampling the same number of days as the number of days in a given set of macroeconomic announcement combinations.

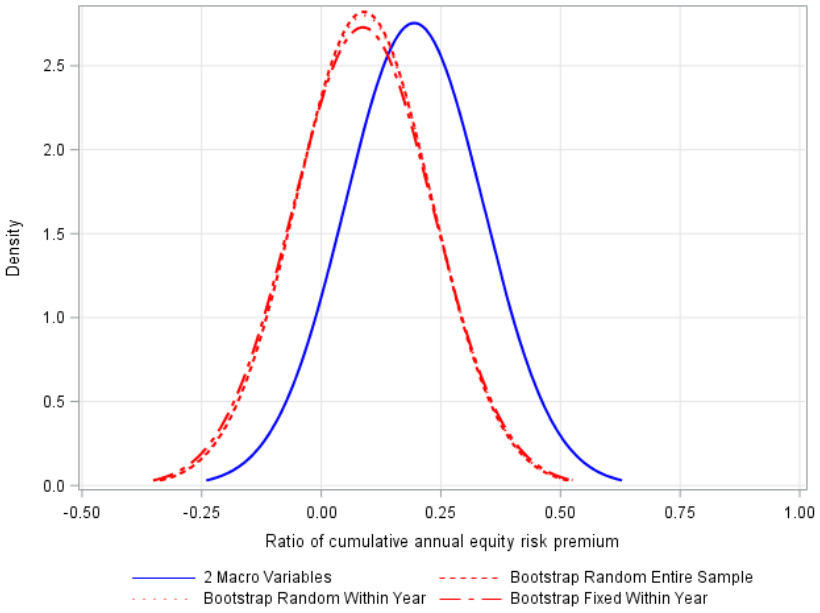
We construct this bootstrapped benchmark by randomly sampling days in three different ways and without replacement. Each way is designed to capture different elements of the time-series of returns. The first baseline randomly selects 673 (888) trading days over the entire sample period 5,000 times using a uniform distribution (each date is equally likely to be selected). That number of days is equivalent to two (three) macroeconomic variables' monthly announcements over the 29-year time-series.

The second baseline randomly selects the same number of days but selects 1/29 of them each year to mimic the even distribution of macroeconomic announcements over the time-series. The third baseline randomly selects the same number of days but after randomly selecting 1/29 of the trading days in the first year, this same trading days are selected

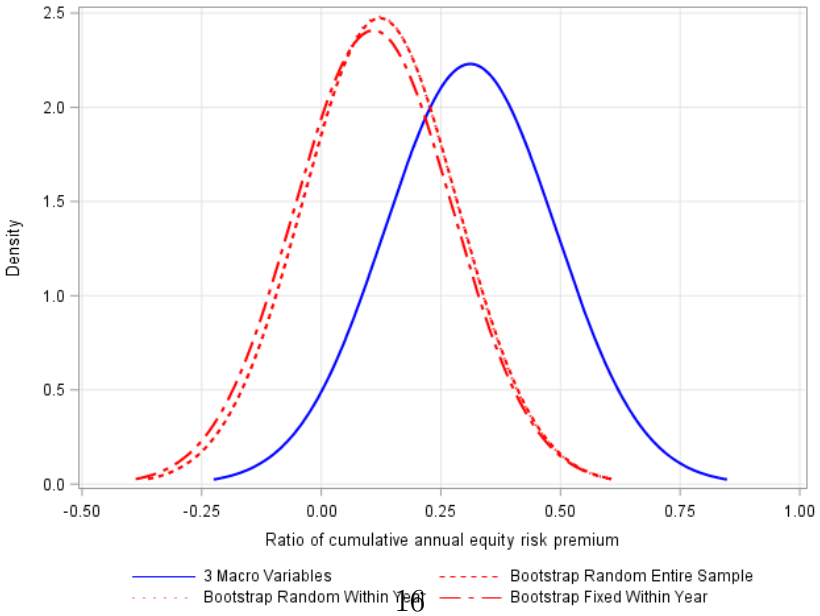
[10]The literature including Savor and Wilson (2013) has shown that the Sharpe ratio on macroeconomic announcement days is as much as an order of magnitude larger than the Sharpe ratio on non-announcement days.

Fig. 2. Distributions of Combinations of Macroeconomics Variables versus Baselines of Equivalent Number of Random Days

The solid blue lines are the fitted normal distributions from Figure 1. The dotted, dashed and dot-dashed red lines are three baselines that randomly draw an equivalent number of days: Panel A (B) plots three baseline densities for 2 (3) macroeconomic variables. "Bootstrap Random Entire Sample" is a bootstrap density of 673 (888) randomly selected trading days over the entire sample. "Bootstrap Random Within Year" is a bootstrap density of 23 (31) randomly selected trading days each year. "Bootstrap Fixed Within Year" is a bootstrap density of 23 (31) randomly selected trading days in the first year, and these same trading days each year. All baselines are repeated for a total of 5,000 trials. The sample period is January 1990 - June 2018.



Panel A: Two macroeconomic variables, excluding FOMC



Panel B: Three macroeconomic variables, including FOMC

each year. This benchmark mimics the tendency for macroeconomic announcements to be announced at roughly the same calendar time each year. Both baselines attempt to account for the seasonality present in returns.[11]

Figure 2 overlays the two (three) macroeconomic variable normal best fit densities from Figure 1, in the solid blue line, with the best fit normal densities from these three bootstrapped baselines (in red and various combinations of dashes and dots). We see that the distribution of equity premium concentration from macroeconomic announcements are economically and statistically different from the bootstrapped baselines.[12] The macroeconomic announcements distribution is shifted rightward relative to the bootstrapped distributions. The mean of the two (three) announcements distribution is 19.4% (31.4%) versus 9.1% (12.4%) for the random sampling over the entire period. The first two columns of Table 5 summarize these means along with additional summary statistics of the distributions.

This shift rightward shows that the concentration of the equity premium is pervasive across macroeconomic announcements, even after accounting for overlap in announcement dates. That there is little difference between the three alternative bootstrapping methodologies shows that these different selection criteria do not interact significantly differently with the seasonality and time-series properties of the return process. Nevertheless, in the next subsection we show that looking at more refined measures of the announcement timing reveals an important interaction of macroeconomic announcements and the seasonality of returns.

3.3. Pseudo-macro days

Typically, agencies have a set announcement pattern, like the first day of the month, the first Friday of the month, or the third Tuesday of the month, etc. Table 6 reports, for each macroeconomic variable, the number of times an announcement is made on the first trading

[11] All bootstrap tests rely on 5,000 trials.

[12] The Kolmogrov-Smirnoff tests for differences in distributions are all highly significant with p-values < 0.0001.

Table 5
Summary Statistics of Distributions of Equity Premium Concentration
Panel A (B) presents summary statistics for the following normal distributions of 2 (3) variables: the exact distribution of actual macroeconomic announcement days from Figure 1, the exact distribution of the baseline which samples randomly across the entire time-series from Figure 2 (bootstrap random entire sample), and the exact distribution of the baseline which samples days by pseudo-macro announcement rules from Figure 3.

Panel A: Two Variables

	Macro Announcements	Random Baseline	Pseudo-Macro Rules
Mean	19.4%	9.1%	17.3%
Standard deviation	14.5%	14.1%	16.9%
25th percentile	8.0%	-0.01%	5.4%
Median	18.9%	9.3%	17.1%
75th percentile	28.3%	18.7%	29.0%
95th percentile	45.5%	31.9%	45.3%

Panel B: Three Variables

	Macro Announcements	Random Baseline	Pseudo-Macro Rules
Mean	31.4%	12.4%	24.9%
Standard deviation	18.1%	16.0%	20.0%
25th percentile	17.9%	1.6%	11.1%
Median	30.8%	12.2%	24.7%
75th percentile	43.3%	23.3%	38.6%
95th percentile	61.7%	38.5%	57.8%

day of the month (day 1), the second trading day of the month (day 2), ..., the last trading day of the month (day -1). Since the minimum number of trading days per month in our sample is 18 and the maximum is 23, we group the "middle" days together (up to five of them).[13] This grouping allows us to always identify the beginning and ending days of the month separately from each other. This separation is important given the prior literature's identification of these days as having different return patterns than other days of the month.

Table 6 shows that some announcements are concentrated at specific points in the month, though most announcements have variation across several days. For example the unemployment rate is almost always released at the beginning of the month, with the mode on the fifth trading day. This is consistent with the Bureau of Labor Statistics' rule of announcing on the first Friday of each month. The CPI is released in the middle of the month and durable goods is announced near the end of the month.

[13]September 2001 is the one exception with even fewer trading days.

Table 6

Timing of Macroeconomic Announcements: This table records the number of times each macroeconomic variable is released on a given trading day of the month. Days 1 through 9 are the first nine trading days of the month. Days -1 through -9 are the last nine trading days of the month. Mid are the remaining middle days of the month (up to five days).

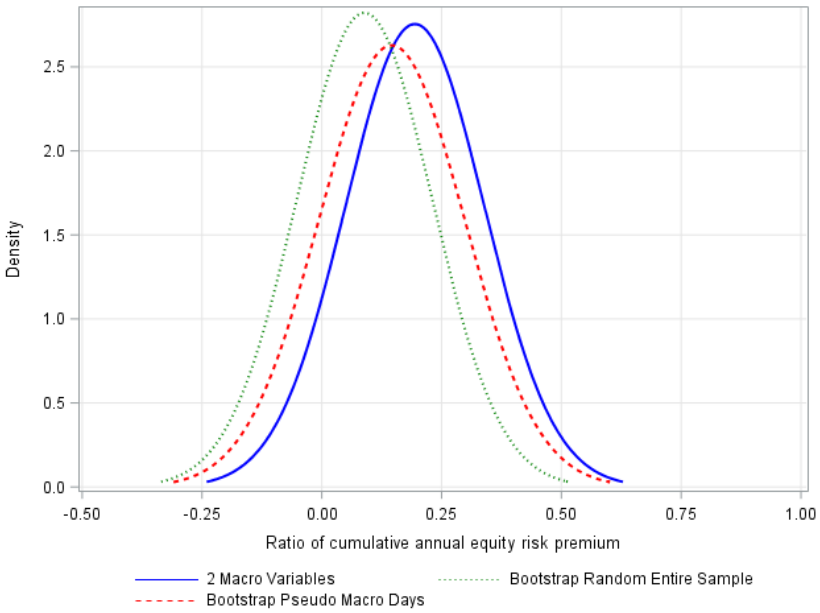
	Trading Day																		
Variable	1	2	3	4	5	6	7	8	9	Mid	-9	-8	-7	-6	-5	-4	-3	-2	-1
Const Spend	303	24	0	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	9
FOMC	8	12	13	8	5	2	9	8	7	37	17	25	8	6	5	13	19	12	14
NAPM	338	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Consumer Conf	2	0	0	0	0	0	0	0	0	0	0	0	0	1	36	128	62	49	46
New Home Sales	3	39	6	3	0	1	1	0	0	0	0	0	6	35	60	49	48	51	37
Housing Starts	0	0	0	0	0	0	0	0	0	163	91	63	18	1	1	0	2	0	0
Unemploy Rate	23	43	45	72	117	21	9	3	0	0	1	1	0	0	0	0	0	0	0
UM Cons Conf F	30	16	6	3	0	0	0	0	0	0	0	0	4	23	18	26	37	44	120
PPI	1	0	0	0	1	7	26	43	78	141	15	13	9	2	0	1	2	0	1
Adv Retail Sales	0	0	0	0	0	0	0	6	204	122	3	1	1	0	0	0	2	1	0
Durable Goods	0	0	1	0	0	0	0	0	0	1	0	0	2	51	75	66	103	40	2
Personal Consumpt	79	15	2	0	0	0	0	0	0	0	0	0	2	20	11	12	30	56	110
Capacity Util	0	0	0	0	0	0	0	0	9	298	21	8	1	1	0	1	0	0	0
Factory Orders	5	132	104	55	7	0	0	0	0	1	0	0	0	0	0	0	0	3	34
CPI	1	0	0	0	0	0	1	14	31	216	28	18	11	13	2	2	0	3	0
Trade Balance	0	8	23	21	12	8	23	53	21	65	42	35	21	7	0	0	0	1	1
Business Inventory	0	0	0	0	0	1	0	3	87	237	7	1	1	0	0	0	0	1	0
Lead Indicators	29	50	14	3	1	0	0	0	0	39	32	43	62	27	5	2	5	11	18
UM Cons Conf P	0	0	0	0	4	5	9	14	48	211	23	7	5	1	0	0	0	0	0
Mthly Budget Stmnt	0	0	0	0	0	0	4	143	13	15	18	47	38	30	19	4	3	0	0
Consumer Credit	0	0	0	5	326	6	1	1	0	0	0	0	0	0	0	0	0	0	0

We construct a baseline that samples returns randomly following these announcement patterns. For this, we first randomly select an announcement pattern, i.e., we select a row from Table 6, and then we randomly select trading days according to this structure, i.e., according to the exact distribution given by that row. An additional one or two rows are selected to give a set of two or three pseudo-macro announcement series. This process is repeated for 5,000 trials.[14] Figure 3 shows the the distribution of the concentration of the equity premium for these randomly selected pseudo-macro days. The figure also includes the distributions for days randomly selected over the entire sample from Figure 2 and the exact distribution for macroeconomic announcement days from Figure 1.

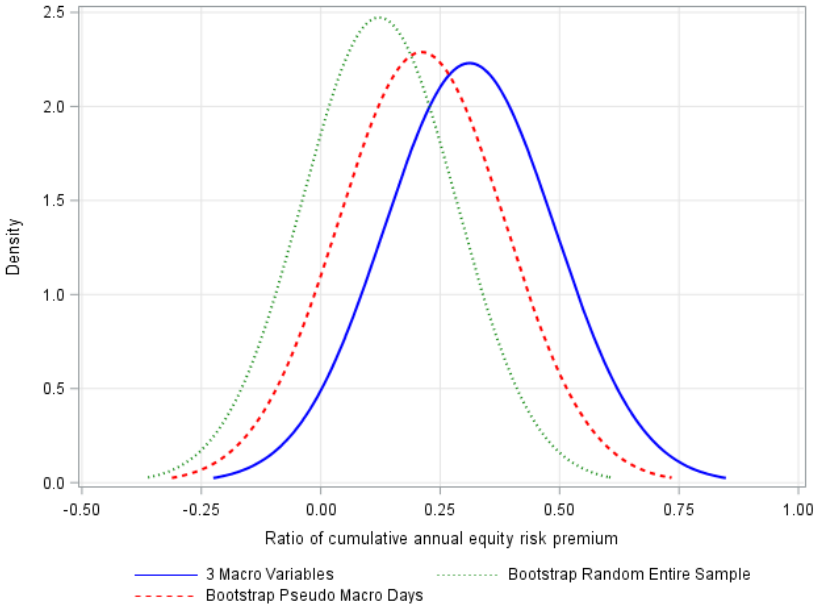
We see that for both the two and three macroeconomic announcement combinations, the distribution of pseudo-macro announcement days bootstrapped with the rules established in

[14]The bootstrap procedure selects from all days according to the announcement distribution, not just non-announcement days, as there are not enough of them.

Fig. 3. Distributions using Pseudo-Macro Announcement Rules
Panel A (B) shows the exact distribution from selecting 2 (3) macroeconomic variables from Figure 1 overlaid with the baseline of 673 (888) randomly selected trading days over the entire time-series from Figure 2, and a distribution using announcement-rule mimicking structures. For this, we first randomly select two or three macroeconomic variables from Table 6 and then we randomly select trading days over the entire sample period according to these structures. This process is repeated for 5,000 trials.



Panel A: Two macroeconomic variables, excluding FOMC



Panel B: Three macroeconomic variables, including FOMC

Table 6 more closely matches the concentration of the equity premium in actual macroeconomic announcement days. Table 5 shows that the mean of this bootstrapped distribution is 17.3% (24.9%) versus 19.4% (31.4%) for the 2 (3) combinations of actual macroeconomic announcements.

These distributional tests suggest that macroeconomic announcement days as a whole are special. They are special in that they earn a substantial percentage of the equity premium compared to randomly selected days. However, randomly selecting days according to rules that mimic the way macroeconomic variables are released also produces a substantial concentration in the equity premium compared to days randomly selected using a uniform distribution across the time series. This concentration of the equity premium for random days mimicking the announcement timing of macroeconomic announcements suggests that part of the specialness of macroeconomic announcements may be due to a coincidence of their timing and not the information they contain. In the next section we use fixed effect regressions to distinguish between these two sources of the concentration in the equity premium.

4. Fixed Effects Regressions

To distinguish the source of the concentration in the equity premium between the timing of macroeconomic announcements and the information content they are expected to contain, we utilize fixed effect regressions. These regressions include a fixed effect for each macroeconomic announcement and for the day of the month. These fixed effects distinguish the timing and information content by exploiting the fact that macroeconomic announcements do not always fall on the same day of the month (Table 6).

For example the announcement of consumer confidence typically falls four days before the end of the month. It also often falls on any of the five days prior to the end of the month. The prediction is that if the concentration in the equity premium is due to the expected

information content of the consumer confidence report, then this higher expected return should occur on the announcement day as it varies with respect to the end of the month. If however, part of the equity premium concentration is due to the general information released throughout the economy on days near the end of the month (see for instance Ogden (1990); Meng and Pantzalis (2018); Etula et al. (2019) and references therein), then that concentration should not vary as the timing of the consumer confidence announcement varies.

Identifying these two sources of the equity premium concentration relies on there being sufficient variation in the timing of macroeconomic announcements. Reviewing the announcement timings in Table 6 shows three macroeconomic announcements have very little variation in their announcement day pattern. The NAPM index, for instance, is always released on the first day of the month, with only 3 exceptions over our entire sample period. Consumer credit and construction spending also have little variation in their announcement patterns. This small variation leads to additional noise, hence higher standard errors, in the fixed effect point estimates. The impact from these three variables is not central to the conclusions of these fixed effects regressions as we will discuss in more detail later.

Including day of month fixed effects is complicated by the fact that the number of trading days vary from 18 to 23, and the prior literature has established that there are important time-series patterns in returns around the beginning and end of each month. To clearly identify these beginning and end of month effects, we continue the numbering methodology from the previous section: counting in the first 9 days from the beginning of the month, counting back from the end of the month for the last 9 days, and grouping together the 0 to 5 middle days of the month in a fixed effect labeled "mid."[15]

[15]This procedure essentially creates 19 "daily" intercept estimates. Our results are robust to other numbering methodologies, such as counting from the beginning or the end of the month. But such procedures implicitly create a bias towards the end or the beginning of the month due to the uneven number of days across months.

4.1. Baseline with macroeconomic fixed effects only

Before including the day of month fixed effects, we show the baseline concentration of the equity premium on macroeconomic announcement days by including fixed effects only for the announcement days. These fixed effects provide an arithmetic measure of the concentration of the equity premium. We use two specifications. First, we include each macroeconomic fixed effect separately, estimating the following equation for each variable:

$$r^e_{m,t} = \alpha + \phi \mathbb{1}(Macro_i)_t + \varepsilon_t \tag{2}$$

for $i \in [1, 21]$, where i represents each macro variable. Second, we include the fixed effects for the macroeconomic announcements jointly, estimating equation:

$$r^e_{m,t} = \alpha + \sum_{i=1}^{21} \phi_i \mathbb{1}(Macro_i)_t + \varepsilon_t. \tag{3}$$

The inclusion of fixed effects separately is analogous to the individual results presented in Tables 1, 2 and 3. The joint inclusion controls for the overlap in announcement days and allows the separation of the effects between individual variables.

Table 7 reports these baseline fixed effects regressions. To ease interpretation of the regression estimates, we scale the daily excess market returns by the cumulative annual equity premium (6.7% over our sample period) divided by 252 trading days. Hence the regression coefficients can be interpreted as the percent of the daily average equity risk premium attributable to the macroeconomic announcement (per announcement). Therefore, a coefficient of zero indicates that the macroeconomic announcement contributes no additional equity premium. A coefficient of one indicates that the macroeconomic announcement earns 100% more of the average equity risk premium. Thus a day with such an announcement would be expected to earn 200% of the daily equity risk premium if all days otherwise earn the average equity premium.[16]

[16]Of course the average day may earn less than the average equity premium.

Table 7
Fixed Effects for Macroeconomic Announcements
This table reports baseline fixed effects regressions. The individual regression specification is:

$$r^e_{m,t} = \alpha + \phi \mathbb{1}(Macro_i)_t + \varepsilon_t$$

for $i \in [1, 21]$, where i represents each macro variable. The combined regression specification is:

$$r^e_{m,t} = \alpha + \sum_{i=1}^{21} \phi_i \mathbb{1}(Macro_i)_t + \varepsilon_t.$$

Daily excess market returns are scaled by the cumulative annual equity premium divided by 252 trading days. Standard errors are reported in parentheses. *, **, and *** indicate significance at the 10, 5 and 1 percent levels. The F-statistic for the joint significance of the macro announcement fixed effects in the combined regression is 1.67 with a P-value of 0.0276.

	Individual	Combined		Individual	Combined
Unemployment Rate	2.21	3.48	Consumer Conf	3.35	3.53
	(2.30)	(2.46)		(2.34)	(2.38)
CPI	0.41	0.34	Factory Orders	0.39	0.78
	(2.28)	(2.44)		(2.28)	(2.33)
Durable Goods	1.59	1.27	NAPM	5.45**	-2.65
	(2.28)	(2.39)		(2.28)	(4.78)
Housing Starts	2.53	2.60	New Home Sales	2.63	2.39
	(2.29)	(2.38)		(2.29)	(2.40)
Lead Indicators	-1.08	-1.02	Personal Consumpt	1.48	-0.23
	(2.28)	(2.31)		(2.29)	(2.50)
Trade Balance	0.32	1.50	Mthly Budget Stmnt	-2.75	-1.93
	(2.28)	(2.34)		(2.30)	(2.35)
PPI	1.84	2.24	Consumer Credit	-2.81	-2.69
	(2.28)	(2.44)		(2.29)	(2.44)
Adv Retail Sales	1.75	3.36	Umich Cons Conf P	-2.35	-2.77
	(2.28)	(2.67)		(2.33)	(2.52)
Capacity Util	1.20	2.20	Umich Cons Conf F	1.98	1.87
	(2.29)	(2.52)		(2.33)	(2.50)
Business Inventory	-0.99	-1.85	FOMC	9.29***	8.94***
	(2.29)	(2.67)		(2.76)	(2.78)
Const Spend	6.99***	9.78**			
	(2.28)	(4.79)			

We see that across the individual and joint specifications the fixed effect estimates are qualitatively and quantitatively similar. Only the NAPM announcement changes materially from significantly positive to insignificantly negative across the two specifications. This similarity suggests that the overlap in announcement days does not substantially change the

inferences about the concentration of the equity premium.

Consistent with our prior findings, we see that some variables earn economically significant percentages of the equity premium, most notably the FOMC, construction spending, and consumer confidence. Nevertheless, there is wide variation in the concentration of the equity premium across announcements with fixed effects in the joint specification ranging from -2.77 to 9.78. Only three announcements are statistically significant in the individual specification and only two are statistically significant in the joint specification. The test of joint significance (F-test) is significant with a P-value of 0.0276. Together these results are consistent with macroeconomic variables having a concentration of the equity premium, but realized returns inducing significant noise that makes estimates of individual variables' expected returns difficult.

4.2. Adding day-of-the-month fixed effects to baseline

To assess how much of this concentration is due to the timing of the macroeconomic announcements throughout the month, we introduce day-of-the-month fixed effects. We again estimate the macroeconomic announcement fixed effects individually and jointly with equations

$$r^e_{m,t} = \sum_{j=-9}^{9} \gamma_j \mathbb{1}(Tradeday_j) + \phi \mathbb{1}(Macro_i) + \varepsilon_t \tag{4}$$

for $i \in [1, 21]$ where i represents each macro variable and

$$r^e_{m,t} = \sum_{j=-9}^{9} \gamma_j \mathbb{1}(Tradeday_j) + \sum_{i=1}^{21} \phi_i \mathbb{1}(Macro_i) + \varepsilon_t. \tag{5}$$

Table 8 reports the coefficient estimates from this full fixed effects regressions. As before, coefficients are scaled by the cumulative annual equity premium divided by 252 trading days. Panel A lists the coefficients on the macroeconomic variables for the individual and combined estimates. Panel B lists the coefficients on the days of the month for the combined regression. The day-of-month coefficients are similar across the individual and combined specifications.

Table 8
Fixed Effects Including Day of the Month
This table records the coefficient estimates from the fixed effects regressions. Panel A lists the coefficients on the macroeconomic variables and Panel B lists the coefficients on the days of the month. The regression specification for the individual regressions is:

$$r^e_{m,t} = \sum_{j=-9}^{9} \gamma_j \mathbb{1}(Tradeday_j) + \phi \mathbb{1}(Macro_i) + \varepsilon_t$$

for $i \in [1, 21]$ where i represents each macro variable. The regression specification for the combined regression is:

$$r^e_{m,t} = \sum_{j=-9}^{9} \gamma_j \mathbb{1}(Tradeday_j) + \sum_{i=1}^{21} \phi_i \mathbb{1}(Macro_i) + \varepsilon_t.$$

Daily excess market returns are scaled by the cumulative annual equity premium divided by 252 trading days. Standard errors are in parentheses. *, **, and *** indicate significance at the 10, 5 and 1 percent levels. The F-statistic for the joint significance of the macro announcement fixed effect in the combined regression is 1.16 with a P-value of 0.2804. The F-statistic for the joint significance of the day-of-the-month fixed effects in the combined regression is 1.26 with a P-value of 0.1963.

Panel A: Fixed effects on the macroeconomic variables

	Individual	Combined		Individual	Combined
Unemployment Rate	3.91	4.08	Consumer Conf	1.02	1.07
	(2.52)	(2.54)		(2.61)	(2.66)
CPI	-0.70	-0.64	Factory Orders	0.08	0.64
	(2.42)	(2.49)		(2.62)	(2.65)
Durable Goods	1.01	0.64	NAPM	-13.57	-15.38
	(2.51)	(2.56)		(15.58)	(15.62)
Housing Starts	2.97	2.19	New Home Sales	2.13	2.09
	(2.47)	(2.54)		(2.39)	(2.45)
Lead Indicators	-0.32	-0.25	Personal Consumpt	-0.85	-0.86
	(2.35)	(2.38)		(2.50)	(2.59)
Trade Balance	1.21	1.42	Mthly Budget Stmnt	-0.97	-0.73
	(2.32)	(2.37)		(2.56)	(2.58)
PPI	1.02	1.66	Consumer Credit	2.02	1.95
	(2.40)	(2.48)		(7.75)	(7.75)
Adv Retail Sales	-1.69	-0.01	Umich Cons Conf P	-4.23*	-3.85
	(2.88)	(3.15)		(2.48)	(2.55)
Capacity Util	-0.69	-0.04	Umich Cons Conf F	0.63	0.94
	(2.59)	(2.67)		(2.51)	(2.63)
Business Inventory	-4.02	-3.32	FOMC	8.97***	8.64***
	(2.54)	(2.77)		(2.77)	(2.79)
Const Spend	8.08	8.70			
	(4.92)	(4.97)			

Table 8
Continued...

Panel B: Fixed effects on the days of the month for the combined regression

Day	$r^e/\bar{r}$	Day	$r^e/\bar{r}$	Day	$r^e/\bar{r}$
1	13.82	9	5.40*	-4	4.34*
	(15.93)		(2.87)		(2.53)
2	0.55	Mid	3.86**	-3	2.53
	(2.56)		(1.79)		(2.45)
3	-0.50	-9	-0.73	-2	2.68
	(2.39)		(2.39)		(2.36)
4	-1.06	-8	-1.56	-1	1.15
	(2.33)		(2.35)		(2.57)
5	-5.09	-7	-5.18**		
	(7.75)		(2.30)		
6	-1.68	-6	-2.96		
	(2.23)		(2.29)		
7	-1.70	-5	-2.09		
	(2.24)		(2.35)		
8	-0.52				
	(2.52)				

In Panel A we see that the fixed effects for the macroeconomic announcements are again similar across the individual and combined specifications. Comparing the estimates from Panel A to those in Table 7 without the day-of-month fixed effects, we see that they are on average smaller. Only the FOMC announcement remains statistically significant, individually or in the combined regression. There remains substantial spread in the coefficients, ranging from -15.38 to 8.97. The test for joint significance (F-test) of the macroeconomic announcements is no longer significant (P-value of 0.2804).

Panel B shows that the day-of-the-month coefficients have large point estimates on the first day of the month, the middle of the month (days 9 and mid) along with the end of the month (days -4 through -1). These are the parts of the month in Table 6 where macroeconomic announcements are concentrated. These point estimates at the beginning and end of the month are consistent with the previously documented turn-of-the-month effect (see McConnell and Xu (2008) and references therein). The day-of-month fixed effects are jointly significant in each of the individual macroeconomic announcement fixed effect

regressions (see Appendix Table A1). Nevertheless, the test of joint significance of the day-of-month fixed effects is insignificant (P-value of 0.1963) in the combined specification.

The large point estimates for the day-of-month fixed effects along with the lower fixed effect estimates for the macro announcements are consistent with the timing of macroeconomic announcements contributing to the concentration of the equity premium on these days. However, the statistical insignificance of both sets of fixed effects together, despite the economically significant point estimates, make one wonder if the results of Table 8 are due to merely adding too many fixed effects that induce noise driving out the macroeconomic announcements. We show this is not the case in Section 4.5, but first we show how these fixed-effects allow the measurement of the equity premium concentration across all macroeconomic announcements.

4.3. Concentration of the equity premium using fixed effects

We now use the fixed effects to answer what fraction of the equity premium is due to macroeconomic announcements. The first column of Table 9 reports the baseline macro fixed effects from the combined regression in Table 7, and the second column reports the macro fixed effects from the combined regression with day-of-the-month fixed effects in Table 8. The rows are sorted by the value of the baseline fixed effects from equation 3.

Each macro fixed effect gives the daily effect of each macroeconomic variable for a single announcement event. These fixed effects are implicitly arithmetic average of daily returns. To convert this to an annual arithmetic measure, the coefficient is multiplied by the number of annual announcements (12 for the monthly and 8 for the FOMC) and divided by the number of annual trading days (252). The third and fourth columns in Table 9 show the cumulative sum of these effects as more macroeconomic announcements are included.

The fifth column shows the number of fixed effect events included relative to the total number of observations in the sample. Since the estimation of macro fixed effects jointly controls for announcements that overlap on the same day, it is more accurate to think of

Table 9
Concentration of Equity Premium Implied by Fixed Effects
This table shows the cumulative percent of the equity premium earned by investing in the market on subsequent combinations of macroeconomic variables. Column 1 reports the macroeconomic fixed effects (FE) coefficients from the baseline regression and column 2 reports the estimates from the day-of-the-month regression. The rows are sorted by the magnitude from the baseline regression. The cumulative arithmetic sum of the annual percent of the equity premium is calculated for each specification (columns 3 and 4). Column 5 records the cumulative sum of announcement events used divided by the total number of observations. Column 6 reports the cumulative sum of the percentage of the equity premium earned following the geometric methodology in Table 2. Column 7 repeats the exercise in Column 6 but using a daily market return time series that is purged of the day-of-the-month fixed effects. Column 8 reports the fraction of days with announcements. (Overlapping announcements count at 1 day.)

	Arithmetic Averages					Geometric Averages		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variable	Baseline FE	With Day FE	Base. FE Sum	FE Sum	#Ann./#Obs.	Original % of EP	Joint % of EP	% of days invested
Construction Spending	9.78	8.70	0.47	0.41	5%	36.2%	-22.6%	4.7 %
FOMC	8.94	8.64	0.75	0.69	8%	68.1%	5.9%	7.8 %
Consumer Confidence	3.53	1.07	0.92	0.74	13%	88.1%	14.1%	12.0%
Unemployment Rate	3.48	4.08	1.08	0.93	17%	104.3%	39.2%	16.3%
Advance Retail Sales	3.36	-0.01	1.24	0.93	22%	117.4%	30.1%	20.9%
Housing Starts	2.60	2.19	1.37	1.04	27%	122.4%	30.2%	25.2%
New Home Sales	2.39	2.09	1.48	1.14	32%	141.1%	46.1%	29.0%
PPI	2.24	1.66	1.59	1.22	37%	149.6%	49.8%	31.8%
Capacity Utilization	2.20	-0.04	1.69	1.21	41%	149.4%	39.0%	34.7%
UM Consumer Confidence F	1.87	0.94	1.78	1.26	46%	150.8%	35.4%	38.0%
Trade Balance	1.50	1.42	1.85	1.33	51%	154.9%	40.0%	41.8%
Durable Goods	1.27	0.64	1.91	1.36	56%	159.0%	41.7%	44.4%
Factory Orders	0.78	0.64	1.95	1.39	60%	158.4%	41.1%	47.8%
CPI	0.34	-0.64	1.97	1.36	65%	157.1%	37.1%	49.4%
Personal Consumption	-0.23	-0.86	1.96	1.32	70%	155.3%	32.4%	50.8%
Leading Indicators	-1.02	-0.25	1.91	1.30	75%	145.3%	26.7%	53.8%
Business Inventory	-1.85	-3.32	1.82	1.15	79%	144.7%	22.7%	54.7%
Monthly Budget Statement	-1.93	-0.73	1.73	1.11	84%	134.7%	17.5%	57.7%
NAPM	-2.65	-15.38	1.60	0.38	89%	136.0%	13.8%	58.0%
Consumer Credit	-2.69	1.95	1.47	0.47	94%	122.7%	15.9%	61.0%
UM Consumer Confidence P	-2.77	-3.85	1.34	0.29	98%	121.0%	13.2%	61.6%
All Macro Variables			134%	29%	98%	121.0%	13.2%	61.6%

announcement events rather than announcement days. This column thus can be thought of as showing the number of announcement events in a year relative to the number of total days in year. This ratio gives a way to normalize the concentration of the equity premium.

From the cumulative sum using the baseline macro announcement fixed effects (column 3), we see a rephrasing of the puzzle. One can easily obtain more than 100% of the equity premium by picking more and more days, in particular "special" macroeconomic announcement days. 100% of the equity premium is reached with just four variables (1.08 = 108%) whose announcement events represent only 17% of the sample. Stopping at 14 variables, one earns almost 200% of the equity premium (197%) with announcement events that represent 65% of the sample. Over all 21 variables, we obtain slightly more than 130% of the equity premium with announcement events that represent almost 100% of the sample.

Column 4 shows the cumulative sum of the macro fixed effects in the presence of the day-of-the-month fixed effects. Since this sum crosses the 100% threshold with six variables, we still see the danger of using ex-post selected subsets of announcements. This selection effect is substantially muted, topping out at 139% of the equity premium (with 13 variables). The total concentration of the equity premium across all macroeconomic announcements is 29%. Thus we see that controlling for the timing of announcements along with considering all macroeconomic variables, and not just the ex-post important ones, allows us to substantially reduce the too-much-return puzzle.

The preceding measure of the equity premium concentration based on arithmetic averages can overstate the concentration relative to the geometric average method that has been used in the literature, because it ignores the volatility of returns.[17] For consistency with the literature, we now redo the geometric average calculations from Tables 1, 2 and 3, accounting for the day-of-the-month fixed effects. By removing the estimate of the day-of-the-month fixed effect from each day's return of the CRSP value-weighted market index, we generate a time-series of returns purged of each day-of-the-month's average effect. Then, as before, we

[17]Recall that the arithmetic average is approximately the geometric average plus the half the standard deviation.

compute the return to a portfolio that invests in the market on days with macroeconomic announcements and in the risk-free asset otherwise.

Column 6 in Table 9 reports the (original simple) cumulative percentage of the equity premium from Table 2 earned as more variables get added. This once again shows the too-much-return puzzle: up to 159% of the equity premium using 12 variables and 121% using all variables. Column 7 replicates this exercise controlling for the day-of-the-month effects. Column 8 shows the percentage of days invested in the market by this strategy, i.e., the number of announcement days after accounting for overlapping announcements. Having controlled for the day of the month, we see that the too-much-return puzzle is substantially reduced. The percentage of the equity premium earned peaks at 49.8% over 31.8% of days (8 variables) and, combining all variables, macroeconomic announcements as a whole represent 13.2% of the equity premium earned over 61.6% of days.

The arithmetic average exercise was an over-estimate of the equity premium concentration because it ignored the return volatility. This geometric approach is potentially an under estimate because it potentially includes too much return volatility. In controlling for the day-of-the-month effect we removed the average return, but did not change the return volatility. If part of average return due to the day-of-the-month effect is due to news (rather than for example price pressure due to monthly pension flows in an out of the market) then we are failing to remove the volatility due to that news. Nevertheless, the closeness of the arithmetic method and the geometric method give us relatively tight bounds on the concentration of the equity premium on macroeconomic returns.

4.4. Sharpe ratio

The previous literature has suggested an excess Sharpe ratio puzzle on macroeconomic announcement days: since returns are high on those days, but volatility only increases marginally. For example Savor and Wilson (2013) report the Sharpe ratio on announcement days is an order of magnitude higher than on non-announcement days. We confirm

their findings in our sample. The Sharpe ratio (average daily return divided by average daily standard deviation) for PPI, unemployment and FOMC announcement is .1132 and the Sharpe ratio on the complementary non-announcement day is 0.0169.

Table 10 shows these high Sharpe ratios on announcement days relative to non-announcement days occur when selecting small subsets of the macroeconomic announcements that earn the highest return. Considering all macroeconomic announcement days together yields much lower Sharpe ratios. The Sharpe ratio of all days is 0.051 which is barely twice the Sharpe ratio over all days of 0.0290. Thus considering all announcements together significantly reduces the excess Sharpe ratio puzzle. This occurs because considering all announcement days eliminates the bias of focusing on announcement days with ex-post high returns.

That all such announcements together still lead to more than 100% of the equity premium can be seen in the negative Sharpe ratio for the non-announcement days complementary to the set of all macroeconomic announcement days. Controlling for the day of the month effects corrects this issue. The last column of Table 10 shows this Sharpe ratio is a much more reasonable 0.011. Thus solving the too-much-return problem also solves the excess Sharpe ratio puzzle. The small increase in volatility on all macroeconomic announcement days is consistent with the small increase in the risk premium earned on those days.

4.5. Single macroeconomic fixed effect for all variables

Thus far we have included fixed effects for each macroeconomic variable. Including these individual fixed effects allows separate estimates of each variable's expected return and implicitly its individual importance. Yet as we have shown, these estimates are subject to noise from ex-post realization of returns. If this noise is large compared to any true difference in the importance of the macroeconomic announcements and we lack sufficient ex-ante information about such differences in importance, then the best we can do is consider the coefficients jointly.[18] This joint consideration treats all the macroeconomic announcements

[18]The lack of individual significance and even joint significance of the macro fixed effects suggest the noise in these individual estimates is considerable.

Table 10
Sharpe Ratios on Announcement and Non-Announcement Days
This table lists the Sharpe Ratios of holding the market on announcement and non-announcement days for cumulative combinations of the macroeconomic variables. The "original" columns 1 and 2 calculate the Sharpe ratios using the unaltered time-series. The "joint" column 3 uses the daily market time-series where each day has been purged by its day-of-the-month fixed effect (from the combined regression).

	Original Sharpe Ratio		Joint Sharpe Ratio
Variable	Ann.	Non-ann.	Ann.
Construction Spending	0.168	0.021	-0.096
FOMC	0.197	0.013	0.023
Consumer Confidence	0.166	0.009	0.032
Unemployment Rate	0.146	0.004	0.059
Advance Retail Sales	0.130	0.000	0.038
Housing Starts	0.113	-0.002	0.033
New Home Sales	0.115	-0.008	0.042
PPI	0.113	-0.011	0.042
Capacity Utilization	0.104	-0.012	0.032
UM Consumer Confidence F	0.097	-0.013	0.028
Trade Balance	0.090	-0.020	0.028
Durable Goods	0.088	-0.018	0.028
Factory Orders	0.082	-0.020	0.026
CPI	0.080	-0.020	0.024
Personal Consumption	0.076	-0.020	0.021
Leading Indicators	0.068	-0.017	0.017
Business Inventory	0.066	-0.017	0.015
Monthly Budget Statement	0.060	-0.013	0.013
NAPM	0.060	-0.014	0.011
Consumer Credit	0.052	-0.008	0.012
UM Consumer Confidence P	0.051	-0.007	0.011

as ex-ante the same and has taken the form of averaging across these individual fixed effects.

In this section we use an alternative method: including a single fixed effect for all macroeconomic announcement days. Not only is this method consistent with treating all variables the same ex-ante, but it requires less variation in the data than do individual fixed effects. Individual macroeconomic fixed effects require variation in the timing of announcements for each variable to separately identify their importance and to separate the expected news from the day-of-the-month effects. For the majority of announcements this is not a problem, but the NAPM index, consumer credit and construction spending have little variation in their

announcement timing. When grouping all variables together ex-ante with a single fixed effect, this variation at the individual announcement level is no longer needed. Also, there is sufficient variation in the announcement timing across the days of the month to identify each of the day-of-the-month effects separately from the overall macroeconomic announcement effect. Thus the single fixed effect also serves as a robustness check for the conclusions drawn from the individual fixed effects.

Table 11 shows the results of the following regression equation:

$$r^e_{m,t} = \phi_{\text{all}} \mathbb{1}(Macro_{\text{all}}) + \varepsilon_t \tag{6}$$

for $i \in [1, 21]$ where i represents each macro variable and:

$$r^e_{m,t} = \phi_{\text{all}} \mathbb{1}(Macro_{\text{all}}) + \sum_{j=-9}^{9} \gamma_j \mathbb{1}(Tradeday_j) + \varepsilon_t. \tag{7}$$

Panel A shows the fixed effect for the single macroeconomic announcement across the two specifications. We see that without the day-of-the-month fixed effects, the macroeconomic fixed effect is large, economically and statistically significant. In the presence of the day-of-month fixed effects, it is much smaller and no-longer statistically significant. Panel B shows the day-of-month fixed effects. They are qualitatively and quantitatively similar to the previous specifications. They continue to have large values where the macroeconomic announcements are concentrated. Here, just as in the individual macroeconomic fixed effect regressions, the day-of-the-month fixed effects are jointly significant (F-test P-value of 0.0498) confirming that they are not operating by simply inducing noise.

To interpret these fixed effects in the presence of a single macroeconomic fixed effects, we replicate the methodology from above. The arithmetic calculation is $1.12 \times 61.6 = 69.9\%$ of the equity premium. This stems from the estimated ϕ_{all} coefficient in the presence of the day-of-the-month fixed effects, which is earned on 61.6% of days. After purging the daily market return of the day-of-the-month fixed effects reported in Panel B of Table 11, the

Table 11
Single Macroeconomic Announcement Fixed Effect
This table records the coefficient estimates from the fixed effects regressions using a single dummy variable called "macro" that is equal to 1 if there is any macroeconomic announcement on a given day. The baseline specification is:

$$r^e_{m,t} = \alpha + \phi_{all}\mathbb{1}(Macro_{all}) + \varepsilon_t$$

and the full specification is:

$$r^e_{m,t} = \phi_{all}\mathbb{1}(Macro_{all}) + \sum_{j=-9}^{9} \gamma_j \mathbb{1}(Tradeday_j) + \varepsilon_t.$$

Panel A shows the fixed effect of the macroeconomic announcements for both specifications along with the intercept for the first specification. Panel B shows the day-of-month fixed effects. Standard errors are in parenthesis. *, **, and *** indicate significance at the 10, 5 and 1 percent levels. The test of joint significance (F-test) for the day-of-month fixed effects gives a P-value of 0.0498.

Panel A: Fixed effect on the macroeconomic announcements

	Day of the month fixed effects	
	Excluded	Included
ϕ_{all}	2.40**	1.12
	(1.00)	(1.10)
α	-0.29	
	(0.78)	

Panel B: Fixed effects on the days of the month

Day	$r^e/\bar{r}$	Day	$r^e/\bar{r}$	Day	$r^e/\bar{r}$
1	5.59**	9	3.71	-4	4.81**
	(2.48)		(2.38)		(2.33)
2	1.62	Mid	2.24	-3	2.95
	(2.35)		(1.55)		(2.35)
3	0.14	-9	-0.57	-2	2.84
	(2.29)		(2.32)		(2.31)
4	-0.25	-8	-1.20	-1	1.34
	(2.27)		(2.32)		(2.37)
5	-2.77	-7	-5.41**		
	(2.46)		(2.28)		
6	-1.46	-6	-3.06		
	(2.22)		(2.27)		
7	-1.49	-5	-1.93		
	(2.24)		(2.29)		
8	-1.03				
	(2.32)				

geometric calculation leads to 56.1% of the equity premium.

Though this total is near the 60% reported in Savor and Wilson (2013) for their subset of three macroeconomic announcements, the interpretation is importantly different. Their value is obtained on only 13% of trading days. Our same total is earned over nearly five times as many days (62%). Our total is the same despite the larger number days because there are many macro announcements with higher ex-post returns than those selected by Savor and Wilson and many macro announcement with lower ex-post returns (see Table 5 and Figure 1).

That the premium for macroeconomic risk is earned over vastly more days is important for understanding the risk return trade-off for macroeconomic risk. Focusing on only a small set of days led to the puzzle of seemingly insufficient macroeconomic risk on those days to explain the higher returns. This is the puzzle of excessively high Sharpe ratios–an order of magnitude larger–on this small subset of macroeconomic announcements compared to non-announcement days. When the premium is earned over nearly five times as many days, the small increase in risk on those days is able to explain the higher premium. The Sharpe ratio on all these macroeconomic announcement days, after controlling of the day of the month effect, is 0.0272 which is virtually the same as the Sharpe ratio on all days of 0.0290.

5. The CAPM Fit

In this section, we revisit the fit of the CAPM on macroeconomic announcement days using the same methodology as in the prior sections. We first replicate the literature's findings and then expand to all combinations of two and three macroeconomic variables. We also document that the CAPM fits well on days of high market returns, independent of the presence of news releases. This suggests that the fit of the CAPM is not a separate piece of evidence highlighting the importance of macroeconomic announcements. Rather, it is a direct by-product of the fact that we observe ex-post high market returns on those days.

5.1. Replicating and extending the prior literature

Savor and Wilson (2014) state that, if the news on macroeconomic days is particularly important, then the CAPM should work better on those days since those are days when the market news is more important. They write "on days when news about inflation, unemployment, or Federal Open Markets Committee (FOMC) interest rate decisions is scheduled to be announced, stock market beta is economically and statistically significantly related to returns on individual stocks."

We first replicate their main result in our sample period using the same test assets. We follow their procedure for creating beta-sorted portfolios and we obtain the 25 size and book-to-market sorted portfolios and ten industry portfolios from Ken French's website. Their main measure of fit is the average slope of the CAPM coefficient, i.e., premium, in cross-sectional regressions. Appendix Table A2 shows the average cross-sectional market beta slopes on these test assets, which are obtained from running Fama-MacBeth regressions on announcement and non-announcement days separately. We follow their procedure for estimating the test assets' betas each day using a rolling one-year window.

The main result holds in that the CAPM slope coefficient is significantly larger on announcement days compared to non-announcement days. This difference is particularly large when using all three macroeconomic variables (inflation, unemployment and FOMC) but significantly smaller when the FOMC is not included. The point estimates on announcement days are larger in our more recent sample period compared to their original result (0.00122 in our Panel D versus 0.00087 in their Table 1's Panel C).

Second, we ask whether the higher premium on macroeconomic announcement days occurs only on the days chosen by Savor and Wilson (2014) or is it present irrespective of the macroeconomic variables chosen. To do so, we repeat the distributional exercise from Section 3, but for the Fama-MacBeth CAPM premium on announcement days, rather than the average market return on announcement days.

Figure 4 presents distributions of average Fama-MacBeth CAPM slope coefficients for all

possible combinations of two (Panel A) or three (Panel B) macroeconomic announcement variables (solid blue lines). We again overlay these exact distributions with two baseline bootstrap distributions: the bootstrap distribution where we randomly draw the same number of days over the entire time-series (dotted green line) and the bootstrap distribution where we create pseudo macro days by drawing randomly following the actual announcement timing distribution (dashed red line). Appendix Table A3 shows the summary statistics for these distributions.

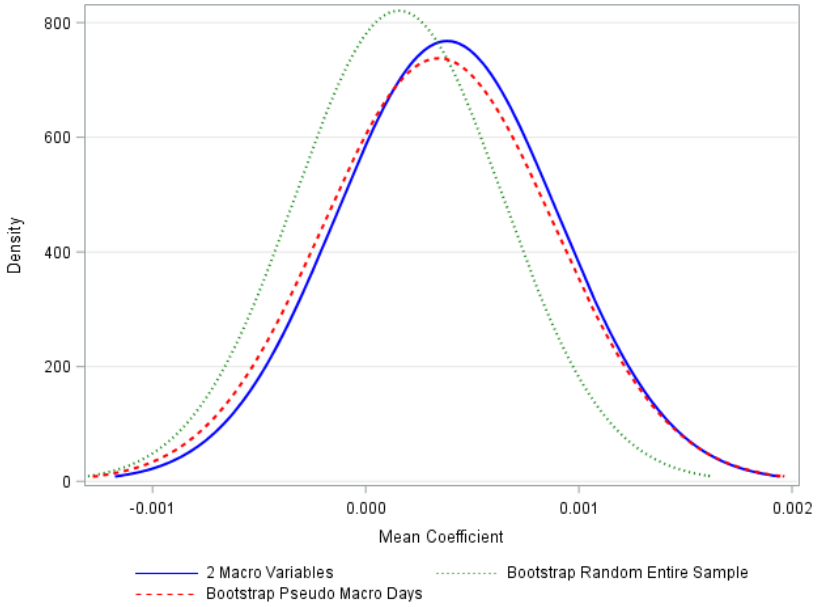
We see that the higher CAPM premium on macroeconomic announcement days occurs across not just for the variables chosen by Savor and Wilson (inflation, unemployment and FOMC). Indeed, the premium estimated in Appendix Table A2 falls at the 65th percentile when the FOMC is excluded and at the 89th percentile when it is included. Many other combinations of three macroeconomic variables deliver higher premia. More broadly, these distributions echo those of the average market return, with higher average market returns giving higher CAPM premium estimates.

5.2. CAPM fit by market return deciles

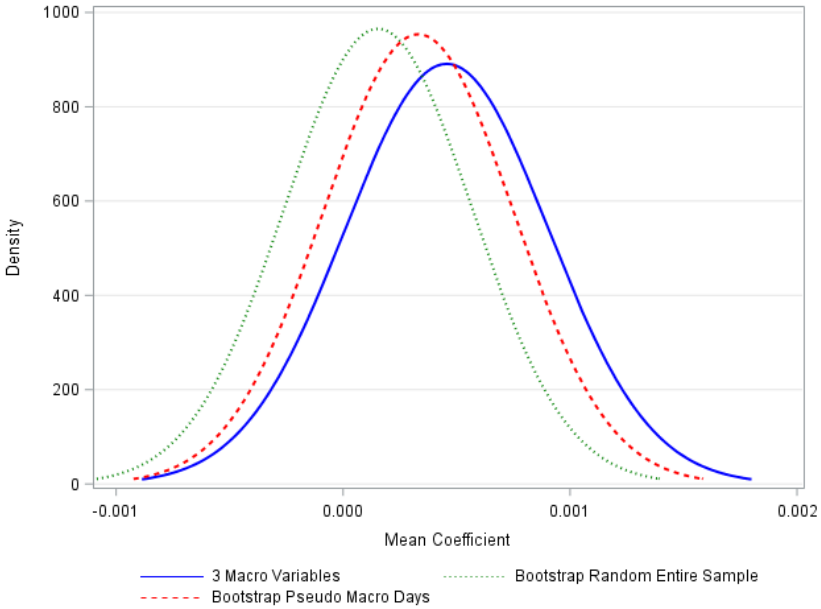
It is worth noting that Savor and Wilson (2014) do not use pricing errors as measure of the differential performance of the CAPM between announcement and non-announcement days. The pricing errors across these two sets of days are virtually identical as can be seen in the near identical average cross-sectional R^2 presented in their Table 1 (51.4% on announcement days versus 49.2% on non-announcement days). Moreover, the above Fama-MacBeth CAPM slope results do not show that macroeconomic announcement days are special beyond the information already presented that ex-post market returns are higher on these days.[19] To see that these slopes mechanically reproduce the information about ex-post market returns,

[19]Franzoni and Schmalz (2017) show that alphas are more visible when the factor realizations (market returns) are low. We show that alphas/slopes are less/more visible when market returns are large.

Fig. 4. Distributions of Average Fama-MacBeth CAPM Slope Coefficients
This figure plots the average coefficients from Fama-MacBeth regressions on pre-selected announcement days. The solid blue lines in panel A (B) are fitted normal distributions for all combinations of 2 (3) macroeconomic variables. The dotted green lines are a bootstrap density of 673 (888) randomly selected trading days over the entire sample. The dashed red lines are distributions using an announcement-rule mimicking structures, where we first randomly select a macroeconomic announcement distribution, and then we randomly select trading days over the entire sample period according to this structure. The set of 45 test assets used are 10 beta sorted portfolios, 25 Fama-French portfolios, and 10 Fama-French industry portfolios. The sample period is January 1990 - June 2018.



Panel A: Two macroeconomic variables, excluding FOMC



Panel B: Three macroeconomic variables, including FOMC

consider the following return generating process for the test assets:

$$r_{i,t} = a_i + \beta_i r^e_{m,t} + \theta_{i,t} \tag{8}$$

where for simplicity of illustration $\theta_{i,t}$ is mean zero and independent of the market excess return. Importantly, this return generating process does *not* say the CAPM holds. It merely says that returns on the test assets co-move with the market, a fact undeniable in the data.

Let the estimated market beta at any time t, estimated using daily data over the prior year, be $\hat{\beta}_{i,t}$, which will be the true beta plus some measurement noise $\beta^*_{i,t}$. Consider the cross-sectional regression run on these test assets each period t:

$$r_{i,t} = c_t + \lambda_t \hat{\beta}_{i,t} + \psi_{i,t}. \tag{9}$$

Substituting in the return generating process and splitting the beta estimate into its true and noise components gives

$$a_i + \beta_i r^e_{mkt,t} + \theta_{i,t} = c_t + \lambda_t(\beta_i + \beta^*_{i,t}) + \psi_{i,t}. \tag{10}$$

Assuming the beta estimation error has zero correlation with the return $r_{i,t}$, we can derive the cross-sectional premium:[20]

$$\lambda_t = w_m r^e_{mkt,t} + (1 - w_m) \times 0 \tag{11}$$

[20]From equation 10, we can define the regression coefficient as

$$\lambda_t = \frac{cov[\beta_i + \beta^*_{i,t}, a_i + \beta_i r^e_{mkt,t} + \theta_{i,t}]}{var[\beta_i + \beta^*_{i,t}]}$$

, which immediately leads to equations 11 and 12 above. The result goes through without zero correlation, simply replacing the zero in the following equation with the appropriate noise coefficient to reflect the non-zero correlation.

where the weights are determined by the standard attenuation bias formula:

$$w_m = \frac{\sigma^2_{CS}(\beta)}{\sigma^2_{CS}(\beta) + \sigma^2_{CS}(\beta^*)} \tag{12}$$

where σ^2_{CS} stands for the cross-sectional variances of the betas and its measurement noise. Thus we see that the cross-sectional coefficient is mechanically increasing in the realized market return on a given day.

The market return can of course be higher on a given date because the equity premium is higher on that same date. This is consistent with the concentration hypothesis. However, the realized market return can be high simply due to random realizations. Both outcomes give higher estimated CAPM premia. Because of this effect, running Fama-MacBeth regressions across announcement days merely picks up the higher average realized returns on those days.[21]

To further illustrate that the apparent "better fit" of the CAPM on macroeconomic announcement days is merely a mechanical reflection of the realized market returns, we sort days in our sample into deciles based on the realized market return on those days. We then run Fama-MacBeth CAPM regressions on each of these deciles of days. Table 12 shows that the CAPM premium estimates are monotonically increasing in the market return decile, as predicted. This increase occurs for all test assets and explains the robustness of Savor and Wilson's finding across a large variety of test assets.

As long as there is a spread in betas on a set of test assets large enough relative to the estimation noise then one will obtain higher CAPM premia on days with larger market returns. These higher premia do not show that the CAPM fits better (pricing errors are not lower) nor do these higher premia show that "the cross-sectional patterns and the nature of the aggregate risk-return trade-off are completely different depending whether there is a pre-scheduled release of important information to the public."

[21] That the premium is driven by the realized market returns explains why Savor and Wilson obtain the same results regardless of how they estimate betas, and why they find virtually identical market betas across announcement and non-announcement days.

Table 12
CAPM Fit by Market Return Deciles
This table provides the average CAPM slope coefficients from Fama-Macbeth regressions for deciles of days ranked by excess market returns, where decile 1 (10) represents the lowest (highest) decile of market return days. The set of test assets are the ten portfolios sorted by market beta, the 25 Fama-French portfolios sorted by size and book-to-market, and the ten Fama-French industry portfolios, all value-weighted. Standard errors are in parentheses, and *, ** and *** indicate significance at the 10, 5 and 1 percent levels.

Decile	Beta Sorted	FF 25	FF Industry	All
1	-0.020***	-0.019***	-0.020***	-0.020***
	(0.000)	(0.001)	(0.001)	(0.000)
2	-0.009***	-0.010***	-0.009***	-0.008***
	(0.000)	(0.000)	(0.000)	(0.000)
3	-0.005***	-0.005***	-0.005***	-0.004***
	(0.000)	(0.000)	(0.000)	(0.000)
4	-0.003***	-0.003***	-0.003***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
5	-0.001***	-0.001***	0.000	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
6	0.001***	0.001***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
7	0.003***	0.003***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
8	0.005***	0.004***	0.004***	0.005***
	(0.000)	(0.000)	(0.000)	(0.000)
9	0.009***	0.009***	0.009***	0.009***
	(0.000)	(0.000)	(0.000)	(0.000)
10	0.021***	0.020***	0.020***	0.019***
	(0.001)	(0.001)	(0.001)	(0.000)

6. Conclusion

This paper addresses the puzzling fact that existing published papers have together documented well over 100% of the equity premium being earned on a small set of macroeconomic announcement days. This greater than 100% of the equity premium leaves no room for other systematically important announcements such as earnings. Moreover, if macroeconomic announcements were truly responsible for more than 100% of the equity premium, then an investment in the market must earn predictably negative expected returns for the majority of the year.

We build on the insights of Fama and French (2010) that looking at the entire distribution of managers can provide information that cannot be obtained simply by looking at ex-post good performance and the insights of Kelly and Jiang (2014) that one can use the cross-section of similar events to effectively lengthen the time-series observations. We ask how much of the equity premium is attributable to all monthly macroeconomic variables (and the FOMC) rather than looking only at variables with relatively high ex-post returns.

This entire distribution contains an above average concentration of the equity premium, consistent with the literature's conclusion that macroeconomic announcements contain above average information in expectation. Exploiting the whole distribution and controlling for the day-of-the-month effect shows that macroeconomic announcements as a whole are responsible for about 60% of the equity premium. Importantly this premium is earned over 62% of trading days rather than only a small set of days previously considered.

Solving this too-much-return puzzle also addresses the complementary excess Sharpe ratio puzzle on macroeconomic announcement days. If the equity premium concentration on macroeconomic announcements is lower than previously documented, then so is the Sharpe ratio on those days. That the macroeconomic announcement premium is composed of a small rise in expected returns over many days is consistent with the small rise in risk as measured by slightly higher volatility on macroeconomic announcement days. The Sharpe ratio on macroeconomic announcement days after controlling for the day-of-the-month effect is 0.027 which is almost identical to the Sharpe ratio on all days of 0.029. Finally, we show that the "improved" fit of the CAPM on announcement days as measured by higher premia measured from cross-sectional regressions is a mechanical reflection of the higher realized returns on these days. The higher premia thus do not represent a separate piece of information as to the importance of macroeconomic announcements.

Throughout all the results of this paper, the FOMC appears to stand out from the other macroeconomic announcements. It has among the largest point estimates for the concentration of the equity premium. It also often has the only statistically significant fixed

effect. However, the joint test of significance of all the macroeconomic announcement fixed effects including the FOMC, Equation (5), yields an insignificant P-value. This means one should interpret this large point estimate and lone significance with caution. The lack of joint significance means such an outcome is a reasonably plausible one from testing across many macroeconomic announcements.

Nevertheless, perhaps one important difference between the FOMC and all the other variables is that the FOMC is also about actions to be taken in the financial markets (or inaction), and not only information about the (past) state of the economy. Or perhaps the FOMC is a summary statistic of all other variables (Gilbert, Kogan, Lochstoer, and Ozyildirim, 2012). Or perhaps the FOMC is more forward looking while all other variables are backward looking (Kadan and Manela, 2018). If there is indeed any difference, explaining it is beyond the scope of this paper, and we leave it for future research (Jarociński and Karadi, 2019).

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Appendix A. Additional Tables

Table A1
Test of Joint Significance for Day of Month Fixed Effects
This table records the F-tests of joint significance of the days of the month fixed effects for each of the individual macroeconomic variables. For each macroeconomic variable, we run the following regression:

$$r^e_{m,t} = \sum_{j=-9}^{9} \gamma_j \mathbb{1}(Tradeday_j) + \gamma_{mid} \mathbb{1}(Tradeday_{mid}) + \phi \mathbb{1}(Macro_i) + \varepsilon_t$$

for $i \in [1, 21]$ where i represents each macro variable. We then test the joint significance of the days of the month fixed effects.

	F-statistic	Prob. > F
Unemployment Rate	2.17	0.0024
CPI	2.13	0.0029
Durable Goods	2.08	0.0038
Housing Starts	2.09	0.0036
Lead Indicators	2.15	0.0025
Trade Balance	2.14	0.0027
PPI	2.07	0.0041
Adv Retail Sales	2.08	0.0038
Capacity Util	2.10	0.0035
Business Inventory	2.28	0.0012
Const Spend	1.64	0.0391
Consumer Conf	1.97	0.0073
Factory Orders	2.13	0.0030
NAPM	1.76	0.0218
New Home Sales	2.05	0.0046
Personal Consumpt	2.09	0.0037
Mthly Budget Stmnt	2.14	0.0028
Consumer Credit	2.13	0.0029
UM Cons Conf P	2.30	0.0011
UM Cons Conf F	2.06	0.0043
FOMC	1.97	0.0073

Table A2
Replicating Savor and Wilson (2014)

This table reports average slope estimates from Fama-MacBeth regressions of daily excess returns on estimated betas for various test portfolios. Announcement days include only days with scheduled inflation news and unemployment news, and with or without FOMC interest rate decisions. Non-announcement days include all other days. Panel A shows results for ten portfolios sorted by CAPM beta, rebalanced monthly, and value-weighted. Panel B shows results for the 25 Fama-French portfolios sorted by size and book-to-market (value-weighted). Panel C shows results for the ten Fama-French industry portfolios (value-weighted). Panel D includes all 45 portfolios. Betas for the test assets are computed each day using one-year rolling windows. For brevity, we do not report the average intercepts of the regressions nor tests of the difference between announcement and non-announcement days. Standard errors are in parentheses, and *, ** and *** indicate significance at the 10, 5 and 1 percent levels. The sample period is January 1990 to June 2018. See Savor and Wilson (2014) for further methodological details.

Panel A: Ten beta-sorted portfolios

	Without FOMC	With FOMC
Announcement days	0.00098*	0.00133***
	(0.00051)	(0.00044)
Non-announcement days	0.00007	-0.00001
	(0.00016)	(0.00016)

Panel B: Fama-French 25 portfolios

	Without FOMC	With FOMC
Announcement days	0.00110*	0.00127**
	(0.00057)	(0.00051)
Non-announcement days	-0.00023	-0.00030
	(0.00020)	(0.00020)

Panel C: Fama-French ten industry portfolios

	Without FOMC	With FOMC
Announcement days	0.00055	0.00116**
	(0.00060)	(0.00053)
Non-announcement days	-0.00001	-0.00012
	(0.00020)	(0.00020)

Panel D: All 45 portfolios

	Without FOMC	With FOMC
Announcement days	0.00080*	0.00122***
	(0.00044)	(0.00037)
Non-announcement days	0.00037***	0.00030**
	(0.00014)	(0.00014)

Table A3
Summary Statistics of Distributions of Average Fama-MacBeth CAPM Slope Coefficients

Panel A (B) shows summary statistics for the distributions of 2 (3) variables presented in Figure 4: the first column is for the distribution of all combinations of announcement days of 2 (3) macroeconomic variables; the second column is for the distribution of the baseline which samples randomly across the entire time-series to generate the same number of announcement days as 2 (3) macroeconomic variables (bootstrap random entire sample); and the third column is for the distribution of the baseline which samples days with the announcement-rule-mimicking distributions (bootstrap pseudo macro days). The set of test assets includes ten beta sorted portfolios, 25 Fama-French portfolios, and ten Fama-French industry portfolios, all value-weighted.

Panel A: Two variables

	Macro announcements	Bootstrap random	Pseudo days
Mean	0.00067	0.00041	0.00067
Standard deviation	0.00044	0.00041	0.00053
25th percentile	0.00036	0.00012	0.00029
Median	0.00065	0.00041	0.00065
75th percentile	0.00092	0.00069	0.00104
95th percentile	0.00148	0.00109	0.00155

Panel B: Three variables

	Macro announcements	Bootstrap random	Pseudo days
Mean	0.00074	0.00041	0.00066
Standard deviation	0.00038	0.00035	0.00042
25th percentile	0.00047	0.00018	0.00037
Median	0.00071	0.00042	0.00065
75th percentile	0.00098	0.00065	0.00095
95th percentile	0.00138	0.00096	0.00134