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Announcement**

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Level Shifts in Beta, Spurious Abnormal Returns and the TARP Announcement*

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Abstract

Using high frequency data, we develop an event study method to test for level shifts in beta and measure abnormal returns for events that produce such level shifts. Using this method, we estimate abnormal returns for the Troubled Asset Relief Program (TARP) announcement and find that its abnormal returns are largely realized on the first day. The abnormal returns in the remaining post event period, which show up as a drift using standard methodology, are attributed to level shifts in beta.

Keywords: Event studies, intraday returns, systematic risk.

JEL: G12, G14.

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1 Introduction

Measuring the cumulative abnormal return (CAR) of an asset post the announcement of an event is the focus of a substantial body of literature in the fields of economics, finance, accounting, management, marketing and law; see MacKinlay (1997). The vast majority of CARs are computed using what is termed the ‘market model,’ which is motivated by the capital asset pricing model (CAPM) of Sharpe (1964) and Lintner (1965). Generalizations of this market model are also sometimes used, as motivated, for instance, by the Fama and French (1993) three-factor model. Model parameter estimates are critical to the determination of CARs, with model estimation typically based on pre-event daily returns over a year; see for example, Masulis et al. (2007) and Giroud and Mueller (2010).

In event studies where significant abnormal returns are detected many days after the event, changes in an asset’s sensitivity to the overall market (as well as to other, potential, sources of systematic risk) are often suggested as an explanation of the perceived under-reaction or over-reaction in stock returns. However, prior empirical studies have typically found that controlling for changes in systematic risk does not significantly impact CAR estimates. In contrast, this paper demonstrates that controlling for systematic risk using an estimator well suited to detect changes in betas around events in a short time horizon can result in significantly different CARs.

In this paper, we apply econometric theory of the realized beta estimator developed in Barndorff-Nielsen and Shephard (2004). Researchers such as Andersen et al. (2005 and 2006), Todorov and Bollerslev (2010) and Patton and Verardo (2012) find this estimator substantially improves the (high frequency) measurement of systematic risk. The realized beta estimator is also prominent in the recent literature on beta forecasting, both in generating forecasts and in forecast evaluation; see Hooper et al. (2008), Chang et al. (2012), Reeves and Wu (2013) and Cenesizoglu et al. (2016). We use this estimator to measure changes in market betas after an influential macroeconomic event. Specifically, we study the announcement of the Troubled

Asset Relief Program (TARP)¹, where we expect to see significant decreases in the systematic risk of financial institutions following the announcement.

Although we use market betas as our main measure of systematic risk exposure, we do not (necessarily) assume that the CAPM holds. Changes in market betas are also important in Merton's (1973) ICAPM, for instance, and our event study approach allows for an intercept term to capture constant exposures to state variables. This approach demonstrates that controlling for changes in market betas sourced to the event under study can significantly alter the conclusions drawn on the effects of the event; specifically, on whether those effects link (primarily) to idiosyncratic or systematic factors.

Relative to standard event study methodology, our results suggest that when reliable high-frequency data is available, estimation of asset market betas around the event study window using the realized beta estimator offers a more complete decomposition of return deviations and so is a more robust alternative. Use of this estimator in event studies can, thus, be seen as a robustness check. Recent studies to which this robustness check, generally, and this paper's test results, specifically, most readily apply include Veronesi and Zingales (2010) and Bayazitova and Shivdasani (2012), which both analyze the effects of the TARP announcement on equity returns. In this context, controlling for changes in market betas owed to the TARP announcement is shown to be important when estimating post-event CARs, so as to avoid (potentially) misleading conclusions.

¹Following this announcement, which occurred on 9/19/08, the US Congress signed off on a provision of US\$700bn to inject capital into struggling entities, especially financial institutions.

2 Testing for post-event level shifts in beta

2.1 Econometric method

There is now an established literature that argues in favor of time-varying systematic risk exposure, as evidenced through time-varying betas (see; e.g., Robichek and Cohn (1974), Ferson et al. (1987), Lewellen and Nagel (2006) and Patton and Verardo (2012), among others). The exact degree of this variation is, itself, associated with healthy variation. Lewellen and Nagel (2006), posit that market betas stay fixed within a quarter, while Patton and Verardo (2012) assume that market betas change daily. In this paper, we align more with the former, in that we assume that systematic risk exposure, as measured by an asset's market beta, is a (relatively) slow moving process that stays fixed within a time period ranging from approximately two-months to half a month. The market betas that we estimate are then defined as

$$\widehat{\beta}_{i,T}(S) \equiv \frac{RCov_{i,m,T}(S)}{RV_{m,T}(S)} = \frac{\sum_{j=1}^S r_{i,j,T} r_{m,j,T}}{\sum_{j=1}^S r_{m,j,T}^2}, \quad (1)$$

where $r_{i,j,T}$ is the simple return earned on asset i over intraday sub-interval j of time period T , and m denotes the market. That is, we estimate an asset's market beta as the ratio between that asset's realized covariance with the market return and the market return's realized variance. Each realized measure is estimated using a total of S intraday sub-intervals within a given time period, where those time periods are $T = \{60\text{-days}, 30\text{-days}, 15\text{-days}\}$.

To understand the limiting behavior of (1), start by considering (using the notation of Patton and Verardo (2012), Appendix 1) a $N \times 1$ vector of risky asset returns $d \log \mathbf{P}(t)$, where the N^{th} return is the market return, that follows the diffusion

$$d \log \mathbf{P}(t) = d \log \mathbf{M}(t) + \Theta(t) d\mathbf{W}(t),$$

$$\Sigma(t) = \Theta(t) \Theta(t)',$$

where $d \log \mathbf{M}(t)$ is a drift term with finite variation, $\mathbf{W}(t)$ is a standard vector Brownian motion, and $\Sigma(t)$ is an instantaneous (or spot) covariance matrix of returns. Let

$$ICov_T = \int_{T-1}^T \Sigma(t) dt,$$

so that

$$\beta_{i,T} \equiv \frac{ICov_{im,T}}{IV_{m,T}},$$

where $ICov_{mm,T} = IV_{m,T}$, the "integrated" variance of the market return over time period T . Then by the theory of quadratic variation,

$$\widehat{\beta}_{i,T}(S) \xrightarrow{p} \beta_{i,T}, \quad S \rightarrow \infty,$$

and by Barndorff-Nielsen and Shephard (2004, Proposition 2),

$$\frac{\widehat{\beta}_{i,T}(S) - \beta_{i,T}}{\sqrt{\left(\sum_{j=1}^S r_{m,j,T}^2\right)^{-2} \times \widehat{g}_{i,m,T}(S)}} \xrightarrow{L} N(0, 1), \quad S \rightarrow \infty, \quad (2)$$

where

$$\widehat{g}_{i,m,T}(S) = \sum_{j=1}^S \widehat{x}_{j,T}^2 - \sum_{j=1}^{S-1} \widehat{x}_{j,T} \widehat{x}_{j+1,T} \quad (3)$$

and

$$\widehat{x}_{j,T} = r_{i,j,T} r_{m,j,T} - \widehat{\beta}_{i,T}(S) r_{m,j,T}^2, \quad (4)$$

a result that is both empirically feasible and straightforward to implement.

We are interested in detecting level shifts in systematic risk exposure by computing the betas

in (1) for the 30 components to the Dow Jones Industrial Average (DJIA) within symmetric windows (labeled pre and post) around the TARP announcement, where the S&P 500 return proxies for the market return.² Regardless of the size of these windows, the pre-event window always ends at the close of the trading on 9/17/08, and the post-event window always begins at the open of trading on 9/19/08. We study the DJIA components because they are all highly liquid and so minimize micro-structure effects and measurement error in the beta estimates. The intraday sub-period j that we select is 10-minutes, so (1) is computed using 10-minute, simple returns measured between 9:30 AM and 4:00 PM EST each day.³ All intraday data sources to Price-Data.⁴

Let $k = \{\text{pre}, \text{post}\}$. Given (1), we consider $\widehat{\beta}_{i,T}(k, S)$ and its associated (finite-sample) variance $\widehat{\sigma}_{i,T}^2(k, S)$, the latter of which is determined using (2)–(4). The null hypothesis we consider is then

$$H_0 : \beta_{i,T}(\text{pre}) = \beta_{i,T}(\text{post}) = \beta$$

for a constant β . Given (2), the test statistic we construct to evaluate this null is

$$\frac{\widehat{\beta}_{i,T}(\text{pre}, S) - \widehat{\beta}_{i,T}(\text{post}, S)}{\sqrt{\widehat{\sigma}_{i,T}^2(\text{pre}, S) + \widehat{\sigma}_{i,T}^2(\text{post}, S)}} \sim N(0, 1). \quad (5)$$

This test statistic is properly specified asymptotically as $S \rightarrow \infty$ since, under the null,

$$\text{Cov}(\beta_{i,T}(\text{pre}), \beta_{i,T}(\text{post})) = 0.$$

Level shifts in beta, thus, can be detected using a conventional two-sided, difference-in-means

²Those windows are the 60-day, 30-day, and 15-day time periods mentioned above.

³When $T = 60$ -days then, S is approximately 2,000.

⁴This data was originally accessed at

http://www.grainmarketresearch.com/djx_stocks.cfm.

test based on the asymptotics developed in Barndorff-Nielsen and Shephard (2004).

2.1.1 Potential misspecification

Empirical evidence supports

$$Cov\left(\widehat{\beta}_{i,T}(\text{pre}, S), \widehat{\beta}_{i,T}(\text{post}, S)\right) \geq 0, \quad (6)$$

for finite S (see; e.g., Anderson et al., 2006, Figures 4 and 6). As a consequence, while under the null, our test statistic is asymptotically unbiased, in finite samples, it may be biased, with this bias owing to the denominator in (5) being better represented by

$$\sqrt{\widehat{\sigma}_{i,T}^2(\text{pre}, S) + \widehat{\sigma}_{i,T}^2(\text{post}, S) - 2 \times Cov\left(\widehat{\beta}_{i,T}(\text{pre}, S), \widehat{\beta}_{i,T}(\text{post}, S)\right)} \quad (7)$$

Comparing the denominator in (5) to (7), under H_0 and given (6), the test statistic in (5) is biased towards failing to reject (in finite samples). As a consequence, we consider our testing method to be a conservative gauge for detecting a level shift in beta, owing to this bias. The degree of this bias, however, is relatively muted in the sense that realized beta estimates tend to display (far) less persistence than either the realized covariance or realized variance estimates from which they are constructed (see; e.g., Anderson et al., 2006).

2.2 Empirical analysis of level shifts in beta post-TARP

Table 1 displays the test results from applying (5) to all 30 DJIA stocks for 60-, 30-, and 15-day windows immediately before and following the TARP announcement.⁵ As evidenced in the

⁵Owing to the construction of $\widehat{\beta}_{i,T}(S)$ in (1), econometric analysis of these betas can also follow under the usual \sqrt{T} asymptotics (i.e., in the context of (1), hold S fixed, and let $T \rightarrow \infty$). As a consequence, standard errors for $\widehat{\beta}_{i,T}(S)$ can alternatively be generated according to Newey and West (1987). Patton and Verardo (2012) apply such asymptotics in their analysis of realized betas. An earlier version of this paper followed a similar tack, with results very similar to those reported in Table 1.

table, nearly half of the stocks (14, in particular) experience statistically significant level shifts in beta from the pre- to the post-event windows at a 10% significance level (at least). In light of the discussion in the previous section, these findings provide strong evidence supporting level shifts in beta as a result of the TARP announcement. The 60-day window tends to display the smallest p-values because the standard errors tend to be the smallest. As the window size decreases, the standard errors of the beta estimates tend to increase (especially in the post-event window). Signs of the beta differences do not tend to change with the window size, however, and significant differences (at a 10% significance level) are discovered for all window sizes, making the finding of TARP-induced changes in betas robust.

Consistent with the intent of TARP, financial stocks display the most notable level shifts in beta across all window sizes (see AXP, BAC, GE, and JPM),⁶ where these differences are uniformly positive, indicating a decline in the level of systematic risk. In the pre-event window, financial stocks have the highest betas across all window sizes of the DJIA components, where (with the exception of GE) these betas are all statistically greater than one. In the post-event window, in contrast (again, with the exception of GE), none of the financial stock betas are statistically distinguishable from one. For both the 60- and 30-day windows, beta differences for financial stocks are significant at the 1% level. Across these windows, reductions in the betas of Bank of America (BOA) and JPMorgan (JPM), for example, are at (or near) 50%. Even at the 15-day window, where betas are the most imprecisely estimated, beta differences for financial stocks remain significant at the 10% level. In this case, reductions in the betas of BOA and JPM still exceed 30% in absolute value.

Veronesi and Zingales (2010, Table 4) report beta estimates for BOA and JPM from a pre-event window of 1/1/07–10/9/08 obtained using traditional event study methodology.⁷ These estimates are quite comparable to those reported under the 60-day pre-event window in Table

⁶At the time, GE included GE Capital, which was at the time and continues to be a large bank.

⁷The event under study is the announcement of the Revised Paulson Plan that occurred on 10/13/08.

1. Veronesi and Zingales (2010) use their pre-event beta estimates to calculate CARs for BAC and JPM occurring over the event window 10/10/08–10/14/08. These CARs are 4% and –22%, respectively. Veronesi and Zingales (2010) also report what the CARs would be if the betas for BAC and JPM were both one. These CARs are 16% and –13%, respectively, a 4× and 0.6× increase relative to the pre-event beta case. From the discussion in the preceding paragraph, financial stock betas (including those of BAC and JPM) appear statistically indistinguishable from one following the (initial) TARP announcement. Pre-event betas then (in this instance), are not good measures for post-event systematic risk exposure, and using them as such in the calculation of traditional CARs can distort the magnitudes of those CARs by multiple orders.

Table 1 also evidences significant beta differences for non-financial stocks. Relative to financial stocks, however, instances of significant beta differences are less robust across window sizes. For instance, only one of the six non-financial stocks displaying statistically significant beta differences at the 1% level in the 60-day window continues to display a significant beta difference at the 1% level in the 30-day window. Moreover, none of the six non-financial stocks display significant beta differences at a 10% level in the 15-day window.

In general, the direction of shifts in betas correlates with leverage and with TARP bailout funds awarded. The betas of financials and levered firms tend to decrease, while those which are cash rich (negative debt-to-equity ratios) tend to increase. Of the non-financial stocks experiencing a statistically significant increase in beta, those evidencing the largest percentage increase tend to be economic bellwethers (e.g., CVX, KO, JNJ, and PG). Consistent with these increases, then, is the TARP announcement signaling a shift of risk from financial firms onto a broader cross-section of firms. Overall, the prevalence of significant level shifts in beta occurring across components of the DJIA in response to TARP indicates that this policy-event triggered sufficient variation in betas to study the impact of these shifts on CARs.

3 CAR measurements

We now examine the impact of post-announcement level shifts in beta on the estimation of portfolio CARs. Specifically, conventional CARs computed using standard event study methodology benchmark CARs reliant upon post-event realized betas that account for level shifts in beta. The Conventional CARs are computed using the following two approaches:

- 1. Daily.** The market model is estimated for each stock using daily returns over the prior year (250 trading days prior to the announcement) to fit the regression model

$$r_{i,t} = \alpha_{pre,i} + \beta_{pre,i}r_{m,t} + \epsilon_{i,t},$$

where $r_{i,t}$ and $r_{m,t}$ represent the return of stock i and the return on the market index, respectively, earned on day t , and $\epsilon_{i,t} \perp r_{m,t} \forall i$. Post announcement abnormal returns for stock i are then calculated as

$$AR_{i,t} = r_{i,t} - (\hat{\alpha}_{pre,i} + \hat{\beta}_{pre,i}r_{m,t}),$$

so that the post announcement n -day cumulative abnormal return on stock i is

$$CAR_{i,n} = \sum_{t=1}^n AR_{i,t}, \tag{8}$$

and the post announcement n -day, equally-weighted portfolio CAR is

$$CAR_{N,n} = N^{-1} \sum_{i=1}^N CAR_{i,n}. \tag{9}$$

The Daily approach is the most widely used in the literature.

- 2. Daily FF.** The Fama and French (1993) three factor model (hereafter, the FF model)

is estimated for each stock using daily returns over the prior year (250 trading days prior to the announcement) fit to the augmented regression model

$$r_{i,t} = \alpha_{pre,i} + \beta_{pre,i,m}r_{m,t} + \beta_{pre,i,s}SMB_t + \beta_{pre,i,v}HML_t + \epsilon_{i,t},$$

where $r_{i,t}$ and $r_{m,t}$ retain their, respective, definitions from above, SMB_t and HML_t represent the size and value premia, respectively, earned on day t , and $\epsilon_{i,t} \perp r_{m,t}, SMB_t, HML_t \forall i$. Post announcement abnormal returns for stock i are then calculated as

$$AR_{i,t} = r_{i,t} - (\hat{\alpha}_{pre,i} + \hat{\beta}_{pre,i,m}r_{m,t} + \hat{\beta}_{pre,i,s}SMB_t + \hat{\beta}_{pre,i,v}HML_t),$$

with the post announcement n -day portfolio CAR retaining its definition from (8) and (9).

The Daily FF approach has the potential to explain relatively more of the systematic variation in equity returns, thereby reducing the standard errors of the individual and portfolio CARs used for determining the statistical significance of any abnormal returns. In practice, however, the gains in the Daily FF approach over the Daily approach in terms of reduced standard errors are found to be somewhat muted; see, Campbell, Lo, and MacKinlay (1997, Chapter 4.3.3).

3. High Frequency (HF) 21-60. Under this approach, abnormal returns earned on security i are computed as

$$AR_{i,t} = r_{i,t} - \left(\hat{\alpha}_{i,T}(\text{pre}, S) - \hat{\beta}_{i,T}^o(\text{post}, S) \times r_{m,t} \right),$$

where

$$\hat{\alpha}_{i,T}(\text{pre}, S) = T^{-1} \sum_{t=1}^T \left(r_{i,t} - \hat{\beta}_{i,T}(\text{pre}, S) \times r_{m,t} \right),$$

for the T corresponding to the 60-day, pre-event window defined in the previous section. The post-event realized beta $\widehat{\beta}_{i,T}^o$ (post, S) is calculated using $T = 21 - 60$ days following the TARP announcement, where o denotes that this realized beta estimate is obtained out-of-sample relative to the CAR. Under this convention, there is no overlap between the beta estimation window and CAR estimation window, which avoids the potential of abnormal returns in the CAR estimation window influencing the beta estimation.

Two portfolios of five Dow stocks each are formed based on the largest downward and upward post announcement realized beta level shifts. The five stocks showing the largest downward level shift are American Express, Bank of America, General Electric, Home Depot and JP Morgan, which form the equally-weighted portfolio named "TARP Down." The five stocks showing the largest upward level shift are Chevron, Coca Cola, Exxon Mobil, Johnson & Johnson and Procter & Gamble, which form the equally-weighted portfolio named "TARP Up." CARs for these portfolios are computed for 20 days post announcement with stock and S&P500 Index returns as well as size and value premiums, all measured daily.⁸

In order to make statistical comparisons between portfolio CARs estimated over a 20-day post-event window (see the description of HF 21-60 for the justification of this post-event window size), conventional n -day CAR standard deviations are estimated under the Daily and Daily FF approaches so as to determine the, respective, 95% Gaussian confidence intervals. For each component stock of the TARP Down and TARP Up portfolios, risk factor betas are computed from daily returns using either the market or FF model, over the prior year,

⁸The source of daily stock and S&P 500 Index returns is the Center for Research in Security Prices, [CRSP/Compustat Merged Database], Wharton Research Data Services,

<http://www.whartonwrds.com/datasets/crsp/>.

The source of daily size and value premiums is the Kenneth French Data Library,

http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

excluding the 10 days immediately before the TARP announcement. The standard deviation of the portfolio residuals is computed over the 240-day control period and multiplied by \sqrt{n} to compute the n-day CAR standard deviation. Portfolio CARs computed under the HF 21-60 approach that appear outside of the confidence intervals constructed using these portfolio standard deviation estimates are interpreted as being statistically distinct from the conventional CAR estimates.

Figure 1 displays CARs for the TARP Down portfolio over the 20-day post-announcement window for the three approaches (Daily, Daily FF, HF 21-60). Differentiating the top and bottom panels is the source of the 95% confidence interval: for the top panel, that source is the Daily approach; for the bottom panel, the source is the Daily FF approach. Evidenced in Figure 1 is an upward drift in CARs measured using the Daily and Daily FF approaches across the post-announcement window, where this drift is statistically significant. In contrast, the HF 21-60 CARs display notably less of a drift. Moreover, moving across the post-announcement window, the HF 21-60 CARs tend to fall outside of the 95% confidence intervals. Specifically, following 10/6/08, the HF 21-60 CARs exist below the lower bound of the confidence intervals. This tendency is accentuated using the Daily FF-based confidence intervals, which is, of course, consistent with standard errors for FF model CARs being less than or equal to the standard errors for market model CARs. In either case, the confidence intervals are rather wide, and they comfortably cover both the Daily and Daily FF CARs. Since the HF 21-60 CARs can exist below the lower-bound of these confidence intervals, CARs measured using realized betas are (quite) different, in a statistical sense, from CARs measured using standard betas. Moreover, level shifts in betas go a long way in explaining the "abnormally" positive returns earned (mostly) on financial stocks following the TARP announcement. It is also interesting to note that on day one, both the HF 21-60 and Daily AR exists above the FF model 95% confidence interval. It seems, then, that movement in a non-market systematic risk factor explains these

apparent "abnormal" returns.

Figure 2 displays the CARs for the TARP Up portfolio. In contrast to the TARP Down portfolio, there does not appear to be much of a drift overall in the CARs for the TARP Up portfolio estimated under the different approaches. There is, however, a notable downward shift in the CARs on 10/10/08, which (partially) reverts by the end of the post-announcement window. At this time, the downward shift in the HF 21-60 CAR is quite near the upper bound of the market model-based 95% confidence interval and exists above the 95% confidence interval for the FF model CARs (where it remains through the end of the post-announcement window). As a consequence, even the TARP Up CARs estimated using the HF 21-60 approach display statistically significant departures from the CARs estimated using conventional methods, where these departures are in the direction away from evidencing any "abnormal" returns in the post-announcement window.

4 Conclusion

We find that the systematic risk (measured using market betas) of many stocks in our sample changes following the TARP announcement. We demonstrate that this change can be detected using high-frequency data. We then estimate CARs using various methods. CARs using realized betas (estimated after the event, and after the CAR estimation window) suggest that there was in fact no under-reaction or over-reaction of investors to the TARP event. However, we find that standard event study methodologies *spuriously* generate statistically and economically significant drifts in CARs. Using the market model approach with daily returns (the most widely used in the literature) the spurious drift in CAR was as high as 26.11% on day 16 post announcement. Based on this evidence, we suggest that future event study researchers who find large and significant CARs and have access to high-frequency data for their sample consider the possibility of controlling for post-event level shifts in beta using a method similar to the

one outlined in this paper.

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Table 1: Test of post TARP announcement realized beta level shifts

Ticker	D/E	Window Size								
		60-Day			30-Day			15-Day		
		β_{pre}	β_{post}	p-val	β_{pre}	β_{post}	p-val	β_{pre}	β_{post}	p-val
AA	0.28	1.10 (0.07)	1.27 (0.05)	0.07	1.08 (0.11)	1.23 (0.08)	0.22	1.20 (0.13)	1.32 (0.14)	0.33
AXP	0.84	1.64 (0.08)	1.10 (0.07)	0.00	1.45 (0.11)	0.99 (0.10)	0.00	1.35 (0.13)	0.94 (0.19)	0.08
T	0.36	0.84 (0.04)	0.83 (0.05)	0.40	0.90 (0.05)	0.80 (0.08)	0.24	0.87 (0.06)	0.66 (0.15)	0.16
BAC	0.38	2.14 (0.14)	1.14 (0.07)	0.00	1.81 (0.19)	0.95 (0.11)	0.00	1.71 (0.21)	1.17 (0.25)	0.10
BA	0.00	0.70 (0.05)	0.80 (0.05)	0.14	0.72 (0.07)	0.75 (0.08)	0.38	0.66 (0.07)	0.61 (0.14)	0.38
CAT	0.42	0.87 (0.05)	1.01 (0.06)	0.10	0.84 (0.08)	0.97 (0.09)	0.22	0.80 (0.08)	1.03 (0.12)	0.12
CVX	-0.02	0.56 (0.04)	0.99 (0.05)	0.00	0.75 (0.06)	1.01 (0.07)	0.01	0.84 (0.07)	0.91 (0.10)	0.34
CSCO	-0.15	0.84 (0.06)	0.85 (0.04)	0.40	0.74 (0.08)	0.87 (0.06)	0.17	0.69 (0.09)	0.98 (0.13)	0.08
KO	-0.03	0.30 (0.03)	0.54 (0.04)	0.00	0.35 (0.04)	0.49 (0.06)	0.07	0.29 (0.04)	0.30 (0.11)	0.40
DD	0.09	0.78 (0.04)	0.87 (0.05)	0.14	0.75 (0.05)	0.82 (0.07)	0.30	0.72 (0.06)	0.79 (0.05)	0.26
XOM	-0.08	0.59 (0.05)	0.90 (0.05)	0.00	0.73 (0.07)	0.95 (0.07)	0.04	0.81 (0.08)	0.77 (0.11)	0.38
GE	1.35	1.21 (0.09)	0.87 (0.06)	0.00	1.31 (0.14)	0.74 (0.09)	0.00	1.30 (0.17)	0.78 (0.24)	0.08
HPQ	-0.07	0.63 (0.05)	0.69 (0.05)	0.28	0.58 (0.07)	0.67 (0.08)	0.27	0.54 (0.08)	0.66 (0.12)	0.28
HD	0.23	1.17 (0.07)	0.84 (0.05)	0.00	0.97 (0.09)	0.78 (0.07)	0.11	0.86 (0.10)	0.63 (0.13)	0.15
IBM	0.07	0.69 (0.04)	0.74 (0.04)	0.26	0.69 (0.06)	0.69 (0.06)	0.40	0.67 (0.07)	0.67 (0.13)	0.40
INTC	-0.09	0.87 (0.08)	0.76 (0.05)	0.18	0.74 (0.11)	0.74 (0.07)	0.40	0.73 (0.12)	0.73 (0.16)	0.40
JNJ	-0.02	0.22 (0.02)	0.47 (0.04)	0.00	0.26 (0.03)	0.41 (0.07)	0.06	0.22 (0.04)	0.29 (0.08)	0.29
JPM	0.37	1.93 (0.13)	1.03 (0.07)	0.00	1.76 (0.20)	0.87 (0.10)	0.00	1.70 (0.23)	1.16 (0.20)	0.08
KFT	0.36	0.41 (0.04)	0.49 (0.04)	0.13	0.41 (0.06)	0.45 (0.06)	0.36	0.37 (0.06)	0.26 (0.14)	0.31
MCD	0.11	0.58 (0.04)	0.59 (0.04)	0.39	0.55 (0.05)	0.57 (0.06)	0.37	0.46 (0.05)	0.48 (0.10)	0.40
MRK	-0.09	0.53 (0.04)	0.69 (0.05)	0.02	0.59 (0.06)	0.64 (0.08)	0.36	0.52 (0.07)	0.39 (0.17)	0.32
MSFT	-0.10	0.70 (0.05)	0.75 (0.04)	0.32	0.64 (0.07)	0.72 (0.06)	0.27	0.59 (0.08)	0.63 (0.14)	0.38
MMM	0.04	0.62 (0.06)	0.70 (0.04)	0.23	0.61 (0.09)	0.66 (0.07)	0.36	0.54 (0.11)	0.60 (0.08)	0.36
PFE	-0.16	0.60 (0.05)	0.63 (0.04)	0.37	0.59 (0.08)	0.58 (0.07)	0.40	0.52 (0.09)	0.54 (0.12)	0.39
PG	0.09	0.35 (0.03)	0.55 (0.04)	0.00	0.35 (0.04)	0.53 (0.07)	0.03	0.29 (0.04)	0.40 (0.14)	0.30
TRV	0.00	0.99 (0.15)	0.84 (0.07)	0.24	0.97 (0.24)	0.81 (0.11)	0.33	0.92 (0.28)	0.74 (0.21)	0.35
UTX	0.08	0.77 (0.04)	0.83 (0.05)	0.24	0.77 (0.06)	0.78 (0.07)	0.40	0.71 (0.07)	0.56 (0.18)	0.30
VZ	0.34	0.72 (0.04)	0.80 (0.05)	0.17	0.77 (0.06)	0.78 (0.07)	0.40	0.72 (0.08)	0.60 (0.08)	0.20
WMT	0.13	0.64 (0.05)	0.53 (0.04)	0.08	0.50 (0.07)	0.50 (0.07)	0.40	0.44 (0.07)	0.57 (0.12)	0.25
DIS	0.14	0.76 (0.04)	0.88 (0.05)	0.07	0.75 (0.07)	0.82 (0.07)	0.30	0.70 (0.08)	0.75 (0.08)	0.36

Notes: D/E is Debt-to-Equity and is computed on 18 September 2008 as (long-term debt - cash and short term investments)/market value of equity, sourced from S&P Global, [Compustat North America], Wharton Research Data Services,

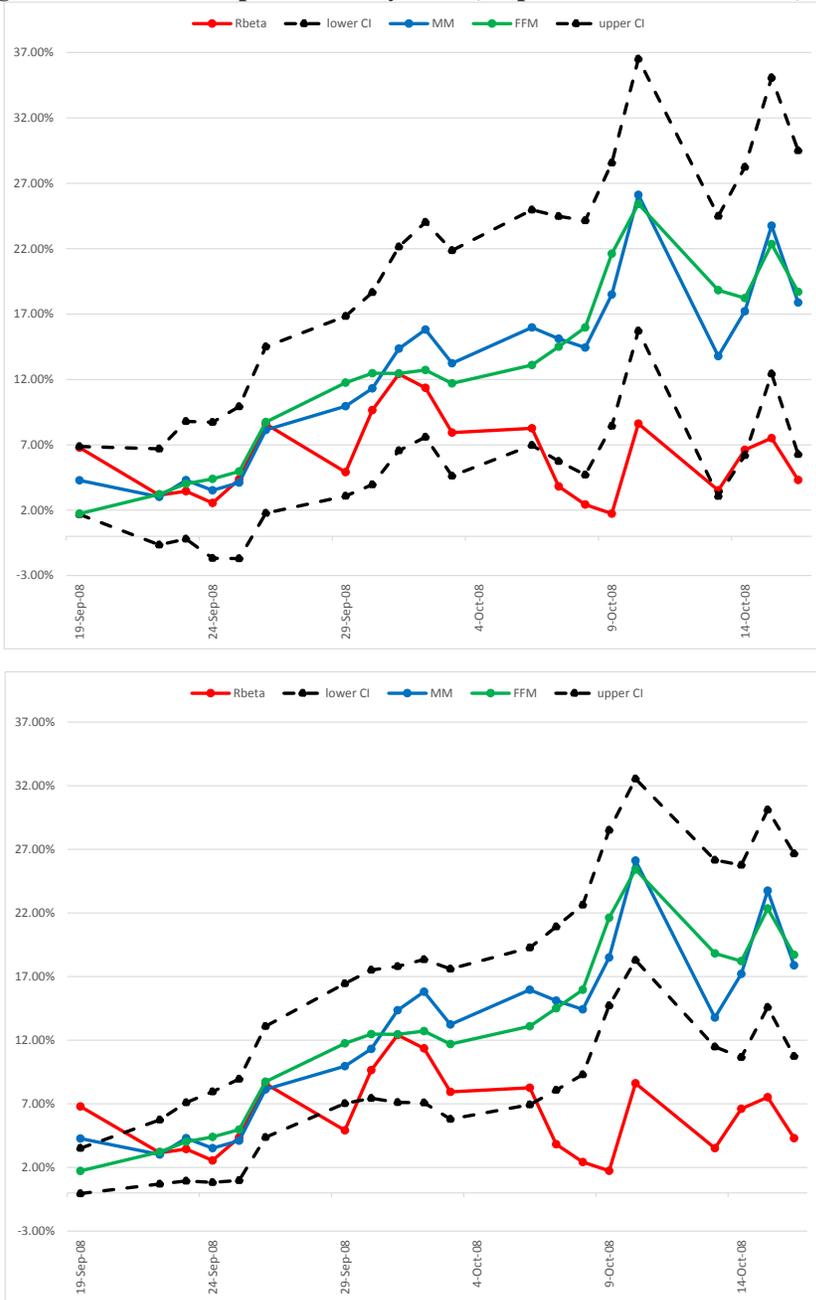
<http://www.whartonwrds.com/datasets/capital-iq/>.

Realized betas are estimated within 60-, 30-, and 15-day windows prior to (pre) and following (post) the TARP announcement, which occurred on 9/18/08. The data underlying all realized beta estimates sources to Price-Data, originally accessed at

http://www.grainmarketresearch.com/djx_stocks.cfm.

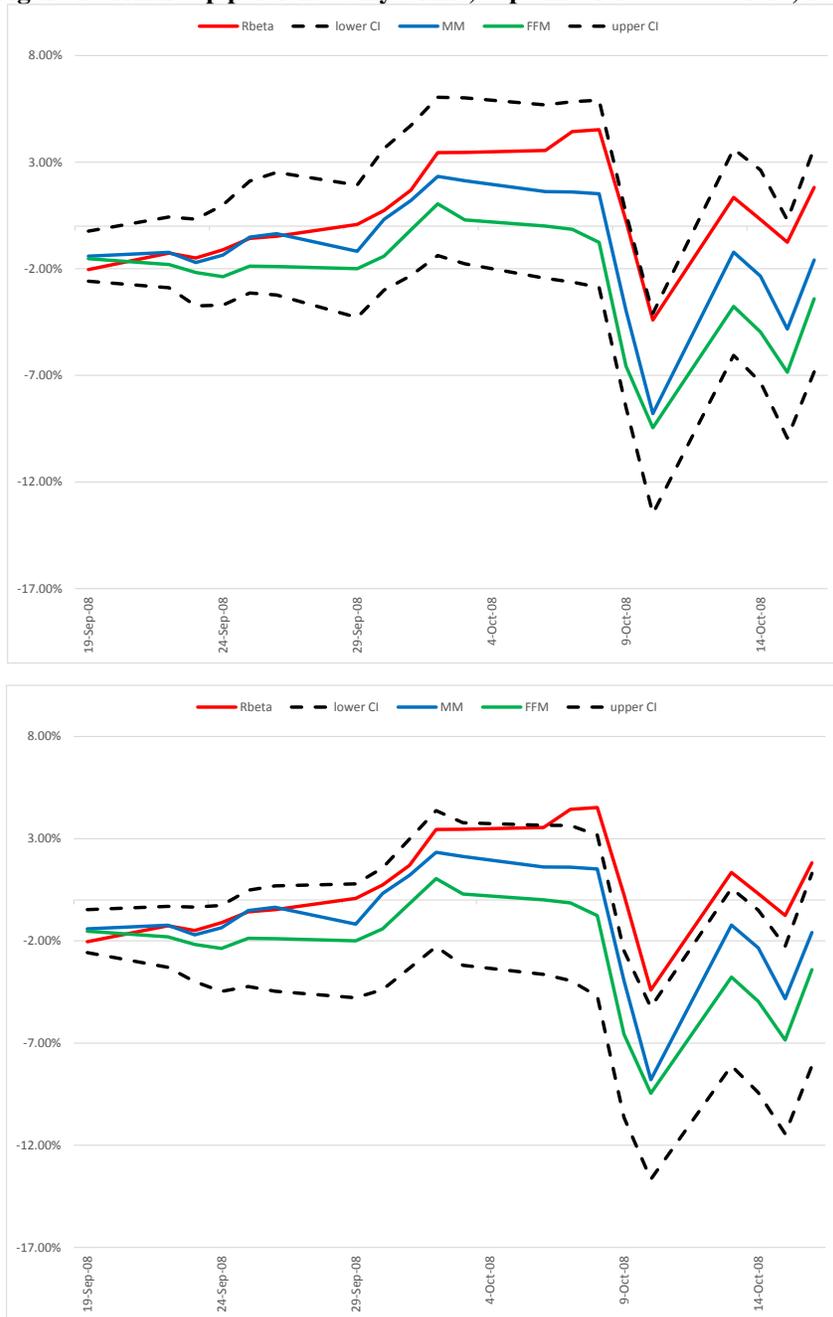
Standard errors for these estimates are reported in parentheses and are estimated following Barndorff-Nielsen and Sheppard (2004, Proposition 2). P-values from the test for differences in realized beta estimates between the pre- and post-periods are also reported.

Figure 1: TARP Down portfolio daily CARs, September 19 - October 16, 2008



Notes to Figure 1: The "TARP Down" portfolio is an equally weighted portfolio of American Express, Bank of America, General Electric, Home Depot, and JP Morgan. These five stocks showed the largest downward level shift in beta. Portfolio CARs (depicted as solid lines) are the sums of portfolio abnormal returns up to and including a given day within the event window. The top panel also depicts the 95% confidence interval (dashed lines) for the CARs computed using the market model. The bottom panel also depicts the 95% confidence interval (dashed lines) for the CARs computed using the Fama and French (1993) three factor model. Daily stock and S&P 500 Index returns source to the Center for Research in Security Prices, [CRSP/Compustat Merged Database], Wharton Research Data Services, <http://www.whartonwrds.com/datasets/crsp/>. Daily size and value premiums source to the Kenneth French Data Library, http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

Figure 2: TARP Up portfolio daily CARs, September 19 - October 16, 2008



Notes to Figure 2: The "TARP UP" portfolio is an equally weighted portfolio of Chevron, Coca Cola, Exxon Mobil, Johnson & Johnson, and Proctor & Gamble. These five stocks showed the largest upward level shift in beta. Portfolio CARs (depicted as solid lines) are the sums of portfolio abnormal returns up to and including a given day within the event window. The top panel also depicts the 95% confidence interval (dashed lines) for the CARs computed using the market model. The bottom panel also depicts the 95% confidence interval (dashed lines) for the CARs computed using the Fama and French (1993) three factor model. Daily stock and S&P 500 Index returns source to the Center for Research in Security Prices, [CRSP/Compustat Merged Database], Wharton Research Data Services, <http://www.whartonwrds.com/datasets/crsp/>. Daily size and value premiums source to the Kenneth French Data Library, http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.