A FCVAR Analysis of Price Discovery and Financial Integration

By

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1 Introduction

The price discovery process is an attribute of free competitive markets. It is the search for the fundamental economic concept of “equilibrium price”. The best examples of a market that incorporate new information at blazing speed, limiting arbitrage possibilities to very little, are financial markets. Obvious economic reasons explain this fact: transaction costs are low, all the (public) information is easily accessible to all market participants at the same time and the exchanged good can be traded almost *ad vitam eternam*. Hence, the price discovery literature is mainly a finance one.

Most analyses are based on time series models that have a structural interpretation by market microstructure theory. The literature is interested into quantifying the informational content of a market, that is, assessing which proportion of the discovery of the common efficient price is attributable to this very market. This will be referred as the price discovery share of a market. In order to meet such goal, assets expected to be tied together by a “fundamental value” are analyzed. The econometrician would translate this as two random walks tied together in the long run by a common stochastic trend (or common latent factor), or in a shorter manner, cointegrated variables. Such relationships may be an option and its underlying asset, the futures and spot price of a commodity or an arbitrage type relationship (the same good on different markets). The latter example, which will be investigated in the paper, is tied to another important concept of empirical market microstructure, financial integration. At the micro level, it can be seen as the speed at which the arbitrage mechanism operates. If financial integration is complete, different markets unite to be only one and same goods on a same market should have the same price at all times by the law of one price. The macro result of this is that whole exchanges’ indexes should follow each other if they share similar assets or assets influenced by the same latent factors.

Studying quantitatively the informational content of two markets and the level of financial integration is certainly interesting from a forecasting point of view. Especially, an investor might be interested in knowing which market will most often adjust itself to the other and not the other way around. Plus, having an estimate of how long differences between the two prices are expected to last is crucial to an arbitrage strategy. Hence, if a model can tell us than on a certain type of day, market a prices will mostly lead those of market b and that on that very day, frictions are expected to last longer, an arbitrageur could devise a strategy to earn profit out of it (unless all other arbitrageurs have a similar strategy).

Furthermore, having reliable estimates to describe the price discovery process is also important to the policy maker. It is always a concern that bigger exchanges will end up dominating the price discovery process, restraining smaller exchanges to a satellite role even for domestic assets. Such a phenomenon is the reflection of (mainly) institutional investors switching to the market where asset prices converge to their efficient price more quickly, providing liquidity to that market. Investors remaining in the satellite market are left with less efficiently priced assets and less liquidity, compromising the efficient capital allocation of that market and restraining capital access for smaller firms. It is then interesting to investigate how price discovery shares evolve through time, how they respond to new information arrival and how financial integration might influence them.

Obvious proxies for the general (but not so tangible) concept of new information arrival are macroeconomic news. It is well known that overall trading volume increases on days of macroeconomic announcement, re-pricing the assets according to the new information about the state of the economy. Hence, it is expected that the price discovery share of a given market may change on these days according to its capacity to process new information. The expected effect on financial integration is not clear. Announcements days could lead to more integration by an increased trading volume and more "attention" from investors. It could also lead to longer-lasting frictions in case of an "information shock" or less technically, a macroeconomic surprise.

Like all economic concepts of latent nature, price discovery shares or the level of financial integration need to be estimated. If one wants to analyze how the price discovery share of a given market is affected by X, one has to rely on estimates as dependent variables. While such a procedure is not fundamentally problematic – estimates are the Y variable, not the X –, problems obviously arise if the estimates are inconsistent.

Two widely used methods have emerged to estimate contribution to price discovery: Hasbrouck (1995) Information shares and Gonzalo & Granger (1995) Permanent-Transitory decomposition. They both are constructed on estimates from a cointegrated vector autoregressive (CVAR) model. However, using the recently developed fractionally cointegrated VAR (FCVAR), studies have shown that imposing the restricted model (the CVAR is a FCVAR with $d = b = 1$) might lead to diverging conclusions and different forecasts[1]. Since the FCVAR framework estimates b, one can easily test if such a restriction significantly affects the likelihood. Hence, when one rejects this hypothesis, it follows that the estimates of the unconstrained model should be used to do any further analysis. The proposed paper will analyze how price discovery is affected by information shocks using both methodologies and compare conclusions. The benchmark for most of the comparison is Frijns, Indriawan & Tourani-Rad (2015) (henceforth, FIT (2015)) but some features will be added as well. If divergences were to be large, this would be further evidence to suggest that the FCVAR is (i) a more appropriate way of modeling those specific financial time series and (ii) should always be considered for this type of research.[2] Finally, the fractional parameter b will provide a natural methodology to assess short run financial integration fluctuations.

[1] This note is a prelude to the more detailed sections 4.1.1 and 4.1.2. Fractional cointegration occurs when two – but possibly more – series of order d cointegrate to a lower order $d - b$. In the context of log prices, it is common wisdom that $d = 1$, that is, log prices follow a random walk. Hence, a FCVAR in this paper is partially restricted and will allow two $I(1)$ series to yield a long-run disequilibrium series that is $I(1 - b)$. The CVAR imposes that $b = 1$ to get the usual paradigm: two $I(1)$ series that cointegrate to $I(0)$.

[2] As the frequency gets higher, we can expect more "long-memory" to be observed.

This paper is about how the FCVAR usefully applies to empirical market microstructure questions. The paper will carefully explain how price discovery shares are obtained from a CVAR, as it is often done in the literature and especially in FIT (2015). Then, we will show how the more general FCVAR can be used as well and how fractional cointegration has a useful interpretation in the context of an arbitrage relationship as financial integration. Thereby, this paper indirectly proposes a new way to assess the time-varying level of financial integration. The paper will then compare how conclusions of an analysis inspired by FIT (2015) may depend of the use of FCVAR-inspired measures versus existing measures of the literature.

The rest of the paper goes as follows. A literature review covering relevant works about the FCVAR, price discovery and financial integration will be done in Section 2. Section 3 will discuss the data used. Section 4 will cover both theoretical and statistical models. Plus, this section will explain in more detail the measures used to assess price discovery shares and the level of financial integration. Results of the empirical analysis will be presented in Section 5. A brief discussion will conclude the paper in Section 6.

2 Literature review & background

2.1 FCVAR literature

Dolatabadi, Narayan, Nielsen & Xu (2015) (henceforth DNNX (2015)) use the recently developed FCVAR to forecast commodities' prices and to estimate price discovery coefficients between the spot and futures market. They use the daily data provided in Narayan, Ahmed & Narayan (2014) and find that for most commodities, the more flexible FCVAR has better out-of-sample fit and that its superiority is statistically significantly according to Clark & West (2007) test statistic.[3] This result holds for different horizon of forecast: daily ($h = 1$),

3 This is only a modified version of the Diebold-Mariano (1995) test, which accounts for the fact that the CVAR is nested in the FCVAR.

weekly ($h = 5$) and monthly ($h = 21$). The result is so clear-cut that there are no CW statistics (all commodities, spot or futures, whatever h) for which the preferable model is the CVAR and that it is statistically significant. This might not come as a surprise. Even if we were comparing out of sample fit rather than in sample fit, one might remember that the FCVAR is a generalization of the CVAR.

The authors also show that not only the FCVAR brings a significant improvement in forecasting those series but it also can bring a significant economic improvement. By that, it means that using a dynamic trading strategy based on a portfolio with weights derived from a mean-variance utility function with different frequency of rebalancing and risk aversion coefficients, it is found the FCVAR brings on average positive returns that are significantly higher than what a similar strategy using the CVAR would have given.

Another interesting fact emerges from this paper although it is clearly not the main focus of the authors. They estimate price discovery contribution with Gonzalo & Granger (1995) Permanent-Transitory decomposition and find that, in line with theory and previous evidence, information runs from the futures market to the spot market. However, for three commodities (out of 15), the FCVAR estimates lead to conclude that the spot market dominates the price discovery process while it the case for five commodities according to the CVAR. Even if the dichotomous prediction of which market dominates the price discovery process is mainly consistent across both models, the information shares, $\alpha_{\perp,1}$ and $\alpha_{\perp,2} = 1 - \alpha_{\perp,1}$, differ quite a bit and even more so when the estimate of the fractional parameter b is not close to the CVAR value of one. Table 1 (included in the appendix) is based on Table 2 from DNNX (2015) and summarizes these sometimes-considerable differences.

Thus, one should conclude from this table that having the right b matters to correctly figure out the information shares. Hence, when fractional cointegration is suspected, one should test if $\hat{b} = 1$ before imposing it with a standard CVAR.

This opens the way to a pertinent revisit of many earlier results in the light of the FCVAR.

Dolatabadi, Nielsen & Xu (2014) (henceforth DNX (2014)) is another interesting application of the FCVAR to market microstructure questions. The paper uses the same data as in Figuerola-Ferrettiand & Gonzalo (2010) to observe if using the more flexible FCVAR would lead to different conclusions about backwardation/contango in the commodity futures markets. As expected, the FCVAR allows the use of fewer lags and $\hat{b} = 1$ is rejected for all metals except copper. This again means that one should not impose $b = 1$ while analyzing such series. As expected from theory, the cointegration rank is one for all metals, meaning that there exists only one long-run relationship.

The conclusions of DNX (2014) are indeed different from Figuerola-Ferrettiand & Gonzalo (2010). They find more support for a cointegrating vector of $(-1, 1)$ between spot and futures prices. Actually, only two metals markets rejected this hypothesis while four of them rejected the null for long-run backwardation in Figuerola-Ferrettiand & Gonzalo (2010).

Finally, Bollerslev, Osterrieder, Sizova & Tauchen (2013) also estimate a FCVAR to investigate the relation between aggregate stock market returns and volatility. Using tick-by-tick observations on the Chicago Mercantile Exchange futures contract for the S&P 500 aggregate market portfolio and the corresponding CBOE VIX volatility index, the authors find that the FCVAR nontrivially outperforms (according to out of sample R^2) standard models of the literature (simple univariate AR models, ARFIMA models and risk-volatility regressions) for various horizons, especially the longer ones.

2.2 Information shocks and price discovery literature

Frijns, Indriawan & Tourani-Rad (2015) examine 38 cross-listed stocks of Canadian companies both listed on the TSX and NYSE. They find that price discovery significantly shifts to the NYSE, independent of the origin of the macroeconomic news. Using their estimated information shares as dependent variables in some between-days regressions, the authors find that the impact of an announcement day still exists when controlling for liquidity. This essay will be mainly based around the procedure used in this latter paper and the FCVAR methodology used by the papers in the previous section.

Pascual, Pascual-Fuster & Climent (2006) finds, using Spanish stocks cross-listed on the NYSE that the home market leads in term of price discovery. Frijns, Gilbert & Tourani-Rad (2010) and Lok & Kalev (2006) reach similar conclusions analyzing Australian and New Zealand cross-listed stocks.

Mizrach & Neely (2008) find little evidence of the impact of macroeconomic news on price discovery independently of liquidity using U.S. treasuries futures market at one-minute frequency from 1997 to 2000. Using one-minute frequency data from the whole 2002 year, Taylor (2010) finds evidence that the E-mini futures market becomes more dominant (than the S&P 500 index constituents) on the price discovery process in times of high information asymmetry and high liquidity, which obviously corresponds mostly to announcement days.

2.3 Financial Integration literature

Most of the financial integration literature use data sets and methods that are different from what will done in this paper. However, the purpose of this section is to review proposed methods to assess financial integration. This essay proposes a new method (detailed in forthcoming sections) to estimate the level financial integration and applies it to intraday stock data. With some adjustments, the (soon-to-be) proposed method could be used to answer the different questions of the surveyed papers of this present section.

Calvi (2010) uses national equities market indexes to study financial integration in Europe and East Asia. The author uses daily data from the middle of the nineties (exact beginning dates depends of data availability, thus, countries) to July 2009 to test for the existence of a common stochastic trend with Johansen (1988) rank test. To assess financial integration evolution through time, tests are also done on subsamples. The delimiting dates are chosen accordingly to important economic events: the creation of the monetary union for Europe and the East Asian financial crisis. It is found that after the creation of European Monetary Union (EMU), one cointegrating vector drives all EMU members' equities market. Such an approach certainly cannot asses short run changes in financial integration neither quantify it.

Lok & Kalev (2006) study New Zealand and Australian stocks market integration by the mean of Granger causality testing. They find that causality is bidirectional. Actually, all their tests based on the error correction model that only use overlapping market hours strongly reject the null of no causality. This assessment of short-run integration, as Johansen-inspired testing, does not provide any indication of the level of such integration. Such trivial results are of no help to assess short-run variation of financial integration.

Volosovych (2011) proposes a financial integration index inspired by Nellis (1982) that has better time series properties. The paper aims to estimate the long-run trend of financial integration between 1875 and 2009 for the sovereign bonds' markets of fifteen industrialized economies The author performs Principal Component Analysis (PCA) on the panel of country specific levels of financial returns. He argues that the resulting first component has a structural interpretation as the "world return". The index is the proportion of the multivariate variance explained by the first principal component.[4] In order to build a time series, the author performs PCA on a 156 months rolling window of the variables set. Hence, the financial integration index for month t is the previously explained measure obtained from a sample time-centered on date t. Controlling for numerous factors, but ignoring possible simultaneity bias of policy variables, the author finds a J-type trend for integration in the last century. For the present paper, it is the methodology of Volosovych (2011) rather than its results that is of interest. The author suggests that, among others, government trade and capital controls, default risk, institutions, price of physical capital and information asymmetries are usual suspects as causes of

[4] This is easily computed as the largest eigenvalue of the correlation matrix divided by the trace of that very matrix.

cross-border frictions. All of these are expected to be stable in the short run, except maybe for asymmetry of information.

Donadelli and Paradiso (2014) use an analogous methodology to Volosovych (2011) to build their financial integration index. Using industry equity indexes monthly data for several countries (G7, Emerging Markets, Europe) that runs from 1992 to 2012, the authors compute a 60-month rolling-window index of financial integration. They use PCA on a correlation matrix of excess returns and then compute the proportion of the variance of some country/industry explained by the principal component. The authors do not find a homogenous response to financial crisis for all national or industry indexes. There is no homogenous trend in the estimated indexes as well. Instead, 3 different patterns emerge: a linear increasing one, a U-shape and a J-shape. This might be because there is no such homogenous behaviour of financial integration. On the other hand, maybe aggregate data and the rolling window cloud the issue.

Such an estimator does not have desirable properties for further regression analysis taking out as the dependent variable: high level of autocorrelation is expected in the residuals by construction since the set of observations used to compute the index at $t+1$ is different by only one observation to the set used to compute the index at t. On the other hand, this is not an issue for the sake of this paper: daily estimations can be done on minute data to constitute a daily time series of the financial integration index.

Also, the method assumes one latent factor from theory but does not provide any formal test to justify it (unlike Johansen tests in Calvi (2010) that sometimes found more than one stochastic trends). We are left with a rule of thumb of the type “does the first principal component explains a significant majority of the multivariate variance?” Backed up with a theoretical model, like the one that we will expose later in this paper, this still can be legitimate.

The major problem, as it is often the case with PCA, is one of interpretation. The question “What is it we have estimated?” may still remain since it is impossible to distinguish between the true level of financial integration and a common shock to all assets. Perhaps this is a possible explanation of mixed results in Donadelli and Paradiso (2014) for the impact of financial crisis on financial integration. This will certainly be an issue when using this measure for short-run variation financial integration: it should be naturally positively correlated with announcements days (as the common information shock).

3 Data

Using Canadian (Toronto Stock Exchange (TSE)) and American (New York Stock Exchange (NYSE)) cross-listed stock data comes naturally for a Canadian paper. However, the North-American duo has many advantages over other possible combinations of markets that explain the interest it has gained in the price discovery literature. First, both markets' opening hours are similar and second, they are highly integrated. A third attribute of Canadian shares listed in the United States with respect to most other foreign shares is that they are not listed as American Depositary Receipts (ADRs), but as ordinary shares. Hence, it is expected that the law of one price, which is the fundamental idea in background of the theoretical model presented in the next section, holds for every stock because TSE-NYSE cross-listed stocks are two representations of the same asset observable simultaneously at all times and there are no shackles to arbitrage.

The data that will be used, intraday bid/ask quotes are again inspired by FIT (2015). They use 38 Canadian stocks listed on both the TSX and the NYSE from January 1 2004 to January 31 2011. The authors use the one-second frequency to do their analysis. For feasibility purposes, data from January 1st 2014 to May 15th 2015 is used at the one-minute frequency.[5] Dropping days for which one market or both are not operating, we get a total of 339 trading days. Data are obtained for the 38 stocks as in FIT (2015). However, two companies are either not listed anymore in 2014 or have stopped being listed during the sample. They are dropped out of the sample. Finally, stocks that had less than

[5] Feasibility here refers to the time it takes for the estimation algorithm to yield the estimates for all days and stocks.

a 60% average of percentage of active minutes per day on the TSE (the usually less active market) were dropped. Hence, the resulting panel that will be used in the analysis section is $N = 30$ and $T = 339$ and is described in Table 2. This is so because there is great variance in the market betas (from NYSE) but the mean is close to one. The same is observed for the trade proportion of NYSE and the spread: both vary a lot but the mean is close to the desired .5, that is, equality of trade/spread proportions between the two markets. The average numbers of active minutes per market for the whole portfolio are pretty much the same. This excludes the possibility that the study *a priori* selected stocks that had certain “desirable” characteristics. Finally, the table displays general results for the augmented Dickey-Fuller tests of unit root on each stock for each day. On average, 9% of the nulls are rejected at the 1% level. The individual models’ specification are chosen by an algorithm that chooses the number of lags to minimize the BIC criterion conditional on no autocorrelation left in the residuals. This 9% rejection frequency is quite higher than the expected 1% rejection frequency due to multiple testing even if the null is true. However, while this is not enough to worry about it, one has to keep in mind that for certain days and stocks, the cointegration relationship might be weak.

[Insert Table 2 about here]

The stocks data were obtained from Kibot Historical Intraday Database. Each trading day goes from 9:30 AM to 16:00 PM. The time series used to estimate daily CVAR and FCVAR will thus have 390 observations. Midpoints of quotes will be used rather than trading prices to avoid two possible problems of using trading prices. Even if this is less worrisome for one-minute data than for higher frequencies, last trade price may suffer from bid/ask bounce and higher autocorrelation. Higher autocorrelation is the statistical result of the obvious underlying problem of trading prices: prices may be updated without a trade to occur. This way, for less liquid stocks, last trade price can potentially miss part of the price discovery process. The use of such data is interesting because most FVCAR comparison studies were done on daily data.

In order to compare apples with apples, the intraday Canadian-U.S. exchange rate will be used to obtain both series in U.S. dollar. The data were obtained from Dukascopy, a Swiss foreign exchange broker firm that provides free historical intraday data of currencies to its members. Again, midquotes are used.

Data on macroeconomic news will be divided in two sets. The first will be the same as in FIT (2015). Data on dates of the announcement are from the in-charge institutions' website. Table 3 summarizes the frequency of each event in the sample. US announcements represent 70.5% of the sample while Canadian ones represent 23.3% of the sample of days. There are a total of 20 US announcement days and 8 Canadian ones.

[Insert Table 3 about here]

Another sample of macroeconomic announcements will also be used. Since we are interested in news from the perspective of an equity market participant, we use calendar data from *Trading Economics*, a site that provides financial and economic information to its clients. Among many things a client of them can obtain is a calendar of economic events (mainly inspired by Bloomberg's one) where events are ranked from 1 to 3 stars in terms of how much attention should be given to the scheduled event. Data from the 3 stars' calendar will be used as another set of dummies on top of FIT (2015) inspired sample of events. This second set of events will be referred as "TE3" Events. Using two sets of events will check if results depend of the chosen set of dummies. This is an interesting addition, especially since the choice of announcement types to include in a set can be fairly arbitrary. Table 4 summarizes the frequency of each event in the sample. US announcements represent 46.02% of the sample while Canadian ones represent 11.8% of the sample of days. There are a total of 21 US announcement days and 8 Canadian ones. This set of events is more heterogeneous than

FIT (2015), having events that occur less often and that are not strictly related to the public issuing of new statistics.

[Insert Table 4 about here]

Finally, daily data on both markets aggregated volume are obtained from Yahoo. Well-known composite indexes S&P/TSX and NYA are used.

4 Methodology

The main contribution of this paper will be to adapt the FCVAR methodology to the question of interest and observe if its results are significantly different from those of competing methodologies. As will be detailed later on, the analysis will be done on a set of estimated dependent variables and results will be compared. First, we must detail the different methods that will be used to estimate price discovery shares and the financial integration index.

4.1 Econometric Models of Intraday Data

4.1.1 A brief note on fractional integration and cointegration

A mean zero series y is said to be fractionally integrated of order d if

$$\triangle^d y_t = \varepsilon_t \tag{1}$$

where $\triangle = (1-L)$, L is the lag operator and ε is an $I(0)$ process. $d<1/2$ is needed for y to be a stationary process. This expression has an infinite order autoregressive representation

$$y_t = \sum_{k=0}^{\infty} \pi_k(d) y_{t-k} + \varepsilon_t \tag{2}$$

where $\pi_k(-d)$ are weights obtained from the binomial expansion

$$\pi_k(d) = \frac{\prod_{i=0}^{k-1}(i-d)}{k!}. \tag{3}$$

Fractional cointegration occurs when two series – but possibly more – of order d cointegrate to a lower order $d-b$. The usual paradigm implies $d=b=1$ which is two $I(1)$ series that cointegrate to a $I(0)$ process. In the case of this study, there is an *a priori* about the value of d by the nature of the data: prices are expected to follow a random walk. This has been tested by standard ADF tests of Section 3. Hence, in our context, the contribution of the FCVAR will be to allow the difference between the two stock prices $\chi_{a,t}-\chi_{b,t}$ to be a fractional white noise so that $\triangle^{1-b}\left(\chi_{a,t}-\chi_{b,t}\right)=\varepsilon_t$.[6] It allows long-run disequilibrium errors to have a "long-memory", which can be interpreted as lasting frictions or again, non-perfect financial integration for a given asset on a given day.

4.1.2 CVAR & FCVAR

This section will first present briefly the FCVAR model and how it generalizes to the CVAR. According to the famous Engle-Granger representation theorem, the baseline CVAR with an unrestricted constant is

$$\Delta Y_t = c + \alpha L \beta' Y_t + \sum_{i=1}^{k} \Gamma_i L^i \Delta Y_t + \varepsilon_{t.} \tag{4}$$

DNX (2014) extend the FCVAR model for it to include linear trends in levels. The final model is

$$\Delta X_t = c\pi_t(1) + \alpha L_b \Delta^{1-b} \beta' X + \sum_{i=1}^{k} \Gamma_i L_b^i \Delta X_t + \varepsilon_t \tag{5}$$

where $Y_t = \Delta^{1-b} X_t$, $L_b = 1-\Delta^b$, and $\pi_t(d)$ is the fractional coefficient as defined above. Details and intermediary steps for the derivation of this model may be found in DNX (2014) (for the inclusion of linear trends) and Johansen & Nielsen (2014) (for the derivation of the binomial expansion that characterize $\pi_t(d)$). The latter model obviously reduces to the former if $b=1$.

[6] The origin of $\chi_{a,t}-\chi_{b,t}$ will be explained in section 4.1.4. For now, understanding that this term represents a long run disequilibrium error term in a theoretical model suffices.

As proposed in DNX (2014), the FCVAR with $d = 1$ as we have above can be estimated the following way: we can estimate by reduced rank regression (of ΔX_t on $\alpha L_b \Delta^{1-b} \beta' X$, corrected for $\{\Gamma_i L_b^i \Delta X_t\}_{i=1}^k$ and $\pi_t(1)$) the latter equation above for a fixed b and then maximize numerically the resulting profile likelihood (that is only a function of b). Since the fractional difference operator is an infinite sum and any data set is obviously finite, this has to be taken into account for the estimation. Johansen & Nielsen (2014) show that this bias can be avoided in many ways.[7] In this case, we will apply maximum likelihood conditional on the initial values as done in DNX (2014). Nielsen & Morin (2014) and Nielsen & Popiel (2014) provide a Matlab program that estimates this model and provide the usual statistics of interest.

4.1.3 Model selection and estimation algorithm

A total of 10170 FCVARs and 10170 CVARs had to be estimated. We thus had to figure out an automated chain of commands that shared two opposing goals: accuracy and speed. After various tests of different algorithms on subsamples, a second-best was chosen, yielding results for price discovery shares of both models and $\hat{b}$ that were highly correlated ($> .97$) with the optimal but overwhelmingly long algorithm.

First, the preliminary chosen model minimizes the Bayesian Information criterion conditional on no evidence (at the 5% level) of serial correlation according to the two univariate Ljung-Box Q-tests on the residuals of the full rank ($r = 2$) model. The maximum number of lags at this stage is 6. If the "no evidence of serial correlation" condition is not satisfied by any of the less than 7 lags models, the maximum number of lags is pushed up to 12 and a similar selection process applies again. Splitting the lag selection exercise in two might seem suspicious to some readers. The benefit is a significant increase in the algorithm speed and the cost is limiting some models to have a higher BIC criterion than what it would have been if lag selection were done once for

[7] In some special cases, one could assume that values that preceded $t = 1$ were zero. It would however be dubious to assume such a thing with prices.

$k \in [0,12]$. As it turns out, the gain in speed is highly significant (twice as fast) and the imprecision is tiny.[8] If no model passes the no residuals autocorrelation criterion, the model that has shown to be the least worst in that manner is kept. This cap of 12 lags is imposed mainly to avoid a high lag order slip, especially for FCVAR models where misspecification becomes evident as $\hat{b}$ goes to the floor.

Then, the Johansen cointegration rank test is done. The resulting cointegrating rank r is imposed for the final model estimation. Univariate Q-tests are performed on the residuals of the reduced rank $(r = 1)$ model. If autocorrelation is found in the residuals, the rank tests and estimation of the final model is done with one more lag until it reaches (if it does) 12 lags. If such a thing happens, the procedure for problematic days described for the preliminary model is once again applied. Those cases do not happen often (will be shown in the results section) so the results are not expected to depend in any way on the way of these problematic days are dealt with.

The CVAR estimation is conditional on $k + 1$ observations, which is reduced rank regression. The FCVAR model, in order to cope with the infinite sum problem caused by the fractional difference operator, is conditioned on 5 observations if $k \leq 5$ and on k observations otherwise. All Q-tests of autocorrelation of the residuals are done on 10 lags.

4.1.4 Market Microstructure Model

In order for estimates obtained from the preceding sections to have any market microstructure meaning, we need a theoretical model. The model presented here is the same as in FIT (2015). We assume that there is an efficient (or fundamental) log price common to both markets that follows a random walk where innovations are shocks of public beliefs:

[8] The gain in speed comes mainly from not estimating models of higher lag orders when not necessary. Plus, the loss is precision is tiny since (i) most models do not have more than 6 lags and (ii) most models than need more than 6 lags do so for residuals autocorrelation considerations rather than for the minimization of the BIC criterion. Hence, in cases (i) and (ii), the chosen algorithm just does the same thing as what the optimal one would, cutting out the unnecessary calculations.

$$m_t = m_{t-1} + u_t. \tag{6}$$

The subscript t refers to the intraday frequency of the data that are used to estimate daily price discovery shares. Hence, is our case t is a minute between 9:30 and 16:00. In both cases, $\triangle m_t$ is assumed to be $I(0)$, has mean zero (no trend) and has finite variance. A transaction price is

$$p_t = m_t + \chi_t \tag{7}$$

where χ_t is the friction component of the observable price. χ_t is expected negative for a sell, positive for a buy. Since m_t is not observed, the case of two markets following the same stochastic trend is useful. Equation (7) was the one market case. Generalizing (7) to a case where two transaction prices depend on the same m_t, we get

$$\begin{bmatrix} p_{a,t} \\ p_{b,t} \end{bmatrix} = \iota m_t + \begin{bmatrix} \chi_{a,t} \\ \chi_{b,t} \end{bmatrix} \tag{8}$$

and the long-run equilibrium relationship, which can also be seen as a no-arbitrage condition is thus

$$p_{a,t} = p_{b,t} + \chi_{a,t} - \chi_{b,t}. \tag{9}$$

The fundamental difference between the CVAR and the FCVAR happens here. In the former, we will do a strict assumption of which kind of process follow $\chi_{a,t} - \chi_{b,t}$: it is $I(0)$, has mean zero and finite variance. The latter is more flexible and, rather than imposing an integration order to $\chi_{a,t} - \chi_{b,t}$, will estimate it. Hence, in the FCVAR case, $\chi_{a,t} - \chi_{b,t}$ is assumed a $I(1-b)$ process with mean zero and finite variance.[9] To ensure stationarity, we need to impose $b > 1/2$. In both cases, the expected cointegrating vector is $(1, -1)$. However, in the standard non-fractional case, long-run disequilibrium errors are assumed $I(0)$ while in the fractional one, these are assumed $I(1-b)$. We hence get that, in the standard setup, cross-listed stocks are cointegrated while in the second setup, they are fractionally cointegrated.

[9] The general notation is $I(d-b)$ for processes integrated of order d that cointegrate to order b. We impose $d = 1$ because stocks are expected to follow a random walk and this has been independently tested in section 3.

4.1.5 Price Discovery shares measure

The Gonzalo & Granger (1995) Permanent-Transitory method will be used to calculate the price discovery shares, Ω_{k}. The authors propose a multivariate decomposition of X_t (as defined earlier) that works under two plausible conditions. The first is that the common factor that leads the series of X to be cointegrated must be a linear combination of the observable series and the second is that the part of X orthogonal to the common factor only has a transitory impact on X. More formally, the first condition is

$$m_t = B_1 X_t \tag{10}$$

where B_1 is a p by 1 vector of parameters. Plugging this in a standard factor analysis setup

$$X_t = A_1 m_t + \tilde{X}_t \tag{11}$$

where A_1 is a p by 1 vector of loadings, the authors get

$$X_t = A_1 B_1 X_t + \tilde{X}_t \tag{12}$$

and

$$\tilde{X}_t = (I - A_1 B_1) X_t. \tag{13}$$

Hence, the proposed decomposition is

$$X_t = A_1 m_t + (I - A_1 B_1) X_t. \tag{14}$$

The authors show that the only vector B_1 that satisfies the conditions is $\alpha_\perp$ where $\alpha'_\perp \alpha = 0$ and α is as defined in section 4.1.2. This way, $A_1 m_t = A_1 B_1 X_t = A_1 \alpha'_\perp X_t$ and when normalized to one, $\alpha'_\perp$ gives the contribution of each series (in our case, transaction prices) to the common factor m_t (also known as the efficient price in our case). This is easily obtained once the FCVARs & CVARs are estimated. The "take-out" formula

$$\Omega_{a,j,i} = \frac{\alpha_{b,j,i}}{|\alpha_{a,j,i}| + \alpha_{b,j,i}} \tag{15}$$

is straightforward where $\Omega_{a,j,i}$ is price discovery share of market a for stock j at day i. The relative speed at which a is corrected by a disequilibrium in long-run permanent relationship in inversely proportional to how it contributes to disequilibrium errors (i.e. moving the principal component m_t). In the empirical section, market a is the NYSE.

4.1.6 FCVAR Measure of Financial Integration

Applying the FCVAR to the theoretical model of section 4.1.4 allows investigating the question of financial integration. Among studies surveyed earlier, several methods have been proposed. The parametric methods are either Granger non-causality testing (Calvi (2010), Lok & Kalev (2006)) or Johansen tests (Calvi (2010)) for the cointegrating rank. The former aims to test which market drives short run relations. The latter tests for the existence of a common stochastic trend for all markets. In section 4.1.4, the common stochastic trend is the efficient (or fundamental) price m_t. Hence, for a cointegrating relationship to exist, a linear combination of non-stationary series must yield a stationary series, often referred as the long run disequilibrium error.

In this paper's setup, this term is $\chi_{a,t} - \chi_{b,t}$. Thus, as mentioned earlier, some studies of financial integration using cointegration techniques test the null that $\chi_{a,t} - \chi_{b,t}$ is $I(0)$ with as alternative $I(1)$. The more flexible setup of the FCVAR allows to estimate the order of integration of the long-run disequilibrium error, $1 - b$. Instead of answering the question of financial integration by yes or no, it is possible with this setup to estimate the daily level of integration per stock. Frictions with a "longer" memory are associated with lower financial integration since it takes more time units before we observe $p_{a,t} = p_{b,t}$ again after a shock. Hence, $\omega_{j,i}^{FCVAR} = \hat{b}_{j,i}$.

Building a panel of financial integration parameters, one can analyze what drives its short run fluctuations. Hence, as $1 - b$ tends to 0, financial integration increases. Conversely, as it tends to 1, financial integration vanishes (disequilibrium errors are a random walk). This is an addition to the current literature described earlier. It actually has the interesting clear-cut interpretation of Johansen testing, fit nicely with theoretical framework and provide a time-series of estimates that can be used for further regression analysis. Plus, since assuming a particular value for $1-b$ a priori may lead to different price discovery shares that an unrestricted model would give, it leads to think that price discovery shares are not independent to financial integration. Hence, knowing what drives the latter proves even more useful.

A drawback of this measure of integration is its distribution. If one imposes $b \leq 1$ to ensure a non-negative integration order for the disequilibrium error at all times, the resulting empirical distribution of b is highly skewed to the right. Relaxing this restriction would still yield a distribution highly concentrated around $\hat{b}=1$ and a cointegrating error that is integrated of a negative order does not have a trivial interpretation.[10] The log-odds transformation of $\hat{b}$ could have been an option if there were not many $\hat{b}$ values equal to one.[11]

4.1.7 Alternative Measure of Financial Integration

Again, two competing measures will be computed and compared. The first one, denoted $\omega_{j,i}^{FCVAR}$, does not need any more explanation by now, it is $\hat{b}_{j,i}$ as detailed in the previous section.

The second, $\omega_{j,i}^{PCA}$, is the one proposed by Volosovych (2011). It uses the standard PCA setup on excess returns. Using excess returns rather than log prices or returns is to have a stationary vector which part of the common shock bias discussed earlier has been differentiated out. The bias can be illustrated as

$$\Delta X = \Lambda \Delta m + \Delta \tilde{X} \tag{16}$$

where Λ is the loading matrix. To achieve identification, further restrictions must be imposed. In order for the first principal component of ΔX to truly pin down Δm, the elements of $\Delta \tilde{X}$ must not be contemporaneously correlated. If they are, the PCA procedure, in order to maximize the variance explained by the first principal component, will estimate a factor that has more than Δm in it. Using excess returns thus differentiate out correlations in $\Delta \tilde{X}$ attributable to the state of the market as a whole at a given time on a given day. If a shock

[10] If $\hat{b} > 1$ then a $I(1-\hat{b})$ series is $I(<0)$.

[11] If $\hat{b} = 1$ then $\log(\hat{b}/(1-\hat{b}))$ encounters division by zero.

not attributable to the market as a whole is common to both stocks, the financial integration index of Volosovych (2011) is expected to have an upward bias on these days: it is the percentage of the multivariate variance explained by the common – estimated – fundamental price.

If the common shock bias is not large, it is a legitimate way to assess financial integration. The common excess return arbitrage relationship is equivalent to the common efficient price one. Starting from the relationship behind the PCA-based financial index, the equivalence can be quickly shown the following way. The common excess return arbitrage relationship is

$$r^*_{a,j,t} = r^*_{b,j,t} + u_{b,j,t} + u_{a,j,t} \tag{17}$$

where r^* denotes the excess return and u excess return frictions. Replacing $r^*_{a,j,t}$ by its definition, we get

$$\left(r_{a,j,t} - \bar{r}_t\right) = \left(r_{b,j,t} - \bar{r}_t\right) + u_{a,j,t} - u_{b,j,t}. \tag{18}$$

Canceling $\bar{r}_t$ and replacing the remaining terms by their definitions, we get

$$\Delta p_{a,j,t} = \Delta p_{b,j,t} + \Delta\chi_{a,j,t} - \Delta\chi_{b,j,t} \tag{19}$$

which becomes

$$\begin{aligned} p_{a,j,t} = p_{b,j,t} &+ \left(p_{a,j,t-1} - p_{b,j,t-1}\right) + \left(\chi_{a,j,t} - \chi_{b,j,t}\right) \\ &- \left(\chi_{a,j,t-1} - \chi_{b,j,t-1}\right) \end{aligned} \tag{20}$$

if we break the Δ operator and rearrange terms. Since

$p_{a,j,t-1} - p_{b,j,t-1} = \left(m_{j,t-1} + \chi_{a,j,t-1}\right) - \left(m_{j,t-1} + \chi_{b,j,t-1}\right) = \chi_{a,j,t-1} - \chi_{b,j,t-1}$
we can write

$$\begin{aligned} p_{a,j,t} = p_{b,j,t} &+ \left(\chi_{a,j,t-1} - \chi_{b,j,t-1}\right) + \left(\chi_{a,j,t} - \chi_{b,j,t}\right) \\ &- \left(\chi_{a,j,t-1} - \chi_{b,j,t-1}\right) \end{aligned} \tag{21}$$

and by canceling $\chi_{a,j,t-1} - \chi_{b,j,t-1}$, the desired

$$p_{a,j,t} = p_{b,j,t} + \chi_{a,j,t} - \chi_{b,j,t} \tag{22}$$

is obtained. Equation (22) is the same as equation (9).

The two indexes are expected correlated by construction. While the first describes the duration of market frictions, the second is based on how much the variance of shocks can explain the variance of observed excess returns. The variance of these idiosyncratic shocks increases with their integration order $1-b$.

4.2 Analysis of announcement days vs. non-announcement days

The first part of the analysis is referred as "Specific Announcement days' test". This analysis will be done on a total of ten different dependent variables. For the sake of space, all the proposed specifications will be written with the generic

$$W_{j,i} \equiv \left\{ \begin{array}{c} \Omega^{CVAR}_{a,j,i}, \Omega^{FCVAR}_{a,j,i}, \Omega^{LR}_{a,j,i}, \omega^{FCVAR}_{j,i}, \omega^{PCA}_{j,i}, \\ \left|\tilde{\Omega}^{CVAR}_{a,j,i}\right|, \left|\tilde{\Omega}^{FCVAR}_{a,j,i}\right|, \left|\tilde{\Omega}^{LR}_{a,j,i}\right|, \left|\tilde{\omega}^{FCVAR}_{j,i}\right|, \left|\tilde{\omega}^{PCA}_{j,i}\right| \end{array} \right\}.$$

We obtain the elements of $W_{j,i}$ from section 4.1. For example, the first element of the set is the price discovery contribution of the NYSE (a) for stock j at **day i (the subscript t was used for minutes)** obtained from equation (15) using CVAR estimates. $\Omega^{FCVAR}_{a,j,i}$ refers to the same thing, but constructed out of FCVAR estimates. $\Omega^{LR}_{a,j,i}$ has been added for one concern: a researcher that does a Likelihood Ratio (LR) test of the unconstrained model vs. the constrained one might want to impose the constrained one if the null ($\mathcal{H}^{LR}_0$) is not rejected. Hence, $\Omega^{LR}_{a,j,i}$ is $\Omega^{FCVAR}_{a,j,i}$ when $\mathcal{H}^{LR}_0$ is rejected at the 5% level and $\Omega^{CVAR}_{a,j,i}$ otherwise. $\omega^{FCVAR}_{j,i}$ and $\omega^{PCA}_{j,i}$ have been described in sections 4.1.6 and 4.1.7 respectively. The last five elements of $W_{j,i}$ are a transformation of the first five. Formally, for a generic case, it means

$$\left|\tilde{w}_{j,i}\right| = \left|w_{j,i} - \overline{w}_j\right| \tag{23}$$

where the superscript "$-$" means the sample mean. Hence, $\left|\tilde{w}_{j,i}\right|$ is the absolute deviation from the time series mean of stock j. This transformation is used in FIT (2015) as well. Hence, $W_{j,i}$ is a set of panel of estimates that we use to test for the impact of announcement days by two methods. The first will not allow for heterogeneity in the slopes while the second will.

4.2.1 Specific Announcement Day's Tests

The first method implies the model

$$W_{j,i} = c + \beta_d d_i + \varepsilon_{ji}. \tag{24}$$

Since d_i is expected not be correlated with stock fixed effects, a random effects method can be used. However, the classic random effect GLS regression cannot be applied here. The common wisdom for ε_{ji} in this context is that it is cross-section and time non-independent. Clustered standard errors could deal with the latter and (many) time dummies could be added to the model to control for cross-sectional dependence. However, this procedure forgets about the fact that the dependent variable is estimated and will only be unbiased if $W_{j,i}$ is heteroscedastic only between different j and not within which, of course, is not plausible. Plus, for such a long panel, using time dummies makes the number of estimated parameters really high. A more suitable option here is to use a random effect feasible GLS regression that (i) allows for heteroscedasticity across panel, (ii) allows for cross-section correlation and (iii) allows for heterogeneous autocorrelation structure across panels. The latter means that each stock will have its own AR(1) autocorrelation correction.

The second method exploits the medium T medium N size of the panel. It allows for heterogeneous slopes. Hence, each j element of $W_{j,i}$ is allowed to respond in a different way to d_i. This method is the mean group estimator proposed by Pesaran and Smith (1995). The model becomes

$$\begin{aligned} W_{j,i} &= c_j + \beta_{j,d} d_i + \varepsilon_{ji} \\ c_j &= c + e_j^c \\ \beta_{j,d} &= \beta_d + e_j^\beta \end{aligned} \tag{25}$$

and β will be obtained by robust to outliers mean of the J $\beta_{j,d}$ obtained from individual regressions.

This exercise will be repeated for all q sort of days: types of announcement individually, Canadian announcements, American announcements and all announcements. Plus, β_d will be reported for regressions with and without controls. As suggested in FIT (2015), these controls will be

$$Z_i = \left[\ln\left(\frac{N_{a,i}}{N_{a,i}+N_{b,i}}\right) \quad \ln\left(\frac{S_{a,i}}{S_{a,i}+S_{b,i}}\right) \quad t \right]' \tag{26}$$

where the dependent variable is the mean odds-ratio for all j stocks, $N_{k,i}$ is the daily (i) number of trades in market k and $S_{k,i}$, the daily (i) average percentage spread in market k and t is a time-trend. Adding these controls, the two preceding models become

$$W_{j,i} = c + \beta_d d_i + \beta_Z Z_i + \varepsilon_{ji} \tag{27}$$

and

$$\begin{aligned} W_{j,i} &= c_j + \beta_{j,d} d_i + \beta_{j,Z} Z_i + \varepsilon_{ji} \\ c_j &= c + e_j^c \\ \beta_{j,d} &= \beta_d + e_j^\beta \\ \beta_{j,Z} &= \beta_Z + e_j^Z \end{aligned} \tag{28}$$

where β_Z, $\beta_{j,Z}$ and e_j^Z are 1 by 3 vectors. This last model accounts for the fact that liquidity and market depth is certainly not orthogonal to d_i and thus, aims to test if there is a significant difference between announcement and non-announcement days independently of those two factors. Those two latter additions to the model are in line with Jiang & Lo (2014) that suggest that those do have predictive power on prices.

4.2.2 Regressions Combining General Dummies

Different combinations of q's will be used for D_i, which is a vector of d_i's. Only the first five elements of $W_{j,i}$ will be used. The combinations will be straightforward:

$$D_i^1 = [\textit{All Canadian TE3}_i, \textit{All US TE3}_i, \textit{All Canadian FIT } (2014)_i, \textit{All US FIT } (2014)_i]',$$

$$D_i^2 = [\textit{All Canadian FIT } (2014)_i, \textit{All US FIT } (2014)_i]',$$

and

$$D_i^3 = [\textit{All Canadian TE3}_i, \textit{All US TE3}_i]'.$$

The two econometric methods from section 4.2.1 will be used and the models will be

$$W_{j,i} = c + \beta_D D_i + \beta_Z Z_i + \varepsilon_{ji} \tag{29}$$

and

$$\begin{aligned} W_{j,i} &= c_j + \beta_{j,D} D_i + \beta_{j,Z} Z_i + \varepsilon_{ji} \\ c_j &= c + e_j^c \\ \beta_{j,D} &= \beta_D + e_j^D \\ \beta_{j,Z} &= \beta_Z + e_j^Z \end{aligned} \tag{30}$$

where $\beta_{j,D}$, β_D and e_j^D are 1 by 4 vectors for D_i^1 and 1 by 2 vectors for D_i^2 and D_i^3.

4.2.3 Dynamic & $\omega_{j,i}^{FCVAR}$ Augmented Specifications

It is suspected that members of $W_{j,i}$ may be linked to each other as well, especially price discovery shares and financial integration. Additionally, these variables might follow dynamic processes. For instance, one might think that $\Omega_{a,j,i}^{FCVAR}$ is mean-reverting. However, the direction of causality within members of $W_{j,i}$ is not obvious and results from this last section should not be interpreted in a causal way unless some assumptions are made. Furthermore, given the context of financial data and rapid intraday adjustments, it is quite unlikely that a PVAR could have been of any help to pin down Granger Causality.[12] Although the general $W_{j,i}$ will be used to display the model's framework, the analysis will be concentrated around the dependency between $\Omega_{a,j,i}^{FCVAR}$ and $\omega_{j,i}^{FCVAR}$ and $\Omega_{a,j,i}^{CVAR}$ and $\omega_{j,i}^{FCVAR}$.

The introduction of $\omega_{j,i}^{FCVAR}$ as regressor yields endogeneity issues. However, if one agrees that most of the endogeneity is due to the fact that both $\omega_{j,i}^{FCVAR}$ and $\Omega_{a,j,i}^{FCVAR}$ are affected by latent factors that are common to all J stocks, models from the panel time-series literature can be used to deal with this issue.

[12] Actually, the PVAR was tried and did not give any interesting results: its frequency (days) is too low to pin down the relation we are interested in.

Pesaran (2006) common correlated effects mean group (CCEMG) estimator will be used. The model becomes

$$
\begin{aligned}
(1-\phi_j \mathrm{L})W_{j,i} &= \beta_{j,\omega}\ \omega_{j,i}^{FCVAR} + \varepsilon_{ji} \\
\varepsilon_{ji} &= c_j + \Lambda_j F_i + v_{ij} \\
\omega_{j,i}^{FCVAR} &= \eta_j + \Theta_j F_i + \xi_{ij} \\
\phi_j &= \phi + e_j^{\phi} \\
\beta_{j,\omega} &= \beta_\omega + e_j^{\omega} \\
c_j &= c + e_j^{c} \\
\Lambda_j &= \Lambda + e_j^{\Lambda} \\
\eta_j &= \eta + e_j^{\eta} \\
\Theta_j &= \Theta + e_j^{\Theta}
\end{aligned}
\tag{31}
$$

where F_i is a time-varying set of common factors and Λ_j its loading vector for $\Omega_{a,j,i}^{FCVAR}$ and Θ_j is the loading vector for $\omega_{j,i}^{FCVAR}$.[13] F_i can possibly be a limited number of strong factors and an infinite number of weak factors. If F_i is p by 1 then Λ_j, Θ_j, Λ, Θ, e_j^{Λ} and e_j^{Θ} are 1 by p vectors. However, these loadings will not be estimated. The unbiased estimators of $\beta_{j,\omega}$'s are obtained by J regressions augmented with the cross-sectional mean of the regressors and the regressand. By having these in the individual regressions, each stock has its own loading Λ_j of the common dynamic process. In this paper, F_i can be interpreted as anything that affects all W_j at time i but that is unobserved. A lot of things come in mind: macroeconomic surprises, announcement days from other countries, political factors. Adding cross-sectional means to the J regressions will difference out the common dynamic process of information F_i and will make proxies to F_i like D_i and Z_i irrelevant. This approach has a lot to do with the CAPM design. There is a common information shares dynamic process – factors F_i – that every

[13] Endogeneity remains if $Cov(\xi_{ij}, v_{ij}) \neq 0$. This is highly plausible: a shock affecting one firm at one moment is likely to affect both its financial integration measure and the distribution of price discovery shares. The work from this brief section shall thus be interpreted as correlation rather than causality because one of the three components of ε_{ji} is still problematic. However, this is likely to be less of a problem than if we did not have controlled for c_j and $\Lambda_j F_i$.

individual asset can load at a different level. The whole panel β_ω is the outlier-robust mean of $\beta_{j,\omega}$.

5 Results

5.1 Comparison of Summary Statistics

Before getting to compare how the estimates from the FCVAR & CVAR might yield different results when employing them to do the analysis proposed in section 4.2, it is certainly useful to simply compare summary statistics obtained from section 4.1.3 first. These results are displayed by stock in Table 5 & 6.

[Insert Table 5 & 6 about here]

The first broad message to take out from this table is that there are visibly stock fixed effects for pretty much all the information reported in the table.[14] Hence, Ω^{CVAR}, Ω^{FCVAR}, ω^{FCVAR} and other models' features such as the number of lags and the number of significant trends vary partly according to the member of the panel.[15] Same is observed for the % of rejected nulls for the Likelihood ratio test ($\mathcal{H}_0^{LR}$) and the correlation between Ω^{CVAR} and Ω^{FCVAR}.

For the vast majority of stocks, between 40% and 60% of $\mathcal{H}_0^{LR}$ are rejected. The whole panel average is 48%. This is way more than the 5% of rejection one would expect for the multiple testing of an hypothesis given that the null is true. Given that this is generalized to all stocks (the minimum percentage of rejection is 38%), the FCVAR, by allowing the disequilibrium error to be of higher order than $I(0)$, provides a better fit to the data for a significant number of days. This finding varies in level (38% to 65%) but is clearly not solely

[14] Least Squares Dummy Variable regressions not reported in this paper more rigorously attest that.

[15] To make this section easier to read, the redundant subscripts of the elements of $W_{j,i}$ were dropped. Hence, $\Omega^{CVAR}_{a,j,i}$ is Ω^{CVAR} and so on.

attributable to a certain group of stocks (e.g.: those with a lower trading frequency).

Time series average estimates of Ω^{CVAR} and Ω^{FCVAR} are never too far from each other. Hence, for the whole panel, the difference is not significant according to a T-test for the comparison of means. Looking at Table 5 by stock averages of these estimates also displays that, averaging over all time periods i for each j stock, the measures follow each other.[16] However, the by-stock correlation between estimates of Ω^{CVAR} and Ω^{FCVAR} is way lower, ranging from .42 to .75. The overall panel correlation is .74. However, this latter measure is not representative because of stock-specific levels (Ω^{CVAR} and Ω^{FCVAR} will both naturally be higher/lower for a stock for which the price discovery shares of the NYSE is higher/lower). The average by-stock correlation is .58. Both measures conclude that for the whole panel, the NYSE dominates price discovery with a price discovery share of .594 for the FCVAR and .578 for the CVAR. Figure 1 displays J by-stock Kernel densities of Ω^{CVAR} and Ω^{FCVAR}: it resumes broadly the previous discussion. One has to remember that a flexible ω^{FCVAR} is the key difference between Ω^{CVAR} and Ω^{FCVAR}. Since ω^{FCVAR} is stock-dependent, we observe that for some j, both densities are really similar while for some others there are noticeable differences.

[Insert Figure 1 about here]

The previous discussions about measures correlation and percentage of rejected $\mathcal{H}_0^{LR}$ has its justification in the column containing stocks' average of ω^{FCVAR} (or $\hat{b}_{j,i}$) which ranges from .82 to .93. This is certainly different from the CVAR's assumed 1. As Figure 2 shows, estimates of ω^{FCVAR} (rather than its time series averages) vary a lot between its two imposed limits of .1 and 1. The density of the .9 to 1 range is quite high, suggesting that a lot of

[16] The correlation of the time averages displayed in Table 5 is .997. The correlation of the cross-sectional averages (mean of the portfolio for day i) displayed in Table 5 is .727.

disequilibrium terms are not so far to meet the $I(0)$ process imposed by the CVAR. Plus, most of the sample estimates of $\hat{b}_{j,i}$ are higher than .5, which suggest that in most cases, frictions are stationary.

Imposing $b = 1$ with a CVAR when in fact $b < 1$ usually leads to specifications with higher lags order than what the more general framework of the FCVAR would pick. There is slight evidence of that phenomenon in Table 1 from the results of DNNX (2015). With the estimation of 20340 FCVARs and CVARs, the present paper provides clear cut evidence that the imposition of a wrong cointegration order leads to higher lag order specifications. For every stock in Table 6, the average number of lags is lower for a FCVAR than for a CVAR. The maximum by stock average of the lag order of FCVARs (2.20) is even lower than the minimum of the same measure for CVARs (2.38). The whole panel average for the lag order of the FCVAR is 1.76 while it is 3.24 for the CVAR.

Ignoring fractional cointegration also has other impacts on the obtained model. With an estimation algorithm bound to a maximum of 12 lags, 5% of the 10170 FCVARs could not completely get rid of autocorrelation in the residuals at the 5% level. Keeping in mind that even if the null is true, we reject it 5% of times, this result is not a cause of big worry. However, in the CVAR case, it is the case for 21% of the sample. Ignoring the long-memory of the disequilibrium error can thus lead to autocorrelation that does not go away. This difference between the two econometric models exists even for stocks that are less problematic on that very issue. Hence, the maximum for time series averages of the FCVAR is 7% of cases with remaining autocorrelation and the minimum for the CVAR is 15%. Finally, the percentage of significant trends at the 5% level is significantly higher for the CVAR with respect to its fractional counterpart for both NYSE (average of 88.6% for the former and 52.3% for the latter) and TSE (average of 97.3% for the former and 68.1% for the latter). Table 6 thus has a lot to say on the impact of forcing a CVAR on fractionally cointegrated data: the CVAR is biased since other terms of the specification –

unrestricted trends, lag order, residuals autocorrelation – partially accommodate for the overlooked long-memory of the long-run disequilibrium error.

A short comment must be made about the estimates of the cointegrating vector $\beta_{j,i}$, $\hat{\beta}_{j,i}$. Both the FCVAR and the CVAR mostly pin down correctly the expected $\hat{\beta}_{j,i} = -1$.[17] However, the FCVAR is a little more precise as shows this appendix to Table 6. It has less outliers (65) than the CVAR (165) and its outliers-robust mean does not rejects the null of $\hat{\beta}_{j,i} = -1$ at the 5% level while the CVAR's one does.

Table 6 Appendix: $\hat{\beta}_{j,i}$'s Comparison

	$\beta_{j,i}^{CVAR}$	$\beta_{j,i}^{FCVAR}$
% of Outliers ($\hat{\beta}_{j,i} \notin [-0.9, -1.1]$)	1.62	.64
Outliers-robust mean rejects $\hat{\beta}_{j,i} = -1$ at the 5% level	Yes	No
Mean rejects $\hat{\beta}_{j,i} = -1$ at the 5% level	No	No

Finally, the estimates of the alternative measure of short-run financial integration ω^{PCA} have by-stock means that are pretty much all the same, .94, which contradicts the stock-varying mean of ω^{FCVAR}. The distribution of the PCA-based index range from roughly .5 to .97. However, a great part of the density is estimates in the .9 and .95 range. The analysis of the next section will tell us more about the properties of ω^{PCA}.

5.2 Results of Specific Announcement Day's Tests

Since $W_{j,i}$ has 10 elements, that we are using two different methods and that we are using two different sets of announcement days, the numerous detailed tables are available in the Appendix.[18] However, summary tables will be

[17] From section 4.1.4, we know that the cointegrating relationship must be $p_{a,j,t} = p_{b,j,t}$ or, putted another way, $p_{a,j,t} + \beta_{j,i} p_{b,j,t} = 0$ with $\beta_{j,i} = -1$. Hence, by the theoretical model, $E(\hat{\beta}_{j,i}) = \beta_{j,i} = -1$.

[18] Each table has five dependent variable, either all $w_{j,i}$ or all $|\tilde{w}_{j,i}|$. There is a table for each of models (24), (25), (27) and (28). That is, models with/without controls and homogenous/heterogeneous slopes models. There is a table for each of the two set of dummies. That sums to $2 * 2 * 2 * 2 = 16$ tables.

displayed throughout. Panel unit root tests (not reported) for all members of $W_{j,i}$ rejected that some panels had a unit-root.

Table 15: Summary Table of Selected Single FIT (2015) Events Models

Dependent variable:	$\Omega^{CVAR}_{a,j,i}$	$\Omega^{FCVAR}_{a,j,i}$	$\Omega^{LR}_{a,j,i}$	$\omega^{FCVAR}_{j,i}$	$\omega^{PCA}_{j,i}$
Homo. Slopes, $w_{j,i}$, with Controls	16%	6%	13%	6%	10%
Het. Slopes, $w_{j,i}$, with Controls	3%	3%	3%	3%	35%
Homo. Slopes, $\lvert\tilde{w}_{j,i}\rvert$, with Controls	10%	10%	13%	0%	3%
Het. Slopes, $\lvert\tilde{w}_{j,i}\rvert$, with Controls	3%	0%	0%	0%	39%
Average	**8%**	**5%**	**7%**	**2%**	**22%**

The percentage reported is the total number of models with a significant β_d at the 5% level out of total number of models (which correspond to the number of possible dummies, including aggregation ones). In order, the referred Tables are 8, 10, 12 and 14.

Table 15 summarizes the findings of Tables 8, 10, 12 and 14.[19] These are the "With Controls" tables. The events are those inspired by FIT (2015). The main conclusion that one can get out of the former is difference in the sensitivities of the competing estimates. Ω^{CVAR} and $\left|\widetilde{\Omega}^{CVAR}\right|$ have, on average, more significant events than Ω^{FCVAR} and $\left|\widetilde{\Omega}^{FCVAR}\right|$ if we pool together both estimation methods. The pooled total of Ω^{LR} and $\left|\widetilde{\Omega}^{lR}\right|$ stands in between. A possible cause of this is the overall sensibility of ω^{FCVAR} and $|\tilde{\omega}^{FCVAR}|$ which we impose to be 0% in the case of a CVAR. This evidence is way too broad and we have to dig into the detailed tables.

If we look specifically at Table 8 (equation (27) for $w_{j,i}$), conclusions would substantially diverge between models using Ω^{CVAR} rather than Ω^{FCVAR}. Using Ω^{CVAR}, one can conclude that "All US Announcements" (referring here to the so-called dummy, not all US announcements individually) has a statistically significant positive effect on the price discovery share of the NYSE. So does the "All Announcements" dummy, at the 1% level. On the other hand, these two effects are nonexistent when using Ω^{FCVAR} or Ω^{LR}. It is also worth mentioning that the non-existence of the effect when using Ω^{FCVAR} or Ω^{LR} rather than

[19] In order, we have equation (27) and equation (28) for $w_{j,i}$ then equation (27) and equation (28) for $|\tilde{w}_{j,i}|$. The chosen set of dummies is FIT (2015).

Ω^{CVAR} is not due to smaller standard errors when using the latter.[20] In both cases – all US announcements and all announcements – the coefficient of Ω^{CVAR} is 3 times as high as its fractional counterparts. In the same specific table, Ω^{CVAR} is significantly higher on Chicago PMI announcement day and significantly lower on Canadian CPI release days. No such effect is found for Ω^{FCVAR}. Another interesting example is the US CPI release day. Ω^{FCVAR} is 2.85 points of percentage lower on these days (significant at the 1% level) while Ω^{CVAR} is 2.2 points of percentage lower (significant at the 5% level). Ω^{LR} is significant at the 1% level and has a coefficient of -3.11. It is also observed that ω^{FCVAR} is higher by 1.86 point of percentage on that day (significant at the 5% level). In this very case, having a model that allowed the financial integration level to vary across days led to a quantitatively different answer for the analysis of price discovery shares movements. This conclusion is invariant to the researcher decision of imposing or not $b = 1$ after a non-rejection of $\mathcal{H}_0^{LR}$.

Table 10 (equation (28) for $w_{j,i}$) also brings further evidence of this phenomenon. Allowing for heterogeneous parameters, the Ω^{FCVAR} coefficient for the Fed Funds rate announcement day is negative and now significant at the 1% level. It only was at the 10% level in Table 8. The coefficient on ω^{FCVAR} was 2.83 for model (27) and is 3.09 for model (28). The first is significant at the 1% level and the second is significant at the 0.1% level. Higher financial integration thus seems to happen on that day, which goes with the "more attentive" markets proposition. The coefficient of Ω^{CVAR} (-1.4) is way smaller in absolute value than the one of Ω^{FCVAR} (-3.25) while Ω^{LR}'s one stands in between (-2.53) and is non-significant. In this case, the conclusion is not invariant to the researcher's decision rule. Keeping in mind the significant coefficient of this dummy on ω^{FCVAR} imposing $b = 1$ after a non-rejection of $\mathcal{H}_0^{LR}$, in some cases, loose potentially desirable flexibility. Plus, as it was the case in the homogenous slopes model (equation (27)), Ω^{CVAR} responds positively

[20] This is interesting to mention since one could worry about the fact that Ω^{FCVAR} is only a noisier version of Ω^{CVAR} due to estimation reasons.

and significantly to the "All Announcement days" dummy (coefficient of 1.43, significant at the 1% level) while Ω^{FCVAR} and Ω^{LR} have non-significant coefficients that are respectively .51 and .55. There are some other cases in Table 10 where Ω^{FCVAR} (or both fractional measures) respond significantly to a dummy while Ω^{CVAR} does not (or less so). For "US – Construction Spending", Ω^{CVAR}, Ω^{FCVAR} and Ω^{LR} have respectively coefficients of 2.38 (p<0.5), 2.64 (p<0.01) and 3.11 (p<0.01). For "US – Consumer Confidence Index", only Ω^{FCVAR} has a significant β_d. Its β_d is 2.35 and is significant at the 0.1% level. Again, having a model that allows the integration order of frictions to be flexible – and as we have shown, to also jump on announcement days – leads to qualitatively and quantitatively different conclusions.

Finally, the absolute deviation from the stock's mean tables (Tables 11-14) reveal mainly two things.[21] First, one notices that both Ω^{CVAR} and Ω^{FCVAR} do have some significant announcement days. However, none of them coincides. Second, we now observe that for both models with homogenous slopes (equations (24) and (27)), the "All US announcements" and "All Canadian announcements" dummies do have a significant impact on $\left|\widetilde{\Omega}^{CVAR}\right|$ and $\left|\widetilde{\Omega}^{lR}\right|$. Coefficients are close to each other. It is not the case for $\left|\widetilde{\Omega}^{FCVAR}\right|$ which coefficient is always smaller is absolute value. With model (28), only the "All US announcements" dummy is significant for $\left|\widetilde{\Omega}^{CVAR}\right|$. Again, no such effect is obtained when $\left|\widetilde{\Omega}^{FCVAR}\right|$ is the dependent variable and now, for $\left|\widetilde{\Omega}^{lR}\right|$ as well. Results obtained with model (24) are relatively similar.

[21] These are equations (24), (25), (27) and (28) for $|\tilde{w}_{j,i}|$.

Table 24: Summary Table of Selected Single TE3 Events Models

Dependent variable:	$\Omega_{a,j,i}^{CVAR}$	$\Omega_{a,j,i}^{FCVAR}$	$\Omega_{a,j,i}^{LR}$	$\omega_{j,i}^{FCVAR}$	$\omega_{j,i}^{PCA}$
Homo. Slopes, $w_{j,i}$, with Controls	13%	3%	6%	9%	22%
Het. Slopes, $w_{j,i}$, with Controls	13%	19%	19%	25%	78%
Homo. Slopes, $\lvert\tilde{w}_{j,i}\rvert$, with Controls	3%	9%	0%	6%	13%
Het. Slopes, $\lvert\tilde{w}_{j,i}\rvert$, with Controls	16%	13%	13%	31%	78%
Average	**11%**	**11%**	**9%**	**18%**	**48%**

The percentage reported is the total number of models with a significant β_d at the 5% level out of total number of models (which correspond to the number of possible dummies, including aggregation ones). In order, the referred Tables are 17, 19, 21 and 23.

Table 24 summarizes the finding of Tables 17, 19, 21 and 23.[22] These are the "With Controls" tables. Again, but now using the *Trading Economics* (TE3) set of events, the same general conclusion comes out. Very loosely speaking, estimates obtained from a CVAR are more sensible to announcement days than those of the FCVAR/CVAR combination. However, one has to remember that part of the events of TE3 overlap with the FIT (2015) set. Thus, for summary statistics such as those presented in Table 24, this is not completely new evidence. A more interesting observation is how the percentage of significant dummies increases for ω^{FCVAR} and ω^{PCA} for both $w_{j,i}$ and $\lvert\tilde{w}_{j,i}\rvert$ forms when the model allows for heterogeneous slopes. While the jump in ω^{PCA} might partly be attributable to high autocorrelation and cross-correlation of residuals, the jump in ω^{FCVAR} seems more reasonable and is evidence to suggest that there is substantial heterogeneity in the $\beta_{j,d}$s of ω^{FCVAR}.

Some events that are unique to the TE3 set of dummies bring some interesting supplemental evidence. For model (27) (Table 17), Ω^{CVAR} diminishes by 4.01 point of percentage on days when the Fed Chairman Yellen speaks (publicly). It is significant at the 0.1% level. A negative 1.85 point of percentage is found for Ω^{FCVAR} and is only significant at the 10% level. Ω^{LR} has a coefficient of -3.58 and is significant at the 1% level. Finally, the whole set of Canadian

[22] In order, we have equation (27) and equation (28) for $w_{j,i}$ then equation (27) and equation (28) for $\lvert\tilde{w}_{j,i}\rvert$. The chosen set of dummies is TE3.

announcements' dummy is significant for Ω^{CVAR} while it is not for Ω^{FCVAR} and Ω^{LR}.

Models (25) and (28) (Tables 18 & 19) have some results that considerably differ from those of models (24) and (27). For example, "US - ISM Manufacturing PMI", "US - GDP" and "CAN – All Announcements" are now significant for our three price discovery shares variables. There also are still dummies for which the answer we get from Ω^{CVAR} is different from Ω^{LR} and Ω^{FCVAR}. For instance, the two latter measures react significantly (at 0.1% level and with coefficients of 3.83 and 3.63) to "CAN - Employment Rate". A non-significant coefficient of 1.63 is found for the same event and Ω^{CVAR}. Also, "Unemployment Rate" is significant at the 5% level for both Ω^{LR} and Ω^{FCVAR} but not for Ω^{CVAR}. The heterogeneous parameters model (equation (28)) has ω^{FCVAR} that reacts strongly to some announcement days dummies. All significant at the 0.1% level, "US - Federal Funds Rate", "US - Reuters Michigan Consumer Sentiment", "US - Midterm Elections US" and "US - FOMC Economic Projections" increase the expected ω^{FCVAR} by 3.09, 3.74, 6.14 and 6.92 points of percentage respectively. Finally, it is important to mention that the heterogeneous parameters model (equation (28)) has a different conclusion than the homogenous one (equation (27)) concerning "CAN – All Announcements". The three measures are now significant and both in terms of coefficients and level of significance (# of stars) we get $\Omega^{FCVAR} > \Omega^{LR} > \Omega^{CVAR}$. This is the contrary of the homogenous slopes model. Something that might explain this is the observed heterogeneity in ω^{FCVAR} that Ω^{FCVAR} accommodates for.

From the absolute difference tables, again, dummies that are significant for Ω^{CVAR} do not coincide with those of Ω^{FCVAR}. For instance, in the homogenous slopes model with controls, $\left|\widetilde{\Omega}^{CVAR}\right|$ increases on Canadian Core Inflation Rate release days, it is not the case for $\left|\widetilde{\Omega}^{FCVAR}\right|$.

As mentioned earlier, a researcher might want to impose $b = 1$ if he cannot reject the null of the LR test. The results obtained when using Ω^{LR} for all tables often is between those of Ω^{CVAR} and Ω^{FCVAR}. However, Ω^{LR} sometimes brings events of its own to be significant or some that were significant for Ω^{CVAR} or Ω^{FCVAR} to have a larger coefficient. Hence, Ω^{LR} has conclusions of its own. Whatever the strategy the researcher chooses, results will differ from only using the CVAR.

ω^{PCA} follows patterns that are difficultly reconcilable with those of ω^{FCVAR}. We first saw that contrary to one might expect from a by-stock financial integration measure, it is not stock-dependent. For instance, this implies low volume stocks do not have a significantly different mean of financial integration from high volume ones in the sample. This is surprising, even more so that ω^{FCVAR} is stock dependent. Furthermore, the PCA measure is highly time persistent (correlation of .87 with its lag) while the FCVAR one is not (correlation of .04 with its lag). As a result of these evident differences, the correlation between both measures is only 0.05. It is thus not really surprising to see that results obtained with ω^{PCA} are completely unrelated to all the other measures of every table. First, the two summary tables tell us that the measure is way more sensitive than all the VECM inspired ones. Knowing that ω^{FCVAR} is highly time and cross-sectionally dependent, it makes sense to believe that only the homogeneous slopes model (equation (24) and (27)) provides appropriate standard errors. Table 8 (equation (27) for $w_{j,i}$) shows that for the FIT (2015) set of events, US announcements as a whole and both countries announcements as a whole do have a positive significant impact on financial integration. The coefficients have the same signs as those of ω^{FCVAR}. The latter are however far from being significant. Since, these coefficients for equations with ω^{PCA} as dependent variable vary a lot across econometric methods and specifications, they can hardly be trusted.

For the analysis of price discovery, these numerous tables show that there is mixed economically significant evidence that price discovery shifts partially on announcement days. The same goes for the FCVAR measure of financial integration. Some announcements distinguish themselves by being really significant. The first one that comes to mind is the Fed Funding rate. It makes common sense to think that if an event had to have an impact on price discovery and financial integration, it should be this one. The direction in which price discovery shifts during these days depends on events. However, for the "All Canadian announcements" and "All announcements dummies", a positive shift in Ω^{CVAR} is observed for both, which is in line with the findings of FIT (2015) that the price discovery process partially shift to the NYSE on announcement days. Unfortunately, we have shown that this finding does not hold when one uses the newly proposed Ω^{FCVAR} and Ω^{LR}.

5.3 Results of Regressions Combining General Dummies

This section will shed light on two issues. First, regressions using methods from the previous section will be displayed entirely and one will observe how the first five elements of $W_{j,i}$ will respond differently – or not – to elements of Z_i. Second, these regressions combine different sets of dummies in D_i rather than test one at the time.[23]

[Insert Table 25, 26 & 27 about here]

The general results are in line with those of the previous section: Ω^{CVAR} reacts differently from Ω^{FCVAR} and Ω^{LR}. When we put the 4 general dummies together – D_i^1 – in the homogenous slopes model (equation (29)), we find that only for Ω^{CVAR} the Canadian TE3 set and the US FIT (2015) are significant. Regressions on only the two TE3 set's dummies and only the two FIT (2015)'s dummies – D_i^2 and D_i^3 – reveal the same effect. These positive effects of announcements coincide with the findings of FIT (2015). On the other hand, no such effect is found for Ω^{FCVAR} and Ω^{LR} only responds positively to one of them. For model (29), a positive shift of the price discovery shares of the NYSE exists

[23] Each table has its own dependent variable $W_{j,i} \equiv \{\Omega^{CVAR}_{a,j,i}, \Omega^{FCVAR}_{a,j,i}, \Omega^{LR}_{a,j,i}, \omega^{FCVAR}_{j,i}, \omega^{PCA}_{j,i}\}$. Each table is split in two parts, one for equation (29) and the other for equation (30). For each of these two parts, they are three regressions for different $D_i \equiv \{D_i^1, D_i^2, D_i^3\}$.

only if one imposes *a priori* $b = 1$ with a CVAR. This conclusion remains if we use D_i^2 and D_i^3 for Ω^{FCVAR} and Ω^{LR} as well. The positive effect once observed for the Canadian TE3 dummy on Ω^{LR} vanishes when using D_i^3 rather than D_i^1. The effect observed with for $\Omega_{a,j,i}^{LR}$ was only significant for TE3 Canadian events of that are not part of those of FIT (2015).[24]

The heterogeneous slopes model (equation (30)) brings interesting new insights. For Ω^{CVAR}, the results remains qualitatively unchanged. Quantitatively, coefficients of set of announcement days dummies are smaller and the sensibility to the spread proportion is way higher and more in line with those of Ω^{FCVAR} and Ω^{LR}. The sensitivities of Ω^{FCVAR} and Ω^{LR} to the spread proportion also increase a little with heterogeneous slopes model but never as much as for Ω^{CVAR}. This shows that imposing the assumption of homogenous slopes might have got Ω^{CVAR} to be more sensible to events rather than the spread proportion. In the case of Ω^{FCVAR} and Ω^{LR}, this flexibility of coefficients makes the Canadian TE3 dummy significant at the 0.1% level for Ω^{FCVAR} and 1% for Ω^{LR}. A similar, but tinier effect is found for Ω^{CVAR}. These results show that there might be more heterogeneity in β_D for price discovery shares estimated with a FCVAR rather than a CVAR.

It is also interesting to observe the difference between the coefficients of the markets' volume ratio. For Ω^{CVAR}, all coefficients are around the 90-100 range and are all significant at the 0.1% level for model (30) and at the 1% level for model (29). For $\Omega_{a,j,i}^{FCVAR}$, all coefficients are around the 80-90 range and are all significant at the 0.1% level for model (30) and at the 1% level for model (29). For $\Omega_{a,j,i}^{LR}$, all coefficients are around the 60-70 range and are all significant at the 1% level for model (30) and at the 5% level for model (29). Hence, using either of these three dependent variables yields again, quantitatively different answers.

[Insert Table 28 & 29 about here]

[24] This is possible since D_i^2 and D_i^3 partially overlap.

Coefficients for ω^{FCVAR} are not significant for any of the set of events dummies. In the homogenous slopes model (equation (29)), they however respond negatively and significantly to the spread proportion. Hence, the higher the market spread proportion of the NYSE, the lower is financial integration. If the relative cost of trading in on the NYSE diminishes, market integration increases. Model (29) also has a positive trend significant at the 5% level. This makes economic sense. On the other hand, this is quite surprising to find for such a short period of time. This finding does not hold for model (30). However, it makes sense to think that a common trend should be imposed. Again, knowing the high degree of autocorrelation and cross-dependency of ω^{PCA}, only model (29) seems legitimate since it corrects for both. Results differ largely from ω^{FCVAR}. The spread ratio does not have any significant impact but a significant positive trend in find. ω^{PCA} is positively affected by the US TE3 dummy at the 5% level.

While this section shows additional evidence of how results using a FCVAR differ from those obtained with the traditional CVAR, it cannot explain these differences by simultaneous jumps in ω^{FCVAR} for the concerned dummies like it was sometimes the case in section 5.2.

5.4 Results of Dynamic & $\omega_{j,i}^{FCVAR}$ Augmented Specifications

This section departs from regressions proposed in FIT (2015) and aims to analyze the interdependency of $\Omega_{a,j,i}$ and $\omega_{j,i}^{FCVAR}$ with model (31).

Table 30: Dynamic & $\omega_{j,i}^{FCVAR}$ Augmented Specifications

Dependent variable:	$\Omega_{a,j,i}^{CVAR}$	$\Omega_{a,j,i}^{FCVAR}$
AR(1)	0.018	0.038**
	(0.012)	(0.012)
$\omega_{j,i}^{FCVAR}$	0.046*	0.080
	(0.020)	(0.042)
Constant	0.220	3.820
	(6.85)	(6.40)
χ^2	7.49	13.12
N	10140	10140

Standard errors in parentheses, * p<0.05, **p<0.01, *** p<0.001. All elements of $W_{j,i}$ have been multiplied by 100 to avoid useless zeroes in the tables. Hence, the "points of percentage" interpretation applies. Cross-sectional means that controls for the common factors errors structure are not reported since they have non-interpretable values.

The integration factor ω^{FCVAR} has a small positive impact on both Ω^{FCVAR} and Ω^{CVAR}: the former has a coefficient of .08 and a p-value of .054 while the latter has a coefficient of .046 and a p-value of .02. Hence, on average, there is tiny evidence that market integration positively affects the expected information share of the NYSE for all stocks individually. Again, this should not be interpreted as causality but as correlation. Plus, the relationship holds in a relatively similar way for Ω^{FCVAR} and Ω^{CVAR}, which clears the worries that the relationship would only hold for Ω^{FCVAR} because it is simultaneously estimated with ω^{FCVAR}. Assuming that financial integration is likely to have a positive trend over time – and we found tiny evidence of this in the previous section, this could be quite worrisome for the TSE if the coefficients would have been greater. The AR(1) term is only statistically significant for Ω^{FCVAR}. It is so at 1% level. However, the coefficient is very small (.0399) and the conclusion is that long-run effects are almost identical to short-run ones. This makes finance sense: at the speed things go, it is quite unlikely that yesterday has something to do with today in times of no ground-breaking shocks.

6 Conclusion

By comparing the CVAR and the FCVAR results for an analysis mainly inspired by FIT (2015), the paper answered mainly three questions: Does the CVAR provide adequate estimates for $\Omega_{a,j,i}$? How and how much does it affect price discovery research results to use one model or another? Can differences between competing estimates be explained by time-varying financial integration?

First, summary statistics of the estimation algorithm results clearly show that imposing a CVAR on fractionally cointegrated data leads to 4 distinct sources of bias in the analysis:

1. The model has a higher lag order;
2. The model is more likely to have a significant unrestricted trend;
3. The model is more likely to still have autocorrelation left in the residuals when a decent maximum number of lag is imposed;
4. The model has different point estimates of parameters.

The fourth point is what leads to the second section of the analysis. Using measures of price discovery constructed out of biased estimates can partially change the outcome of an analysis that uses these as dependant variables. Sections 5.2 and 5.3 clearly show that important differences sometimes emerge between conclusions of models using Ω^{FCVAR}, Ω^{LR} and Ω^{CVAR} as dependent variables. In order to make sure these differences were not specific to methods and specifications, the analysis was quite extensive. Hence, homogenous/heterogeneous slopes model with/without controls have been used on the variable itself and its absolute difference from the stock's mean. Models that are more alike what is used in FIT (2015) yield similar responses for some crucial dummies. However, it shown that this finding does not hold with fractional version of the price discovery measures. Plus, for some events and specifications, only Ω^{FCVAR} and Ω^{LR} were significantly affected by a given dummy. The analysis thus shows that wrongly imposing $b = 1$ leads to quantitatively and – more importantly, but less frequently – qualitatively different conclusions. While a unique direction of the bias has not been pinned down, for some dummies of section 5.2, it is observed that substantial differences between the results of Ω^{FCVAR}, Ω^{LR} and Ω^{CVAR} happen when a statistically significant jump is observed for ω^{FCVAR} for the same dummy.

This paper also proposed an economic interpretation of the fractional parameter b as a measure of financial integration. ω^{FCVAR} proved to have more intelligible properties than an alternative measure ω^{PCA} estimated by PCA on excess returns. Plus, the results it gave were far more consistent across methods and specifications. The heterogeneous slopes model (equations (25) and (28)) showed that some announcement days had a strong impact on the average length of memory of the disequilibrium error – interpreted as frictions in the market microstructure model. On the other hand, imposing a maximum value of 1 on ω^{FCVAR} does not correspond to imposing a maximum value of 1 on ω^{PCA}. When $\omega^{PCA} = 1$, it means that the estimated principal component (assumed to be the efficient return) explains everything and implies $r^*_{a,j,t} = r^*_{b,j,t}$ for all t. When $\omega^{FCVAR} = 1$, it only means that underlying prices follow a common stochastic trend and that the long-run disequilibrium error is $I(0)$. An interesting additional exercise would be to allow $b > 1$ in the estimation.[25]

Results concerning the price discovery process, independently of the method used, are less clear-cut than FIT (2015). Their sample of eight years rather than one and a third might have helped. The use of the minute frequency by this study rather than the second frequency might affect the outcome as well.[26] Plus, some stocks have been dropped because it seemed unreasonable to estimate anything with such rarely traded assets. Using the second frequency for series where $p_t = p_{t-1}$ can last for a long time might yield serious autocorrelation problems that are never discussed in FIT (2015). Key observations for the comparison study are the following. For single dummy regressions on price

[25] This was tried and gave decent distributions for ω^{FCVAR} centered around 1. However, it was taking way more time to estimate FCVARs with the algorithm and we fell this extension was going beyond the scope of this paper.

[26] This is in line with Mizrach & Neely (2008) that did not find a significant effect of macroeconomic news using minute frequency data.

discovery shares (not absolute deviations), “All Announcements” is always positive and significant for Ω^{CVAR} regardless of the panel method used. This is in line with FIT (2015). No such effect is found for the fractional measures Ω^{FCVAR} and Ω^{LR}. Finally, in multi-dummies regressions, “All US Announcements (FIT (2015))” is significant and positive regardless of the method for Ω^{CVAR}. Again, no such evidence is found for Ω^{FCVAR} and Ω^{LR}.

This paper shows not only that results obtained from a FCVAR rather than a CVAR differ, but it also argues that time-varying and stock-varying level of financial integration is often the reason of the bias. This goes beyond simple statistical observations by providing a market microstructure justification for the fractional cointegration parameter. By doing so, this study thus proposes an alternative measure of financial integration that has desirable time-series properties and is not affected by the common shock bias of PCA-based measures.

Possible extensions of this paper could include estimation of models that rely even more on the quality of the estimates of $\Omega_{a,j,i}$. For instance, one could be interested in estimating a linear relationship between the size of an information shock and change in price discovery or financial integration. This would be an interesting addition: an announcement day with a surprising outcome is likely to have a different impact on financial integration than a less surprising one. Furthermore, different measures of price discovery could be used, like the well-known method of Hasbrouck (1995). Also, one could do the same inquiry with one-second frequency data to see if the FCVAR is still preferable to the CVAR (which is expected since longer memory has been observed at the minute level).

Answering such technical – but applied – questions is certainly important for validity and accuracy of econometric finance work.

7 Bibliography

Baillie, R. T. (1996). Long memory processes and fractional integration in econometrics. *Journal of Econometrics*, *73*, 5-59.

Bollerslev, T., Osterrieder, D., Sizova, N., & Tauchen, G. (2013). Risk and return: Long-run relations, fractional cointegration, and return predictability. *Journal of Financial Economics*, *108*, 409-424.

Calvi, R. (2010). *Assessing financial integration: a comparison between Europe and East Asia* (No. 423). Directorate General Economic and Monetary Affairs (DG ECFIN), European Commission.

Clark, T. E., & West, K. D. (2007). Approximately normal tests for equal predictive accuracy in nested models. *Journal of Econometrics*, *138*, 291-311.

Donadelli, M., & Paradiso, A. (2014). Is there heterogeneity in financial integration dynamics? Evidence from country and industry emerging market equity indexes. *Journal of International Financial Markets, Institutions and Money*, *32*, 184-218.

Diebold, F. X., & Mariano, R. S. (1995). Comparing predictive accuracy. *Journal of Business & Economic Statistics*, *13*, 253-63.

Dolatabadi, S., Nielsen, M. Ø., & Xu, K. (2014). *A fractionally cointegrated VAR model with deterministic trends and application to commodity futures markets.* QED working paper 1327, Queen's University.

Dolatabadi, S., Narayan, P. K., Nielsen, M., & Xu, K. (2015). *Economic significance of commodity return forecasts from the fractionally cointegrated VAR model*. QED working paper 1337, Queen's University.

Engle, R. F., & Granger, C. W. (1987). Co-integration and error correction: representation, estimation, and testing. *Econometrica*, *55*, 251-276.

Frijns, B., Indriawan, I., & Tourani-Rad, A. (2015). Macroeconomic news announcements and price discovery: Evidence from Canadian–US cross-listed firms. *Journal of Empirical Finance*, *32*, 35-48.

Frijns, B., Gilbert, A., & Tourani-Rad, A. (2010). The dynamics of price discovery for cross-listed shares: evidence from Australia and New Zealand. *Journal of Banking & Finance*, *34*, 498-508.

Gonzalo, J., & Granger, C. (1995). Estimation of common long-memory components in cointegrated systems. *Journal of Business & Economic Statistics*, *13*, 27-35.

Hasbrouck, J. (1995). One security, many markets: Determining the contributions to price discovery. *Journal of Finance*, *50*, 1175-1199.

Jiang, G. J., & Lo, I. (2014). Private information flow and price discovery in the US treasury market. *Journal of Banking & Finance*, *47*, 118-133.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, *12*, 231-254.

Johansen, S., & Nielsen, M. Ø. (2014). *The role of initial values in conditional sum-of-squares estimation of nonstationary fractional time series models*. QED working paper 1300: Queen's University.

Lewis, J. B., & Linzer, D. A. (2005). Estimating regression models in which the dependent variable is based on estimates. *Political Analysis*, *13*, 345-364.

Lok, E., & Kalev, P. S. (2006). The intraday price behaviour of Australian and New Zealand cross-listed stocks. *International Review of Financial Analysis*, *15*, 377-397.

Mizrach, B., & Neely, C. J. (2008). Information shares in the US Treasury market. *Journal of Banking & Finance*, *32*, 1221-1233.

Nellis, J. G. (1982). A principal components analysis of international financial integration under fixed and floating exchange rate regimes. *Applied Economics*, *14*, 339-354.

Narayan, P. K., Ahmed, H. A., & Narayan, S. (2014). Do Momentum-Based Trading Strategies Work in the Commodity Futures Markets?. *Journal of Futures Markets*, *00*, 1-24.

Nielsen, M. Ø., & Morin, L. (2014). *FCVARmodel. m: a Matlab software package for estimation and testing in the fractionally cointegrated VAR model*. QED working paper 1273, Queen's University.

Nielsen, M. Ø., & Popiel, M. K. (2014). *A Matlab program and user's guide for the fractionally cointegrated VAR model*. QED working paper 1330, Queen's University.

Pascual, R., Pascual-Fuster, B., & Climent, F. (2006). Cross-listing, price discovery and the informativeness of the trading process. *Journal of Financial Markets*, *9*, 144-161.

Pesaran, M. H., & Smith, R. (1995). Estimating long-run relationships from dynamic heterogeneous panels. *Journal of Econometrics*, *68*, 79-113.

Pesaran, M. H. (2006). Estimation and inference in large heterogeneous panels with a multifactor error structure. *Econometrica*, *74*, 967-1012.

Petersen, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies*, *22*, 435-480.

Taylor, N. (2011). Time-varying price discovery in fragmented markets. *Applied Financial Economics*, *21*, 717-734.

Volosovych, V. (2011). Measuring financial market integration over the long run: Is there a U-shape?. *Journal of International Money and Finance*, *30*, 1535-1561.

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica*, *48*, 817-838.

8 Appendix

Since a large body of tables to come are similar and take a whole page, common notes will be displayed here.

Table 1: Details can be found in the text or in DNNX (2015).

Table 2: "Ratio Trade" corresponds to $\frac{N_{a,i}}{N_{a,i}+N_{b,i}}$. "Ratio Spread" corresponds to $\frac{S_{a,i}}{S_{a,i}+S_{b,i}}$. "# of Active Minutes" has a maximum of 390 minutes. "ADF Tests rejected" is the percentage of days (out of 339) days which we reject the null of a unit root at the 1% level. The individual models specifications for the ADF test are chosen by an algorithm that set the number of lags to minimize the BIC criterion conditional on no autocorrelation left in the residuals.

Tables 3-4: The percentage reported is the number of specific announcement days divided by the total number of days, 339.

Tables 5-6: "% of rejected $\mathcal{H}_0^{LR}$" is at the 5% level. The whole panel average of $\text{Corr}(\Omega_{a,j,i}^{FCVAR}, \Omega_{a,j,i}^{CVAR})$ is not the average of the by-stock correlations but the correlation computed for the whole panel. "% with AC left" refers to the percentage of estimated models for which autocorrelation still remains in the final specification at the 5% level according to Univariate Q-tests. "% of sign. trends NYSE" and "% of significant trends TSE" refers to the percentage of models that have an unrestricted trend that is significant at the 5% for the NYSE and TSE log prices.

Tables 7-14 & 16-23: These tables display the results to the many regressions of section 5.2 for one-dummy models presented in section 4.2.1. **All elements of $\boldsymbol{W}_{j,i}$ have been multiplied by 100 to avoid useless zeroes in the tables.** Hence, the "points of percentage" interpretation applies. Hence, they only differ by their titles that all have the following form: "Set of Events/Econometric model/Controls or no controls". Plus, tables are split by those which display the first 5 elements of $W_{j,i}$ ($w_{j,i}$) and those which display the last 5 ($|\tilde{w}_{j,i}|$). For all tables, only β_d and its standard error are reported for each model. For each table, * is p-value<0.05, ** is p-value<0.01 and *** is p-value<0.001.

Tables 25-29: These tables display the results to the many regressions of section 5.3 for combination of different general dummies regressions. **All elements of $\boldsymbol{W_{j,i}}$ have been multiplied by 100 to avoid useless zeroes in the tables.** Hence, the "points of percentage" interpretation applies. "Ratio Spread", "Ratio Trade" and t are the elements of Z_i as described in section 4.2.1. Standard errors are in parentheses. * is p-value<0.05, ** is p-value<0.01 and *** is p-value<0.001. The only thing that changes from one table to another is the dependent variable. The reported χ^2 has nothing to do with the theoretical frictions of the model presented in section 4.1.4: it is the usual test statistic for the existence of the regression.

Figure 1-2: These are Epanechnikov kernels. Bandwidth is automatically selected by Stata for each $\Omega_{a,j,i}^{CVAR}$, $\Omega_{a,j,i}^{FCVAR}$ and $\omega_{a,j,i}^{FCVAR}$.

Table 1: FCVAR – CVAR (DNNX (2015))

Variables	Diff. Lags	$\hat{b}$	$se(\hat{b})$	Diff. $\hat{\alpha}_{\perp,1}$
Canola	-1	0.424	0.068	0.391
Cocoa	0	0.217	0.008	-0.845
Copper	-3	0.337	0.032	-0.068
Coffee	-1	0.535	0.056	0.266
Corn	0	0.922	0.044	0.022
Cotton	0	1.025	0.033	-0.007
Crude oil	0	0.699	0.052	0.255
Gold	-2	0.758	0.018	-0.090
Palladium	0	0.987	0.034	-0.010
Silver	-1	0.632	0.048	-0.041
Soybean	0	0.868	0.035	0.031
Soy meal	1	0.614	0.052	-0.249
Soy oil	-1	0.433	0.052	-0.836
Sugar	-1	0.471	0.081	0.095
Wheat	0	0.992	0.050	0.001

Table 2: Properties of Selected Stocks

#	Company Name	Ticker	Stock Information			# of Active Minutes		ADF Tests rejected	
			Market β	Ratio Trade	Ratio Spread	NYSE	TSE	NYSE	TSE
1	Agnico Eagle Mines Limited	AEM	-0.74	0.68	0.51	383	366	11%	10%
2	Agrium Inc.	AGU	0.87	0.59	0.51	349	318	12%	13%
3	Bank of Montreal	BMO	1.33	0.26	0.58	336	367	10%	10%
4	The Bank of Nova Scotia	BNS	1.48	0.20	0.57	340	374	10%	11%
5	Barrick Gold Corporation	ABX	0.19	0.82	0.50	389	355	12%	12%
6	BCE Inc.	BCE	0.56	0.36	0.51	370	359	8%	8%
7	Cameco Corporation	CCJ	1.58	0.63	0.50	376	339	9%	9%
8	Canadian Imperial Bank of Commerce	CM	1.46	0.16	0.62	275	362	8%	9%
9	Canadian National Railway Company	CNI	1.16	0.45	0.51	376	373	9%	9%
10	Canadian Natural Resources Limited	CNQ	1.00	0.52	0.50	386	380	8%	8%
11	Canadian Pacific Railway Limited	CP	1.07	0.68	0.51	345	307	9%	9%
12	CGI Group, Inc.	GIB	1.30	0.22	0.57	271	333	9%	9%
13	Enbridge Inc.	ENB	0.28	0.40	0.52	363	360	11%	12%
14	Encana Corporation	ECA	1.32	0.70	0.49	388	357	11%	10%
15	Enerplus Corporation	ERF	1.17	0.48	0.53	345	321	10%	10%
16	Gildan Activewear Inc.	GIL	0.74	0.37	0.59	256	284	11%	10%
17	Goldcorp Inc.	GG	-0.09	0.72	0.49	388	373	9%	8%
18	Kinross Gold Corporation	KGC	-0.03	0.80	0.50	386	249	8%	8%
19	Manulife Financial Corporation	MFC	1.41	0.34	0.50	366	356	9%	8%
20	Pengrowth Energy Corporation	PGH	2.09	0.61	0.50	345	245	6%	6%
21	Potash Corporation of Saskatchewan Inc.	POT	0.40	0.74	0.49	388	361	11%	10%
22	Precision Drilling Corporation	PDS	1.97	0.62	0.50	370	296	8%	9%
23	Rogers Communications Inc.	RCI	0.96	0.27	0.57	312	338	9%	9%
24	Royal Bank of Canada	RY	1.34	0.24	0.57	351	381	10%	9%
25	Shaw Communications, Inc.	SJR	0.81	0.26	0.52	294	299	8%	6%
26	Sun Life Financial Inc.	SLF	1.15	0.19	0.56	276	347	11%	10%
27	Suncor Energy Inc.	SU	0.67	0.54	0.49	387	379	9%	9%
28	The Toronto-Dominion Bank	TD	1.19	0.30	0.52	372	380	10%	10%
29	TransAlta Corp.	TAC	0.58	0.14	0.55	187	253	7%	6%
30	TransCanada Corporation	TRP	0.72	0.41	0.52	360	359	9%	9%
	Average		0.93	0.46	0.53	344.33	339.03	9%	9%

Table 3: FIT (2014) Announcement Days

Day Type	Percentage of the Total Sample of Days
US - Construction Spending	4.72%
US - Factory Orders	5.01%
US - Trade Balance	5.01%
US - Consumer Confidence Index	5.01%
US - Nonfarm Payroll employment	4.72%
US - Government Budget	5.01%
US - Retail Sales & Business Inventories	5.01%
US - PPI	5.01%
US - CPI	4.72%
US - Housing Starts	4.72%
US - Industrial Production & Capacity Utilization	5.01%
US - Leading Indicators Index	4.42%
US - New Home Sales	4.72%
US - Durable Goods Orders	4.72%
US - Consumer Confidence Index	4.72%
US - Federal Funds Rate	3.24%
US - GDP	4.72%
US - GDP Price Index	4.13%
US - Personal Income	4.72%
US - Chicago PMI	8.85%
US - All Announcements	**70.50%**
CAN - Housing Starts	5.01%
CAN - Unemployment Rate	5.01%
CAN - Interest Rates	3.24%
CAN - Retail Sales	4.72%
CAN - CPI	4.72%
CAN - Current Account Balance	1.18%
CAN - GDP	1.47%
CAN - Capacity Utilization Rate	1.47%
CAN - All Announcements	**23.30%**
All Announcements	**81.42%**

Table 4: TE3 Announcement Days

Day Type	Percentage of the Total Sample of Days
US - ISM Manufacturing PMI	4.72%
US - Fed Chairman Yellen Speaks	5.01%
US - Balance of Trade	5.01%
US - ADP Employment Change	5.01%
US - FOMC Minutes	3.24%
US - Non Farm Payrolls & Unemployment Rate	4.72%
US - Retail Sales	5.01%
US - CPI	4.72%
US - Initial Jobless Claims	0.29%
US - Existing Home Sales	1.18%
US - Durable Goods Orders	1.47%
US - Consumer Confidence Index	4.72%
US - QE Treasuries & MBS	2.06%
US - QE Total	1.47%
US - Federal Funds Rate	3.24%
US - GDP	4.72%
US - Pending Home Sales	1.18%
US - ISM Non-Manufacturing PMI	4.72%
US - Reuters Michigan Consumer Sentiment	1.18%
US - Midterm Elections	0.29%
US - FOMC Economic Projections	0.29%
US - All Announcements	**46.02%**
CAN - Employment Rate	2.95%
CAN - Interest Rates	2.95%
CAN - GDP MoM	0.29%
CAN - Ivey PMI S.A.	0.59%
CAN - Core Inflation Rate	1.18%
CAN - GDP Growth QoQ	1.77%
CAN - Inflation Rate	0.88%
CAN - Unemployment Rate	2.95%
CAN - All Announcements	**11.80%**
All Announcements	**51.62%**

Table 5: Results of the Estimation Algorithm Part 1

Ticker	% of rejected $\mathcal{H}_0^{LR}$	Corr($\Omega_{a,j,i}^{FCVAR}$, $\Omega_{a,j,i}^{CVAR}$)	$\Omega_{a,j,i}^{FCVAR}$	$\Omega_{a,j,i}^{CVAR}$	$\omega_{j,i}^{FCVAR}$	$\omega_{j,i}^{PCA}$
AEM	40.71	0.52	0.75	0.75	0.89	0.94
AGU	49.85	0.46	0.73	0.72	0.89	0.94
BMO	43.07	0.55	0.36	0.36	0.90	0.94
BNS	38.94	0.54	0.34	0.32	0.91	0.94
ABX	48.38	0.48	0.81	0.78	0.89	0.94
BCE	45.43	0.64	0.58	0.57	0.88	0.94
CCJ	51.92	0.42	0.78	0.74	0.87	0.94
CM	38.35	0.60	0.23	0.23	0.93	0.94
CNI	47.49	0.52	0.62	0.61	0.89	0.94
CNQ	53.10	0.47	0.69	0.68	0.87	0.94
CP	50.15	0.56	0.77	0.75	0.89	0.94
GIB	38.35	0.66	0.34	0.34	0.91	0.94
ENB	46.02	0.64	0.59	0.59	0.89	0.94
ECA	64.90	0.51	0.77	0.75	0.85	0.94
ERF	47.49	0.60	0.69	0.67	0.88	0.94
GIL	46.02	0.75	0.48	0.48	0.90	0.94
GG	45.43	0.51	0.78	0.76	0.87	0.94
KGC	47.20	0.59	0.71	0.71	0.85	0.92
MFC	62.83	0.55	0.66	0.62	0.82	0.94
PGH	50.74	0.59	0.70	0.69	0.87	0.93
POT	61.95	0.50	0.77	0.75	0.85	0.94
PDS	52.80	0.47	0.76	0.76	0.87	0.93
RCI	35.10	0.70	0.43	0.41	0.92	0.94
RY	39.23	0.71	0.36	0.35	0.92	0.94
SJR	52.51	0.54	0.56	0.52	0.88	0.94
SLF	39.23	0.67	0.34	0.31	0.92	0.94
SU	59.88	0.58	0.72	0.67	0.85	0.94
TD	59.00	0.68	0.52	0.50	0.85	0.94
TAC	34.51	0.69	0.40	0.40	0.91	0.94
TRP	46.61	0.63	0.57	0.55	0.90	0.94
Minimum	34.51	0.42	0.23	0.23	0.82	0.92
Maximum	64.90	0.75	0.81	0.78	0.93	0.94
Whole Panel Average	47.91	0.74	0.59	0.58	0.88	0.94

Table 6: Results of the Estimation Algorithm Part 2

	Average # of lags		% with AC left		% of sign. trends NYSE		% of significant trends TSE	
Ticker	FCVAR	CVAR	FCVAR	CVAR	FCVAR	CVAR	FCVAR	CVAR
AEM	1.74	2.99	7.37	19.76	31.86	71.68	71.09	96.76
AGU	2.20	4.08	6.19	29.20	56.34	95.28	80.24	99.71
BMO	1.61	2.76	3.83	18.88	76.11	99.71	63.72	98.23
BNS	1.57	2.82	3.24	19.17	74.93	99.12	60.18	95.87
ABX	1.65	3.12	5.01	19.47	25.37	64.90	73.16	96.76
BCE	1.63	2.74	5.01	19.47	57.82	98.23	68.44	99.41
CCJ	1.82	3.51	6.19	18.88	33.92	78.17	70.21	97.94
CM	1.47	2.57	4.42	17.70	83.78	99.71	62.83	96.46
CNI	1.70	3.18	5.01	21.24	54.87	97.05	68.14	98.23
CNQ	1.70	3.43	2.65	19.17	38.64	88.79	58.70	98.53
CP	2.05	4.04	5.90	26.55	49.26	92.33	82.01	99.12
GIB	1.73	3.25	4.72	27.73	75.81	97.35	64.01	89.97
ENB	1.85	3.44	5.31	25.66	55.46	95.28	68.73	97.35
ECA	2.00	3.53	5.31	24.19	28.02	81.71	67.26	98.53
ERF	2.14	4.01	6.78	21.83	42.48	73.45	73.45	96.17
GIL	1.78	3.17	2.65	26.25	74.04	96.17	74.04	95.87
GG	1.45	2.68	5.90	17.99	27.73	77.58	68.44	97.05
KGC	1.97	3.84	5.01	23.60	29.50	53.69	70.21	95.58
MFC	1.71	3.08	4.72	15.04	35.40	96.17	62.54	98.53
PGH	1.87	3.63	3.83	21.83	32.74	63.42	74.04	95.28
POT	1.89	3.17	4.13	21.83	36.87	92.92	69.03	98.53
PDS	2.11	3.92	6.49	26.84	28.02	60.18	72.86	98.53
RCI	1.79	3.44	5.60	24.19	76.70	97.94	69.91	96.46
RY	1.31	2.38	2.95	15.34	70.21	100.00	57.23	98.23
SJR	1.89	3.50	2.36	22.42	66.67	98.82	74.34	99.71
SLF	1.70	2.98	2.36	16.22	76.99	98.53	62.83	92.92
SU	1.88	3.08	5.60	23.30	35.10	93.22	60.77	98.82
TD	1.65	2.95	4.42	19.17	50.44	99.12	52.80	98.23
TAC	1.14	2.58	1.18	15.34	81.12	99.12	70.50	95.28
TRP	1.78	3.45	3.54	22.71	61.95	97.05	71.39	99.41
Minimum	1.14	2.38	1.18	15.04	25.37	53.69	52.80	89.97
Maximum	2.20	4.08	7.37	29.20	83.78	100.00	82.01	99.71
Whole Panel Average	1.76	3.24	4.59	21.37	52.27	88.55	68.10	97.25

Table 7: FIT (2014) Events, Homogenous Slopes, No Controls

	$\Omega^{CVAR}_{a,j,i}$		$\Omega^{FCVAR}_{a,j,i}$		$\Omega^{LR}_{a,j,i}$		$\omega^{FCVAR}_{j,i}$		$\omega^{PCA}_{j,i}$	
Dummies	β_d	SE	β_d	SE	β_d	SE	β_d	SE	β_d	SE
US - Construction Spending	1.56	(1.14)	2.01*	(1.02)	2.68*	(1.12)	0.65	(0.91)	0.01	(0.04)
US - Factory Orders	-1.19	(1.10)	0.26	(0.99)	-1.01	(1.08)	-0.47	(0.88)	-0.03	(0.04)
US - Trade Balance	-0.44	(1.10)	-0.31	(0.99)	0.30	(1.08)	-0.98	(0.88)	0.06	(0.04)
US - Consumer Confidence Index	1.52	(1.10)	1.68	(0.99)	1.38	(1.08)	-0.48	(0.88)	0.01	(0.04)
US - Nonfarm Payroll employment	0.72	(1.13)	-0.01	(1.02)	0.43	(1.11)	-0.08	(0.91)	0.06	(0.04)
US - Government Budget	-1.06	(1.10)	-1.29	(0.99)	-1.63	(1.08)	0.97	(0.88)	-0.11**	(0.04)
US - Retail Sales & Business Inventories	-0.50	(1.10)	0.18	(0.99)	0.65	(1.08)	1.18	(0.88)	0.12***	(0.04)
US - PPI	0.66	(1.10)	0.60	(0.99)	0.72	(1.08)	0.72	(0.88)	-0.08*	(0.04)
US - CPI	-2.09	(1.13)	-2.94**	(1.01)	-3.20**	(1.11)	1.79*	(0.91)	0.00	(0.04)
US - Housing Starts	1.25	(1.13)	0.21	(1.02)	1.62	(1.11)	-1.09	(0.91)	-0.03	(0.04)
US - Industrial Production & Capacity Utilization	-0.50	(1.11)	-0.80	(1.00)	-1.24	(1.09)	-0.35	(0.88)	-0.04	(0.04)
US - Leading Indicators Index	1.03	(1.17)	0.37	(1.05)	0.27	(1.15)	0.17	(0.94)	0.03	(0.04)
US - New Home Sales	1.78	(1.13)	2.18*	(1.02)	2.12	(1.11)	1.11	(0.91)	-0.01	(0.04)
US - Durable Goods Orders	0.57	(1.13)	0.03	(1.02)	0.15	(1.11)	-0.12	(0.91)	0.03	(0.04)
US - Consumer Confidence Index	1.28	(1.13)	0.92	(1.02)	1.48	(1.11)	0.36	(0.91)	-0.01	(0.04)
US - Federal Funds Rate	-1.18	(1.36)	-2.02	(1.22)	-1.87	(1.34)	2.87**	(1.08)	-0.05	(0.05)
US - GDP	-1.55	(1.13)	-1.03	(1.02)	-1.39	(1.11)	-0.64	(0.91)	0.03	(0.04)
US - GDP Price Index	-1.61	(1.21)	-1.17	(1.09)	-1.71	(1.19)	-0.06	(0.97)	0.03	(0.04)
US - Personal Income	2.48*	(1.13)	2.63**	(1.02)	2.42*	(1.11)	-0.53	(0.91)	-0.05	(0.04)
US - Chicago PMI	2.71**	(0.83)	1.59*	(0.75)	2.40**	(0.81)	0.08	(0.68)	-0.04	(0.03)
US - All Announcements	1.17*	(0.54)	0.53	(0.49)	0.82	(0.53)	0.37	(0.42)	-0.01	(0.02)
CAN - Housing Starts	0.53	(1.10)	-0.64	(0.99)	-0.54	(1.08)	1.51	(0.88)	0.02	(0.04)
CAN - Unemployment Rate	1.81	(1.10)	1.18	(0.99)	1.56	(1.08)	0.93	(0.88)	0.05	(0.04)
CAN - Interest Rates	1.38	(1.36)	-0.21	(1.23)	-0.03	(1.34)	-0.64	(1.09)	0.01	(0.05)
CAN - Retail Sales	-0.55	(1.13)	0.57	(1.02)	-0.10	(1.11)	-0.01	(0.91)	0.03	(0.04)
CAN - CPI	-3.03**	(1.12)	-1.81	(1.02)	-3.07**	(1.10)	-0.76	(0.91)	0.04	(0.04)
CAN - Current Account Balance	1.31	(2.25)	-2.61	(2.03)	-2.20	(2.21)	-1.47	(1.79)	0.04	(0.08)
CAN - GDP	-1.50	(2.02)	0.88	(1.81)	0.89	(1.98)	-0.49	(1.60)	-0.15*	(0.07)
CAN - Capacity Utilization Rate	-0.89	(2.02)	-0.80	(1.82)	-1.72	(1.98)	-2.76	(1.60)	0.09	(0.07)
CAN - All Announcements	-0.01	(0.58)	-0.28	(0.52)	-0.59	(0.57)	-0.21	(0.46)	0.03	(0.02)
All Announcements	1.42*	(0.62)	0.57	(0.56)	0.71	(0.61)	0.32	(0.50)	0.02	(0.02)

Table 8: FIT (2014) Events, Homogenous Slopes, With Controls

	$\Omega^{CVAR}_{a,j,i}$		$\Omega^{FCVAR}_{a,j,i}$		$\Omega^{LR}_{a,j,i}$		$\omega^{FCVAR}_{j,i}$		$\omega^{PCA}_{j,i}$	
Dummies	β_d	SE	β_d	SE	β_d	SE	β_d	SE	β_d	SE
US - Construction Spending	1.17	(1.13)	1.61	(1.01)	2.43*	(1.11)	0.65	(0.87)	-0.01	(0.04)
US - Factory Orders	-0.95	(1.09)	0.51	(0.97)	-0.87	(1.07)	-0.64	(0.84)	-0.01	(0.04)
US - Trade Balance	-0.25	(1.08)	-0.22	(0.97)	0.46	(1.07)	-0.81	(0.84)	0.06	(0.04)
US - Consumer Confidence Index	1.42	(1.08)	1.65	(0.96)	1.37	(1.06)	-0.54	(0.84)	0.02	(0.04)
US - Nonfarm Payroll employment	0.72	(1.12)	0.05	(1.00)	0.54	(1.10)	0.01	(0.86)	0.04	(0.04)
US - Government Budget	-0.81	(1.09)	-1.12	(0.97)	-1.40	(1.07)	1.11	(0.84)	-0.12**	(0.04)
US - Retail Sales & Business Inventories	-0.38	(1.09)	0.11	(0.97)	0.58	(1.07)	1.08	(0.84)	0.12**	(0.04)
US - PPI	0.70	(1.08)	0.66	(0.97)	0.82	(1.06)	0.61	(0.84)	-0.08	(0.04)
US - CPI	-2.20*	(1.11)	-2.85**	(0.99)	-3.11**	(1.09)	1.86*	(0.86)	0.01	(0.04)
US - Housing Starts	1.84	(1.11)	0.66	(1.00)	1.93	(1.10)	-0.92	(0.87)	-0.04	(0.04)
US - Industrial Production & Capacity Utilization	-0.37	(1.09)	-0.74	(0.97)	-1.18	(1.07)	-0.43	(0.84)	-0.03	(0.04)
US - Leading Indicators Index	1.02	(1.15)	0.32	(1.03)	0.23	(1.13)	0.22	(0.89)	0.04	(0.04)
US - New Home Sales	1.48	(1.12)	1.94	(1.00)	1.85	(1.10)	1.24	(0.86)	0.00	(0.04)
US - Durable Goods Orders	0.34	(1.12)	-0.41	(1.00)	-0.29	(1.10)	-0.35	(0.86)	0.06	(0.04)
US - Consumer Confidence Index	1.25	(1.12)	0.96	(1.00)	1.40	(1.10)	0.03	(0.87)	0.01	(0.04)
US - Federal Funds Rate	-1.32	(1.34)	-2.20	(1.20)	-1.88	(1.32)	2.83**	(1.03)	-0.04	(0.05)
US - GDP	-1.43	(1.12)	-1.15	(1.01)	-1.57	(1.10)	-0.75	(0.87)	0.02	(0.04)
US - GDP Price Index	-1.52	(1.20)	-1.22	(1.07)	-1.86	(1.18)	-0.37	(0.92)	0.03	(0.05)
US - Personal Income	2.16	(1.12)	2.32*	(1.00)	2.10	(1.10)	-0.66	(0.86)	-0.06	(0.04)
US - Chicago PMI	2.60**	(0.81)	1.43	(0.73)	2.28**	(0.80)	-0.16	(0.65)	-0.03	(0.03)
US - All Announcements	1.15*	(0.53)	0.39	(0.48)	0.73	(0.52)	0.33	(0.40)	0.00	(0.02)
CAN - Housing Starts	0.27	(1.08)	-0.88	(0.97)	-0.81	(1.07)	1.48	(0.84)	0.01	(0.04)
CAN - Unemployment Rate	1.72	(1.08)	1.09	(0.97)	1.51	(1.06)	0.87	(0.84)	0.03	(0.04)
CAN - Interest Rates	1.86	(1.35)	0.13	(1.21)	0.22	(1.33)	-0.74	(1.04)	0.03	(0.05)
CAN - Retail Sales	0.03	(1.14)	1.17	(1.02)	0.26	(1.12)	0.03	(0.88)	0.02	(0.04)
CAN - CPI	-2.59*	(1.13)	-1.31	(1.01)	-2.80*	(1.11)	-0.73	(0.88)	0.02	(0.04)
CAN - Current Account Balance	1.32	(2.22)	-3.07	(1.98)	-2.51	(2.18)	-1.44	(1.70)	0.06	(0.08)
CAN - GDP	-0.05	(2.03)	2.53	(1.81)	2.48	(1.99)	0.22	(1.55)	-0.15*	(0.08)
CAN - Capacity Utilization Rate	-1.05	(1.99)	-1.08	(1.78)	-1.96	(1.95)	-2.82	(1.52)	0.11	(0.07)
CAN - All Announcements	0.27	(0.58)	-0.05	(0.52)	-0.44	(0.57)	-0.09	(0.44)	0.02	(0.02)
All Announcements	1.62**	(0.62)	0.59	(0.56)	0.74	(0.61)	0.40	(0.48)	0.01	(0.02)

Table 9: FIT (2014) Events, Heterogeneous Slopes, No Controls

	$\Omega^{CVAR}_{a,j,i}$		$\Omega^{FCVAR}_{a,j,i}$		$\Omega^{LR}_{a,j,i}$		$\omega^{FCVAR}_{j,i}$		$\omega^{PCA}_{j,i}$	
Dummies	β_d	SE	β_d	SE	β_d	SE	β_d	SE	β_d	SE
US - Construction Spending	2.71*	(1.15)	2.98***	(0.69)	3.39***	(0.88)	1.33	(0.72)	-0.34***	(0.07)
US - Factory Orders	-0.88	(0.98)	0.32	(1.13)	0.37	(1.17)	0.03	(0.86)	-0.06	(0.03)
US - Trade Balance	-0.48	(0.87)	0.75	(1.12)	0.50	(1.08)	-0.69	(1.05)	0.04	(0.04)
US - Consumer Confidence Index	0.72	(0.68)	2.42***	(0.56)	1.29	(0.80)	0.12	(0.82)	0.10**	(0.04)
US - Nonfarm Payroll employment	0.66	(0.95)	0.95	(0.89)	1.07	(1.08)	0.01	(0.78)	0.06	(0.04)
US - Government Budget	-0.87	(1.14)	-0.69	(0.94)	-1.17	(0.97)	1.56	(0.84)	-0.12***	(0.03)
US - Retail Sales & Business Inventories	-0.10	(1.08)	0.04	(0.77)	0.40	(0.83)	1.26	(0.65)	0.04	(0.03)
US - PPI	0.66	(1.23)	0.39	(1.27)	0.74	(1.24)	0.88	(0.64)	0.00	(0.03)
US - CPI	-1.84	(0.99)	-1.50	(0.88)	-1.63	(0.98)	1.68*	(0.75)	-0.04	(0.02)
US - Housing Starts	0.06	(1.23)	-0.26	(0.87)	0.57	(1.21)	-0.61	(1.05)	-0.06*	(0.03)
US - Industrial Production & Capacity Utilization	-0.39	(0.99)	-0.93	(1.03)	-1.05	(1.15)	0.09	(0.73)	0.03	(0.03)
US - Leading Indicators Index	1.60	(0.95)	0.52	(1.14)	0.52	(0.99)	0.39	(0.93)	0.10***	(0.03)
US - New Home Sales	1.33	(1.15)	0.99	(0.95)	0.78	(1.19)	0.93	(0.75)	0.09**	(0.03)
US - Durable Goods Orders	-0.17	(0.90)	-1.23	(0.80)	-0.91	(0.84)	-0.27	(0.84)	0.12***	(0.02)
US - Consumer Confidence Index	1.07	(0.61)	1.42	(0.82)	1.91*	(0.75)	0.61	(0.51)	0.09**	(0.03)
US - Federal Funds Rate	-1.04	(1.39)	-2.90*	(1.24)	-2.26	(1.33)	3.24***	(0.64)	0.16***	(0.03)
US - GDP	-2.24*	(0.88)	-2.34*	(1.04)	-2.49*	(1.03)	-0.01	(0.85)	0.19***	(0.02)
US - GDP Price Index	-1.74	(0.90)	-1.54	(0.99)	-2.17*	(0.99)	0.12	(0.77)	0.63***	(0.02)
US - Personal Income	1.99*	(0.99)	1.40	(1.21)	1.24	(1.11)	-0.09	(0.78)	0.19***	(0.02)
US - Chicago PMI	2.28***	(0.61)	1.00	(0.58)	1.59*	(0.63)	0.21	(0.51)	0.31***	(0.02)
US - All Announcements	0.76	(0.41)	-0.09	(0.42)	0.06	(0.41)	0.66	(0.40)	-0.21***	(0.02)
CAN - Housing Starts	0.93	(1.02)	0.51	(1.14)	0.25	(1.04)	1.23*	(0.53)	0.16***	(0.03)
CAN - Unemployment Rate	1.47	(0.86)	2.34*	(0.91)	2.22*	(0.98)	0.69	(0.66)	0.20***	(0.04)
CAN - Interest Rates	1.21	(1.05)	0.41	(1.09)	0.69	(1.05)	-0.97	(1.03)	-0.13***	(0.02)
CAN - Retail Sales	-0.43	(0.97)	0.09	(0.69)	0.03	(1.00)	0.14	(0.97)	0.04	(0.02)
CAN - CPI	-2.02	(1.09)	-0.83	(1.01)	-1.76	(1.04)	-1.24	(0.75)	0.06	(0.04)
CAN - Current Account Balance	1.85	(1.96)	-0.51	(2.00)	-0.74	(1.67)	-0.75	(1.68)	-0.47***	(0.04)
CAN - GDP	-1.62	(2.08)	0.94	(1.92)	0.28	(2.12)	0.49	(1.48)	-0.04	(0.05)
CAN - Capacity Utilization Rate	-1.14	(1.83)	-1.28	(1.54)	-1.73	(1.76)	-1.49	(1.65)	0.29***	(0.04)
CAN - All Announcements	0.07	(0.52)	0.29	(0.55)	0.05	(0.46)	-0.49	(0.47)	-0.11***	(0.02)
All Announcements	1.05*	(0.52)	0.20	(0.51)	0.32	(0.59)	0.25	(0.41)	-0.40***	(0.02)

Table 10: FIT (2014) Events, Heterogeneous Slopes, With Controls

	$\Omega_{a,j,i}^{CVAR}$		$\Omega_{a,j,i}^{FCVAR}$		$\Omega_{a,j,i}^{LR}$		$\omega_{j,i}^{FCVAR}$		$\omega_{j,i}^{PCA}$	
Dummies	β_d	SE	β_d	SE	β_d	SE	β_d	SE	β_d	SE
US - Construction Spending	2.38*	(1.13)	2.64***	(0.66)	3.11***	(0.87)	1.35	(0.72)	-0.25***	(0.07)
US - Factory Orders	-0.76	(0.98)	0.48	(1.13)	0.50	(1.17)	0.08	(0.86)	0.02	(0.03)
US - Trade Balance	-0.32	(0.86)	0.83	(1.11)	0.61	(1.08)	-0.57	(1.03)	0.11*	(0.04)
US - Consumer Confidence Index	0.66	(0.68)	2.35***	(0.56)	1.22	(0.81)	0.11	(0.82)	0.14***	(0.03)
US - Nonfarm Payroll employment	0.93	(0.92)	1.17	(0.88)	1.23	(1.08)	0.21	(0.77)	0.32***	(0.04)
US - Government Budget	-0.62	(1.14)	-0.48	(0.95)	-1.04	(0.98)	1.51	(0.85)	-0.19***	(0.03)
US - Retail Sales & Business Inventories	-0.03	(1.07)	0.16	(0.78)	0.43	(0.80)	1.14	(0.65)	-0.05	(0.03)
US - PPI	0.65	(1.23)	0.37	(1.27)	0.74	(1.24)	0.87	(0.64)	-0.10***	(0.03)
US - CPI	-1.74	(1.00)	-1.41	(0.86)	-1.63	(0.96)	1.64*	(0.74)	0.03	(0.02)
US - Housing Starts	0.50	(1.21)	0.15	(0.91)	0.79	(1.15)	-0.51	(1.06)	0.01	(0.03)
US - Industrial Production & Capacity Utilization	-0.13	(0.99)	-0.75	(1.07)	-0.95	(1.18)	0.06	(0.74)	-0.10***	(0.03)
US - Leading Indicators Index	1.71	(0.93)	0.62	(1.14)	0.57	(1.00)	0.32	(0.94)	0.02	(0.03)
US - New Home Sales	1.06	(1.18)	0.75	(0.95)	0.66	(1.20)	0.92	(0.74)	0.11***	(0.03)
US - Durable Goods Orders	-0.33	(0.89)	-1.39	(0.80)	-1.06	(0.84)	-0.36	(0.84)	0.11***	(0.02)
US - Consumer Confidence Index	0.83	(0.63)	1.18	(0.80)	1.68*	(0.74)	0.44	(0.53)	0.05*	(0.03)
US - Federal Funds Rate	-1.40	(1.41)	-3.25**	(1.23)	-2.53	(1.32)	3.09***	(0.61)	0.07**	(0.03)
US - GDP	-2.26*	(0.90)	-2.33*	(1.04)	-2.55*	(1.05)	-0.14	(0.87)	0.10***	(0.02)
US - GDP Price Index	-1.92*	(0.97)	-1.88	(1.01)	-2.36*	(1.04)	-0.13	(0.79)	0.12***	(0.02)
US - Personal Income	1.82	(0.98)	1.23	(1.21)	1.07	(1.11)	-0.15	(0.78)	0.10***	(0.02)
US - Chicago PMI	1.93**	(0.60)	0.67	(0.59)	1.31*	(0.60)	-0.04	(0.51)	0.11***	(0.02)
US - All Announcements	0.74	(0.40)	-0.15	(0.43)	0.02	(0.40)	0.60	(0.40)	-0.08***	(0.02)
CAN - Housing Starts	0.68	(1.02)	0.29	(1.14)	0.06	(1.05)	1.14*	(0.51)	0.17***	(0.03)
CAN - Unemployment Rate	1.35	(0.86)	2.19*	(0.91)	2.13*	(0.99)	0.68	(0.67)	0.22***	(0.03)
CAN - Interest Rates	1.74	(1.02)	0.93	(1.07)	1.10	(1.06)	-0.87	(1.05)	-0.07**	(0.03)
CAN - Retail Sales	0.21	(0.97)	0.97	(0.62)	0.47	(1.06)	-0.08	(0.98)	-0.01	(0.02)
CAN - CPI	-1.69	(1.06)	-0.08	(1.01)	-1.51	(1.08)	-1.44	(0.76)	0.05	(0.05)
CAN - Current Account Balance	2.11	(2.02)	-0.49	(2.04)	-0.84	(1.69)	-0.51	(1.69)	0.07	(0.04)
CAN - GDP	0.29	(2.24)	3.38	(1.84)	1.95	(2.22)	1.02	(1.66)	-0.02	(0.07)
CAN - Capacity Utilization Rate	-1.20	(1.83)	-1.36	(1.55)	-1.79	(1.77)	-1.55	(1.65)	0.25***	(0.04)
CAN - All Announcements	0.51	(0.49)	0.71	(0.53)	0.37	(0.44)	-0.39	(0.48)	0.15***	(0.03)
All Announcements	1.43**	(0.48)	0.51	(0.46)	0.55	(0.53)	0.29	(0.43)	-0.05**	(0.02)

Table 11: FIT (2014) Events, Homogenous Slopes, No Controls

Dummies	$\left\|\widetilde{\Omega}_{a,j,i}^{CVAR}\right\|$ β_d	SE	$\left\|\widetilde{\Omega}_{a,j,i}^{FCVAR}\right\|$ β_d	SE	$\left\|\widetilde{\Omega}_{a,j,i}^{LR}\right\|$ β_d	SE	$\left\|\tilde{\omega}_{j,i}^{FCVAR}\right\|$ β_d	SE	$\left\|\tilde{\omega}_{j,i}^{PCA}\right\|$ β_d	SE
US - Construction Spending	-0.79	(0.65)	-0.77	(0.66)	-0.88	(0.68)	-0.34	(0.64)	0.02	(0.04)
US - Factory Orders	-0.35	(0.63)	0.18	(0.64)	0.54	(0.66)	-0.03	(0.62)	0.05	(0.04)
US - Trade Balance	0.97	(0.63)	1.33*	(0.64)	1.01	(0.66)	0.76	(0.62)	-0.04	(0.04)
US - Consumer Confidence Index	-0.80	(0.63)	-1.08	(0.64)	-1.33*	(0.66)	0.45	(0.62)	0.02	(0.04)
US - Nonfarm Payroll employment	-0.15	(0.65)	-0.09	(0.66)	0.24	(0.68)	-0.62	(0.64)	0.00	(0.04)
US - Government Budget	-0.54	(0.63)	-0.50	(0.64)	-0.93	(0.66)	-1.09	(0.62)	0.01	(0.04)
US - Retail Sales & Business Inventories	-1.04	(0.63)	0.94	(0.64)	-0.88	(0.66)	-0.23	(0.62)	-0.04	(0.04)
US - PPI	0.40	(0.63)	0.23	(0.65)	0.38	(0.67)	-0.63	(0.62)	0.06	(0.04)
US - CPI	1.10	(0.65)	1.01	(0.66)	1.14	(0.68)	-0.79	(0.64)	-0.07	(0.04)
US - Housing Starts	-0.35	(0.65)	-0.60	(0.66)	-0.30	(0.69)	0.98	(0.63)	0.05	(0.04)
US - Industrial Production & Capacity Utilization	-0.95	(0.63)	0.22	(0.65)	-0.39	(0.67)	0.43	(0.62)	0.00	(0.04)
US - Leading Indicators Index	-0.13	(0.67)	-0.27	(0.68)	-0.52	(0.71)	0.29	(0.66)	-0.01	(0.04)
US - New Home Sales	-0.68	(0.65)	0.14	(0.66)	0.21	(0.69)	-0.84	(0.64)	0.01	(0.04)
US - Durable Goods Orders	-0.58	(0.65)	-1.57*	(0.66)	-0.71	(0.68)	-0.20	(0.64)	-0.06	(0.04)
US - Consumer Confidence Index	-0.92	(0.65)	-1.46*	(0.66)	-1.57*	(0.68)	-0.84	(0.64)	-0.08*	(0.04)
US - Federal Funds Rate	-0.14	(0.78)	-0.92	(0.79)	-0.49	(0.82)	-1.48	(0.76)	0.02	(0.05)
US - GDP	0.39	(0.65)	0.57	(0.66)	0.20	(0.69)	0.81	(0.64)	0.00	(0.04)
US - GDP Price Index	0.89	(0.69)	1.08	(0.71)	0.60	(0.73)	0.48	(0.68)	-0.02	(0.04)
US - Personal Income	1.50*	(0.65)	0.67	(0.66)	0.88	(0.68)	0.17	(0.64)	0.03	(0.04)
US - Chicago PMI	0.11	(0.49)	-0.49	(0.49)	-0.12	(0.51)	0.46	(0.47)	0.03	(0.03)
US - All Announcements	-0.84**	(0.30)	-0.54	(0.31)	-0.88**	(0.32)	-0.15	(0.30)	0.00	(0.02)
CAN - Housing Starts	0.69	(0.63)	-0.13	(0.64)	0.59	(0.66)	-1.04	(0.62)	-0.02	(0.04)
CAN - Unemployment Rate	0.33	(0.63)	-0.20	(0.64)	0.25	(0.67)	-1.03	(0.62)	-0.02	(0.04)
CAN - Interest Rates	-0.40	(0.78)	0.98	(0.79)	0.66	(0.82)	0.21	(0.76)	0.02	(0.05)
CAN - Retail Sales	-0.51	(0.65)	-0.09	(0.66)	-0.80	(0.68)	0.26	(0.64)	-0.02	(0.04)
CAN - CPI	0.72	(0.65)	0.55	(0.66)	0.66	(0.68)	0.45	(0.64)	-0.04	(0.04)
CAN - Current Account Balance	1.70	(1.28)	0.90	(1.31)	0.79	(1.35)	1.13	(1.25)	-0.10	(0.07)
CAN - GDP	2.40*	(1.14)	1.81	(1.17)	3.11**	(1.20)	0.98	(1.12)	-0.01	(0.07)
CAN - Capacity Utilization Rate	1.02	(1.15)	1.06	(1.17)	0.64	(1.21)	1.53	(1.12)	-0.02	(0.07)
CAN - All Announcements	0.82*	(0.33)	0.57	(0.33)	0.76*	(0.34)	0.09	(0.32)	-0.03	(0.02)
All Announcements	-0.39	(0.36)	-0.25	(0.36)	-0.44	(0.37)	-0.11	(0.35)	-0.03	(0.02)

Table 12: FIT (2014) Events, Homogenous Slopes, With Controls

	$\left\|\widetilde{\Omega}_{a,j,i}^{CVAR}\right\|$		$\left\|\widetilde{\Omega}_{a,j,i}^{FCVAR}\right\|$		$\left\|\widetilde{\Omega}_{a,j,i}^{LR}\right\|$		$\left\|\tilde{\omega}_{j,i}^{FCVAR}\right\|$		$\left\|\tilde{\omega}_{j,i}^{PCA}\right\|$	
Dummies	β_d	SE	β_d	SE	β_d	SE	β_d	SE	β_d	SE
US - Construction Spending	-0.63	(0.65)	-0.52	(0.65)	-0.64	(0.67)	-0.29	(0.63)	0.01	(0.04)
US - Factory Orders	-0.45	(0.63)	0.18	(0.63)	0.43	(0.65)	0.01	(0.61)	0.06	(0.04)
US - Trade Balance	0.97	(0.62)	1.23*	(0.62)	0.99	(0.64)	0.80	(0.61)	-0.04	(0.04)
US - Consumer Confidence Index	-0.76	(0.62)	-1.01	(0.62)	-1.27*	(0.64)	0.51	(0.61)	0.03	(0.04)
US - Nonfarm Payroll employment	-0.07	(0.64)	-0.09	(0.65)	0.31	(0.66)	-0.63	(0.63)	0.00	(0.04)
US - Government Budget	-0.65	(0.63)	-0.68	(0.63)	-1.07	(0.64)	-1.19	(0.61)	0.02	(0.04)
US - Retail Sales & Business Inventories	-1.17	(0.62)	0.83	(0.63)	-0.98	(0.64)	-0.24	(0.61)	-0.03	(0.04)
US - PPI	0.37	(0.63)	0.15	(0.63)	0.38	(0.64)	-0.62	(0.61)	0.07	(0.04)
US - CPI	1.03	(0.64)	0.97	(0.64)	1.09	(0.66)	-0.78	(0.63)	-0.07	(0.04)
US - Housing Starts	-0.49	(0.65)	-0.85	(0.65)	-0.46	(0.67)	0.89	(0.63)	0.06	(0.04)
US - Industrial Production & Capacity Utilization	-1.03	(0.62)	0.09	(0.63)	-0.51	(0.65)	0.40	(0.61)	0.00	(0.04)
US - Leading Indicators Index	-0.15	(0.67)	-0.28	(0.67)	-0.50	(0.69)	0.27	(0.65)	-0.03	(0.04)
US - New Home Sales	-0.55	(0.64)	0.32	(0.65)	0.39	(0.67)	-0.84	(0.63)	0.01	(0.04)
US - Durable Goods Orders	-0.52	(0.64)	-1.40*	(0.64)	-0.60	(0.66)	-0.12	(0.63)	-0.07	(0.04)
US - Consumer Confidence Index	-0.85	(0.64)	-1.35*	(0.64)	-1.46*	(0.66)	-0.77	(0.63)	-0.08*	(0.04)
US - Federal Funds Rate	-0.07	(0.77)	-0.69	(0.77)	-0.31	(0.80)	-1.43	(0.75)	0.01	(0.05)
US - GDP	0.40	(0.64)	0.72	(0.65)	0.35	(0.67)	0.85	(0.63)	0.00	(0.04)
US - GDP Price Index	0.84	(0.69)	1.13	(0.69)	0.66	(0.71)	0.56	(0.67)	-0.01	(0.05)
US - Personal Income	1.58*	(0.64)	0.74	(0.64)	1.01	(0.66)	0.16	(0.63)	0.03	(0.04)
US - Chicago PMI	0.19	(0.48)	-0.47	(0.48)	-0.05	(0.50)	0.54	(0.47)	0.03	(0.03)
US - All Announcements	-0.80**	(0.30)	-0.44	(0.30)	-0.76*	(0.31)	-0.11	(0.29)	0.00	(0.02)
CAN - Housing Starts	0.77	(0.62)	0.10	(0.63)	0.84	(0.64)	-0.97	(0.61)	-0.01	(0.04)
CAN - Unemployment Rate	0.47	(0.63)	0.01	(0.63)	0.51	(0.65)	-0.97	(0.61)	-0.02	(0.04)
CAN - Interest Rates	-0.69	(0.77)	0.52	(0.78)	0.32	(0.80)	0.10	(0.76)	0.02	(0.05)
CAN - Retail Sales	-0.86	(0.65)	-0.43	(0.66)	-1.19	(0.67)	0.21	(0.64)	-0.01	(0.04)
CAN - CPI	0.54	(0.65)	0.29	(0.66)	0.38	(0.67)	0.40	(0.64)	-0.04	(0.04)
CAN - Current Account Balance	1.75	(1.26)	1.21	(1.27)	1.13	(1.31)	1.14	(1.24)	-0.09	(0.08)
CAN - GDP	1.90	(1.15)	0.97	(1.16)	2.29	(1.19)	0.48	(1.13)	0.00	(0.08)
CAN - Capacity Utilization Rate	0.98	(1.13)	1.17	(1.14)	0.74	(1.17)	1.59	(1.11)	-0.03	(0.07)
CAN - All Announcements	0.75*	(0.33)	0.50	(0.33)	0.71*	(0.34)	0.04	(0.32)	-0.03	(0.02)
All Announcements	-0.43	(0.36)	-0.18	(0.36)	-0.37	(0.37)	-0.13	(0.35)	-0.03	(0.02)

Table 13: FIT (2014) Events, Heterogeneous Slopes, No Controls

Dummies	$\left\|\widetilde{\Omega}^{CVAR}_{a,j,i}\right\|$ β_d	SE	$\left\|\widetilde{\Omega}^{FCVAR}_{a,j,i}\right\|$ β_d	SE	$\left\|\widetilde{\Omega}^{LR}_{a,j,i}\right\|$ β_d	SE	$\left\|\tilde{\omega}^{FCVAR}_{j,i}\right\|$ β_d	SE	$\left\|\tilde{\omega}^{PCA}_{j,i}\right\|$ β_d	SE
US - Construction Spending	-1.30*	(0.57)	-0.65	(0.59)	-0.98	(0.65)	-0.98*	(0.48)	0.38***	(0.06)
US - Factory Orders	-0.33	(0.54)	0.06	(0.66)	0.47	(0.69)	-0.05	(0.66)	0.01	(0.03)
US - Trade Balance	1.00*	(0.46)	0.62	(0.64)	0.98	(0.64)	0.35	(0.68)	-0.06	(0.03)
US - Consumer Confidence Index	-0.58	(0.55)	-1.17**	(0.37)	-1.26**	(0.47)	0.20	(0.58)	-0.11**	(0.04)
US - Nonfarm Payroll employment	0.15	(0.68)	0.03	(0.75)	0.21	(0.74)	-0.80	(0.53)	-0.18***	(0.04)
US - Government Budget	-1.12**	(0.42)	-1.11**	(0.42)	-0.74	(0.66)	-1.26*	(0.58)	0.14***	(0.04)
US - Retail Sales & Business Inventories	-1.55***	(0.42)	0.15	(0.57)	-0.97	(0.53)	-0.58	(0.55)	0.05	(0.03)
US - PPI	-0.07	(0.60)	-0.51	(0.65)	0.03	(0.64)	-1.19	(0.61)	0.07**	(0.03)
US - CPI	0.79	(0.63)	0.26	(0.54)	0.63	(0.76)	-0.67	(0.51)	0.03	(0.02)
US - Housing Starts	-0.33	(0.71)	-0.71	(0.54)	-0.54	(0.67)	0.76	(0.67)	0.05	(0.03)
US - Industrial Production & Capacity Utilization	-0.87	(0.64)	0.72	(0.71)	-0.20	(0.75)	0.07	(0.64)	0.04	(0.03)
US - Leading Indicators Index	-0.67	(0.48)	-0.26	(0.57)	-0.43	(0.55)	-0.69	(0.65)	0.03	(0.03)
US - New Home Sales	-0.45	(0.63)	-0.04	(0.60)	-0.05	(0.61)	-0.73	(0.50)	-0.06*	(0.02)
US - Durable Goods Orders	-0.34	(0.75)	-0.94	(0.60)	-0.43	(0.72)	-0.01	(0.58)	-0.06**	(0.02)
US - Consumer Confidence Index	-0.95*	(0.46)	-1.13	(0.65)	-1.56**	(0.54)	-0.75	(0.52)	-0.09***	(0.02)
US - Federal Funds Rate	-0.55	(0.60)	-0.37	(0.68)	-0.19	(0.77)	-1.67***	(0.47)	-0.12***	(0.03)
US - GDP	-0.01	(0.68)	0.35	(0.64)	0.01	(0.64)	-0.13	(0.73)	-0.09***	(0.02)
US - GDP Price Index	0.51	(0.77)	0.67	(0.67)	0.33	(0.67)	0.03	(0.68)	-0.23***	(0.02)
US - Personal Income	0.87	(0.72)	0.38	(0.74)	0.38	(0.70)	-0.03	(0.57)	-0.17***	(0.02)
US - Chicago PMI	0.15	(0.52)	-0.58	(0.44)	-0.38	(0.52)	0.24	(0.46)	-0.15***	(0.02)
US - All Announcements	-0.81**	(0.28)	-0.58*	(0.28)	-0.71**	(0.25)	-0.30	(0.27)	0.03**	(0.01)
CAN - Housing Starts	0.56	(0.63)	-0.15	(0.60)	0.80	(0.57)	-1.06	(0.56)	-0.19***	(0.04)
CAN - Unemployment Rate	0.65	(0.57)	0.07	(0.65)	0.25	(0.70)	-0.93	(0.56)	-0.18***	(0.03)
CAN - Interest Rates	-0.90	(0.71)	0.49	(0.85)	0.54	(0.89)	0.12	(0.81)	0.05	(0.03)
CAN - Retail Sales	-0.74	(0.70)	-0.15	(0.59)	-1.11*	(0.56)	0.02	(0.78)	-0.02	(0.02)
CAN - CPI	0.59	(0.60)	-0.08	(0.53)	-0.03	(0.61)	0.38	(0.52)	-0.02	(0.04)
CAN - Current Account Balance	-0.70	(1.06)	0.45	(1.08)	-0.42	(1.06)	-0.17	(1.07)	-0.14***	(0.04)
CAN - GDP	2.42**	(0.90)	2.27	(1.18)	2.64**	(0.89)	-0.21	(1.00)	-0.18***	(0.04)
CAN - Capacity Utilization Rate	0.45	(0.98)	1.55	(1.06)	1.03	(1.11)	0.45	(1.08)	-0.27***	(0.04)
CAN - All Announcements	0.71*	(0.30)	0.61	(0.39)	0.72*	(0.34)	0.22	(0.40)	-0.15***	(0.02)
All Announcements	-0.51	(0.28)	-0.20	(0.39)	-0.28	(0.31)	-0.08	(0.32)	-0.04***	(0.01)

Table 14: FIT (2014) Events, Heterogeneous Slopes, With Controls

	$\lvert\widetilde{\Omega}_{a,j,i}^{CVAR}\rvert$		$\lvert\widetilde{\Omega}_{a,j,i}^{FCVAR}\rvert$		$\lvert\widetilde{\Omega}_{a,j,i}^{LR}\rvert$		$\lvert\tilde{\omega}_{j,i}^{FCVAR}\rvert$		$\lvert\tilde{\omega}_{j,i}^{PCA}\rvert$	
Dummies	β_d	SE	β_d	SE	β_d	SE	β_d	SE	β_d	SE
US - Construction Spending	-0.88	(0.83)	-0.44	(0.81)	-0.81	(0.87)	-0.37	(0.84)	0.52***	(0.10)
US - Factory Orders	-0.39	(0.77)	0.20	(0.87)	0.50	(0.88)	-0.03	(0.83)	-0.02	(0.08)
US - Trade Balance	1.01	(0.75)	0.72	(0.83)	0.94	(0.81)	0.56	(0.85)	-0.03	(0.08)
US - Consumer Confidence Index	-0.52	(0.80)	-0.99	(0.74)	-1.20	(0.74)	0.29	(0.78)	-0.08	(0.08)
US - Nonfarm Payroll employment	0.19	(0.90)	-0.02	(0.95)	0.22	(0.92)	-0.74	(0.76)	-0.16*	(0.08)
US - Government Budget	-0.52	(0.88)	-0.82	(0.78)	-0.55	(0.91)	-0.93	(0.83)	0.26*	(0.11)
US - Retail Sales & Business Inventories	-1.26	(0.79)	0.22	(0.80)	-0.87	(0.78)	-0.29	(0.80)	-0.02	(0.08)
US - PPI	0.10	(0.82)	-0.14	(0.88)	0.17	(0.88)	-0.78	(0.80)	0.10	(0.07)
US - CPI	0.90	(0.87)	0.72	(0.82)	0.86	(0.92)	-0.52	(0.75)	-0.04	(0.07)
US - Housing Starts	-0.29	(0.91)	-0.71	(0.80)	-0.21	(0.93)	0.85	(0.86)	-0.04	(0.08)
US - Industrial Production & Capacity Utilization	-0.90	(0.83)	0.54	(0.88)	-0.11	(0.92)	0.18	(0.82)	-0.02	(0.07)
US - Leading Indicators Index	-0.26	(0.84)	-0.27	(0.81)	-0.39	(0.85)	0.36	(1.03)	-0.07	(0.08)
US - New Home Sales	-0.47	(0.86)	0.30	(0.85)	0.23	(0.87)	-0.51	(0.76)	0.05	(0.08)
US - Durable Goods Orders	-0.33	(0.94)	-1.07	(0.84)	-0.56	(0.90)	0.02	(0.79)	-0.06	(0.07)
US - Consumer Confidence Index	-0.79	(0.77)	-1.09	(0.83)	-1.34	(0.81)	-0.72	(0.74)	-0.11	(0.08)
US - Federal Funds Rate	-0.15	(0.93)	-0.26	(0.95)	0.09	(1.03)	-1.48	(0.81)	-0.09	(0.09)
US - GDP	0.33	(0.96)	0.67	(0.88)	0.37	(0.91)	0.26	(0.95)	-0.18*	(0.08)
US - GDP Price Index	0.70	(1.03)	0.93	(0.94)	0.67	(0.97)	0.12	(0.89)	-0.27***	(0.08)
US - Personal Income	1.17	(0.94)	0.55	(0.90)	0.46	(0.89)	0.33	(0.80)	-0.08	(0.11)
US - Chicago PMI	0.25	(0.67)	-0.41	(0.61)	-0.28	(0.66)	0.46	(0.64)	-0.17**	(0.06)
US - All Announcements	-0.77*	(0.39)	-0.48	(0.38)	-0.74	(0.39)	-0.24	(0.37)	-0.02	(0.04)
CAN - Housing Starts	0.73	(0.83)	0.25	(0.83)	0.86	(0.81)	-0.81	(0.77)	-0.18*	(0.08)
CAN - Unemployment Rate	0.64	(0.79)	0.14	(0.88)	0.35	(0.92)	-0.79	(0.78)	-0.10	(0.08)
CAN - Interest Rates	-1.05	(1.02)	0.37	(1.08)	0.36	(1.11)	0.28	(1.05)	-0.06	(0.09)
CAN - Retail Sales	-0.76	(0.93)	-0.32	(0.80)	-1.08	(0.87)	0.42	(0.93)	-0.26***	(0.08)
CAN - CPI	0.59	(0.87)	0.32	(0.84)	0.33	(0.95)	0.67	(0.77)	-0.27***	(0.08)
CAN - Current Account Balance	0.66	(1.92)	1.25	(1.62)	0.77	(1.71)	0.91	(1.66)	-0.23	(0.15)
CAN - GDP	1.93	(1.32)	1.31	(1.49)	1.96	(1.35)	0.49	(1.54)	-0.28	(0.15)
CAN - Capacity Utilization Rate	0.77	(1.41)	1.55	(1.42)	1.02	(1.47)	1.33	(1.55)	-0.27*	(0.13)
CAN - All Announcements	0.63	(0.42)	0.58	(0.47)	0.68	(0.46)	0.20	(0.46)	-0.28***	(0.04)
All Announcements	-0.44	(0.44)	-0.19	(0.50)	-0.35	(0.49)	-0.15	(0.45)	-0.19***	(0.05)

Table 16: TE3 Events, Homogenous Slopes, No Controls

	$\Omega^{CVAR}_{a,j,i}$		$\Omega^{FCVAR}_{a,j,i}$		$\Omega^{LR}_{a,j,i}$		$\omega^{FCVAR}_{j,i}$		$\omega^{PCA}_{j,i}$	
Dummies	β_d	SE	β_d	SE	β_d	SE	β_d	SE	β_d	SE
US - ISM Manufacturing PMI	1.71	(1.14)	2.01*	(1.02)	2.27*	(1.16)	0.32	(0.91)	0.04	(0.04)
US - Fed Chairman Yellen Speaks	-3.95***	(1.15)	-1.73	(1.05)	-3.37**	(1.18)	-1.37	(0.89)	-0.03	(0.04)
US - Balance of Trade	-0.44	(1.10)	-0.31	(0.99)	0.56	(1.12)	-0.98	(0.88)	0.06	(0.04)
US - ADP Employment Change	2.45*	(1.09)	1.48	(0.99)	2.01	(1.12)	-0.15	(0.88)	0.04	(0.04)
US - FOMC Minutes	-1.04	(1.36)	-1.20	(1.23)	-1.65	(1.38)	0.54	(1.09)	-0.02	(0.05)
US - Non Farm Payrolls & Unemployment Rate	0.72	(1.13)	-0.01	(1.02)	1.88	(1.15)	-0.08	(0.91)	0.06	(0.04)
US - Retail Sales	-0.50	(1.10)	0.18	(0.99)	-1.03	(1.12)	1.18	(0.88)	0.12***	(0.04)
US - CPI	-2.09	(1.13)	-2.94**	(1.01)	-1.86	(1.15)	1.79*	(0.91)	0.00	(0.04)
US - Initial Jobless Claims	1.75	(4.49)	2.17	(4.05)	1.72	(4.57)	-2.05	(3.56)	-0.45**	(0.16)
US - Existing Home Sales	-0.11	(2.25)	-0.38	(2.03)	-0.02	(2.29)	-1.19	(1.79)	0.03	(0.08)
US - Durable Goods Orders	2.39	(2.01)	1.60	(1.82)	-1.37	(2.05)	1.35	(1.60)	0.10	(0.07)
US - Consumer Confidence Index	1.28	(1.13)	0.92	(1.02)	1.10	(1.15)	0.36	(0.91)	-0.01	(0.04)
US - QE Treasuries & MBS	-0.64	(1.70)	-0.75	(1.54)	-0.87	(1.73)	1.68	(1.36)	-0.02	(0.06)
US - QE Total	-0.12	(2.01)	0.76	(1.81)	0.04	(2.05)	0.00	(1.60)	-0.06	(0.07)
US - Federal Funds Rate	-1.18	(1.36)	-2.02	(1.22)	-1.58	(1.38)	2.87**	(1.08)	-0.05	(0.05)
US - GDP	-1.55	(1.13)	-1.03	(1.02)	-1.48	(1.15)	-0.64	(0.91)	0.03	(0.04)
US - Pending Home Sales	0.11	(2.25)	1.15	(2.03)	2.99	(2.29)	-2.41	(1.79)	0.02	(0.08)
US - ISM Non-Manufacturing PMI	0.20	(1.13)	-0.08	(1.02)	0.98	(1.15)	-0.28	(0.91)	0.03	(0.04)
US - Reuters Michigan Consumer Sentiment	-0.15	(2.25)	1.24	(2.03)	1.63	(2.29)	2.24	(1.79)	-0.11	(0.08)
US - Midterm Elections	-2.28	(4.49)	2.69	(4.05)	0.94	(4.57)	0.57	(3.56)	0.00	(0.16)
US - FOMC Economic Projections	3.36	(4.49)	-2.57	(4.05)	1.53	(4.57)	8.40*	(3.54)	-0.35*	(0.15)
US - All Announcements	-0.19	(0.47)	-0.13	(0.42)	-0.01	(0.48)	0.39	(0.39)	0.04**	(0.02)
CAN - Employment Rate	0.94	(1.43)	2.42	(1.28)	2.81	(1.45)	-0.89	(1.14)	0.14**	(0.05)
CAN - Interest Rates	0.61	(1.43)	-0.77	(1.29)	0.27	(1.45)	0.82	(1.14)	-0.01	(0.05)
CAN - GDP MoM	0.15	(4.50)	0.75	(4.05)	-3.83	(4.57)	-6.89	(3.55)	-0.81***	(0.15)
CAN - Ivey PMI s.a	2.68	(3.18)	2.94	(2.86)	1.59	(3.23)	-0.82	(2.52)	0.12	(0.11)
CAN - Core Inflation Rate	3.71	(2.25)	1.92	(2.03)	2.88	(2.29)	-0.52	(1.79)	0.07	(0.08)
CAN - GDP Growth QoQ	-1.04	(1.84)	0.17	(1.66)	0.15	(1.87)	-0.32	(1.46)	-0.12	(0.06)
CAN - Inflation Rate	1.36	(2.60)	0.50	(2.34)	-0.07	(2.64)	1.24	(2.06)	0.04	(0.09)
CAN - Unemployment Rate	1.65	(1.43)	2.02	(1.28)	2.16	(1.45)	0.02	(1.14)	0.02	(0.05)
CAN - All Announcements	1.33	(0.74)	0.63	(0.66)	1.12	(0.75)	-0.35	(0.60)	0.01	(0.03)
All Announcements	-0.13	(0.47)	-0.07	(0.42)	-0.04	(0.48)	0.07	(0.38)	0.04*	(0.02)

Table 17: TE3 Events, Homogenous Slopes, With Controls

	$\Omega^{CVAR}_{a,j,i}$		$\Omega^{FCVAR}_{a,j,i}$		$\Omega^{LR}_{a,j,i}$		$\omega^{FCVAR}_{j,i}$		$\omega^{PCA}_{j,i}$	
Dummies	β_d	SE	β_d	SE	β_d	SE	β_d	SE	β_d	SE
US - ISM Manufacturing PMI	1.26	(1.14)	1.51	(1.02)	1.80	(1.16)	0.31	(0.87)	0.00	(0.04)
US - Fed Chairman Yellen Speaks	-4.01***	(1.14)	-1.85	(1.03)	-3.58**	(1.16)	-1.32	(0.85)	-0.01	(0.05)
US - Balance of Trade	-0.25	(1.08)	-0.22	(0.97)	0.79	(1.10)	-0.81	(0.84)	0.06	(0.04)
US - ADP Employment Change	2.63*	(1.08)	1.45	(0.97)	1.95	(1.10)	-0.23	(0.84)	0.01	(0.04)
US - FOMC Minutes	-0.53	(1.35)	-0.81	(1.20)	-1.28	(1.37)	0.98	(1.04)	-0.05	(0.05)
US - Non Farm Payrolls & Unemployment Rate	0.72	(1.12)	0.05	(1.00)	1.95	(1.13)	0.01	(0.86)	0.04	(0.04)
US - Retail Sales	-0.38	(1.09)	0.11	(0.97)	-0.91	(1.10)	1.08	(0.84)	0.12**	(0.04)
US - CPI	-2.20*	(1.11)	-2.85**	(0.99)	-1.79	(1.13)	1.86*	(0.86)	0.01	(0.04)
US - Initial Jobless Claims	1.30	(4.43)	1.36	(3.97)	1.22	(4.51)	0.32	(3.40)	-0.57***	(0.17)
US - Existing Home Sales	-0.63	(2.22)	-0.81	(1.99)	-0.53	(2.26)	-0.71	(1.70)	0.05	(0.08)
US - Durable Goods Orders	1.90	(2.00)	1.06	(1.79)	-1.66	(2.04)	1.02	(1.52)	0.15*	(0.08)
US - Consumer Confidence Index	1.25	(1.12)	0.96	(1.00)	1.09	(1.14)	0.03	(0.87)	0.01	(0.04)
US - QE Treasuries & MBS	-0.81	(1.68)	-0.96	(1.50)	-1.21	(1.71)	2.15	(1.29)	-0.01	(0.06)
US - QE Total	-0.29	(1.99)	0.41	(1.78)	-0.41	(2.03)	0.70	(1.53)	-0.03	(0.07)
US - Federal Funds Rate	-1.32	(1.34)	-2.20	(1.20)	-1.79	(1.36)	2.83**	(1.03)	-0.04	(0.05)
US - GDP	-1.43	(1.12)	-1.15	(1.01)	-1.63	(1.14)	-0.75	(0.87)	0.02	(0.04)
US - Pending Home Sales	0.28	(2.24)	1.69	(2.00)	3.36	(2.27)	-2.17	(1.71)	-0.04	(0.08)
US - ISM Non-Manufacturing PMI	0.32	(1.12)	-0.08	(1.00)	1.03	(1.13)	-0.40	(0.86)	0.03	(0.04)
US - Reuters Michigan Consumer Sentiment	-0.80	(2.23)	0.88	(1.99)	0.94	(2.27)	2.29	(1.70)	-0.04	(0.08)
US - Midterm Elections	-1.48	(4.43)	3.37	(3.96)	1.70	(4.50)	0.52	(3.39)	0.13	(0.17)
US - FOMC Economic Projections	3.50	(4.43)	-2.08	(3.96)	2.45	(4.51)	7.72*	(3.38)	-0.27	(0.17)
US - All Announcements	-0.25	(0.46)	-0.28	(0.41)	-0.15	(0.47)	0.41	(0.37)	0.04*	(0.02)
CAN - Employment Rate	1.00	(1.41)	2.44	(1.25)	2.82*	(1.43)	-0.62	(1.09)	0.12*	(0.05)
CAN - Interest Rates	0.94	(1.41)	-0.51	(1.26)	0.57	(1.43)	0.89	(1.09)	0.02	(0.05)
CAN - GDP MoM	0.91	(4.43)	0.76	(3.97)	-3.74	(4.51)	-6.38	(3.39)	-0.95***	(0.16)
CAN - Ivey PMI s.a	2.74	(3.13)	2.65	(2.80)	1.39	(3.19)	-0.87	(2.40)	0.07	(0.12)
CAN - Core Inflation Rate	3.91	(2.22)	1.60	(1.99)	3.03	(2.26)	-0.85	(1.71)	0.04	(0.08)
CAN - GDP Growth QoQ	0.04	(1.83)	1.20	(1.64)	1.18	(1.86)	0.08	(1.41)	-0.12	(0.07)
CAN - Inflation Rate	2.09	(2.58)	0.81	(2.31)	0.65	(2.62)	1.29	(1.98)	0.02	(0.10)
CAN - Unemployment Rate	1.68	(1.41)	2.16	(1.25)	2.20	(1.43)	0.15	(1.08)	0.04	(0.05)
CAN - All Announcements	1.71*	(0.73)	0.87	(0.65)	1.44	(0.74)	-0.22	(0.57)	0.00	(0.03)
All Announcements	-0.01	(0.46)	-0.06	(0.41)	-0.01	(0.47)	0.16	(0.37)	0.03*	(0.02)

Table 18: TE3 Events, Heterogeneous Slopes, No Controls

	$\Omega^{CVAR}_{a,j,i}$		$\Omega^{FCVAR}_{a,j,i}$		$\Omega^{LR}_{a,j,i}$		$\omega^{FCVAR}_{j,i}$		$\omega^{PCA}_{j,i}$	
Dummies	β_d	SE	β_d	SE	β_d	SE	β_d	SE	β_d	SE
US - ISM Manufacturing PMI	2.60**	(0.98)	2.58***	(0.65)	2.90***	(0.76)	0.69	(0.80)	-0.33***	(0.07)
US - Fed Chairman Yellen Speaks	-3.52**	(1.17)	-2.68**	(1.01)	-2.64*	(1.17)	-0.78	(0.98)	-0.96***	(0.03)
US - Balance of Trade	-0.48	(0.87)	0.75	(1.12)	0.50	(1.08)	-0.69	(1.05)	0.04	(0.04)
US - ADP Employment Change	1.54	(1.17)	1.47	(1.15)	1.23	(1.34)	-0.30	(0.88)	0.01	(0.03)
US - FOMC Minutes	0.48	(1.13)	-0.86	(1.07)	-0.41	(1.10)	2.25**	(0.87)	-0.11	(0.06)
US - Non Farm Payrolls & Unemployment Rate	0.66	(0.95)	0.95	(0.89)	1.07	(1.08)	0.01	(0.78)	0.06	(0.04)
US - Retail Sales	-0.10	(1.08)	0.04	(0.77)	0.40	(0.83)	1.26	(0.65)	0.04	(0.03)
US - CPI	-1.84	(0.99)	-1.50	(0.88)	-1.63	(0.98)	1.68*	(0.75)	-0.04	(0.02)
US - Initial Jobless Claims	4.68	(3.39)	3.24	(2.52)	3.19	(2.51)	3.81*	(1.79)	-6.46***	(0.36)
US - Existing Home Sales	0.88	(1.95)	0.55	(1.76)	0.21	(1.78)	-0.85	(2.05)	-0.76***	(0.07)
US - Durable Goods Orders	2.59*	(1.27)	1.70	(1.51)	1.51	(1.52)	2.35	(1.26)	0.18***	(0.04)
US - Consumer Confidence Index	1.07	(0.61)	1.42	(0.82)	1.91*	(0.75)	0.61	(0.51)	0.09**	(0.03)
US - QE Treasuries & MBS	-1.58	(1.82)	-2.32	(1.78)	-2.15	(1.82)	1.89*	(0.87)	-1.09***	(0.05)
US - QE Total	0.48	(1.85)	-1.15	(1.77)	-0.30	(1.92)	0.62	(1.10)	-1.79***	(0.08)
US - Federal Funds Rate	-1.04	(1.39)	-2.90*	(1.24)	-2.26	(1.33)	3.24***	(0.64)	0.16***	(0.03)
US - GDP	-2.24*	(0.88)	-2.34*	(1.04)	-2.49*	(1.03)	-0.01	(0.85)	0.19***	(0.02)
US - Pending Home Sales	-1.62	(1.97)	-0.22	(1.73)	0.41	(2.01)	0.43	(1.85)	-0.92***	(0.05)
US - ISM Non-Manufacturing PMI	0.10	(0.85)	0.33	(0.85)	0.55	(0.91)	-0.39	(0.56)	0.30***	(0.03)
US - Reuters Michigan Consumer Sentiment	1.09	(1.61)	2.52	(1.86)	2.77	(1.86)	3.96***	(0.83)	0.13*	(0.05)
US - Midterm Elections	-0.88	(4.05)	2.15	(3.66)	1.48	(3.76)	6.58***	(1.14)	1.64***	(0.05)
US - FOMC Economic Projections	4.07	(4.36)	-1.09	(4.36)	1.76	(4.56)	7.51***	(1.06)	2.12***	(0.07)
US - All Announcements	0.15	(0.35)	0.01	(0.45)	0.44	(0.41)	0.37	(0.36)	-0.22***	(0.02)
CAN - Employment Rate	1.11	(1.04)	3.27*	(1.28)	3.24**	(1.00)	-0.65	(0.83)	-0.37***	(0.05)
CAN - Interest Rates	-0.15	(1.09)	-0.22	(1.23)	-0.37	(1.17)	0.81	(1.04)	-0.41***	(0.02)
CAN - GDP MoM	1.70	(2.88)	-0.50	(2.85)	-1.62	(3.25)	4.11	(2.47)	-5.22***	(0.47)
CAN - Ivey PMI s.a	-0.66	(2.47)	2.82	(2.56)	0.98	(2.46)	2.83**	(1.08)	-1.13***	(0.08)
CAN - Core Inflation Rate	5.46*	(2.40)	3.53	(2.00)	3.64	(2.47)	1.64	(1.80)	-0.19***	(0.05)
CAN - GDP Growth QoQ	-1.54	(2.22)	0.58	(2.11)	-0.03	(2.23)	-0.02	(1.32)	0.32***	(0.04)
CAN - Inflation Rate	1.87	(1.89)	1.81	(1.70)	2.16	(1.70)	1.48	(1.33)	-0.29***	(0.03)
CAN - Unemployment Rate	0.55	(1.05)	2.12*	(1.07)	2.21*	(1.02)	-0.10	(1.03)	0.30***	(0.03)
CAN - All Announcements	0.98	(0.72)	1.39**	(0.53)	1.42*	(0.59)	-0.64	(0.55)	-0.30***	(0.02)
All Announcements	0.19	(0.42)	0.29	(0.42)	0.62	(0.45)	0.02	(0.37)	-0.32***	(0.02)

Table 19: TE3 Events, Heterogeneous Slopes, With Controls

	$\Omega_{a,j,i}^{CVAR}$		$\Omega_{a,j,i}^{FCVAR}$		$\Omega_{a,j,i}^{LR}$		$\omega_{j,i}^{FCVAR}$		$\omega_{j,i}^{PCA}$	
Dummies	β_d	SE	β_d	SE	β_d	SE	β_d	SE	β_d	SE
US - ISM Manufacturing PMI	2.18*	(0.96)	2.06**	(0.65)	2.46**	(0.75)	0.73	(0.81)	-0.24***	(0.07)
US - Fed Chairman Yellen Speaks	-3.36**	(1.18)	-2.44*	(1.04)	-2.46*	(1.16)	-0.58	(0.94)	-0.17***	(0.03)
US - Balance of Trade	-0.32	(0.86)	0.83	(1.11)	0.61	(1.08)	-0.57	(1.03)	0.11*	(0.04)
US - ADP Employment Change	1.65	(1.18)	1.59	(1.15)	1.33	(1.33)	-0.28	(0.88)	0.10**	(0.03)
US - FOMC Minutes	1.13	(1.10)	-0.35	(1.10)	0.10	(1.12)	2.20*	(0.94)	0.14*	(0.06)
US - Non Farm Payrolls & Unemployment Rate	0.93	(0.92)	1.17	(0.88)	1.23	(1.08)	0.21	(0.77)	0.32***	(0.04)
US - Retail Sales	-0.03	(1.07)	0.16	(0.78)	0.43	(0.80)	1.14	(0.65)	-0.05	(0.03)
US - CPI	-1.74	(1.00)	-1.41	(0.86)	-1.63	(0.96)	1.64*	(0.74)	0.03	(0.02)
US - Initial Jobless Claims	5.22	(3.18)	4.06	(2.48)	3.75	(2.54)	3.51	(2.31)	-2.87***	(0.29)
US - Existing Home Sales	0.75	(1.94)	0.31	(1.71)	-0.01	(1.79)	-0.89	(2.08)	-0.43***	(0.07)
US - Durable Goods Orders	1.97	(1.26)	1.17	(1.48)	1.06	(1.52)	2.30	(1.21)	-0.16***	(0.04)
US - Consumer Confidence Index	0.83	(0.63)	1.18	(0.80)	1.68*	(0.74)	0.44	(0.53)	0.05*	(0.03)
US - QE Treasuries & MBS	-1.64	(1.66)	-2.43	(1.58)	-2.26	(1.70)	2.24**	(0.81)	0.27***	(0.04)
US - QE Total	0.69	(1.65)	-0.70	(1.60)	-0.32	(1.83)	1.14	(1.01)	0.28***	(0.07)
US - Federal Funds Rate	-1.40	(1.41)	-3.25**	(1.23)	-2.53	(1.32)	3.09***	(0.61)	0.07**	(0.03)
US - GDP	-2.26*	(0.90)	-2.33*	(1.04)	-2.55*	(1.05)	-0.14	(0.87)	0.10***	(0.02)
US - Pending Home Sales	-0.76	(1.96)	0.46	(1.77)	0.66	(2.06)	-0.18	(1.92)	-0.57***	(0.04)
US - ISM Non-Manufacturing PMI	0.02	(0.83)	0.29	(0.85)	0.51	(0.90)	-0.49	(0.55)	0.13***	(0.03)
US - Reuters Michigan Consumer Sentiment	0.03	(1.65)	1.50	(1.95)	1.84	(1.95)	3.74***	(0.90)	-0.09*	(0.04)
US - Midterm Elections	-0.75	(4.14)	2.24	(3.68)	1.64	(3.83)	6.14***	(1.19)	0.73***	(0.04)
US - FOMC Economic Projections	5.03	(4.22)	-0.50	(4.48)	2.14	(4.49)	6.92***	(1.09)	0.46***	(0.06)
US - All Announcements	0.05	(0.36)	-0.02	(0.43)	0.38	(0.41)	0.37	(0.37)	0.01	(0.02)
CAN - Employment Rate	1.63	(0.99)	3.83***	(1.16)	3.63***	(0.93)	-0.38	(0.84)	0.37***	(0.05)
CAN - Interest Rates	0.38	(1.06)	0.27	(1.23)	0.00	(1.16)	1.11	(1.04)	-0.10***	(0.03)
CAN - GDP MoM	2.22	(3.02)	-0.23	(2.96)	-1.12	(3.35)	4.27	(2.51)	-1.76***	(0.38)
CAN - Ivey PMI s.a	-0.60	(2.44)	3.29	(2.50)	1.03	(2.40)	2.65*	(1.13)	-0.42***	(0.07)
CAN - Core Inflation Rate	5.15*	(2.40)	3.16	(2.17)	3.23	(2.50)	0.96	(1.89)	-0.02	(0.05)
CAN - GDP Growth QoQ	-0.46	(2.29)	1.87	(1.96)	1.01	(2.20)	0.26	(1.39)	-0.22***	(0.05)
CAN - Inflation Rate	2.70	(1.88)	2.66	(1.68)	2.68	(1.65)	2.19	(1.24)	0.52***	(0.06)
CAN - Unemployment Rate	0.64	(1.05)	2.18*	(1.06)	2.33*	(1.02)	0.05	(1.01)	0.41***	(0.04)
CAN - All Announcements	1.48*	(0.74)	1.88***	(0.55)	1.65**	(0.61)	-0.49	(0.54)	0.01	(0.02)
All Announcements	0.33	(0.44)	0.44	(0.41)	0.71	(0.45)	0.08	(0.37)	-0.02	(0.02)

Table 20: TE3 Events, Homogenous Slopes, No Controls

Dummies	$\lvert\widetilde{\Omega}^{CVAR}_{a,j,i}\rvert$ β_d	SE	$\lvert\widetilde{\Omega}^{FCVAR}_{a,j,i}\rvert$ β_d	SE	$\lvert\widetilde{\Omega}^{LR}_{a,j,i}\rvert$ β_d	SE	$\lvert\tilde{\omega}^{FCVAR}_{j,i}\rvert$ β_d	SE	$\lvert\tilde{\omega}^{PCA}_{j,i}\rvert$ β_d	SE
US - ISM Manufacturing PMI	-0.91	(0.65)	-0.59	(0.66)	-0.88	(0.69)	-0.06	(0.64)	0.03	(0.04)
US - Fed Chairman Yellen Speaks	0.64	(0.64)	0.72	(0.65)	1.02	(0.68)	1.21	(0.62)	0.04	(0.04)
US - Balance of Trade	0.97	(0.63)	1.33*	(0.64)	1.40*	(0.67)	0.76	(0.62)	-0.04	(0.04)
US - ADP Employment Change	0.85	(0.63)	0.52	(0.64)	-0.26	(0.67)	0.17	(0.62)	0.02	(0.04)
US - FOMC Minutes	-0.12	(0.78)	-0.11	(0.79)	-0.57	(0.83)	-0.38	(0.76)	0.02	(0.05)
US - Non Farm Payrolls & Unemployment Rate	-0.15	(0.65)	-0.09	(0.66)	-0.24	(0.69)	-0.62	(0.64)	0.00	(0.04)
US - Retail Sales	-1.04	(0.63)	0.94	(0.64)	0.41	(0.67)	-0.23	(0.62)	-0.04	(0.04)
US - CPI	1.10	(0.65)	1.01	(0.66)	0.23	(0.69)	-0.79	(0.64)	-0.07	(0.04)
US - Initial Jobless Claims	-2.24	(2.56)	-5.64*	(2.58)	-3.80	(2.70)	1.84	(2.49)	0.51**	(0.16)
US - Existing Home Sales	0.30	(1.28)	-0.30	(1.31)	1.30	(1.36)	2.36	(1.25)	-0.01	(0.08)
US - Durable Goods Orders	-1.99	(1.15)	-1.59	(1.17)	-2.04	(1.21)	-0.50	(1.12)	-0.13	(0.07)
US - Consumer Confidence Index	-0.92	(0.65)	-1.46*	(0.66)	-0.93	(0.69)	-0.84	(0.64)	-0.08*	(0.04)
US - QE Treasuries & MBS	-0.34	(0.98)	-1.10	(0.99)	-1.10	(1.03)	-1.13	(0.95)	0.08	(0.06)
US - QE Total	-0.57	(1.15)	-1.57	(1.17)	-1.50	(1.22)	-0.35	(1.12)	0.12	(0.07)
US - Federal Funds Rate	-0.14	(0.78)	-0.92	(0.79)	-0.72	(0.83)	-1.48	(0.76)	0.02	(0.05)
US - GDP	0.39	(0.65)	0.57	(0.66)	0.25	(0.69)	0.81	(0.64)	0.00	(0.04)
US - Pending Home Sales	-0.35	(1.28)	-1.33	(1.30)	-0.65	(1.36)	2.61*	(1.25)	0.08	(0.08)
US - ISM Non-Manufacturing PMI	1.24	(0.65)	0.54	(0.66)	0.40	(0.69)	0.16	(0.64)	0.01	(0.04)
US - Reuters Michigan Consumer Sentiment	-0.40	(1.28)	-0.42	(1.31)	-0.19	(1.36)	-1.12	(1.25)	0.10	(0.07)
US - Midterm Elections	0.26	(2.56)	1.18	(2.60)	3.00	(2.71)	0.36	(2.49)	0.00	(0.15)
US - FOMC Economic Projections	1.87	(2.56)	2.03	(2.60)	1.43	(2.71)	-3.86	(2.48)	-0.33*	(0.15)
US - All Announcements	-0.12	(0.28)	0.10	(0.28)	-0.02	(0.29)	-0.12	(0.27)	-0.03	(0.02)
CAN - Employment Rate	1.26	(0.82)	1.51	(0.83)	1.55	(0.86)	-0.11	(0.80)	-0.02	(0.05)
CAN - Interest Rates	-0.02	(0.82)	0.05	(0.83)	-0.65	(0.87)	-0.74	(0.80)	0.00	(0.05)
CAN - GDP MoM	-4.37	(2.55)	-3.31	(2.59)	-4.04	(2.70)	5.14*	(2.48)	0.87***	(0.15)
CAN - Ivey PMI s.a	-2.68	(1.81)	-2.37	(1.84)	-1.88	(1.92)	-0.80	(1.76)	-0.22*	(0.11)
CAN - Core Inflation Rate	2.56*	(1.28)	1.15	(1.30)	1.63	(1.36)	0.59	(1.25)	-0.04	(0.08)
CAN - GDP Growth QoQ	2.11*	(1.05)	1.83	(1.07)	1.76	(1.11)	0.24	(1.02)	0.00	(0.06)
CAN - Inflation Rate	-0.47	(1.48)	-2.12	(1.50)	0.04	(1.57)	-2.53	(1.44)	-0.03	(0.09)
CAN - Unemployment Rate	0.75	(0.82)	-0.33	(0.83)	-0.32	(0.87)	0.06	(0.80)	0.00	(0.05)
CAN - All Announcements	0.67	(0.43)	0.40	(0.44)	0.42	(0.45)	-0.11	(0.42)	-0.01	(0.02)
All Announcements	0.07	(0.28)	0.24	(0.28)	0.14	(0.29)	0.03	(0.27)	-0.03	(0.02)

Table 21: TE3 Events, Homogenous Slopes, With Controls

Dummies	$\left\|\widetilde{\Omega}^{CVAR}_{a,j,i}\right\|$ β_d	SE	$\left\|\widetilde{\Omega}^{FCVAR}_{a,j,i}\right\|$ β_d	SE	$\left\|\widetilde{\Omega}^{LR}_{a,j,i}\right\|$ β_d	SE	$\left\|\tilde{\omega}^{FCVAR}_{j,i}\right\|$ β_d	SE	$\left\|\tilde{\omega}^{PCA}_{j,i}\right\|$ β_d	SE
US - ISM Manufacturing PMI	-0.74	(0.65)	-0.34	(0.65)	-0.72	(0.68)	0.02	(0.64)	0.02	(0.04)
US - Fed Chairman Yellen Speaks	0.76	(0.63)	1.01	(0.63)	1.27	(0.66)	1.19	(0.61)	0.03	(0.05)
US - Balance of Trade	0.97	(0.62)	1.23*	(0.62)	1.28	(0.65)	0.80	(0.61)	-0.04	(0.04)
US - ADP Employment Change	0.77	(0.62)	0.46	(0.63)	-0.25	(0.66)	0.20	(0.61)	0.02	(0.04)
US - FOMC Minutes	-0.21	(0.77)	-0.23	(0.77)	-0.70	(0.81)	-0.55	(0.76)	0.02	(0.05)
US - Non Farm Payrolls & Unemployment Rate	-0.07	(0.64)	-0.09	(0.65)	-0.23	(0.67)	-0.63	(0.63)	0.00	(0.04)
US - Retail Sales	-1.17	(0.62)	0.83	(0.63)	0.25	(0.66)	-0.24	(0.61)	-0.03	(0.04)
US - CPI	1.03	(0.64)	0.97	(0.64)	0.27	(0.67)	-0.78	(0.63)	-0.07	(0.04)
US - Initial Jobless Claims	-1.80	(2.53)	-5.30*	(2.52)	-3.24	(2.65)	1.55	(2.48)	0.52**	(0.17)
US - Existing Home Sales	0.43	(1.27)	-0.29	(1.27)	1.21	(1.33)	2.32	(1.23)	-0.01	(0.09)
US - Durable Goods Orders	-1.89	(1.13)	-1.36	(1.14)	-1.77	(1.19)	-0.38	(1.11)	-0.15	(0.08)
US - Consumer Confidence Index	-0.85	(0.64)	-1.35*	(0.64)	-0.73	(0.67)	-0.77	(0.63)	-0.08*	(0.04)
US - QE Treasuries & MBS	-0.04	(0.97)	-0.54	(0.97)	-0.66	(1.01)	-1.12	(0.94)	0.07	(0.06)
US - QE Total	-0.18	(1.14)	-0.81	(1.14)	-0.93	(1.20)	-0.35	(1.12)	0.10	(0.07)
US - Federal Funds Rate	-0.07	(0.77)	-0.69	(0.77)	-0.57	(0.81)	-1.43	(0.75)	0.01	(0.05)
US - GDP	0.40	(0.64)	0.72	(0.65)	0.47	(0.68)	0.85	(0.63)	0.00	(0.04)
US - Pending Home Sales	-0.54	(1.28)	-1.40	(1.28)	-0.65	(1.34)	2.54*	(1.24)	0.10	(0.09)
US - ISM Non-Manufacturing PMI	1.20	(0.64)	0.39	(0.65)	0.32	(0.67)	0.22	(0.63)	0.01	(0.04)
US - Reuters Michigan Consumer Sentiment	-0.07	(1.27)	0.15	(1.28)	0.24	(1.33)	-1.03	(1.24)	0.08	(0.08)
US - Midterm Elections	-0.04	(2.52)	0.78	(2.53)	2.24	(2.64)	0.37	(2.47)	0.01	(0.17)
US - FOMC Economic Projections	1.09	(2.53)	0.84	(2.54)	0.35	(2.66)	-4.03	(2.47)	-0.33*	(0.17)
US - All Announcements	-0.04	(0.27)	0.28	(0.27)	0.15	(0.29)	-0.07	(0.27)	-0.03	(0.02)
CAN - Employment Rate	1.27	(0.81)	1.54	(0.81)	1.64	(0.84)	-0.11	(0.79)	-0.02	(0.06)
CAN - Interest Rates	-0.19	(0.81)	-0.25	(0.81)	-0.86	(0.85)	-0.84	(0.79)	0.00	(0.05)
CAN - GDP MoM	-3.79	(2.52)	-2.69	(2.53)	-3.20	(2.65)	5.16*	(2.46)	0.96***	(0.17)
CAN - Ivey PMI s.a	-2.62	(1.78)	-1.79	(1.79)	-1.25	(1.87)	-0.71	(1.75)	-0.23	(0.12)
CAN - Core Inflation Rate	2.58*	(1.26)	1.39	(1.27)	1.76	(1.33)	0.82	(1.24)	-0.01	(0.08)
CAN - GDP Growth QoQ	1.69	(1.05)	1.13	(1.05)	1.06	(1.10)	-0.11	(1.03)	0.01	(0.07)
CAN - Inflation Rate	-0.70	(1.47)	-2.17	(1.47)	0.02	(1.54)	-2.51	(1.43)	-0.02	(0.10)
CAN - Unemployment Rate	0.82	(0.81)	-0.20	(0.81)	-0.30	(0.85)	0.02	(0.79)	0.00	(0.05)
CAN - All Announcements	0.60	(0.43)	0.30	(0.43)	0.34	(0.45)	-0.18	(0.42)	0.00	(0.03)
All Announcements	0.08	(0.27)	0.33	(0.27)	0.23	(0.29)	0.03	(0.27)	-0.03	(0.02)

Table 22: TE3 Events, Heterogeneous Slopes, No Controls

Dummies	$\lvert\widetilde{\Omega}^{CVAR}_{a,j,i}\rvert$ β_d	SE	$\lvert\widetilde{\Omega}^{FCVAR}_{a,j,i}\rvert$ β_d	SE	$\lvert\widetilde{\Omega}^{LR}_{a,j,i}\rvert$ β_d	SE	$\lvert\tilde{\omega}^{FCVAR}_{j,i}\rvert$ β_d	SE	$\lvert\tilde{\omega}^{PCA}_{j,i}\rvert$ β_d	SE
US - ISM Manufacturing PMI	-1.31*	(0.65)	-0.62	(0.61)	-0.73	(0.70)	-0.72	(0.51)	0.39***	(0.06)
US - Fed Chairman Yellen Speaks	0.87	(0.51)	1.09*	(0.53)	0.85	(0.47)	0.95	(0.78)	0.33***	(0.03)
US - Balance of Trade	1.00*	(0.46)	0.62	(0.64)	0.98	(0.64)	0.35	(0.68)	-0.06	(0.03)
US - ADP Employment Change	0.35	(0.56)	0.13	(0.62)	0.73	(0.64)	0.09	(0.65)	-0.04	(0.03)
US - FOMC Minutes	-0.07	(1.01)	-0.20	(0.75)	-0.09	(0.79)	-1.80**	(0.60)	-0.05	(0.05)
US - Non Farm Payrolls & Unemployment Rate	0.15	(0.68)	0.03	(0.75)	0.21	(0.74)	-0.80	(0.53)	-0.18***	(0.04)
US - Retail Sales	-1.55***	(0.42)	0.15	(0.57)	-0.97	(0.53)	-0.58	(0.55)	0.05	(0.03)
US - CPI	0.79	(0.63)	0.26	(0.54)	0.63	(0.76)	-0.67	(0.51)	0.03	(0.02)
US - Initial Jobless Claims	-3.12	(2.39)	-6.56***	(1.51)	-7.30***	(1.55)	-3.48***	(0.84)	4.48***	(0.32)
US - Existing Home Sales	-0.44	(1.20)	-0.36	(1.24)	-1.13	(1.43)	-2.39*	(1.05)	1.46***	(0.06)
US - Durable Goods Orders	-2.17*	(1.01)	-2.58**	(0.96)	-1.68	(1.10)	-1.29	(0.90)	0.76***	(0.04)
US - Consumer Confidence Index	-0.95*	(0.46)	-1.13	(0.65)	-1.56**	(0.54)	-0.75	(0.52)	-0.09***	(0.02)
US - QE Treasuries & MBS	-0.80	(0.65)	-0.94	(0.81)	-0.51	(0.75)	-1.33*	(0.59)	-0.38***	(0.05)
US - QE Total	-0.96	(0.98)	-1.74	(1.03)	-1.73	(0.99)	-0.81	(0.73)	-0.03	(0.06)
US - Federal Funds Rate	-0.55	(0.60)	-0.37	(0.68)	-0.19	(0.77)	-1.67***	(0.47)	-0.12***	(0.03)
US - GDP	-0.01	(0.68)	0.35	(0.64)	0.01	(0.64)	-0.13	(0.73)	-0.09***	(0.02)
US - Pending Home Sales	-0.25	(0.96)	-1.15	(0.93)	-1.18	(0.97)	-0.58	(1.01)	1.50***	(0.07)
US - ISM Non-Manufacturing PMI	0.81	(0.60)	0.47	(0.63)	1.36	(0.71)	0.21	(0.48)	-0.20***	(0.03)
US - Reuters Michigan Consumer Sentiment	-1.53	(1.30)	-1.22	(1.14)	-0.18	(1.25)	-3.07***	(0.66)	0.21***	(0.05)
US - Midterm Elections	-0.80	(1.79)	-0.06	(1.95)	-0.10	(1.75)	-3.38***	(0.84)	-0.32***	(0.04)
US - FOMC Economic Projections	1.81	(2.03)	0.70	(1.91)	1.59	(2.00)	-3.33**	(1.07)	0.25***	(0.03)
US - All Announcements	-0.22	(0.25)	0.00	(0.31)	-0.10	(0.27)	-0.22	(0.22)	0.21***	(0.02)
CAN - Employment Rate	1.43*	(0.68)	1.23	(0.89)	0.83	(0.83)	-0.21	(0.83)	0.05	(0.04)
CAN - Interest Rates	-0.64	(0.83)	-0.34	(0.84)	-0.09	(0.92)	-1.19	(0.73)	-0.01	(0.03)
CAN - GDP MoM	-6.60**	(2.02)	-7.93***	(1.47)	-4.47*	(2.05)	-1.13	(0.97)	3.26***	(0.43)
CAN - Ivey PMI s.a	-2.96*	(1.36)	-2.40	(1.36)	-3.38*	(1.49)	-3.85***	(0.79)	1.76***	(0.08)
CAN - Core Inflation Rate	1.81	(1.50)	0.87	(1.32)	2.72	(1.42)	-1.27	(1.02)	0.71***	(0.05)
CAN - GDP Growth QoQ	2.13	(1.12)	2.13*	(1.05)	1.86*	(0.92)	-0.73	(0.74)	-0.13***	(0.03)
CAN - Inflation Rate	-0.88	(1.23)	-2.26*	(1.04)	-1.48	(1.09)	-2.95***	(0.80)	-0.51***	(0.04)
CAN - Unemployment Rate	1.04	(0.89)	-0.26	(0.72)	-0.51	(0.72)	0.02	(0.74)	-0.90***	(0.04)
CAN - All Announcements	0.77	(0.40)	0.51	(0.41)	0.71	(0.46)	0.06	(0.48)	0.11***	(0.02)
All Announcements	0.02	(0.30)	0.13	(0.29)	0.07	(0.28)	-0.02	(0.24)	0.18***	(0.02)

Table 23: TE3 Events, Heterogeneous Slopes, With Controls

	$\left\|\widetilde{\Omega}_{a,j,i}^{CVAR}\right\|$		$\left\|\widetilde{\Omega}_{a,j,i}^{FCVAR}\right\|$		$\left\|\widetilde{\Omega}_{a,j,i}^{LR}\right\|$		$\left\|\tilde{\omega}_{j,i}^{FCVAR}\right\|$		$\left\|\tilde{\omega}_{j,i}^{PCA}\right\|$	
Dummies	β_d	SE	β_d	SE	β_d	SE	β_d	SE	β_d	SE
US - ISM Manufacturing PMI	-1.10	(0.64)	-0.44	(0.60)	-0.55	(0.70)	-0.72	(0.52)	0.51***	(0.06)
US - Fed Chairman Yellen Speaks	1.03*	(0.52)	1.29*	(0.53)	1.00*	(0.47)	0.95	(0.77)	0.19***	(0.02)
US - Balance of Trade	0.96*	(0.46)	0.58	(0.64)	0.91	(0.64)	0.34	(0.67)	-0.04	(0.03)
US - ADP Employment Change	0.32	(0.56)	0.12	(0.63)	0.73	(0.64)	0.09	(0.65)	-0.09**	(0.03)
US - FOMC Minutes	-0.37	(0.99)	-0.41	(0.75)	-0.26	(0.79)	-2.04***	(0.57)	-0.11*	(0.05)
US - Non Farm Payrolls & Unemployment Rate	0.15	(0.67)	-0.02	(0.75)	0.20	(0.73)	-0.85	(0.52)	-0.19***	(0.04)
US - Retail Sales	-1.63***	(0.42)	0.09	(0.56)	-1.07*	(0.51)	-0.58	(0.54)	-0.02	(0.03)
US - CPI	0.77	(0.64)	0.29	(0.53)	0.69	(0.74)	-0.66	(0.50)	-0.05*	(0.02)
US - Initial Jobless Claims	-2.68	(2.42)	-5.90***	(1.61)	-6.43***	(1.67)	-3.59***	(0.83)	3.96***	(0.29)
US - Existing Home Sales	-0.21	(1.19)	-0.07	(1.21)	-0.88	(1.42)	-2.06	(1.20)	1.44***	(0.06)
US - Durable Goods Orders	-2.06*	(0.99)	-2.44**	(0.95)	-1.46	(1.10)	-1.08	(0.91)	0.80***	(0.04)
US - Consumer Confidence Index	-0.92*	(0.45)	-0.95	(0.65)	-1.47**	(0.54)	-0.68	(0.52)	-0.11***	(0.02)
US - QE Treasuries & MBS	-0.36	(0.65)	-0.42	(0.86)	0.03	(0.83)	-1.38*	(0.59)	-0.54***	(0.05)
US - QE Total	-0.44	(0.98)	-1.12	(1.10)	-1.10	(1.07)	-0.83	(0.72)	-0.33***	(0.06)
US - Federal Funds Rate	-0.49	(0.59)	-0.22	(0.68)	-0.07	(0.76)	-1.61***	(0.46)	-0.05	(0.03)
US - GDP	-0.03	(0.69)	0.29	(0.66)	-0.01	(0.65)	-0.07	(0.74)	-0.17***	(0.02)
US - Pending Home Sales	-0.41	(0.96)	-1.19	(0.92)	-1.23	(1.01)	-0.66	(0.98)	1.12***	(0.07)
US - ISM Non-Manufacturing PMI	0.76	(0.59)	0.42	(0.63)	1.30	(0.71)	0.23	(0.48)	-0.18***	(0.03)
US - Reuters Michigan Consumer Sentiment	-1.18	(1.30)	-0.90	(1.17)	-0.09	(1.25)	-2.84***	(0.74)	0.46***	(0.04)
US - Midterm Elections	-1.17	(1.84)	-0.56	(1.97)	-0.58	(1.73)	-3.49***	(0.83)	-0.19***	(0.04)
US - FOMC Economic Projections	1.09	(2.21)	-0.14	(1.78)	0.63	(2.03)	-3.55***	(1.03)	0.03	(0.03)
US - All Announcements	-0.12	(0.25)	0.14	(0.32)	0.03	(0.28)	-0.18	(0.23)	0.16***	(0.01)
CAN - Employment Rate	1.51*	(0.69)	1.20	(0.94)	0.89	(0.83)	-0.25	(0.81)	-0.12*	(0.05)
CAN - Interest Rates	-0.78	(0.84)	-0.46	(0.86)	-0.17	(0.93)	-1.46*	(0.70)	-0.13***	(0.03)
CAN - GDP MoM	-5.08*	(2.13)	-6.26***	(1.56)	-3.22	(2.00)	-1.16	(0.96)	2.80***	(0.39)
CAN - Ivey PMI s.a	-2.72	(1.42)	-1.94	(1.42)	-2.69	(1.58)	-3.71***	(0.82)	1.46***	(0.08)
CAN - Core Inflation Rate	1.90	(1.43)	1.24	(1.29)	2.94*	(1.38)	-0.74	(1.17)	0.46***	(0.05)
CAN - GDP Growth QoQ	1.60	(1.06)	1.22	(1.03)	1.33	(0.96)	-0.84	(0.82)	-0.10*	(0.04)
CAN - Inflation Rate	-0.96	(1.24)	-2.16*	(1.04)	-1.51	(1.01)	-3.19***	(0.82)	-1.03***	(0.05)
CAN - Unemployment Rate	1.06	(0.89)	-0.28	(0.71)	-0.53	(0.74)	-0.09	(0.74)	-0.85***	(0.04)
CAN - All Announcements	0.64	(0.40)	0.42	(0.42)	0.65	(0.47)	0.00	(0.47)	-0.02	(0.02)
All Announcements	0.06	(0.29)	0.17	(0.30)	0.16	(0.28)	-0.02	(0.24)	0.10***	(0.01)

Table 25: Regressions with General Dummies

Dependent variable: $\Omega^{CVAR}_{a,j,i}$	Random Effect GLS (Homogenous slopes)			Mean Group Estimator (Heterogeneous slopes)		
All US Announcements (TE 3 stars)	-0.70		-0.35	-0.23		0.01
	(0.49)		(0.46)	(0.46)		(0.37)
All Canadian Announcements (TE 3 stars)	2.10*		1.76*	1.55		1.49*
	(0.90)		(0.73)	(1.08)		(0.73)
All US Announcements (FIT (2014))	1.36*	1.23*		0.90	0.87*	
	(0.57)	(0.54)		(0.57)	(0.42)	
All Canadian Announcements (FIT (2014))	-0.34	0.50		-0.09	0.68	
	(0.73)	(0.59)		(0.78)	(0.52)	
Ratio Spread	-14.93*	-13.80*	-15.68*	-19.94*	-19.65*	-20.40*
	(6.79)	(6.84)	(6.83)	(8.17)	(8.17)	(8.15)
Ratio Trade	96.17**	91.57**	95.70**	101.99***	99.70***	103.99***
	(29.66)	(29.81)	(29.63)	(22.76)	(22.60)	(23.48)
t	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
Constant	54.97***	55.28***	55.30***	46.32***	46.35***	46.46***
	(4.28)	(4.31)	(4.31)	(5.22)	(5.22)	(5.22)
χ^2	28.43	20.29	21.14	31.6	32.04	30.57
N	10170	10170	10170	10170	10170	10170

Table 26: Regressions with General Dummies

Dependent variable: $\Omega^{FCVAR}_{a,j,i}$	Random Effect GLS (Homogenous slopes)			Mean Group Estimator (Heterogeneous slopes)		
All US Announcements (TE 3 stars)	-0.39		-0.31	-0.02		-0.08
	(0.44)		(0.42)	(0.44)		(0.43)
All Canadian Announcements (TE 3 stars)	1.31		0.89	2.00**		1.85***
	(0.81)		(0.66)	(0.66)		(0.56)
All US Announcements (FIT (2014))	0.46	0.39		0.24	0.12	
	(0.51)	(0.48)		(0.43)	(0.42)	
All Canadian Announcements (FIT (2014))	-0.54	0.02		-0.14	0.69	
	(0.66)	(0.53)		(0.68)	(0.54)	
Ratio Spread	-17.98**	-17.59**	-18.33**	-18.37*	-18.12*	-18.44*
	(6.17)	(6.18)	(6.17)	(8.75)	(8.77)	(8.73)
Ratio Trade	86.36**	83.39**	87.79**	91.80***	90.24***	93.36***
	(27.11)	(27.10)	(26.93)	(22.77)	(23.12)	(24.03)
t	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
Constant	55.32***	55.34***	55.39***	47.43***	47.45***	47.37***
	(3.90)	(3.91)	(3.90)	(3.42)	(3.42)	(3.44)
χ^2	23.64	20.13	21.73	30.8	21.58	31.17
N	10170	10170	10170	10170	10170	10170

Table 27: Regressions with General Dummies

Dependent variable: $\Omega^{LR}_{a,j,i}$	Random Effect GLS (Homogenous slopes)			Mean Group Estimator (Heterogeneous slopes)		
All US Announcements (TE 3 stars)	0.02		0.10	0.29		0.32
	(0.48)		(0.46)	(0.43)		(0.41)
All Canadian Announcements (TE 3 stars)	1.96*		0.98	1.77*		1.62**
	(0.89)		(0.72)	(0.84)		(0.61)
All US Announcements (FIT (2014))	0.56	0.68		-0.12	0.05	
	(0.56)	(0.53)		(0.50)	(0.44)	
All Canadian Announcements (FIT (2014))	-1.26	-0.31		-0.56	0.38	
	(0.72)	(0.58)		(0.70)	(0.50)	
Ratio Spread	-20.53**	-20.08**	-20.67**	-19.32*	-19.28*	-19.64*
	(6.73)	(6.74)	(6.74)	(8.17)	(8.13)	(8.07)
Ratio Trade	60.50*	59.27*	65.14*	67.35**	66.04**	69.83**
	(29.30)	(29.32)	(29.20)	(22.67)	(22.81)	(23.76)
t	-0.00	-0.00	-0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
Constant	52.04***	52.26***	52.37***	46.48***	46.49***	46.52***
	(4.23)	(4.25)	(4.25)	(3.80)	(3.80)	(3.79)
χ^2	21.53	16.52	16.08	20.2	14.73	22.35
N	10170	10170	10170	10170	10170	10170

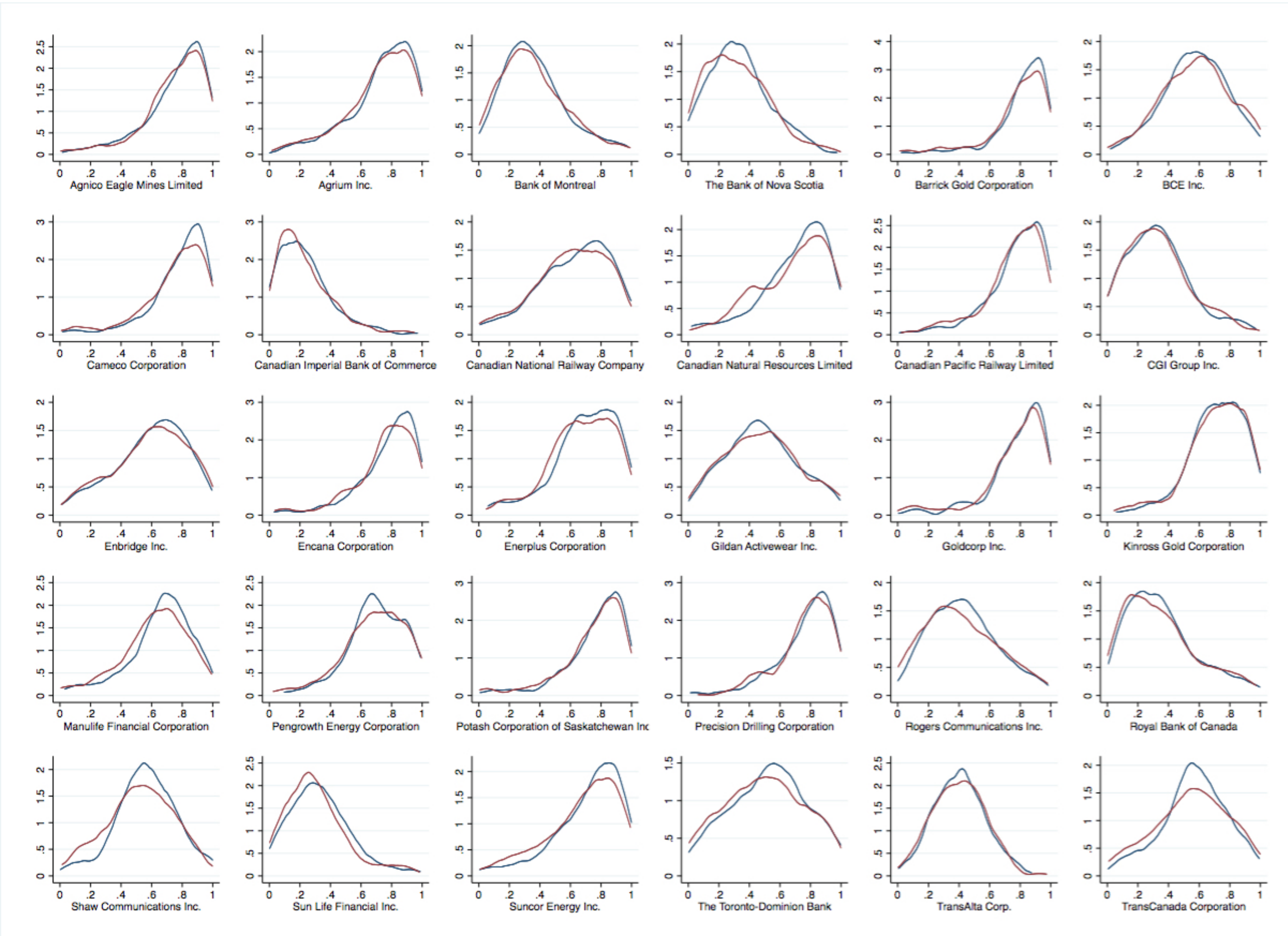
Table 28: Regressions with General Dummies

Dependent variable: $\omega_{j,i}^{FCVAR}$	Random Effect GLS (Homogenous slopes)			Mean Group Estimator (Heterogeneous slopes)		
All US Announcements (TE 3 stars)	0.36		0.42	0.26		0.39
	(0.39)		(0.37)	(0.41)		(0.38)
All Canadian Announcements (TE 3 stars)	-0.31		-0.26	-0.44		-0.52
	(0.71)		(0.57)	(0.76)		(0.54)
All US Announcements (FIT (2014))	0.21	0.33		0.37	0.46	
	(0.44)	(0.41)		(0.38)	(0.39)	
All Canadian Announcements (FIT (2014))	0.10	-0.02		-0.02	-0.24	
	(0.56)	(0.45)		(0.61)	(0.48)	
Ratio Spread	-16.79***	-17.12***	-16.88***	-10.90*	-10.57*	-11.13*
	(4.98)	(4.98)	(4.97)	(5.19)	(5.12)	(5.17)
Ratio Trade	-3.99	-2.15	-4.76	1.14	1.97	-0.10
	(20.20)	(20.18)	(20.06)	(15.48)	(15.13)	(16.05)
t	0.01*	0.01*	0.01*	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	76.52***	76.50***	76.55***	79.64***	79.65***	79.81***
	(3.06)	(3.06)	(3.05)	(3.08)	(3.08)	(3.07)
χ^2	44.93	43.67	44.86	8.67	8.60	9.08
N	10170	10170	10170	10170	10170	10170

Table 29: Regressions with General Dummies

Dependent variable: $\omega_{j,i}^{PCA}$	Random Effect GLS (Homogenous slopes)			Mean Group Estimator (Heterogeneous slopes)		
All US Announcements (TE 3 stars)	0.04		0.04*	0.02		0.00
	(0.02)		(0.02)	(0.02)		(0.02)
All Canadian Announcements (TE 3 stars)	-0.03		-0.00	-0.16***		0.02
	(0.03)		(0.03)	(0.03)		(0.02)
All US Announcements (FIT (2014))	-0.01	-0.00		-0.06***	-0.06***	
	(0.02)	(0.02)		(0.01)	(0.02)	
All Canadian Announcements (FIT (2014))	0.03	0.02		0.20***	0.14***	
	(0.03)	(0.02)		(0.03)	(0.03)	
Ratio Spread	-0.27	-0.30	-0.28	0.54	0.50	0.53
	(0.28)	(0.28)	(0.27)	(0.32)	(0.33)	(0.32)
Ratio Trade	-1.86	-1.71	-2.07	-8.38***	-8.22***	-8.90***
	(1.30)	(1.30)	(1.27)	(1.56)	(1.56)	(1.46)
t	0.02***	0.02***	0.02***	0.02***	0.02***	0.02***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	90.29***	90.28***	90.26***	89.84***	89.84***	89.81***
	(0.20)	(0.21)	(0.20)	(0.26)	(0.26)	(0.26)
χ^2	1496.22	1482.71	1475.28	1567.74	1499.02	1559.12
N	10170	10170	10170	10170	10170	10170

Figure 1: Densities of $\Omega^{CVAR}_{a,j,i}$ and $\Omega^{FCVAR}_{a,j,i}$ by stock



Legend: $\Omega^{CVAR}_{a,j,i}$, $\Omega^{FCVAR}_{a,j,i}$

Figure 2: Densities of $\omega_{a,j,i}^{FCVAR}$ by stock