Internet Appendices, Updated June 19, 2015

These appendices accompany:
Kamstra, Mark J., Lisa A. Kramer, Maurice D. Levi, 2015, "Seasonal Variation in Treasury Returns," *Critical Finance Review,* 4(1), 45-115.

Appendices A and B appear in the published paper. The remainder appear in this supplement.

Contents

Appendix C Evidence of Seasonality in the Short End of the Term Structure, Robustness to Measurement of the Term Structure, and Robustness to Maturity Mismatches

C.1: The Short End of the Treasury Market

When deciding which Treasury security issues to use for this study, we had to consider carefully the role of the Federal Reserve. The Federal Reserve focuses on the short end of the market (primarily but not exclusively bills), both directly through open market operations – by buying and selling Treasury securities when yields deviate from target (as dictated by monetary policy objectives) – and indirectly through its target level for the federal funds rate. The federal funds rate is the rate at which depository institutions make uncollateralized overnight loans to one another. There is no substantial deviation of short-term security yields from the federal funds rate because the depository institutions are able to substitute between making short-term loans in the federal funds market and purchasing Treasury securities with very short maturities (that is, Treasury bills). Unfortunately, controlling for the auction schedule, money supply, and other monetary policy variables does not recover the seasonality in returns that the policy action presumably removes. Controlling for the monetary policy variables merely controls for any seasonality accidentally or purposefully introduced by policy moves.[1] Indeed, as Gibson (1970) points out, the Federal Reserve has a long-standing goal to remove seasonality in interest rates (he remarks primarily on the 90-day bill rate, monthly and quarterly), accomplished through management of the money stock. "An aim of the Federal Reserve System is to accommodate seasonal swings in the financial needs of trade, and the System tries to do this by removing seasonal fluctuations from interest rates. (p.442)" Furthermore, Holland and Toma (1991, p. 675) note that the Fed can reduce seasonality in rates simply through its role as lender of last resort, which naturally reduces seasonality of bank deposits, without short-term activist monetary policy: "The Federal Reserve affects the interest rate because banks and depositors expect the Fed to provide credit to banks during emergencies. Whether or not the Fed actually provides the emergency credit does not influence the interest rate."

To the extent that this activity occurs, the controls we use in our primary analysis are unrelated to this seasonal-dampening influence, and this dampening influence leaves no trail. In any case, we would have to obtain data for what returns would have been in absence of Fed actions, a counterfactual unavailable to us. The Federal Reserve Bank of New York has a reference series called Fedpoints which describes open market operations by commenting specifically on these activities: "By adjusting the level of reserve balances in the banking system through open market operations, the Fed can offset or support permanent, seasonal or cyclical shifts in the supply of reserve balances and thereby affect short- term interest rates and by extension other interest rates."[2]

Dupont and Sack (1999) and Garbade (2007) provide additional details about the operations of the

[1] The impact of monetary policy surprises on shorter maturity Treasuries is remarkably strong, estimated to be as large as a one-for-one change in rates with a change in target rate for Treasuries under 5-years. See, for instance, Cook and Hahn (1989, 1990), Dale (1993), Urich and Wachtel (2001), Radecki and Reinhart (1994), and Roley and Sellon (1995).

[2] http://www.newyorkfed.org/aboutthefed/fedpoints.html, retrieved June 27, 2011.

Treasury market. Altogether, the existing literature suggests that at the shorter end of the Treasury market we should expect to see smaller seasonal movements, and the nearer the maturity is to the very short end, the smaller this seasonal movement should be. We explore seasonality in the short end in detail below.

Table C.1 contains summary statistics and tests for seasonality of the 2-year, 1-year and 90-day Treasury return series in excess of the 30-day rate, as well as on the average of these return series. Results are very similar for nominal returns. (See the main text for statistics on the long end of the Treasury return series.) Consistent with an active monetary policy managing the short end, we see less evidence of seasonality in the 1- and 2-year notes than we see in the 5-year and longer dated securities. At the short end, the shorter the maturity, the smaller the magnitude of the seasonality. The bootstrapped tests confirm the robustness of this result, with the asymptotic p-values closely matching the bootstrapped p-values. (As detailed elsewhere, the bootstrap technique we employ involves resampling data blocks of random length,[3] producing resampled statistics that are robust to autocorrelation and heteroskedasticity.) In untabulated robustness checks, when we test whether the onset/recovery coefficients on the 1- and 2-year bill returns are significantly different from those on the 5-, 7-, 10-, and 20-year Treasuries we find statistically significantly smaller effects for the shorter maturities. Applying the same test to the coefficient estimate across the 5-, 7-, 10-, and 20-year maturities shows the 5-, 7-, 10-, and 20-year series are not statistically significantly different from each other.

Tables C.2 through C.4 contain regression results for the short end of Treasury excess returns. For the sake of brevity, we focus on this small collection of models. The short end is well-known to exhibit substantial autocorrelation, even when measured in excess of the 30-day Treasury rate, (likely as a result of intervention of the Federal Reserve), thus we consider a simple AR(1) model and a simple AR(1) model augmented with the onset/recovery variable. We also consider Model 5 (which includes the CRR and seasonally unadjusted macro factors and is arguably the best-performing model of Models 2-11). Consistent with the methodology adopted throughout our paper, these regressions are estimated with system-equation GMM and HAC (1987, 1994) standard errors.[4] Also available in these tables are seasonality tests of regression residuals and various model specification tests. The Hansen (1982) test of over-identifying restrictions rejects the null that the orthogonality conditions are satisfied in each case, and there is strong evidence of ARCH effects present in the residuals of each model, but evidence of autocorrelation in the residuals is largely absent. There is also strong evidence of the seasonality in the data, with remarkably large fall/winter oscillations in returns, as displayed in Panel B for the "Fall vs. Winter," September vs. March" and October vs. April" calculations. Consistent with the monotonically *decreasing* effectiveness of monetary policy on longer term Treasury rates (see Roley and Sellon (1995)), there is monotonically *increasing* evidence of seasonality in Treasury returns as we move along the term structure.

[3] As in the main text, everywhere in these appendices we employ a mean block length of 5 for our bootstrapped distributions and we resample 1,000 times.

[4] To calculate the standard errors we follow Newey and West (1994) and use the Bartlett kernel and an automatic bandwidth parameter (autocovariance lags) equal to the integer value of $4(T/100)^{2/9}$. The moment conditions we use include orthogonality between the regressors and the errors, and orthogonality between a small set of instruments and the errors. This instrument set consisted of a single lag of each Treasury series return, the 30-day T-bill rate, and a single lag of the CRSP value-weighted return.

The models that exclude the onset/recovery variable are unable to account for this seasonality, displaying rejections of the null of no seasonality at levels far below the 1% (see Panel C in Tables C.2 and C.3). This occurs in spite of the fact that a number of the model explanatory variables themselves display a very similar fall/winter oscillation. (In particular, the seasonally unadjusted data including inflation based on the CPI, (CPI_{SU}), unemployment growth (U_{SU}), inflation based on PPI (PPI_{SU}) and GDP growth (GDP_{SU}) which all display very strong evidence of seasonality, as reported in in the main text under the seasonality test columns of Table 1.) In contrast, when onset/recovery is included in the model specification, presented in Table C.4, most of the seasonality in the short-end returns is removed, both by measure of matching predicted seasonal oscillations in returns to realized (see Panel B) and by measure of our tests for seasonality, in particular the bootstrapped p-values (see Panel C).[5] The onset/recovery coefficients are also jointly significantly different from zero in Table C.4. Across Tables C.2 through C.4 we see that none of the models is able to completely remove evidence of monthly seasonality of nonspecific form, indicated by the significance of the monthly dummy variables joint test.

Finally, the information criteria clearly favor models which include the onset/recovery variable.[6] Models with the constrained onset/recovery variable included (constrained to have the same coefficient across Treasury series) produce the best MMSC-BIC and MMSC-HQIC information criteria values in each case. For example, in Table C.3, the value of MMSC-BIC is most negative for the model with the constrained $\hat{OR}$ term added (-53.31 versus -44.30 for the model without onset/recovery), and the value of MMSC-HQIC is also most negative for the model with the constrained $\hat{OR}$ term added (-17.44 versus -13.55 for the model without onset/recovery).

C.2 Robustness to the Measurement of the Term Structure

Recall that the variable Term is defined as the difference between the return on 20-year Treasuries and the return on 30-day Treasuries. We allow this variable to have different coefficient values for the different Treasury series so that different magnitudes of impact on returns across the Treasury series are allowed. However, if seasonality due to flight-to-quality behavior was evident in 30-day returns and not in 20-year returns, the use of this term-structure variable may absorb (or even induce additional) seasonality in the Treasury returns regression. To ensure our results are not driven by this specification, we report results using alternative term variables for our macroeconomic risks models in 5 alternative ways:

1) the difference between the 90- and 30-day returns (as Harvey (1989) suggests)

[5] When we perform system-equation estimation with bootstrapping, the block bootstrap technique we employ preserves the cross-sectional dependence of the Treasury series, producing robust resampled statistics.

[6] The way we present values of the information criteria in the appendices differs from the presentation in the main text. In presenting results for Model 1 in the main text, we report information criterion values from two model estimations: the full model and a model with only a constant as a regressor. In presenting results for Models 2-11 in the main text, we report information criterion values from both the full model and the full model modified to include the onset/recovery variable (constrained to have equal coefficient estimates across series). In the appendices, in most cases we provide the values of the information criteria for the model (incorporating the explanatory variables for which estimates are included in Panel A of the table) and the model modified to include the onset/recovery variable (constrained to have equal coefficient estimates across series). In the tables, these are typically labeled as "Tabled Model" and "Constrained $\hat{OR}$ Term Included." Note that to calculate the latter information criterion in the case of tabled models that already include onset/recovery as a regressor, we *replace* the unconstrained onset/recovery variable with the onset/recovery variable constrained to have the same coefficient across series.

2) the difference between the 20-year and 90-day returns

3) the difference between the 20-year and 1-year returns

4) the difference between the 20-year and 2-year returns

5) the difference between the 20-year and 5-year returns

Further, we calculate results excluding the term variable altogether.

Table C.5 contains summary statistics and tests for seasonality of the term spread series, and Tables C.6-C.35 contain regression results. These regressions are estimated with system-equation GMM and HAC standard errors, produced as described in the paper with the Bartlett kernel and an automatic bandwidth parameter. The results come in groups of three for each term-structure measure, and the entire set of results are produced for two cases, with and without the onset/recovery variable. The groups of three are the three models which use the term structure variables: Model 3 (the Chen, Roll and Ross macro factors model), Model 5 (the CRR model augmented with the seasonally unadjusted macro factors, and Model 6 (the real-time macro factors model). The title for each set of results lists both the model type and the term structure variable used. The column headings indicate the return series. The first half of the tables exclude the onset/recovery variable and the last half of these tables include the onset/recovery variable. The onset/recovery variable is always presented as the second variable from the top. Although this is a large number of specifications to consider, some commonalities emerge.

When considering models that exclude the onset/recovery variable as an explanatory variable, performance of the alternative term structure measures is virtually identical by measure of information criteria and by measure of evidence of seasonality (none of these measures is able to remove statistical evidence of seasonality in the residuals - see Panel C in each table, and none manages to fit the economic magnitude well - see Panel B in each table). The term structure variable coefficient estimate is typically statistically insignificant. The Hansen (1982) test of over-identifying restrictions either does not reject the null or does but only weakly, indicating that the various models do not show strong evidence of a failure to adequately fit the orthogonality conditions.

When considering models that include the onset/recovery variable, we find similar results relative to the models excluding the onset/recovery variable, both with regard to coefficient estimates for the term structure variable and the Hansen test of over-identifying restrictions. However, we find very little evidence of SAD seasonality remaining when we control for onset/recovery, and no significant evidence of monthly seasonality of nonspecific form. The bootstrapped p-values for the seasonality tests confirm the robustness of this result. Further, in Tables C.6-C.20 we see that the information criteria clearly favor models that include the constrained onset/recovery variable over the base models without onset/recovery. Likewise, in Tables C.21-C.35 we see that the information criteria favor the models that contain the constrained onset/recovery variable over the unconstrained specification (consistent with our failure to reject the null that the onset/recovery coefficients are jointly equal, in Panel C of Tables C.21-C.35).

C.3 Robustness to Maturity Mismatches

The data we use for our primary analysis, the 5-, 7-, 10- and 20-year Treasury index returns, are constructed by CRSP using securities with maturity that matches the stated maturity as closely as possible.

CRSP searches over all available Treasury securities to find the security with maturity closest to the desired maturity, records its return over the month, repeats the process the following month, and so on. The following quote is from the CRSP Manual Data Descriptions Guide, CRSP U.S. Stock & U.S. Indices Databases (Version CA297.200809, p. 30):

> The CRSP U.S. Treasury and Inflation Series (CTI) Files are provided on a monthly frequency. The series contains returns adapted from the CRSP U.S. Treasury Fixed Term Index Series, the CRSP Risk Free Rates File, and the U.S. Government Consumer Price Index. These derived files offer 10 groups of indices: 30-year, 20 year, 10 year, 7 year, 5 year, 2 year, 1 year, 90 day, and 30 day target maturity indices, as well as the Consumer Price Index. For fixed-term series with maturities of one year or greater, a representative Treasury bond or note for each series is selected. Available issues are filtered on the basis of their characteristics. Each month, the most recent non-callable, non-flower, and fully taxable issue closest to the target maturity is selected. If none are found, a second pass allows flower bonds.

To the extent the maturity of the bond varies from the desired maturity, this would most likely be a random event with minimal impact. The evidence of seasonality is very similar across maturity classes and the onset/recovery coefficient is not statistically significantly different across the 5-, 7-, 10- and 20-year return series, so that minor perturbations of maturity within that range would not be expected to change this seasonality in an individual return series. Also, our results are stable across the long end of the term structure, across nominal and excess returns, and across various subsamples. This itself points to a fair amount of robustness in our results, even if the maturity of, say, the 5-year Treasury series is not exactly 5 years each and every period of our sample.

But there remains the question of whether variation in the target maturity within the CRSP fixed term Treasury indices creates seasonal artifacts in the data. Happily, the monthly U.S. Treasury database maintained by CRSP includes the variable TERMTYPE, linking all results in the fixed-term indices file to the individual securities used to form the indices. With this information the actual maturity of securities used to form the monthly return indices is readily available and can be compared to the nominal maturity of the indices.

Only 25% of the 5-year Treasury returns are within 2 weeks of 5 years maturity (many auctions have issues that mature mid-month, not at month end, so that we often cannot get closer than two weeks of the stated maturity), and this falls off with maturity, though not monotonically, to a minimum of only 6% of the 10-year Treasury return series maturing within 2 weeks of 10 years. The mean deviation from target maturity is 2 months for the 5 year series, and tops out at 26 months for the 20-year series (this 26-month mean is skewed by data from the 1950s when 40-year bonds were often the nearest maturity for the 20-year series).

In order to evaluate the impact of these deviations from target, we split our Treasury returns into two categories: (1) returns from issues within one month of target and (2) returns from issues that deviate from target maturity by more than one month. This split the data into a roughly 1-to-2 ratio, as about a

third of the deviations from target were within one month. The first half of the sample has relatively more observations with mismatched maturities because there were far fewer Treasury auctions before 1975 than after, due to financing needs of the government; see Garbade (2007).

The following table reports the monthly mean return in excess of the 30-day T-bill (results are very similar for nominal returns) for each of these two partitions of the data. The pooled maturity-mismatched return data (pooled over the 5-, 7-, 10- and 20-year series) are dated, on average, in the year 1975, and the maturity-matched returns are dated, on average, in the year 1987. This leads to a difference of approximately 14 basis points in the mean returns across the two splits.

Return Seasonality, by Month, for Each Partition

	J	F	M	A	M	J	J	A	S	O	N	D	Av.	N
Maturity Equals Target	.11	-.02	-.09	-.08	.30	.23	.06	.29	.45	.73	.54	.24	.23	976
Mismatched Maturity	.12	-.14	-.20	-.40	-.04	.29	-.05	-.04	.35	.39	.30	.17	.07	1712

The minimum return for the maturity-matched data occurs in the month of March, very nearly equal to the return for April, and the maturity-mismatched returns reach a minimum in April. The month with the maximum return occurs for both samples in October. For both samples, the mean monthly return is above the annual average throughout the fall, and below average for the winter (with the exception of January for the maturity-mismatched data). The variation from minimum to maximum monthly return is 84 basis points for the maturity-matched sample, and 76 basis points for the maturity-mismatched sample. While we hesitate to place much significance on correlations between these two sets of monthly returns, it bears mentioning that the monthly patterns are strongly correlated, with a correlation coefficient of .84. We also explored these seasonal patterns series-by-series, and found very similar individual series results across the 5-, 7-, 10- and 20-year series.

Table C.1
Summary Statistics on Excess Returns for the Short End

Index Estimation Period	N	Mean	Std	Min	Max	Skew	Kurt	Beta	**Seasonality test: Asymptotic p-values [Bootstrapped p-values]** Nonspecific Monthly	Fall vs. Winter	Sep. vs. March	Oct. vs. April
2-year Treasury	672	0.10	0.80	-4.8	7.1	0.87	14.3	0.03	.180	.276	**.022**	**.001**
01/52 - 12/07									[.188]	[.276]	[**.026**]	[<**.001**]
1-year Treasury	672	0.08	0.45	-2.8	4.3	1.21	16.9	0.02	.105	.405	.160	**.003**
01/52 - 12/07									[**.092**]	[.404]	[.182]	[**.002**]
90-day Treasury	672	0.04	0.09	-0.4	0.8	2.62	19.4	0.00	**.016**	.655	.507	.252
01/52 - 12/07									[**.016**]	[.660]	[.492]	[.258]
Average Treasury	672	0.07	0.43	-2.6	4.1	1.15	16.7	0.02	.102	.340	**.045**	**.001**
01/52 - 12/07									[**.086**]	[.322]	[**.046**]	[<**.001**]

Notes: See the notes to Table 1 in the main text.

Table C.2
Simple AR(1) Model Regression Results for the Short End

Parameter or Statistic	2-year Treasury Excess Returns	1-year Treasury Excess Returns	90-day Treasury Excess Returns
Panel A: Estimates			
μ	0.065^{***}	0.057^{***}	0.029^{***}
	(0.024)	(0.013)	(0.003)
ρ_1	0.118^{***}	0.124^{***}	0.148^{***}
	(0.029)	(0.031)	(0.050)
R^2	0.0249	0.0294	0.0419
AR(12)	22.79^{**}	27.89^{***}	12.65
ARCH(12)	89.32^{***}	97.29^{***}	96.70^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)			
Fall-Winter Seasonality			
Fitted	0.0152	0.0074	0.0006
Realized	0.1412	0.0686	0.0095
September-March Seasonality			
Fitted	0.0047	0.0051	0.0013
Realized	0.2364	0.0924	0.0137
October-April Seasonality			
Fitted	0.0280	0.0114	0.0020
Realized	0.2250	0.1358	0.0106
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]			
Nonspecific Monthly Seasonality:			**<.001** [**<.001**]
Fall vs. Winter:			**<.001** [**<.001**]
September vs. March:			**.004** [**.028**]
October vs. April:			**<.001** [**.002**]
Panel D: Systems Equation Information Criteria and Model Statistics			
GMM Test of Overidentification Restrictions			31.99^{***}
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included			-46.10/ -54.94
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included			-15.21/ -18.91
Number of Parameters			6
Number of Number of Moment Conditions			18
Number of Observations (03/52 - 12/07)			670

Notes: Panel A contains coefficient estimates and standard errors (in parentheses) from estimating a system of equations using Hansen's (1982) GMM and Newey West (1987, 1994) HAC standard errors. One, two, and three asterisks denote significance at the 10, 5, and 1 percent level respectively, based on two-sided tests. The model is:

$$r_{i,t} = \mu + \rho_i r_{i,t-1} + \epsilon_t.$$

The instruments used to form the GMM moments include the constant, a lag of the value-weighted CRSP equity index return (entire U.S. market return, including dividends), contemporaneous 30-day T-bill returns, and the explanatory variables (in the case of this model, a lag of the Treasury series). To calculate the standard errors we follow Newey and West (1994) and use the Bartlett kernel and an automatic bandwidth parameter (autocovariance lags) equal to the integer value of $r(T/100)^{2/9}$. We also present R^2, a Wald χ^2 test statistic for the presence of up to 12 lags of autocorrelation (AR), and R^2, a Wald χ^2 test statistic for the presence of up to 12 lags of ARCH. The test for ARCH is a standard LM test of order 12. To perform the test for autocorrelation, we augment our regression with 12 lags of the residuals, estimate MacKinnon and White (1985) bootstrap heteroskedasticity-consistent standard errors with OLS and test for the joint significance of these terms.

In Panel B we provide seasonal differences in realized and fitted returns, by series. We consider the difference between fall and winter returns, September and March returns, and October and April returns. In Panel C we report p-values associated with seasonality tests, with bootstrapped p-values in square brackets. See the main text for details on the bootstrapping technique. The seasonality tests are based on regressing a given Treasury return series on the tabled Treasury return model and a constant and appropriate dummy variable or set of dummy variables, estimated using GMM. The test for nonspecific monthly seasonality adds 11 monthly dummies to the tabled model, the test for fall/winter seasonality adds a fall dummy and a winter dummy to the tabled model, the test for Sep./Mar. seasonality adds a dummy equal to 1 for Sep. and -1 for Mar. to the tabled model, and the test for Oct./Apr. seasonality adds a dummy equal to 1 for Oct. and -1 for Apr. to the tabled model. For instance, the test that the Treasury returns are the same in the fall and winter versus the alternative that they

are equal and opposite has us estimating the original model with the fall/winter dummy variable added as an explanatory variable:

$$r_{i,t} = \mu_i + \beta_{\text{fall/winter}} D_{t,\text{fall/winter}} + \rho_1 r_{i,t-1} + \epsilon_{i,t}.$$

Note that the coefficients on the dummy variable are restricted to be the same across equations. The fall versus winter, Sep./Mar. and Oct./Apr. seasonality tests are two-sided t-tests on the dummy variable coefficient to be different from 0. The test for nonspecific monthly seasonality is performed identically, now with the coefficients on dummy variables for February through December tested to be jointly 0, an 11 degree of freedom test. Bolded p-values are significant at the 10 percent or better. The instruments used for each of the seasonality test regressions include a constant, a lag of the value-weighted CRSP equity index return, the model explanatory variables (in this case of this model, a lag of the Treasury return series), plus the appropriate modified seasonal dummy/dummies. (For the fall versus winter seasonality test, dummies for the fourth and first quarters are added to the instrument list. For the September versus March seasonality test, dummies for September and March are added to the instrument list. For the October versus April seasonality test, dummies for October and April are added to the instrument list.)

In Panel D we report information criteria. In the case of GMM models, we report information criteria specifically designed by Andrews and Lu (2001) for application to GMM estimation in a dynamic panel setting, MMSC-HQIC and MMSC-BIC. We present information criteria for the model. We also present information criteria for the model with the onset/recovery term added, with the coefficient on the onset/recovery variable constrained to be the same across series. (Note that to calculate the latter information criterion in the case of models where the unconstrained onset/recovery variable is already one of the explanatory variables, we replace the unconstrained onset/recovery variable with the onset/recovery variable constrained to have the same coefficient across series.) These criteria are defined so that we wish to minimize them. We also report the number of parameters, number of moment conditions, and estimation period for the model.

Table C.3
Model 5 (CRR and Seasonally Unadjusted Macro Factors) Regression Results for the Short End

Parameter or Statistic	2-year Treasury Excess Returns	1-year Treasury Excess Returns	90-day Treasury Excess Returns
Panel A: Estimates			
μ	0.045	0.005	0.005
	(0.088)	(0.052)	(0.011)
μ_{Term}	0.005	0.003	-0.001
	(0.015)	(0.007)	(0.001)
μ_{Default}	0.196**	0.153***	0.036***
	(0.099)	(0.058)	(0.012)
$\mu_{\text{CPI}_{\text{SU}}}$	-0.181	-0.061	0.008
	(0.145)	(0.080)	(0.014)
$\mu_{\text{IP}_{\text{SU}}}$	0.505	0.115	-0.077
	(1.016)	(0.522)	(0.102)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.036	-0.032	-0.012**
	(0.035)	(0.021)	(0.006)
$\mu_{\text{GDP}_{\text{SU}}}$	0.459	-0.102	-0.041
	(0.775)	(0.426)	(0.089)
$\mu_{\text{U}_{\text{SU}}}$	0.540**	0.314*	0.106***
	(0.258)	(0.169)	(0.033)
μ_{IP}	-0.066**	-0.033**	<.001
	(0.028)	(0.015)	(0.004)
μ_{Inf}	-0.263	-0.128	-0.003
	(0.237)	(0.149)	(0.032)
μ_{InfSurp}	0.141	0.038	0.010
	(0.164)	(0.102)	(0.020)
ρ_1	0.047	0.040	0.076
	(0.042)	(0.036)	(0.050)
R^2	0.0767	0.0929	0.1294
AR(12)	16.48	19.76*	13.44
ARCH(12)	78.60***	97.34***	118.32***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)			
Fall-Winter Seasonality			
Fitted	0.0369	-.0002	-.0034
Realized	0.1347	0.0662	0.0091
September-March Seasonality			
Fitted	0.0640	0.0065	-.0008
Realized	0.2345	0.0897	0.0131
October-April Seasonality			
Fitted	0.0734	0.0205	0.0037
Realized	0.2260	0.1359	0.0112
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]			
Nonspecific Monthly Seasonality:			**<.001** [**<.001**]
Fall vs. Winter:			**<.001** [**.<001**]
September vs. March:			**.001** [**<.001**]
October vs. April:			**<.001** [**.002**]
Panel D: Systems Equation Information Criteria and Model Statistics			
GMM Test of Overidentification Restrictions			33.58***
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included			-44.30/ -53.31
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included			-13.55/ -17.44
Number of Parameters			36
Number of Number of Moment Conditions			48
Number of Observations (03/52 - 12/06)			658

Notes: See the notes to Table C.2.

Table C.4
Simple AR(1) Model Augmented with Onset/Recovery for the Short End

Parameter or Statistic	2-year Treasury Excess Returns	1-year Treasury Excess Returns	90-day Treasury Excess Returns
Panel A: Estimates			
μ	0.068^{***}	0.058^{***}	0.029^{***}
	(0.024)	(0.013)	(0.003)
$\mu_{\hat{OR}}$	0.303^{***}	0.135^{**}	0.016
	(0.115)	(0.066)	(0.013)
ρ_1	0.115^{***}	0.123^{***}	0.147^{***}
	(0.028)	(0.031)	(0.050)
R^2	0.0315	0.0345	0.0441
AR(12)	21.91^{**}	27.30^{***}	12.70
ARCH(12)	88.72^{***}	96.52^{***}	95.39^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)			
Fall-Winter Seasonality			
Fitted	0.1227	0.0556	0.0062
Realized	0.1412	0.0686	0.0095
September-March Seasonality			
Fitted	0.2468	0.1132	0.0139
Realized	0.2364	0.0924	0.0137
October-April Seasonality			
Fitted	0.1812	0.0801	0.0101
Realized	0.2250	0.1358	0.0106
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]			
Nonspecific Monthly Seasonality:			**<.001** [**<.001**]
Fall vs. Winter:			**.031** [**.082**]
September vs. March:			.108 [.156]
October vs. April:			**.087** [.164]
Onset/Recovery Coefficients Jointly 0:			**.037** [**.010**]
Onset/Recovery Treasury Coefficients Jointly Equal:			**.014** [**.006**]
Panel D: Systems Equation Information Criteria and Model Statistics			
GMM Test of Overidentification Restrictions			31.79^{***}
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included			-46.30/ -54.94
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included			-15.41/ -18.91
Number of Parameters			9
Number of Moment Conditions			21
Number of Observations (03/52 - 12/07)			670

Notes: See the notes to Table C.2.

Table C.5
Summary Statistics on Term Spread Variables

Index								**Seasonality test: Asymptotic p-values [Bootstrapped p-values]**			
Estimation Period	N	Mean	Std	Min	Max	Skew	Kurt	Nonspecific Monthly	Fall vs. Winter	Sep. vs. March	Oct. vs. April
Term: 20 Year - 30 Day	672	0.04	0.09	-0.40	0.84	2.62	19.39	**.016**	.680	.819	.716
01/52-12/07								[**.020**]	[.708]	[.825]	[.716]
Term: 20 Year - 90 Day	672	0.09	2.60	-9.43	13.10	0.27	2.20	.285	.459	.433	.122
01/52-12/07								[.368]	[.474]	[.430]	[.141]
Term: 20 Year - 1 Year	672	0.05	2.35	-9.27	10.74	0.18	1.88	.215	.406	.371	.114
01/52-12/07								[.287]	[.436]	[.384]	[.138]
Term: 20 Year - 2 Year	672	0.04	2.07	-8.68	10.60	0.14	2.03	.158	.401	.290	.214
01/52-12/07								[.210]	[.417]	[.302]	[.235]
Term: 20 Year - 5 Year	672	0.01	1.55	-6.29	8.81	0.18	2.89	.164	.903	.382	.569
01/52-12/07								[.221]	[.904]	[.400]	[.590]

Notes: See the notes to Table 1 in the main text.

Table C.6
Model 6: Real-Time Macro Factors
Term Structure Variable: No Term Variable

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.449	0.247	0.330	0.201
	(0.291)	(0.228)	(0.202)	(0.165)
μ_{USurpC}	-1.750	-0.174	-0.337	0.473
	(1.553)	(1.196)	(1.281)	(1.041)
μ_{USurpE}	2.310***	1.939***	1.682***	1.287***
	(0.868)	(0.665)	(0.560)	(0.459)
μ_{ProbC}	1.313*	1.159**	0.986**	0.839**
	(0.672)	(0.582)	(0.458)	(0.362)
μ_{IPSurp}	0.043	0.072	0.037	0.081
	(0.199)	(0.158)	(0.142)	(0.111)
μ_{IP}	1.499***	1.312***	1.059***	1.169***
	(0.452)	(0.370)	(0.331)	(0.273)
μ_{U}	0.061***	0.061***	0.045***	0.051***
	(0.021)	(0.016)	(0.014)	(0.012)
$\mu_{\Delta\text{Default}}$	-0.045***	-0.024*	-0.030**	-0.019**
	(0.017)	(0.014)	(0.012)	(0.010)
μ_{InfSurp}	-1.293*	-0.523	-0.388	-0.174
	(0.750)	(0.523)	(0.460)	(0.400)
μ_{Inf}	-2.151***	-1.659***	-1.508***	-1.297***
	(0.597)	(0.458)	(0.407)	(0.342)
R^2	0.1458	0.1386	0.1634	0.1949
AR(12)	16.47	14.02	12.11	12.75
ARCH(12)	28.80***	31.99***	51.27***	41.62***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.3056	0.1933	0.1969	0.1621
Realized	0.8125	0.5729	0.6853	0.4504
September-March Seasonality				
Fitted	0.0459	0.0226	0.0446	0.0340
Realized	0.8565	0.7955	0.8178	0.7509
October-April Seasonality				
Fitted	0.0324	0.0112	0.0177	0.0090
Realized	1.0951	1.2034	0.8506	0.6192
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				<**.001** [**.084**]
Fall vs. Winter:				.188 [.280]
September vs. March:				**.001** [**.004**]
October vs. April:				.160 [.236]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				11.28
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-37.72/ -54.55
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-19.17/ -29.05
Number of Parameters				40
Number of Moment Conditions				48
Number of Observations (12/65 - 12/03)				457

Notes: See Table the notes to C.2

Table C.7
Model 3 (CRR Factors)
Term Structure Variable: No Term Variable

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.048	-0.067	-0.043	-0.013
	(0.242)	(0.209)	(0.179)	(0.153)
μ_{Default}	0.800^{***}	0.659^{**}	0.588^{***}	0.494^{***}
	(0.285)	(0.263)	(0.204)	(0.180)
μ_{IP}	-0.307^{***}	-0.296^{***}	-0.227^{***}	-0.181^{***}
	(0.085)	(0.073)	(0.068)	(0.054)
μ_{Inf}	-1.499^{***}	-1.183^{***}	-1.001^{***}	-0.920^{***}
	(0.570)	(0.425)	(0.368)	(0.344)
μ_{InfSurp}	-1.068^{**}	-0.567	-0.429	-0.232
	(0.501)	(0.357)	(0.305)	(0.265)
R^2	0.0531	0.0512	0.055	0.057
AR(12)	18.01	15.36	13.42	17.58
ARCH(12)	83^{***}	97.30^{***}	91.33^{***}	113.01^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.0036	-.0028	-.0012	-.0029
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	-.0731	-.0468	-.0365	-.0250
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	-.0177	-.0220	-.0177	-.0180
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.002** [.160]
Fall vs. Winter:				**.078** [.124]
September vs. March:				**.010** [**.012**]
October vs. April:				**.011** [**.008**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				14.14^{*}
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-37.94/ -53.83
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-17.33/ -25.49
Number of Parameters				20
Number of Moment Conditions				28
Number of Observations (01/52 - 12/07)				672

Notes: See the notes to Table C.2

Table C.8
Model 5 (CRR and Seasonally Unadjusted Macro Factors)
Term Structure Variable: No Term Variable

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.062	-0.072	-0.062	-0.029
	(0.242)	(0.210)	(0.178)	(0.152)
μ_{Default}	0.752***	0.630**	0.594***	0.503***
	(0.284)	(0.267)	(0.204)	(0.181)
$\mu_{\text{CPI}_{\text{SU}}}$	-0.898	-0.716	-0.604*	-0.421
	(0.546)	(0.444)	(0.332)	(0.298)
$\mu_{\text{IP}_{\text{SU}}}$	6.559	4.660	3.957	3.355
	(4.195)	(3.388)	(2.615)	(2.115)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.177	-0.093	0.029	0.048
	(0.155)	(0.115)	(0.104)	(0.089)
$\mu_{\text{GDP}_{\text{SU}}}$	3.427	1.064	2.291	1.587
	(2.799)	(2.296)	(1.828)	(1.525)
$\mu_{\text{U}_{\text{SU}}}$	1.713*	1.795**	0.194	0.411
	(0.959)	(0.789)	(0.610)	(0.514)
μ_{IP}	-0.385***	-0.335***	-0.293***	-0.229***
	(0.105)	(0.085)	(0.070)	(0.055)
μ_{Inf}	-0.484	-0.391	-0.510	-0.617
	(0.811)	(0.605)	(0.488)	(0.475)
μ_{InfSurp}	-0.137	0.126	-0.001	0.010
	(0.619)	(0.485)	(0.380)	(0.350)
R^2	0.0742	0.0697	0.0618	0.0626
AR(12)	18.50	13.81	11.71	15.39
ARCH(12)	76.76***	92.94***	93.69***	112.28***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.2003	0.0413	0.1442	0.0712
Realized	0.5333	0.2928	0.4644	0.2905
September-March Seasonality				
Fitted	0.3753	0.1894	0.2222	0.1611
Realized	0.6045	0.5524	0.5604	0.4955
October-April Seasonality				
Fitted	0.3661	0.2189	0.1737	0.1333
Realized	0.9665	0.9608	0.6888	0.5531
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				<**.001** [**.092**]
Fall vs. Winter:				.140 [.168]
September vs. March:				**.058** [**.090**]
October vs. April:				**.038** [**.076**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				14.37*
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-37.57/ -53.63
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-17.05/ -25.42
Number of Parameters				40
Number of Moment Conditions				48
Number of Observations (01/52 - 12/06)				660

Notes: See the notes to Table C.2

Table C.9
Model 6 (Real-Time Macro Factors)
Term Structure Variable: 20 Year - 30 Day

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.469	0.276	0.373*	0.233
	(0.300)	(0.238)	(0.213)	(0.172)
μ_{USurpC}	-2.180	-0.608	-0.686	0.211
	(1.619)	(1.255)	(1.328)	(1.075)
μ_{USurpE}	2.323***	1.904***	1.718***	1.320***
	(0.865)	(0.664)	(0.555)	(0.455)
μ_{ProbC}	1.406**	1.210**	1.090**	0.945**
	(0.675)	(0.559)	(0.472)	(0.375)
μ_{IPSurp}	-0.010	0.022	-0.019	0.034
	(0.203)	(0.164)	(0.149)	(0.117)
μ_{IP}	1.613***	1.294***	1.122***	1.274***
	(0.460)	(0.366)	(0.319)	(0.271)
μ_{U}	0.070***	0.063***	0.055***	0.062***
	(0.025)	(0.019)	(0.015)	(0.014)
$\mu_{\Delta\text{Default}}$	-0.043**	-0.026*	-0.029**	-0.017*
	(0.018)	(0.015)	(0.011)	(0.010)
μ_{Term}	-0.952	-0.751	-1.446	-1.485
	(1.746)	(1.642)	(1.297)	(1.072)
μ_{InfSurp}	-1.474*	-0.600	-0.509	-0.282
	(0.755)	(0.530)	(0.470)	(0.406)
μ_{Inf}	-2.238***	-1.654***	-1.551***	-1.341***
	(0.618)	(0.469)	(0.424)	(0.361)
R^2	0.1466	0.1386	0.168	0.2015
AR(12)	16.41	14.00	11.30	12.40
ARCH(12)	27.11***	29.54***	55.32***	41.1 ***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.3086	0.1985	0.1962	0.1570
Realized	0.8125	0.5729	0.6853	0.4504
September-March Seasonality				
Fitted	0.0349	0.0187	0.0257	0.0123
Realized	0.8565	0.7955	0.8178	0.7509
October-April Seasonality				
Fitted	0.0217	0.0026	-.0083	-.0198
Realized	1.0951	1.2034	0.8506	0.6192
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				<**.001** [**.078**]
Fall vs. Winter:				.173 [.238]
September vs. March:				<**.001** [**.002**]
October vs. April:				.184 [.250]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				10.70
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-38.30/ -55.57
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-19.75/ -30.06
Number of Parameters				44
Number of Moment Conditions				52
Number of Observations (12/65 - 12/03)				457

Notes: See the notes to Table C.2

Table C.10
Model 3 (CRR Factors)
Term Structure Variable: 20 Year - 30 Day

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.023	-0.041	-0.024	0.002
	(0.231)	(0.196)	(0.171)	(0.146)
μ_{Term}	1.320	1.782	1.028	0.929
	(1.250)	(1.139)	(0.951)	(0.756)
μ_{Default}	0.701^{***}	0.526^{**}	0.508^{***}	0.424^{**}
	(0.264)	(0.232)	(0.192)	(0.168)
μ_{IP}	-0.298^{***}	-0.277^{***}	-0.215^{***}	-0.172^{***}
	(0.081)	(0.069)	(0.066)	(0.052)
μ_{Inf}	-1.472^{***}	-1.127^{***}	-0.975^{***}	-0.895^{***}
	(0.564)	(0.411)	(0.363)	(0.338)
μ_{InfSurp}	-1.035^{**}	-0.493	-0.386	-0.193
	(0.506)	(0.362)	(0.313)	(0.267)
R^2	0.0554	0.0525	0.0537	0.0575
AR(12)	17.27	14.69	12.97	16.39
ARCH(12)	79.86^{***}	92.26^{***}	89.65^{***}	109.20^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.0075	0.0026	0.0018	-.0002
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	-.0595	-.0268	-.0250	-.0146
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	-.0003	0.0018	-.0041	-.0057
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.001** [.150]
Fall vs. Winter:				**.062** [.102]
September vs. March:				**.009** [**.022**]
October vs. April:				**.013** [**.038**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				14.71^{*}
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-37.37/ -53.27
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-16.77/ -24.93
Number of Parameters				24
Number of Moment Conditions				32
Number of Observations (01/52 - 12/07)				672

Notes: See the notes to Table C.2

Table C.11
Model 5 (CRR and Seasonally Unadjusted Macro Factors)
Term Structure Variable: 20 Year - 30 Day

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.040	-0.049	-0.045	-0.015
	(0.232)	(0.197)	(0.170)	(0.145)
μ_{Term}	1.052	1.581	0.911	0.872
	(1.264)	(1.136)	(0.943)	(0.755)
μ_{Default}	0.670**	0.508**	0.520***	0.435**
	(0.266)	(0.236)	(0.194)	(0.169)
$\mu_{\text{CPI}_{\text{SU}}}$	-0.889	-0.696	-0.591*	-0.413
	(0.543)	(0.439)	(0.329)	(0.295)
$\mu_{\text{IP}_{\text{SU}}}$	6.519	4.607	3.873	3.296
	(4.173)	(3.344)	(2.594)	(2.096)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.170	-0.085	0.029	0.050
	(0.157)	(0.118)	(0.106)	(0.091)
$\mu_{\text{GDP}_{\text{SU}}}$	3.458	1.125	2.356	1.642
	(2.798)	(2.272)	(1.812)	(1.506)
$\mu_{\text{U}_{\text{SU}}}$	1.700*	1.751**	0.154	0.380
	(0.966)	(0.787)	(0.604)	(0.510)
μ_{IP}	-0.376***	-0.317***	-0.281***	-0.220***
	(0.103)	(0.082)	(0.069)	(0.053)
μ_{Inf}	-0.471	-0.358	-0.490	-0.599
	(0.808)	(0.597)	(0.484)	(0.472)
μ_{InfSurp}	-0.140	0.159	0.024	0.037
	(0.616)	(0.487)	(0.381)	(0.351)
R^2	0.076	0.0707	0.061	0.0631
AR(12)	18.26	13.71	11.53	14.82
ARCH(12)	74.50***	89.87***	92.03***	108.32***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.2026	0.0459	0.1508	0.0765
Realized	0.5333	0.2928	0.4644	0.2905
September-March Seasonality				
Fitted	0.3825	0.2027	0.2318	0.1701
Realized	0.6045	0.5524	0.5604	0.4955
October-April Seasonality				
Fitted	0.3791	0.2377	0.1849	0.1441
Realized	0.9665	0.9608	0.6888	0.5531
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				<**.001** [**.072**]
Fall vs. Winter:				.132 [.218]
September vs. March:				**.062** [**.082**]
October vs. April:				**.044** [**.084**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				14.96*
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-36.98/ -53.44
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-16.46/ -25.24
Number of Parameters				44
Number of Moment Conditions				52
Number of Observations (01/52 - 12/06)				660

Notes: See the notes to Table C.2

Table C.12
Model 6 (Real-Time Macro Factors)
Term Structure Variable: 20 Year - 90 Day

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.498	0.266	0.342	0.210
	(0.303)	(0.237)	(0.209)	(0.171)
μ_{USurpC}	-1.691	-0.124	-0.533	0.357
	(1.578)	(1.218)	(1.265)	(1.020)
μ_{USurpE}	2.123**	1.827***	1.607***	1.219***
	(0.879)	(0.669)	(0.566)	(0.465)
μ_{ProbC}	1.418**	1.231**	1.029**	0.874**
	(0.688)	(0.593)	(0.465)	(0.367)
μ_{IPSurp}	0.058	0.083	0.031	0.084
	(0.196)	(0.159)	(0.143)	(0.110)
μ_{IP}	1.527***	1.331***	1.041***	1.170***
	(0.457)	(0.370)	(0.328)	(0.272)
μ_{U}	0.061***	0.062***	0.045***	0.051***
	(0.022)	(0.016)	(0.014)	(0.012)
$\mu_{\Delta\text{Default}}$	-0.048***	-0.026*	-0.030***	-0.020**
	(0.016)	(0.014)	(0.011)	(0.009)
$\mu_{\text{Term: 20 Year - 90 Day}}$	-0.054	-0.032	-0.026	-0.019
	(0.049)	(0.040)	(0.033)	(0.027)
μ_{InfSurp}	-1.381*	-0.601	-0.441	-0.221
	(0.758)	(0.534)	(0.467)	(0.406)
μ_{Inf}	-2.355***	-1.759***	-1.541***	-1.338***
	(0.652)	(0.493)	(0.427)	(0.361)
R^2	0.1472	0.1389	0.1631	0.194
AR(12)	16.14	13.52	12.38	14.21
ARCH(12)	26.70***	29.02***	50.17***	42.69***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.2976	0.1870	0.1862	0.1548
Realized	0.8125	0.5729	0.6853	0.4504
September-March Seasonality				
Fitted	0.0111	-.0010	0.0254	0.0190
Realized	0.8565	0.7955	0.8178	0.7509
October-April Seasonality				
Fitted	-.0199	-.0213	-.0044	-.0089
Realized	1.0951	1.2034	0.8506	0.6192
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				<**.001** [**.078**]
Fall vs. Winter:				.175 [.242]
September vs. March:				**.001** [**.006**]
October vs. April:				.108 [.150]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				11.44
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-37.56/ -54.54
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-19.01/ -29.03
Number of Parameters				44
Number of Moment Conditions				52
Number of Observations (12/65 - 12/03)				457

Notes: See the notes to Table C.2

Table C.13
Model 3 (CRR Factors)
Term Structure Variable: 20 Year - 90 Day

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.043	-0.062	-0.038	-0.005
	(0.244)	(0.209)	(0.179)	(0.153)
$\mu_{\text{Term: 20 Year - 90 Day}}$	-0.004	0.002	0.004	0.011
	(0.038)	(0.030)	(0.025)	(0.021)
μ_{Default}	0.793^{***}	0.649^{**}	0.573^{***}	0.474^{***}
	(0.286)	(0.265)	(0.206)	(0.180)
μ_{IP}	-0.297^{***}	-0.289^{***}	-0.221^{***}	-0.172^{***}
	(0.081)	(0.072)	(0.066)	(0.051)
μ_{Inf}	-1.504^{***}	-1.180^{***}	-0.979^{***}	-0.902^{***}
	(0.572)	(0.433)	(0.367)	(0.342)
μ_{InfSurp}	-1.097^{**}	-0.592	-0.436	-0.229
	(0.506)	(0.365)	(0.312)	(0.271)
R^2	0.0529	0.0509	0.0548	0.0579
AR(12)	18.86^{*}	15.26	13.02	16.27
ARCH(12)	82.81^{***}	97.17^{***}	90.82^{***}	109.63^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.0029	-.0017	0.0005	0.0010
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	-.0749	-.0473	-.0355	-.0221
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	-.0191	-.0201	-.0144	-.0106
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.002** [.142]
Fall vs. Winter:				**.077** [.106]
September vs. March:				**.008** [**.026**]
October vs. April:				**.011** [**.028**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				14.39^{*}
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-37.70/ -53.93
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-17.09/ -25.59
Number of Parameters				24
Number of Moment Conditions				32
Number of Observations (01/52 - 12/07)				672

Notes: See the notes to Table C.2

Table C.14
Model 5 (CRR and Seasonally Unadjusted Factors)
Term Structure Variable: 20 Year - 90 Day

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.057	-0.068	-0.057	-0.022
	(0.244)	(0.211)	(0.179)	(0.152)
$\mu_{\text{Term: 20 Year - 90 Day}}$	-0.009	-0.003	<.001	0.009
	(0.037)	(0.029)	(0.026)	(0.021)
μ_{Default}	0.752^{***}	0.626^{**}	0.584^{***}	0.487^{***}
	(0.287)	(0.269)	(0.207)	(0.182)
$\mu_{\text{CPI}_{\text{SU}}}$	-0.888	-0.717	-0.600^{*}	-0.414
	(0.548)	(0.446)	(0.333)	(0.298)
$\mu_{\text{IP}_{\text{SU}}}$	6.371	4.464	3.857	3.309
	(4.201)	(3.399)	(2.617)	(2.112)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.179	-0.091	0.029	0.052
	(0.154)	(0.114)	(0.103)	(0.088)
$\mu_{\text{GDP}_{\text{SU}}}$	3.546	1.140	2.411	1.724
	(2.817)	(2.300)	(1.833)	(1.516)
$\mu_{\text{U}_{\text{SU}}}$	1.644^{*}	1.765^{**}	0.168	0.376
	(0.960)	(0.788)	(0.606)	(0.509)
μ_{IP}	-0.376^{***}	-0.330^{***}	-0.289^{***}	-0.223^{***}
	(0.102)	(0.084)	(0.069)	(0.053)
μ_{Inf}	-0.517	-0.402	-0.506	-0.622
	(0.821)	(0.611)	(0.492)	(0.477)
μ_{InfSurp}	-0.189	0.091	-0.020	-0.002
	(0.623)	(0.487)	(0.383)	(0.353)
R^2	0.0743	0.0694	0.0617	0.0631
AR(12)	18.59^{*}	13.78	11.52	15.28
ARCH(12)	76.67^{***}	92.91^{***}	93.40^{***}	109.10^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.2098	0.0495	0.1535	0.0820
Realized	0.5333	0.2928	0.4644	0.2905
September-March Seasonality				
Fitted	0.3756	0.1898	0.2283	0.1707
Realized	0.6045	0.5524	0.5604	0.4955
October-April Seasonality				
Fitted	0.3611	0.2180	0.1774	0.1425
Realized	0.9665	0.9608	0.6888	0.5531
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				**<.001** [**.048**]
Fall vs. Winter:				.145 [.180]
September vs. March:				**.060** [**.066**]
October vs. April:				**.042** [**.066**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				14.44^{*}
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-37.50/ -53.77
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-16.99/ -25.56
Number of Parameters				44
Number of Moment Conditions				52
Number of Observations (01/52 - 12/06)				660

Notes: See the notes to Table C.2

Table C.15
Model 6 (Real-Time Macro Factors)
Term Structure Variable: 20 Year - 1 Year

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.495	0.263	0.337	0.207
	(0.303)	(0.236)	(0.208)	(0.170)
μ_{USurpC}	-1.644	-0.079	-0.499	0.364
	(1.580)	(1.221)	(1.270)	(1.025)
μ_{USurpE}	2.139**	1.849***	1.622***	1.232***
	(0.878)	(0.669)	(0.566)	(0.465)
μ_{ProbC}	1.380**	1.201**	1.011**	0.861**
	(0.687)	(0.594)	(0.465)	(0.367)
μ_{IPSurp}	0.065	0.089	0.041	0.091
	(0.196)	(0.158)	(0.143)	(0.110)
μ_{IP}	1.495***	1.320***	1.032***	1.153***
	(0.458)	(0.368)	(0.330)	(0.273)
μ_{U}	0.059***	0.061***	0.045***	0.050***
	(0.022)	(0.016)	(0.014)	(0.012)
$\mu_{\Delta\text{Default}}$	-0.048***	-0.025*	-0.030***	-0.020**
	(0.017)	(0.014)	(0.011)	(0.010)
$\mu_{\text{Term: 20 Year - 1 Year}}$	-0.054	-0.031	-0.021	-0.014
	(0.054)	(0.044)	(0.036)	(0.029)
μ_{InfSurp}	-1.357*	-0.589	-0.421	-0.201
	(0.758)	(0.534)	(0.466)	(0.405)
μ_{Inf}	-2.306***	-1.736***	-1.514***	-1.312***
	(0.646)	(0.488)	(0.422)	(0.357)
R^2	0.1471	0.1388	0.1628	0.1936
AR(12)	15.78	13.51	12.56	14.25
ARCH(12)	26.92***	29.58***	50.39***	42.94***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.3015	0.1883	0.1879	0.1564
Realized	0.8125	0.5729	0.6853	0.4504
September-March Seasonality				
Fitted	0.0136	-.0004	0.0275	0.0212
Realized	0.8565	0.7955	0.8178	0.7509
October-April Seasonality				
Fitted	-.0134	-.0168	0.0003	-.0044
Realized	1.0951	1.2034	0.8506	0.6192
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				<**.001** [**.054**]
Fall vs. Winter:				.178 [.236]
September vs. March:				<**.001** [**.004**]
October vs. April:				.106 [.148]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				11.76
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-37.24/ -54.21
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-18.69/ -28.71
Number of Parameters				44
Number of Moment Conditions				52
Number of Observations (12/65 - 12/03)				457

Notes: See the notes to Table C.2

Table C.16
Model 3 (CRR Factors)
Term Structure Variable: 20 Year - 1 Year

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.045	-0.062	-0.039	-0.006
	(0.244)	(0.210)	(0.180)	(0.153)
$\mu_{\text{Term: 20 Year - 1 Year}}$	-0.006	-0.005	0.002	0.010
	(0.042)	(0.034)	(0.028)	(0.023)
μ_{Default}	0.793^{***}	0.656^{**}	0.576^{***}	0.477^{***}
	(0.286)	(0.265)	(0.206)	(0.180)
μ_{IP}	-0.296^{***}	-0.291^{***}	-0.221^{***}	-0.173^{***}
	(0.082)	(0.072)	(0.067)	(0.051)
μ_{Inf}	-1.497^{***}	-1.193^{***}	-0.983^{***}	-0.905^{***}
	(0.572)	(0.434)	(0.367)	(0.342)
μ_{InfSurp}	-1.094^{**}	-0.598	-0.436	-0.229
	(0.505)	(0.364)	(0.311)	(0.270)
R^2	0.0529	0.0509	0.0547	0.0575
AR(12)	21.45^{**}	15.61	13.15	16.18
ARCH(12)	82.96^{***}	97.17^{***}	91.02^{***}	110.34^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.0027	-.0037	-.0003	0.0000
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	-.0748	-.0490	-.0361	-.0227
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	-.0196	-.0239	-.0159	-.0122
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.002** [.134]
Fall vs. Winter:				**.080** [.124]
September vs. March:				**.008** [**.014**]
October vs. April:				**.010** [**.020**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				14.26^{*}
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-37.82/ -54.06
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-17.21/ -25.72
Number of Parameters				24
Number of Moment Conditions				32
Number of Observations (01/52 - 12/07)				672

Notes: See the notes to Table C.2

Table C.17
Model 5 (CRR and Seasonally Unadjusted Factors)
Term Structure Variable: 20 Year - 1 Year

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.057	-0.068	-0.057	-0.022
	(0.244)	(0.211)	(0.179)	(0.152)
$\mu_{\text{Term: 20 Year - 1 Year}}$	-0.010	-0.008	-0.002	0.008
	(0.041)	(0.033)	(0.028)	(0.023)
μ_{Default}	0.750^{***}	0.632^{**}	0.586^{***}	0.489^{***}
	(0.287)	(0.269)	(0.207)	(0.182)
$\mu_{\text{CPI}_{\text{SU}}}$	-0.892	-0.723	-0.602^{*}	-0.416
	(0.548)	(0.446)	(0.333)	(0.298)
$\mu_{\text{IP}_{\text{SU}}}$	6.427	4.488	3.900	3.352
	(4.204)	(3.401)	(2.619)	(2.113)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.178	-0.090	0.030	0.052
	(0.155)	(0.114)	(0.103)	(0.088)
$\mu_{\text{GDP}_{\text{SU}}}$	3.491	1.115	2.386	1.696
	(2.816)	(2.300)	(1.835)	(1.520)
$\mu_{\text{U}_{\text{SU}}}$	1.647^{*}	1.772^{**}	0.171	0.380
	(0.960)	(0.787)	(0.608)	(0.510)
μ_{IP}	-0.376^{***}	-0.332^{***}	-0.290^{***}	-0.224^{***}
	(0.103)	(0.084)	(0.069)	(0.054)
μ_{Inf}	-0.505	-0.409	-0.509	-0.623
	(0.820)	(0.612)	(0.492)	(0.478)
μ_{InfSurp}	-0.181	0.090	-0.020	-0.001
	(0.623)	(0.487)	(0.383)	(0.352)
R^2	0.0743	0.0694	0.0615	0.0628
AR(12)	18.92^{*}	13.78	11.49	14.86
ARCH(12)	76.75^{***}	92.93^{***}	93.56^{***}	109.72^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.2064	0.0468	0.1507	0.0791
Realized	0.5333	0.2928	0.4644	0.2905
September-March Seasonality				
Fitted	0.3731	0.1874	0.2266	0.1689
Realized	0.6045	0.5524	0.5604	0.4955
October-April Seasonality				
Fitted	0.3601	0.2147	0.1759	0.1406
Realized	0.9665	0.9608	0.6888	0.5531
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				**<.001** [**.080**]
Fall vs. Winter:				.144 [.186]
September vs. March:				**.058** [**.096**]
October vs. April:				**.038** [**.048**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				14.30^{*}
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-37.64/ -53.71
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-17.13/ -25.51
Number of Parameters				44
Number of Moment Conditions				52
Number of Observations (01/52 - 12/06)				660

Notes: See the notes to Table C.2

Table C.18
Model 6 (Real-Time Macro Factors)
Term Structure Variable: 20 Year - 5 Year

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.495	0.270	0.335	0.203
	(0.303)	(0.237)	(0.207)	(0.169)
μ_{USurpC}	-1.561	0.026	-0.464	0.349
	(1.561)	(1.218)	(1.248)	(1.012)
μ_{USurpE}	2.205**	1.917***	1.673***	1.282***
	(0.877)	(0.667)	(0.564)	(0.466)
μ_{ProbC}	1.320*	1.152*	0.992**	0.852**
	(0.687)	(0.596)	(0.465)	(0.365)
μ_{IPSurp}	0.084	0.102	0.063	0.113
	(0.197)	(0.159)	(0.143)	(0.111)
μ_{IP}	1.401***	1.283***	1.000***	1.114***
	(0.467)	(0.369)	(0.337)	(0.279)
μ_{U}	0.054**	0.060***	0.043***	0.048***
	(0.022)	(0.016)	(0.014)	(0.012)
$\mu_{\Delta\text{Default}}$	-0.048***	-0.024*	-0.029**	-0.019*
	(0.017)	(0.014)	(0.012)	(0.010)
$\mu_{\text{Term: 20 Year - 5 Year}}$	-0.061	-0.044	-0.013	0.008
	(0.083)	(0.069)	(0.051)	(0.042)
μ_{InfSurp}	-1.306*	-0.584	-0.388	-0.160
	(0.763)	(0.539)	(0.467)	(0.404)
μ_{Inf}	-2.193***	-1.706***	-1.475***	-1.261***
	(0.626)	(0.479)	(0.412)	(0.345)
R^2	0.1456	0.1378	0.1612	0.1923
AR(12)	15.84	13.60	12.65	13.82
ARCH(12)	28.27***	30.55***	50.59***	43.96***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.3144	0.1930	0.1874	0.1544
Realized	0.8125	0.5729	0.6853	0.4504
September-March Seasonality				
Fitted	0.0249	0.0016	0.0297	0.0241
Realized	0.8565	0.7955	0.8178	0.7509
October-April Seasonality				
Fitted	0.0105	-.0032	0.0064	-.0016
Realized	1.0951	1.2034	0.8506	0.6192
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				**<.001** [**.048**]
Fall vs. Winter:				.182 [.288]
September vs. March:				**<.001** [**.006**]
October vs. April:				.100 [.136]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				12.44
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-36.56/ -53.38/
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-18.01/ -27.87
Number of Parameters				44
Number of Moment Conditions				52
Number of Observations (12/65 - 12/03)				457

Notes: See the notes to Table C.2

Table C.19
Model 3 (CRR Factors)
Term Structure Variable: 20 Year - 5 Year

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.035	-0.049	-0.025	0.006
	(0.246)	(0.213)	(0.182)	(0.155)
$\mu_{\text{Term: 20 Year - 5 Year}}$	-0.016	-0.046	-0.010	0.016
	(0.068)	(0.057)	(0.044)	(0.036)
μ_{Default}	0.780^{***}	0.663^{**}	0.568^{***}	0.463^{**}
	(0.285)	(0.267)	(0.206)	(0.180)
μ_{IP}	-0.290^{***}	-0.295^{***}	-0.221^{***}	-0.168^{***}
	(0.082)	(0.072)	(0.067)	(0.052)
μ_{Inf}	-1.481^{***}	-1.243^{***}	-0.998^{***}	-0.903^{***}
	(0.564)	(0.433)	(0.364)	(0.337)
μ_{InfSurp}	-1.098^{**}	-0.632^{*}	-0.447	-0.230
	(0.504)	(0.365)	(0.310)	(0.269)
R^2	0.0531	0.0512	0.0542	0.0566
AR(12)	19.95^{*}	16.31	13.10	16.31
ARCH(12)	83.38^{***}	96.71^{***}	91.25^{***}	109.14^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.0042	-.0034	-.0013	-.0024
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	-.0742	-.0517	-.0374	-.0237
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	-.0180	-.0277	-.0185	-.0151
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.001** [.148]
Fall vs. Winter:				**.086** [.128]
September vs. March:				**.007** [**.032**]
October vs. April:				**.007** [**.008**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				13.65^{*}
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-38.44/ -54.67
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-17.83/ -26.33
Number of Parameters				24
Number of Moment Conditions				32
Number of Observations (01/52 - 12/07)				672

Notes: See the notes to Table C.2

Table C.20
Model 5 (CRR and Seasonally Unadjusted Factors)
Term Structure Variable: 20 Year - 5 Year

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.046	-0.055	-0.042	-0.010
	(0.245)	(0.214)	(0.181)	(0.154)
$\mu_{\text{Term: 20 Year - 5 Year}}$	-0.015	-0.045	-0.012	0.016
	(0.068)	(0.058)	(0.045)	(0.037)
μ_{Default}	0.734**	0.638**	0.578***	0.475***
	(0.285)	(0.270)	(0.207)	(0.182)
$\mu_{\text{CPI}_{\text{SU}}}$	-0.925*	-0.753*	-0.614*	-0.430
	(0.548)	(0.448)	(0.334)	(0.298)
$\mu_{\text{IP}_{\text{SU}}}$	6.509	4.407	3.965	3.488
	(4.237)	(3.416)	(2.632)	(2.126)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.171	-0.082	0.036	0.056
	(0.155)	(0.115)	(0.103)	(0.088)
$\mu_{\text{GDP}_{\text{SU}}}$	3.477	1.240	2.439	1.757
	(2.816)	(2.302)	(1.834)	(1.518)
$\mu_{\text{U}_{\text{SU}}}$	1.636*	1.760**	0.187	0.383
	(0.957)	(0.787)	(0.612)	(0.513)
μ_{IP}	-0.370***	-0.336***	-0.290***	-0.221***
	(0.102)	(0.084)	(0.069)	(0.054)
μ_{Inf}	-0.456	-0.434	-0.521	-0.611
	(0.810)	(0.607)	(0.489)	(0.473)
μ_{InfSurp}	-0.160	0.073	-0.026	0.006
	(0.620)	(0.487)	(0.383)	(0.351)
R^2	0.0742	0.0693	0.0609	0.0618
AR(12)	18.90*	14.04	11.49	14.66
ARCH(12)	77.12***	93.12***	93.91***	108.26***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.2107	0.0604	0.1526	0.0794
Realized	0.5333	0.2928	0.4644	0.2905
September-March Seasonality				
Fitted	0.3765	0.1940	0.2307	0.1748
Realized	0.6045	0.5524	0.5604	0.4955
October-April Seasonality				
Fitted	0.3654	0.2194	0.1794	0.1434
Realized	0.9665	0.9608	0.6888	0.5531
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				<**.001** [**.070**]
Fall vs. Winter:				.151 [.210]
September vs. March:				**.058** [**.068**]
October vs. April:				**.027** [**.050**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				13.59*
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-38.34/ -53.99
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-17.83/ -25.79
Number of Parameters				44
Number of Moment Conditions				52
Number of Observations (01/52 - 12/06)				660

Notes: See the notes to Table C.2

Table C.21
Model 6′ (Real-Time Macro Factors Augmented with Onset/Recovery)
Term Structure Variable: No Term Variable

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.460	0.258	0.340*	0.209
	(0.288)	(0.222)	(0.195)	(0.160)
$\mu_{\hat{\text{OR}}}$	1.434**	1.389***	1.206***	1.029***
	(0.614)	(0.467)	(0.367)	(0.304)
μ_{USurpC}	-1.747	-0.198	-0.461	0.383
	(1.535)	(1.159)	(1.268)	(1.020)
μ_{USurpE}	2.334***	1.954***	1.717***	1.313***
	(0.883)	(0.679)	(0.565)	(0.464)
μ_{ProbC}	1.358**	1.206**	1.027**	0.876***
	(0.650)	(0.551)	(0.433)	(0.338)
μ_{IPSurp}	0.111	0.132	0.090	0.128
	(0.203)	(0.160)	(0.143)	(0.112)
μ_{IP}	1.500***	1.301***	1.047***	1.163***
	(0.446)	(0.361)	(0.327)	(0.270)
μ_{U}	0.064***	0.064***	0.048***	0.053***
	(0.021)	(0.016)	(0.013)	(0.012)
$\mu_{\Delta\text{Default}}$	-0.041**	-0.021	-0.027**	-0.017*
	(0.017)	(0.014)	(0.012)	(0.010)
μ_{InfSurp}	-1.441*	-0.658	-0.496	-0.257
	(0.781)	(0.547)	(0.480)	(0.414)
μ_{Inf}	-2.142***	-1.648***	-1.494***	-1.289***
	(0.599)	(0.458)	(0.400)	(0.341)
R^2	0.1545	0.1518	0.1785	0.2099
AR(12)	15.64	13.90	11.27	11.10
ARCH(12)	29.08***	34.09***	56.91***	47.17***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.8074	0.6774	0.6154	0.5184
Realized	0.8125	0.5729	0.6853	0.4504
September-March Seasonality				
Fitted	1.1562	1.0983	0.9770	0.8295
Realized	0.8565	0.7955	0.8178	0.7509
October-April Seasonality				
Fitted	0.7407	0.6983	0.6142	0.5174
Realized	1.0951	1.2034	0.8506	0.6192
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.998 [1.00]
Fall vs. Winter:				.172 [.198]
September vs. March:				.980 [.982]
October vs. April:				.904 [.926]
Onset/Recovery Coefficients Jointly 0:				**.005** [**.008**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.301 [.354]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				10.24
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-38.76/ -54.55
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-20.21/ -29.05
Number of Parameters				44
Number of Moment Conditions				52
Number of Observations (12/65 - 12/03)				457

Notes: See the notes to Table C.2.

Table C.22
Model 3′ (CRR Factors Augmented with Onset/Recovery)
Term Structure Variable: No Term Variable

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.039	-0.057	-0.034	-0.006
	(0.237)	(0.204)	(0.174)	(0.150)
$\mu_{\hat{\text{OR}}}$	1.265***	1.115***	1.033***	0.853***
	(0.427)	(0.340)	(0.273)	(0.228)
μ_{Default}	0.822***	0.675***	0.606***	0.508***
	(0.268)	(0.245)	(0.187)	(0.165)
μ_{IP}	-0.309***	-0.298***	-0.229***	-0.182***
	(0.086)	(0.073)	(0.068)	(0.054)
μ_{Inf}	-1.567***	-1.244***	-1.063***	-0.966***
	(0.568)	(0.422)	(0.362)	(0.340)
μ_{InfSurp}	-1.143**	-0.631*	-0.484	-0.275
	(0.511)	(0.365)	(0.312)	(0.269)
R^2	0.0617	0.0611	0.0681	0.0697
AR(12)	17.46	14.40	12.27	15.37
ARCH(12)	80.95***	96.93***	96.16***	115.29***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.4553	0.3953	0.3676	0.3014
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	0.9343	0.8414	0.7865	0.6545
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	0.6260	0.5453	0.5077	0.4157
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.988 [.998]
Fall vs. Winter:				.576 [.592]
September vs. March:				.252 [.334]
October vs. April:				.264 [.298]
Onset/Recovery Coefficients Jointly 0:				**.004** [**.006**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.118 [.150]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				13.41*
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-38.67/ -53.83
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-18.06/ -25.49
Number of Parameters				24
Number of Moment Conditions				32
Number of Observations (01/52 - 12/07)				672

Notes: See the notes to Table C.2

Table C.23
Model 5′ (CRR and Seasonally Unadjusted Factors Augmented with Onset/Recovery)
Term Structure Variable: No Term Variable

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.001	0.009	0.008	0.034
	(0.236)	(0.203)	(0.174)	(0.147)
$\mu_{\hat{OR}}$	1.293**	1.636***	1.367***	1.216***
	(0.586)	(0.483)	(0.385)	(0.331)
μ_{Default}	0.753***	0.633**	0.598***	0.502***
	(0.276)	(0.253)	(0.193)	(0.171)
$\mu_{\text{CPI}_{\text{SU}}}$	-0.836	-0.620	-0.514	-0.352
	(0.540)	(0.433)	(0.323)	(0.291)
$\mu_{\text{IP}_{\text{SU}}}$	3.342	0.599	0.564	0.336
	(4.399)	(3.527)	(2.709)	(2.179)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.169	-0.082	0.036	0.055
	(0.160)	(0.119)	(0.108)	(0.092)
$\mu_{\text{GDP}_{\text{SU}}}$	-2.980	-6.999**	-4.448*	-4.405**
	(3.578)	(3.101)	(2.474)	(2.154)
$\mu_{\text{U}_{\text{SU}}}$	2.414**	2.692***	0.962	1.073**
	(0.986)	(0.811)	(0.629)	(0.530)
μ_{IP}	-0.308***	-0.240***	-0.214***	-0.159***
	(0.110)	(0.089)	(0.072)	(0.058)
μ_{Inf}	-0.420	-0.350	-0.488	-0.578
	(0.809)	(0.596)	(0.482)	(0.471)
μ_{InfSurp}	-0.219	0.030	-0.089	-0.055
	(0.614)	(0.475)	(0.371)	(0.342)
R^2	0.0771	0.0798	0.0722	0.075
AR(12)	18.40	13.53	11.71	14.78
ARCH(12)	77.43***	90.03***	96.70***	114.40***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.3156	0.1859	0.2629	0.1794
Realized	0.5333	0.2928	0.4644	0.2905
September-March Seasonality				
Fitted	0.9280	0.8910	0.8078	0.6831
Realized	0.6045	0.5524	0.5604	0.4955
October-April Seasonality				
Fitted	0.7259	0.6747	0.5548	0.4721
Realized	0.9665	0.9608	0.6888	0.5531
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.804 [.958]
Fall vs. Winter:				.746 [.740]
September vs. March:				.286 [.344]
October vs. April:				.683 [.702]
Onset/Recovery Coefficients Jointly 0:				**<.001** [**.002**]
Onset/Recovery Treasury Coefficients Jointly Equal:				**.085** [.122]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				13.11
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-38.82/ -53.63
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-18.31/ -25.42
Number of Parameters				44
Number of Moment Conditions				52
Number of Observations (01/52 - 12/06)				660

Notes: See the notes to Table C.2

Table C.24
Model 6′ (Real-Time Macro Factors Augmented with Onset/Recovery)
Term Structure Variable: 20 year - 30 Day

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.476	0.287	0.382*	0.240
	(0.296)	(0.231)	(0.205)	(0.167)
$\mu_{\hat{OR}}$	1.429**	1.321***	1.202***	1.038***
	(0.615)	(0.465)	(0.375)	(0.314)
μ_{USurpC}	-2.140	-0.622	-0.777	0.148
	(1.591)	(1.219)	(1.305)	(1.044)
μ_{USurpE}	2.361***	1.925***	1.764***	1.354***
	(0.878)	(0.674)	(0.557)	(0.458)
μ_{ProbC}	1.489**	1.294**	1.163**	1.007***
	(0.668)	(0.543)	(0.459)	(0.361)
μ_{IPSurp}	0.059	0.079	0.036	0.083
	(0.207)	(0.166)	(0.149)	(0.117)
μ_{IP}	1.641***	1.303***	1.132***	1.286***
	(0.457)	(0.358)	(0.315)	(0.268)
μ_{U}	0.075***	0.067***	0.059***	0.066***
	(0.025)	(0.019)	(0.015)	(0.014)
$\mu_{\Delta\text{Default}}$	-0.040**	-0.023	-0.026**	-0.014
	(0.017)	(0.015)	(0.011)	(0.009)
μ_{Term}	-1.182	-0.986	-1.657	-1.661
	(1.715)	(1.611)	(1.294)	(1.064)
μ_{InfSurp}	-1.647**	-0.757	-0.640	-0.386
	(0.786)	(0.554)	(0.491)	(0.421)
μ_{Inf}	-2.224***	-1.637***	-1.532***	-1.329***
	(0.621)	(0.471)	(0.419)	(0.362)
R^2	0.155	0.1516	0.1834	0.217
AR(12)	15.67	13.81	10.37	10.72
ARCH(12)	27.27***	30.43***	59.89***	44.95***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.8110	0.6611	0.6159	0.5184
Realized	0.8125	0.5729	0.6853	0.4504
September-March Seasonality				
Fitted	1.1377	1.0382	0.9522	0.8120
Realized	0.8565	0.7955	0.8178	0.7509
October-April Seasonality				
Fitted	0.7200	0.6483	0.5796	0.4877
Realized	1.0951	1.2034	0.8506	0.6192
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.991 [.998]
Fall vs. Winter:				.193 [.262]
September vs. March:				.862 [.838]
October vs. April:				.992 [.988]
Onset/Recovery Coefficients Jointly 0:				**.008** [**.024**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.392 [.444]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				9.60
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-39.40/ -55.57
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-20.85/ -30.06
Number of Parameters				48
Number of Moment Conditions				56
Number of Observations (12/65 - 12/03)				457

Notes: See the notes to Table C.2

Table C.25
Model 3′ (CRR Factors Augmented with Onset/Recovery)
Term Structure Variable: 20 year - 30 Day

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.020	-0.036	-0.020	0.004
	(0.229)	(0.193)	(0.168)	(0.144)
$\mu_{\hat{\text{OR}}}$	1.277***	1.111***	1.037***	0.856***
	(0.418)	(0.329)	(0.266)	(0.222)
μ_{Term}	1.219	1.695	0.958	0.859
	(1.230)	(1.138)	(0.964)	(0.766)
μ_{Default}	0.736***	0.553**	0.535***	0.447***
	(0.256)	(0.221)	(0.183)	(0.159)
μ_{IP}	-0.302***	-0.280***	-0.218***	-0.174***
	(0.082)	(0.070)	(0.066)	(0.051)
μ_{Inf}	-1.543***	-1.187***	-1.036***	-0.941***
	(0.562)	(0.408)	(0.357)	(0.334)
μ_{InfSurp}	-1.120**	-0.565	-0.449	-0.243
	(0.519)	(0.371)	(0.322)	(0.273)
R^2	0.0638	0.0624	0.067	0.0702
AR(12)	17.08	14.14	11.97	14.57
ARCH(12)	78.20***	92.64***	95.03***	111.59***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.4633	0.3990	0.3717	0.3052
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	0.9561	0.8568	0.7997	0.6665
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	0.6483	0.5659	0.5223	0.4288
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.985 [1.00]
Fall vs. Winter:				.636 [.656]
September vs. March:				.270 [.286]
October vs. April:				.297 [.314]
Onset/Recovery Coefficients Jointly 0:				**.002** [**.008**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.116 [.124]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				14.01*
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-38.07/ -53.27
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-17.47/ -24.93
Number of Parameters				28
Number of Moment Conditions				36
Number of Observations (01/52 - 12/07)				672

Notes: See the notes to Table C.2

Table C.26
Model 5′ (CRR and Seasonally Unadjusted Factors Augmented with Onset/Recovery)
Term Structure Variable: 20 year - 30 Day

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.021	0.029	0.022	0.045
	(0.227)	(0.192)	(0.167)	(0.142)
$\mu_{\hat{\text{OR}}}$	1.327**	1.636***	1.375***	1.224***
	(0.579)	(0.476)	(0.380)	(0.328)
μ_{Term}	0.995	1.490	0.833	0.795
	(1.249)	(1.125)	(0.947)	(0.751)
μ_{Default}	0.678***	0.521**	0.532***	0.443***
	(0.263)	(0.227)	(0.188)	(0.164)
$\mu_{\text{CPI}_{\text{SU}}}$	-0.828	-0.603	-0.503	-0.345
	(0.536)	(0.428)	(0.320)	(0.288)
$\mu_{\text{IP}_{\text{SU}}}$	3.224	0.546	0.460	0.260
	(4.389)	(3.506)	(2.698)	(2.174)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.164	-0.077	0.034	0.056
	(0.163)	(0.122)	(0.111)	(0.094)
$\mu_{\text{GDP}_{\text{SU}}}$	-3.113	-6.950**	-4.434*	-4.393**
	(3.609)	(3.112)	(2.471)	(2.167)
$\mu_{\text{U}_{\text{SU}}}$	2.411**	2.646***	0.924	1.044**
	(1.000)	(0.815)	(0.627)	(0.531)
μ_{IP}	-0.300***	-0.223**	-0.202***	-0.151***
	(0.110)	(0.088)	(0.072)	(0.057)
μ_{Inf}	-0.411	-0.315	-0.466	-0.558
	(0.807)	(0.588)	(0.478)	(0.467)
μ_{InfSurp}	-0.225	0.061	-0.067	-0.033
	(0.611)	(0.477)	(0.373)	(0.343)
R^2	0.0787	0.0809	0.0716	0.0756
AR(12)	18.21	13.54	11.61	14.37
ARCH(12)	75.35***	87.64***	95.42***	110.75***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.3221	0.1909	0.2706	0.1857
Realized	0.5333	0.2928	0.4644	0.2905
September-March Seasonality				
Fitted	0.9495	0.9036	0.8201	0.6948
Realized	0.6045	0.5524	0.5604	0.4955
October-April Seasonality				
Fitted	0.7475	0.6924	0.5672	0.4841
Realized	0.9665	0.9608	0.6888	0.5531
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.823 [.978]
Fall vs. Winter:				.716 [.752]
September vs. March:				.283 [.348]
October vs. April:				.740 [.780]
Onset/Recovery Coefficients Jointly 0:				**<.001** [**<.001**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.105 [.140]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				13.73*
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-38.21/ -53.44
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-17.70/ -25.24
Number of Parameters				48
Number of Moment Conditions				56
Number of Observations (01/52 - 12/06)				660

Notes: See the notes to Table C.2

Table C.27
Model 6′ (Real-Time Macro Factors Augmented with Onset/Recovery)
Term Structure Variable: 20 Year - 90 Day

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.513*	0.281	0.355*	0.221
	(0.300)	(0.231)	(0.203)	(0.167)
$\mu_{\hat{OR}}$	1.469**	1.401***	1.241***	1.058***
	(0.643)	(0.479)	(0.380)	(0.313)
μ_{USurpC}	-1.635	-0.113	-0.606	0.311
	(1.567)	(1.186)	(1.261)	(1.006)
μ_{USurpE}	2.127**	1.821***	1.627***	1.233***
	(0.893)	(0.683)	(0.571)	(0.469)
μ_{ProbC}	1.464**	1.283**	1.073**	0.912***
	(0.668)	(0.563)	(0.441)	(0.344)
μ_{IPSurp}	0.124	0.141	0.085	0.130
	(0.201)	(0.161)	(0.143)	(0.110)
μ_{IP}	1.532***	1.319***	1.031***	1.167***
	(0.450)	(0.360)	(0.323)	(0.268)
μ_{U}	0.065***	0.065***	0.049***	0.054***
	(0.022)	(0.016)	(0.014)	(0.012)
$\mu_{\Delta\text{Default}}$	-0.044***	-0.023	-0.028**	-0.017*
	(0.016)	(0.014)	(0.011)	(0.009)
$\mu_{\text{Term: 20 Year - 90 Day}}$	-0.060	-0.038	-0.031	-0.023
	(0.050)	(0.040)	(0.033)	(0.027)
μ_{InfSurp}	-1.532*	-0.736	-0.553	-0.308
	(0.790)	(0.558)	(0.487)	(0.419)
μ_{Inf}	-2.366***	-1.764***	-1.542***	-1.344***
	(0.650)	(0.492)	(0.421)	(0.360)
R^2	0.1567	0.1526	0.1786	0.2093
AR(12)	15.08	13.32	11.69	12.68
ARCH(12)	26.68***	30.73***	55.69***	48.86***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.8091	0.6738	0.6156	0.5199
Realized	0.8125	0.5729	0.6853	0.4504
September-March Seasonality				
Fitted	1.1451	1.0816	0.9821	0.8345
Realized	0.8565	0.7955	0.8178	0.7509
October-April Seasonality				
Fitted	0.7015	0.6678	0.6056	0.5107
Realized	1.0951	1.2034	0.8506	0.6192
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.998 [1.00]
Fall vs. Winter:				.176 [.216]
September vs. March:				.951 [.964]
October vs. April:				.829 [.846]
Onset/Recovery Coefficients Jointly 0:				**.004** [**.018**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.302 [.362]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				10.23
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-38.77/ -54.54
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-20.22/ -29.03
Number of Parameters				48
Number of Moment Conditions				56
Number of Observations (12/65 - 12/03)				457

Notes: See the notes to Table C.2

Table C.28
Model 3′ (CRR Factors Augmented with Onset/Recovery)
Term Structure Variable: 20 Year - 90 Day

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.038	-0.055	-0.032	-0.001
	(0.240)	(0.205)	(0.175)	(0.150)
$\mu_{\hat{OR}}$	1.269***	1.115***	1.040***	0.858***
	(0.428)	(0.337)	(0.271)	(0.226)
$\mu_{\text{Term: 20 Year - 90 Day}}$	-0.009	-0.002	<.001	0.008
	(0.038)	(0.029)	(0.026)	(0.021)
μ_{Default}	0.827***	0.675***	0.600***	0.496***
	(0.271)	(0.248)	(0.191)	(0.167)
μ_{IP}	-0.301***	-0.293***	-0.225***	-0.176***
	(0.082)	(0.072)	(0.066)	(0.050)
μ_{Inf}	-1.592***	-1.253***	-1.054***	-0.960***
	(0.571)	(0.431)	(0.364)	(0.340)
μ_{InfSurp}	-1.186**	-0.664*	-0.500	-0.279
	(0.516)	(0.372)	(0.319)	(0.275)
R^2	0.0616	0.0608	0.0679	0.0702
AR(12)	17.37	14.29	11.97	14.97
ARCH(12)	80.76***	96.80***	95.97***	112.57***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.4546	0.3953	0.3704	0.3062
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	0.9339	0.8396	0.7912	0.6606
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	0.6236	0.5450	0.5119	0.4237
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.989 [.998]
Fall vs. Winter:				.614 [.662]
September vs. March:				.272 [.306]
October vs. April:				.277 [.352]
Onset/Recovery Coefficients Jointly 0:				**.003** [**.006**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.126 [.140]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				13.55*
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-38.53/ -53.93
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-17.92/ -25.59
Number of Parameters				28
Number of Moment Conditions				36
Number of Observations (01/52 - 12/07)				672

Notes: See the notes to Table C.2

Table C.29
Model 5′ (CRR and Seasonally Unadjusted Factors Augmented with Onset/Recovery)
Term Structure Variable: 20 Year - 90 Day

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	<-.001	0.008	0.008	0.038
	(0.238)	(0.204)	(0.175)	(0.147)
$\mu_{\hat{OR}}$	1.284**	1.622***	1.361***	1.207***
	(0.593)	(0.487)	(0.387)	(0.333)
$\mu_{\text{Term: 20 Year - 90 Day}}$	-0.013	-0.006	-0.003	0.006
	(0.037)	(0.029)	(0.026)	(0.021)
μ_{Default}	0.761***	0.638**	0.595***	0.492***
	(0.280)	(0.256)	(0.198)	(0.174)
$\mu_{\text{CPI}_{\text{SU}}}$	-0.825	-0.621	-0.510	-0.346
	(0.542)	(0.435)	(0.325)	(0.291)
$\mu_{\text{IP}_{\text{SU}}}$	3.258	0.494	0.502	0.326
	(4.406)	(3.541)	(2.715)	(2.188)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.173	-0.083	0.034	0.056
	(0.159)	(0.118)	(0.107)	(0.091)
$\mu_{\text{GDP}_{\text{SU}}}$	-2.749	-6.813**	-4.269*	-4.213*
	(3.626)	(3.152)	(2.496)	(2.172)
$\mu_{\text{U}_{\text{SU}}}$	2.323**	2.644***	0.922	1.028*
	(0.990)	(0.811)	(0.625)	(0.526)
μ_{IP}	-0.305***	-0.238***	-0.212***	-0.155***
	(0.108)	(0.089)	(0.072)	(0.056)
μ_{Inf}	-0.464	-0.368	-0.489	-0.585
	(0.819)	(0.602)	(0.486)	(0.473)
μ_{InfSurp}	-0.280	-0.009	-0.111	-0.070
	(0.618)	(0.476)	(0.375)	(0.345)
R^2	0.0773	0.0797	0.0721	0.0754
AR(12)	18.38	13.49	11.62	15.03
ARCH(12)	77.27***	90.06***	96.74***	112.13***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.3268	0.1944	0.2730	0.1899
Realized	0.5333	0.2928	0.4644	0.2905
September-March Seasonality				
Fitted	0.9282	0.8881	0.8129	0.6895
Realized	0.6045	0.5524	0.5604	0.4955
October-April Seasonality				
Fitted	0.7194	0.6703	0.5565	0.4778
Realized	0.9665	0.9608	0.6888	0.5531
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.811 [.954]
Fall vs. Winter:				.777 [.846]
September vs. March:				.289 [.324]
October vs. April:				.698 [.706]
Onset/Recovery Coefficients Jointly 0:				**<.001** [**.002**]
Onset/Recovery Treasury Coefficients Jointly Equal:				**.088** [.124]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				13.07
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-38.87/ -53.77
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-18.36/ -25.56
Number of Parameters				48
Number of Moment Conditions				56
Number of Observations (01/52 - 12/06)				660

Notes: See the notes to Table C.2

Table C.30
Model 6′ (Real-Time Macro Factors Augmented with Onset/Recovery)
Term Structure Variable: 20 Year - 1 Year

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.510*	0.278	0.350*	0.218
	(0.300)	(0.230)	(0.202)	(0.166)
$\mu_{\hat{OR}}$	1.459**	1.405***	1.238***	1.055***
	(0.642)	(0.478)	(0.377)	(0.311)
μ_{USurpC}	-1.606	-0.079	-0.587	0.307
	(1.568)	(1.187)	(1.264)	(1.010)
μ_{USurpE}	2.144**	1.845***	1.643***	1.246***
	(0.892)	(0.682)	(0.571)	(0.470)
μ_{ProbC}	1.426**	1.254**	1.056**	0.899***
	(0.666)	(0.563)	(0.440)	(0.343)
μ_{IPSurp}	0.130	0.147	0.094	0.137
	(0.201)	(0.161)	(0.143)	(0.110)
μ_{IP}	1.496***	1.308***	1.020***	1.148***
	(0.450)	(0.359)	(0.324)	(0.268)
μ_{U}	0.063***	0.065***	0.048***	0.053***
	(0.022)	(0.016)	(0.014)	(0.012)
$\mu_{\Delta\text{Default}}$	-0.044***	-0.022	-0.027**	-0.017*
	(0.017)	(0.014)	(0.012)	(0.010)
$\mu_{\text{Term: 20 Year - 1 Year}}$	-0.060	-0.037	-0.026	-0.018
	(0.055)	(0.044)	(0.036)	(0.029)
μ_{InfSurp}	-1.507*	-0.724	-0.532	-0.287
	(0.789)	(0.558)	(0.486)	(0.419)
μ_{Inf}	-2.315***	-1.740***	-1.513***	-1.316***
	(0.644)	(0.488)	(0.416)	(0.356)
R^2	0.1566	0.1524	0.1782	0.2088
AR(12)	14.82	13.34	11.87	12.77
ARCH(12)	26.87***	31.36***	55.97***	49.12***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.8096	0.6764	0.6164	0.5205
Realized	0.8125	0.5729	0.6853	0.4504
September-March Seasonality				
Fitted	1.1402	1.0852	0.9826	0.8349
Realized	0.8565	0.7955	0.8178	0.7509
October-April Seasonality				
Fitted	0.7039	0.6748	0.6098	0.5143
Realized	1.0951	1.2034	0.8506	0.6192
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.998 [1.00]
Fall vs. Winter:				.171 [.226]
September vs. March:				.960 [.954]
October vs. April:				.820 [.820]
Onset/Recovery Coefficients Jointly 0:				**.004** [**.010**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.296 [.358]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				10.55
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-38.45/ -54.21
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-19.90/ -28.71
Number of Parameters				48
Number of Moment Conditions				56
Number of Observations (12/65 - 12/03)				457

Notes: See the notes to Table C.2

Table C.31
Model 3′ (CRR Factors Augmented with Onset/Recovery)
Term Structure Variable: 20 Year - 1 Year

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.038	-0.055	-0.031	-0.001
	(0.240)	(0.206)	(0.176)	(0.150)
$\mu_{\hat{OR}}$	1.261***	1.117***	1.039***	0.857***
	(0.429)	(0.338)	(0.272)	(0.227)
$\mu_{\text{Term: 20 Year - 1 Year}}$	-0.011	-0.009	-0.002	0.006
	(0.042)	(0.033)	(0.028)	(0.023)
μ_{Default}	0.825***	0.681***	0.601***	0.498***
	(0.270)	(0.248)	(0.191)	(0.167)
μ_{IP}	-0.300***	-0.295***	-0.225***	-0.176***
	(0.082)	(0.073)	(0.066)	(0.051)
μ_{Inf}	-1.586***	-1.267***	-1.058***	-0.963***
	(0.571)	(0.433)	(0.364)	(0.341)
μ_{InfSurp}	-1.180**	-0.669*	-0.499	-0.278
	(0.515)	(0.371)	(0.318)	(0.274)
R^2	0.0617	0.0609	0.0678	0.0699
AR(12)	19.04 *	14.43	11.99	14.63
ARCH(12)	80.84***	96.74***	96.10***	113.18***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.4519	0.3940	0.3693	0.3050
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	0.9281	0.8393	0.7899	0.6594
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	0.6195	0.5421	0.5100	0.4218
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.988 [1.00]
Fall vs. Winter:				.603 [.636]
September vs. March:				.271 [.332]
October vs. April:				.264 [.316]
Onset/Recovery Coefficients Jointly 0:				**.003** [**.006**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.127 [.142]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				13.42*
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-38.66/ -54.06
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-18.05/ -25.72
Number of Parameters				28
Number of Moment Conditions				36
Number of Observations (01/52 - 12/07)				672

Notes: See the notes to Table C.2

Table C.32
Model 5′ (CRR and Seasonally Unadjusted Factors Augmented with Onset/Recovery)
Term Structure Variable: 20 Year - 1 Year

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	<.001	0.010	0.010	0.038
	(0.238)	(0.205)	(0.175)	(0.148)
$\mu_{\hat{OR}}$	1.275**	1.626***	1.361***	1.208***
	(0.593)	(0.488)	(0.387)	(0.333)
$\mu_{\text{Term: 20 Year - 1 Year}}$	-0.013	-0.011	-0.004	0.006
	(0.041)	(0.033)	(0.028)	(0.023)
μ_{Default}	0.758***	0.642**	0.595***	0.494***
	(0.280)	(0.257)	(0.197)	(0.173)
$\mu_{\text{CPI}_{\text{SU}}}$	-0.828	-0.626	-0.511	-0.346
	(0.542)	(0.435)	(0.325)	(0.291)
$\mu_{\text{IP}_{\text{SU}}}$	3.325	0.502	0.539	0.364
	(4.412)	(3.544)	(2.716)	(2.188)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.171	-0.081	0.036	0.057
	(0.159)	(0.118)	(0.107)	(0.091)
$\mu_{\text{GDP}_{\text{SU}}}$	-2.759	-6.850**	-4.292*	-4.240*
	(3.620)	(3.147)	(2.497)	(2.172)
$\mu_{\text{U}_{\text{SU}}}$	2.323**	2.653***	0.926	1.033**
	(0.989)	(0.811)	(0.626)	(0.527)
μ_{IP}	-0.305***	-0.239***	-0.212***	-0.156***
	(0.108)	(0.089)	(0.072)	(0.056)
μ_{Inf}	-0.454	-0.377	-0.494	-0.588
	(0.819)	(0.603)	(0.487)	(0.473)
μ_{InfSurp}	-0.271	-0.010	-0.111	-0.068
	(0.618)	(0.477)	(0.375)	(0.345)
R^2	0.0774	0.0797	0.072	0.0751
AR(12)	18.86*	13.47	11.56	14.58
ARCH(12)	77.29***	90.01***	96.79***	112.48***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.3228	0.1924	0.2705	0.1872
Realized	0.5333	0.2928	0.4644	0.2905
September-March Seasonality				
Fitted	0.9223	0.8877	0.8114	0.6881
Realized	0.6045	0.5524	0.5604	0.4955
October-April Seasonality				
Fitted	0.7163	0.6686	0.5554	0.4766
Realized	0.9665	0.9608	0.6888	0.5531
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.804 [.968]
Fall vs. Winter:				.777 [.782]
September vs. March:				.288 [.286]
October vs. April:				.683 [.718]
Onset/Recovery Coefficients Jointly 0:				**<.001** [**.002**]
Onset/Recovery Treasury Coefficients Jointly Equal:				**.082** [.132]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				12.95
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-38.99/ -53.71
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-18.47/ -25.51
Number of Parameters				48
Number of Moment Conditions				56
Number of Observations (01/52 - 12/06)				660

Notes: See the notes to Table C.2

Table C.33
Model 6′ (Real-Time Macro Factors Augmented with Onset/Recovery)
Term Structure Variable: 20 Year - 5 Year

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.508*	0.282	0.345*	0.211
	(0.301)	(0.232)	(0.201)	(0.165)
$\mu_{\hat{OR}}$	1.430**	1.421***	1.247***	1.061***
	(0.631)	(0.476)	(0.368)	(0.302)
μ_{USurpC}	-1.550	0.003	-0.575	0.273
	(1.545)	(1.181)	(1.238)	(0.993)
μ_{USurpE}	2.212**	1.919***	1.697***	1.300***
	(0.893)	(0.682)	(0.571)	(0.472)
μ_{ProbC}	1.368**	1.206**	1.039**	0.892***
	(0.664)	(0.563)	(0.437)	(0.339)
μ_{IPSurp}	0.150	0.163	0.118	0.162
	(0.201)	(0.161)	(0.144)	(0.111)
μ_{IP}	1.398***	1.269***	0.988***	1.107***
	(0.459)	(0.360)	(0.332)	(0.275)
μ_{U}	0.058***	0.063***	0.046***	0.051***
	(0.022)	(0.016)	(0.014)	(0.012)
$\mu_{\Delta\text{Default}}$	-0.045***	-0.021	-0.026**	-0.016*
	(0.017)	(0.015)	(0.012)	(0.010)
$\mu_{\text{Term: 20 Year - 5 Year}}$	-0.063	-0.045	-0.014	0.007
	(0.085)	(0.070)	(0.051)	(0.042)
μ_{InfSurp}	-1.449*	-0.713	-0.494	-0.240
	(0.794)	(0.563)	(0.488)	(0.418)
μ_{Inf}	-2.193***	-1.700***	-1.466***	-1.257***
	(0.625)	(0.480)	(0.406)	(0.345)
R^2	0.1546	0.151	0.1762	0.2071
AR(12)	15.06	13.47	11.85	12.25
ARCH(12)	28.35***	32.84***	56.65***	50.35***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.8134	0.6870	0.6191	0.5209
Realized	0.8125	0.5729	0.6853	0.4504
September-March Seasonality				
Fitted	1.1318	1.1019	0.9936	0.8439
Realized	0.8565	0.7955	0.8178	0.7509
October-April Seasonality				
Fitted	0.7166	0.6992	0.6228	0.5224
Realized	1.0951	1.2034	0.8506	0.6192
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.997 [1.00]
Fall vs. Winter:				.152 [.210]
September vs. March:				.997 [.998]
October vs. April:				.824 [.836]
Onset/Recovery Coefficients Jointly 0:				**.002** [**.020**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.275 [.340]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				11.27
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-37.73/ -53.38
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-19.18/ -27.87
Number of Parameters				48
Number of Moment Conditions				56
Number of Observations (12/65 - 12/03)				457

Notes: See the notes to Table C.2

Table C.34
Model 3′ (CRR Factors Augmented with Onset/Recovery)
Term Structure Variable: 20 Year - 5 Year

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.027	-0.040	-0.016	0.012
	(0.241)	(0.208)	(0.178)	(0.151)
$\mu_{\hat{\text{OR}}}$	1.255***	1.133***	1.048***	0.868***
	(0.429)	(0.344)	(0.273)	(0.227)
$\mu_{\text{Term: 20 Year - 5 Year}}$	-0.020	-0.048	-0.013	0.013
	(0.069)	(0.057)	(0.043)	(0.036)
μ_{Default}	0.810***	0.686***	0.592***	0.483***
	(0.269)	(0.249)	(0.190)	(0.166)
μ_{IP}	-0.293***	-0.299***	-0.224***	-0.170***
	(0.083)	(0.072)	(0.067)	(0.052)
μ_{Inf}	-1.572***	-1.320***	-1.077***	-0.963***
	(0.563)	(0.433)	(0.361)	(0.336)
μ_{InfSurp}	-1.174**	-0.697*	-0.504	-0.276
	(0.514)	(0.372)	(0.317)	(0.273)
R^2	0.062	0.0612	0.0674	0.0692
AR(12)	18.50	15.00	12.01	14.49
ARCH(12)	81.11***	96.33***	96.25***	111.37***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.4520	0.4010	0.3728	0.3072
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	0.9245	0.8507	0.7975	0.6673
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	0.6195	0.5483	0.5141	0.4257
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.984 [.996]
Fall vs. Winter:				.549 [.602]
September vs. March:				.257 [.324]
October vs. April:				.225 [.254]
Onset/Recovery Coefficients Jointly 0:				**.002** [**.014**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.141 [.178]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				12.80
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-39.28/ -54.67
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-18.67/ -26.33
Number of Parameters				28
Number of Moment Conditions				36
Number of Observations (01/52 - 12/07)				672

Notes: See the notes to Table C.2

Table C.35
Model 5′ (CRR and Seasonally Unadjusted Factors Augmented with Onset/Recovery)
Term Structure Variable: 20 Year - 5 Year

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.011	0.024	0.026	0.051
	(0.239)	(0.206)	(0.176)	(0.148)
$\mu_{\hat{OR}}$	1.264**	1.635***	1.371***	1.215***
	(0.590)	(0.489)	(0.387)	(0.331)
$\mu_{\text{Term: 20 Year - 5 Year}}$	-0.018	-0.044	-0.011	0.016
	(0.068)	(0.057)	(0.044)	(0.036)
μ_{Default}	0.740***	0.646**	0.586***	0.479***
	(0.278)	(0.257)	(0.196)	(0.172)
$\mu_{\text{CPI}_{\text{SU}}}$	-0.856	-0.651	-0.519	-0.356
	(0.542)	(0.437)	(0.325)	(0.291)
$\mu_{\text{IP}_{\text{SU}}}$	3.449	0.418	0.581	0.481
	(4.450)	(3.555)	(2.733)	(2.204)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.162	-0.071	0.043	0.062
	(0.160)	(0.119)	(0.107)	(0.092)
$\mu_{\text{GDP}_{\text{SU}}}$	-2.692	-6.763**	-4.283*	-4.215*
	(3.599)	(3.121)	(2.493)	(2.164)
$\mu_{\text{U}_{\text{SU}}}$	2.305**	2.649***	0.947	1.044**
	(0.984)	(0.807)	(0.630)	(0.529)
μ_{IP}	-0.300***	-0.242***	-0.212***	-0.152***
	(0.107)	(0.088)	(0.071)	(0.056)
μ_{Inf}	-0.419	-0.410	-0.513	-0.583
	(0.809)	(0.599)	(0.484)	(0.469)
μ_{InfSurp}	-0.246	-0.022	-0.115	-0.060
	(0.616)	(0.477)	(0.374)	(0.343)
R^2	0.0773	0.0795	0.0714	0.0744
AR(12)	18.70*	13.66	11.59	14.30
ARCH(12)	77.59***	90.26***	96.91***	110.36***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.3265	0.2063	0.2733	0.1879
Realized	0.5333	0.2928	0.4644	0.2905
September-March Seasonality				
Fitted	0.9229	0.8995	0.8208	0.6978
Realized	0.6045	0.5524	0.5604	0.4955
October-April Seasonality				
Fitted	0.7203	0.6774	0.5629	0.4826
Realized	0.9665	0.9608	0.6888	0.5531
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.748 [.940]
Fall vs. Winter:				.808 [.822]
September vs. March:				.264 [.312]
October vs. April:				.649 [.702]
Onset/Recovery Coefficients Jointly 0:				**<.001** [**<.001**]
Onset/Recovery Treasury Coefficients Jointly Equal:				**.076** [**.090**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				12.30
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-39.64/ -53.99
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-19.13/ -25.79
Number of Parameters				48
Number of Moment Conditions				56
Number of Observations (01/52 - 12/06)				660

Notes: See the notes to Table C.2

Appendix D Comprehensive Set of Summary Statistics

These summary statistics build on the basic set of summary statistics presented in Table 1 and Tables B.1–B.8 in the published article.

Table D.1: Summary Statistics on Variables in Models 1-12

Description: This table contains summary statistics for all of the variables used in the study. Sources of all data series are described in Appendix A of the main paper. For each series we present the mean (Mean), standard deviation (Std), minimum (Min), maximum (Max), skewness (Skew), kurtosis (Kurt), and asymptotic p-values (and bootstrapped p-values, in square brackets) for four tests for seasonality, nonspecific monthly, fall vs. winter, September vs. March, and October vs. April. P-values below 10 percent are indicated in bold font. To produce the bootstrapped p-values we follow White (2000) and use the block bootstrap resampling technique of Politis and Romano (1994), using blocks of data of random length, producing resampled statistics that are robust to data dependence. For the Treasury return series, we also present the CAPM beta. Beneath each variable name, we provide the sample period that we employ. For series other than the Treasury data, we provide the abbreviation used in regression models for each variable, in parentheses. Estimation details for regressions that are used to perform the seasonality tests are provided in Section 2 of the paper.

									Seasonality test: Asymptotic p-values [Bootstrapped p-values]			
Series Estimation Period	N	Mean	Std	Min	Max	Skew	Kurt	Beta	Nonspec. Monthly	Fall vs. Winter	Sep. vs. Mar.	Oct. vs. Apr.
Nominal												
20-yearTreasury: Nominal 01/1952-12/2007	672	.54	2.64	-9.36	15.23	.48	2.73	.11	.332 [.386]	**.077** [**.093**]	.169 [.187]	**.007** [**.012**]
10-yearTreasury: Nominal 01/1952-12/2007	672	.52	2.13	-6.68	10.00	.45	1.77	.08	.365 [.417]	.198 [.223]	.113 [.127]	**.002** [**.002**]
7-yearTreasury: Nominal 01/1952-12/2007	672	.55	1.78	-7.04	10.75	.60	3.92	.06	.257 [.308]	**.034** [**.041**]	**.027** [**.034**]	**.001** [<**.001**]
5-yearTreasury: Nominal 01/1952-12/2007	672	.53	1.49	-5.80	10.61	.59	4.81	.04	.453 [.495]	**.090** [.109]	**.023** [**.031**]	**.001** [<**.001**]
AverageTreasury: Nominal 01/1952-12/2007	672	.53	1.94	-6.40	11.26	.52	2.71	.07	.467 [.515]	**.080** [**.094**]	**.064** [**.077**]	**.001** [<**.001**]
Treasury Excess Return Series												
20-yearTreasury: Excess 01/1952-12/2007	672	.13	2.64	-9.43	13.95	.31	2.38	.11	.300 [.366]	**.078** [**.091**]	.172 [.170]	**.007** [**.011**]
10-yearTreasury: Excess 01/1952-12/2007	672	.11	2.11	-7.63	9.45	.28	1.64	.08	.322 [.402]	.203 [.215]	.121 [.114]	**.002** [**.005**]
7-yearTreasury: Excess 01/1952-12/2007	672	.14	1.76	-8.10	9.46	.31	3.51	.06	.238 [.312]	**.033** [**.038**]	**.032** [**.044**]	**.001** [**.002**]
5-yearsTreasury: Excess 01/1952-12/2007	672	.12	1.47	-6.87	9.33	.19	4.27	.04	.414 [.507]	**.096** [.100]	**.027** [**.036**]	**.001** [**.004**]
AverageTreasury: Excess 01/1952-12/2007	672	.13	1.92	-7.36	9.97	.27	2.33	.07	.421 [.506]	**.081** [**.093**]	**.071** [**.068**]	**.001** [**.004**]
Other Treasury and Equity Data												
30-dayTreasury: Nominal 01/1952 - 12/2007	672	.41	.24	0	1.5	1.19	2.2	–	.166 [.156]	.485 [.481]	.892 [.876]	.600 [.599]
Equity Return: Nominal 01/1952-12/2007	672	.98	4.19	-22.5	16.56	-.47	2.07	–	**.014** [**.038**]	.293 [.311]	**.054** [**.072**]	.744 [.729]
Equity Return: Excess 01/1952-12/2007	672	.57	4.21	-23.1	16.03	-.51	2.07	–	**.017** [**.034**]	.320 [.323]	**.055** [**.070**]	.751 [.737]

(Table D.1 is continued on the next page)

Table D.1 (Continued)

Series Estimation Period	N	Mean	Std	Min	Max	Skew	Kurt	Seasonality test: Asymptotic p-values [Bootstrapped p-values] Nonspec. Monthly	Fall vs. Winter	Sep. vs. Mar.	Oct. vs. Apr.
Model 2: Treasury Debt Supply Factors											
Debt-to-GDP Ratio (DebtToGDP) 01/1970-11/2007	455	.495	.13	.31	.67	-.095	-1.71	1.000 [1.00]	.831 [.821]	.875 [.897]	.904 [.930]
FOMC 01/1970-12/2007	456	0.75	0.43	0.00	1.00	-1.16	-0.66	**.000** [**.000**]	**.002** [**.004**]	**.000** [**.000**]	**.001** [**.009**]
Models 3/5: CRR Macro Factors											
Industrial Production Growth (IP) 01/1952-12/2007	672	.268	.93	-3.53	6.43	.474	6.79	.962 [.338]	.692 [.566]	.762 [.352]	.698 [.262]
Expected Inflation (Inf) 01/1952-12/2007	672	.310	.20	-.09	1.09	1.353	1.97	1.000 [1.00]	.753 [.834]	.960 [.889]	.637 [.755]
Surprise Inflation (InfSurp) 01/1952-12/2007	672	<.001	.24	-.94	1.40	.236	2.99	.692 [.583]	.546 [.358]	.268 [.338]	.601 [.787]
Default Spread (Default) 01/1952-12/2007	672	.934	.41	.32	2.69	1.480	2.51	.819 [.814]	.805 [.701]	.804 [.780]	.811 [.750]
Term Spread (Term) 01/1952-12/2007	672	.135	2.64	-9.43	13.95	.308	2.38	.300 [.295]	.479 [.526]	.457 [.493]	.131 [.292]
Models 4/5: Seasonally Unadjusted Macro Variables											
Inflation based on CPI (CPI_{SU}) 01/1952-12/2006	660	.309	.34	-.80	1.81	.579	1.22	**<.001** [**<.001**]	**<.001** [**.003**]	.453 [.564]	.219 [.281]
GDP Growth (GDP_{SU}) 01/1952-12/2006	660	.018	.03	-.11	.10	-.706	.50	**<.001** [**<.001**]	**<.001** [**<.001**]	**<.001** [**<.001**]	**<.001** [**<.001**]
Industrial Production Growth (IP_{SU}) 01/1952-12/2006	660	.003	.02	-.10	.13	-.298	1.69	**<.001** [.338]	**<.001** [.566]	.221 [.352]	**.001** [.262]
Inflation based on PPI (PPI_{SU}) 01/1952-12/2006	660	.261	.72	-3.12	5.79	1.225	8.66	**<.001** [**<.001**]	**.002** [**.003**]	.661 [.564]	.301 [.281]
Unemployment Growth (U_{SU}) 01/1952-12/2006	660	.005	.10	-.19	.55	1.627	3.70	**<.001** [**<.001**]	**<.001** [**<.001**]	**.092** [.107]	**<.001** [**.004**]
Model 6: Real-Time Macro Variables											
Unemployment Surprise, Contraction (USurpC) 12/1965-12/2003	457	.013	.08	-.45	.69	3.101	22.18	.645 [.610]	.205 [.385]	.730 [.855]	.941 [.906]
Unemployment Surprise, Expansion (USurpE) 12/1965-12/2003	457	-.020	.17	-.64	.60	-.180	1.26	.337 [.610]	.537 [.385]	.948 [.855]	.833 [.906]
Probability of Contraction (ProbC) 12/1965-12/2003	457	.158	.28	.01	.99	2.016	2.70	.849 [.848]	.726 [.742]	.701 [.720]	.579 [.592
Industrial Production Surprise (IPSurp) 12/1965-12/2003	457	-.107	.72	-3.53	2.14	-.816	3.06	**.028** [.338]	.988 [.566]	**.047** [.352]	**.084** [.262]
Expected Growth in Industrial Production (IP) 12/1965-12/2003	457	.255	.33	-2.12	1.41	-1.679	11.33	.168 [.168]	.317 [.359]	.143 [.172]	.252 [.255]
Expected Change in Unemployment (U) 12/1965-12/2003	457	1.210	10.28	-46.81	57.26	1.175	6.28	.475 [.540]	.590 [.574]	.327 [.360]	.485 [.514]
Change in Default Spread (ΔDefault) 12/1965-12/2003	457	-.138	11.20	-66.00	55.00	-.647	7.09	**.004** [**.005**]	**<.001** [**<.001**]	.344 [.369]	.157 [.159]
Term Spread (ΔTerm) 12/1965-12/2003	457	.170	3.00	-9.43	13.95	.292	1.56	.307 [.295]	.402 [.526]	.213 [.493]	.120 [.292]
Inflation Surprise (InfSurp) 12/1965-12/2003	457	.001	.21	-.78	1.20	.454	3.09	.352 [.583]	.124 [.358]	.392 [.338]	.928 [.787]
Predicted Inflation (Inf) 12/1965-12/2003	457	.386	.23	-.06	1.34	1.295	1.63	1.000 [1.00]	.913 [.834]	.815 [.889]	.847 [.755]

(Table D.1 is continued on the next page)

Table D.1 (Continued)

Series Estimation Period	N	Mean	Std	Min	Max	Skew	Kurt	Seasonality test: Asymptotic p-values [Bootstrapped p-values] Nonspec. Monthly	Fall vs. Winter	Sep. vs. Mar.	Oct. vs. Apr.
Models 7/8: Factors Related to Cross-Market Hedging											
Turnover (Turnover) 08/1960-12/2007	569	.029	.13	-.40	1.21	2.297	14.36	**<.001** [**<.001**]	.350 [.360]	.132 [.146]	**<.001** [**<.001**]
Conditional Volatility ($\hat{\sigma}^2$) 08/1960-12/2007	569	19.599	11.82	6.32	93.79	2.453	9.30	.963 [.950]	.924 [.925]	.590 [.595]	.847 [.857]
Treasury Liquidity (Liquidity) 08/1960-12/2007	569	<.001	.02	-.09	.02	-1.326	2.62	.850 [.828]	.852 [.867]	.929 [.933]	.877 [.879]
5-Year Forecasted Realized Volatility ($\text{TreasuryVol}_{\text{5Year}}$) 04/1962-12/2007	549	1.34	.71	.28	4.61	1.85	4.75	.918 [.906]	.662 [.660]	.541 [.554]	.935 [.921]
7-Year Forecasted Realized Volatility ($\text{TreasuryVol}_{\text{7Year}}$) 10/1969-12/2007	459	2.01	.92	.74	6.21	2.01	4.44	.774 [.759]	.623 [.623]	.433 [.466]	.944 [.949]
10-Year Forecasted Realized Volatility ($\text{TreasuryVol}_{\text{10Year}}$) 04/1962-12/2007	549	2.39	1.35	.41	8.47	1.61	3.49	.975 [.974]	.794 [.816]	.677 [.709]	.948 [.956]
20-Year Forecasted Realized Volatility ($\text{TreasuryVol}_{\text{20Year}}$) 01/1994-12/2007	168	4.47	.65	3.05	6.27	.51	.07	.913 [.938]	.458 [.500]	**.096** [.134]	.634 [.644]
Models 9/10: Sentiment											
Baker-Wurgler Sentiment (BWSentiment) 03/1966-12/2005	478	.003	.42	-1.69	1.37	-.205	1.24	.342 [.435]	.605 [.618]	.225 [.254]	.702 [.717]
Michigan Consumer Sentiment (MSentiment) 02/1953-12/2007	659	-0.02	3.08	-12.20	17.30	0.13	3.33	**.004** [**.006**]	**.032** [**.036**]	.773 [.793]	.340 [.360]
Model 11: Fama and French Model											
Size (SMB) 01/1952-12/2007	672	.168	2.97	-16.70	22.18	.608	6.67	**<.001** [**<.001**]	**<.001** [**.003**]	.769 [.746]	.290 [.308]
Book-to-Market (HML) 01/1952-12/2007	672	.394	2.71	-12.80	13.80	.068	3.02	**.005** [**.010**]	**<.001** [**<.001**]	.206 [.233]	**.079** [**.090**]
Momentum (MOM) 01/1952-12/2007	672	.853	3.69	-25.05	18.40	-.666	6.31	**<.001** [**<.001**]	**.009** [**.012**]	.197 [.225]	.965 [0.957]
Default Spread (Default) 01/1952-12/2007	672	.934	.41	.32	2.69	1.480	2.51	.819 [.814]	.805 [.701]	.804 [.780]	.811 [.750]
Term Spread (Term) 01/1952-12/2007	672	.135	2.64	-9.43	13.95	.308	2.38	.300 [.295]	.479 [.526]	.457 [.493]	.131 [.292]
Orthogonalized Market Return ($\hat{r}_m$) 01/1952-12/2007	672	.005	3.81	-20.06	14.42	-.250	1.52	**.005** [**.013**]	.693 [.712]	**.005** [**.006**]	.337 [.339]
Model 12: Conditional CAPM											
Excess Dividend Yield ($\widetilde{D/P}$) 01/1952-12/2007	672	.261	.11	.09	.78	1.515	3.26	**<.001** [**<.001**]	.390 [.397]	.493 [.496]	.215 [.252]
Lagged Excess Market Return ($\tilde{r}_m$) 01/1952-12/2007	672	.577	4.21	-23.13	16.05	-.514	2.08	**.012** [**.021**]	.668 [.679]	.319 [.355]	.106 [.115]
Term Spread (Term90) 01/1952-12/2007	672	.042	.09	-.40	.84	2.623	19.39	**.016** [.295]	.680 [.526]	.819 [.493]	.716 [.292]

Appendix E Sub-Sample Stability, Alternative Measures of SAD, and Comparing Models

E.1: Sub-Sample Stability

The question of sub-sample stability of our results requires that we carefully determine sensible break-points in our sample. Garbade (2004) and Garbade (2007) provide very helpful insights, and much of the following draws heavily on these two sources. Although bills have been auctioned since before the 1950s, notes and bonds were not auctioned prior to 1971 but were rather offered in fixed-price sales. Authors such as Campbell (1990) focus on the 1951 accord between the Federal Reserve Board and the U.S. Treasury which permitted interest rates to respond more freely to market forces, but the lack of public auctions of Treasury notes and bonds until the early 1970s complicates the use of the longer maturity Treasury returns, given the difficulty price-setting poses for the Treasury in matching supply and demand. Garbade's (2004) endnote 15 (and related text) discusses the early-1960s literature that took the position that Treasury should auction notes and bonds rather than employing a fixed-price offering, in order to provide more competitive pricing. During the early 1970s Treasury experimented with a variety of auction methods and slowly introduced auctions to note and bond offerings, starting with the 2-year note. Then auctions were also put in place for the 4-year note in 1975, for the 5-year note in 1976, and finally for the 7-year note and 20-year bond in 1981. The modern mid-quarter cycle of refundings was also standardized by 1982, including regular auctions of 3- and 10-year notes and 30-year bonds. Following this regularization of Treasury market offerings by 1982, comparatively little has disturbed the competitive process of price-setting for Treasury issues. Hence the period from 1982 to the present is distinct from both the pre-1971 period and the 1971-1981 period, with the current period having a regular and predictable process for Treasury auctions, unlike the prior periods. Accordingly, we define four roughly equal-length sub-periods to consider for subsample stability, January 1952 to December 1971, January 1972 to December 1981, and, splitting the current period into two halves, January 1982 to December 1994 and January 1995 to December 2007. Given what we know about price-setting in the Treasury market and the Treasury's well-known missteps with fixed-price offerings (see Garbade (2004, 2007)), we have no specific hypothesis for Treasury return seasonality in the first quarter of the data, 1952-1971. We expect to find evidence of the SAD-related seasonal pattern in Treasury returns during the 1982-1994 and 1995-2007 periods when auctions were standard for Treasury offerings. And during the 1972-1981 period when auctions were being slowly introduced, we expect to find seasonal features somewhere in between that seen in the first quarter and the last half of the data. We provide regression results and analysis following some additional details regarding the history of Treasury market auctions.

Garbade (2007) observes that Treasury employed a "tactical" debt management strategy (largely notes and bonds) during the 1960s and early 1970s, occasionally moving offering dates with little or no warning (as it did in April 1962 when the offering came one or two months earlier than expected because individual income tax refunds ran ahead of expectations), surprising the market with a debt maturity shorter or longer than expected (as it did in January 1962 and August 1967), or canceling an announced offering if it had ample cash balances on hand (as it did with the 2-year note offering in March and June of 1973). Treasury began to revise this policy during the 1970s (in part due to the stress of funding the rapidly enlarging federal deficit), never again canceling an offering, even, for instance, if it had no immediate need for additional funds. By 1982 Treasury had adopted the system, still in place today, of selling notes and bonds on a "regular and predictable" schedule, with monthly auctions of 2-year notes and quarterly auctions of longer term securities. Garbade (2007) delineates the period from the 1960s to December 1970 as the period before the Treasury reentered the bond market in 1971 and before it had to rebuild its cash balances, the period from January 1971 to May 1975 as one of a (mostly) regular cycle of 2-year note auctions and many stand-alone cash offerings, and the period of June 1975 to December 1981 as the

introduction of a regular cycle of 4-year notes and the extension of regular and predictable issuance of the 5- and 7-year notes and 20-year bonds. The period following 1981 is described by Garbade (2007) as one of an unambiguous adoption of a regular and predictable strategy of Treasury auctions. More starkly perhaps, Garbade (2004) points out that notes and bonds were not auctioned until the early 1970s, with Treasury instead preferring to set "the yield on a new issue at a level where investors would buy the full amount offered but hardly any more," a policy of fixed price offerings.

In the remainder of this section we report on two different sets of sub-sample analysis. First, we test for the significance of the onset/recovery variable in each of the four sub-periods. Next, we provide results for each of the alternative models over the post-1970 portion of the sample.

E.1.a: Testing Onset/Recovery in Each of the Four Sub-Periods

Panels A-D of Table E.1 contain summary statistics on the Treasury return series for each of the four sub-periods (we discuss Panel E later) and Tables E.2 - E.5 contain results based on subsample analysis for 1952-1970, 1971-1981, 1982-1994, and 1995-2007. We estimate the following system of equations across the Treasury return series for each sub-sample:

$$r_{i,t} = \mu_i + \mu_{\widehat{\mathrm{OR}}} \widehat{\mathrm{OR}}_t + \epsilon_{i,t}.$$

This is Model 1 with the onset/recovery coefficient estimate restricted to be the same across Treasury returns. (We impose this restriction to improve power to reject the null of no effect on these short subsamples; of course this has no impact on the size of the test under the null of no onset/recovery effect). Each table includes diagnostic tests, summary statistics, and information criteria.

Summary statistics in Table E.1 reveal that excess returns are negative on average from 1952-1982, and are substantially less volatile over 1952-1971 than in more recent periods. Returns in the pre-auction period, 1952-1971, display large positive skew and very large kurtosis. By the end of the sample, 1995-2007, the skewness of returns has reversed to a small negative magnitude, and the kurtosis of returns has all but disappeared. Indeed by measure of skewness and kurtosis, the first half of the sample is remarkably different from the last half. Tests for return seasonality are compromised by the short length of the sub-periods and by virtue of being performed one-series-at-a-time, yet each sub-period shows some evidence of a SAD-related seasonal. Arguably there is very little seasonality in the 1952-1970 and 1971-1981 sub-periods, which is confirmed by our regression results, to which we now turn.

Tables E.2 through E.5 contain results for each of the four sub-samples. Panel B in each of those tables contains the magnitudes of the realized and fitted return seasonalities for each sub-period. In Table E.2 the onset/recovery variable is insignificantly different from zero and the seasonality tests reveal very little evidence of seasonality related to SAD. (For the fall/winter and September/March return magnitudes, the signs are opposite to that predicted by SAD and are insignificant.) In Table E.3 we see no evidence of SAD-related seasonality, and in Tables E.4 and E.5 we find statistically significant onset/recovery coefficients with magnitudes similar to those reported in the main text for the full sample.

Regression results in Tables E.2 through E.5 reveal no significant evidence of autocorrelation for any of the sub-samples, while ARCH is fairly typical in the return series, though not prominent in the most recent period, 1995-2007. The GMM over-identification test of model specification shows no evidence to reject the model in any of the time periods, the tests for seasonality show little evidence of residual seasonality after controlling for onset/recovery, in particular when considering the bootstrapped p-values. Both sub-samples in the last half of the sample show very similar onset/recovery coefficients, roughly equal to 1 and statistically significant in both sub-samples. The onset/recovery coefficient is of similar magnitude over the 1970s period, a little below 1, but it is not statistically significant. Data over the 1952-1970 sub-sample are not well captured by the model, with the onset/recovery variable showing little or no statistical significance, and taking on a negative value, albeit of small magnitude (roughly -0.02).

In unreported tests, the onset/recovery coefficient estimate is statistically insignificantly different across Treasury maturity series at the 10% level, for each of the four regressions.

Altogether, this evidence is consistent with a break in the process driving Treasury returns during the 1970s. Knowing that the Treasury switched to a competitive auction process during the 1970s, and that the non-competitive nature of Treasury issuance prior to 1971 was a matter of great concern as early as the late 1950s, we view this as a cautionary note in interpreting regression results that include the pre-1971 period. We hope this appendix of results satisfies the reader that evidence of a strong SAD seasonal is not driven by non-market pricing patterns during the early portion of our full sample, but is rather a robust feature of the modern, market-driven auction process of Treasury issuance in place today.

E.1.b: Testing Each Model in the Post-1970 Auction Era

As described above, prior to 1971 the Treasury Department set the prices of notes and bonds rather than having a competitive price-setting mechanism, and there was very little seasonal variation in the Treasury return data (virtually none of it statistically significant; see Panel A of Table E.1 for statistical significance and Panel B of Table E.2 for economic magnitudes). Accordingly, one might reasonably wonder whether the failure of the alternative models to capture seasonal variation in the Treasury return data (as presented in the main text) is less a failure of the models than a lack of seasonal variation to explain in a substantial portion of the data. Thus we now consider the performance of all the models over only the portion of the sample when auctions were in use, from 1971 on. (We exclude Model 2 and Model 8 from this analysis because the original sample period used for estimating those model is a subset of the "auction era" sample period we consider here.) Recall that Treasury began implementing auctions in 1971 but did not have them fully implemented until 1982. Our findings (available on request) are qualitatively identical to those we present here if instead we consider post-1981 data.

Panel E of Table E.1 contain summary statistics on the Treasury return series for the 1971-2007 period. Returns are positive on average with modest volatility and small positive skewness and kurtosis. Tables E.6 through E.14 contain the full set of coefficient estimates and statistics for estimating Model 3 through Model 7 and Model 9 through Model 12. Tables E.15 through E.24 contain results for models that include the onset/recovery variable: Model 1, Model $3'$ through Model $7'$ and Model $9'$ through Model $12'$. For each model, we conduct a joint estimation for the 20-year, 10-year, 7-year, and 5-year Treasury return series, using Hansen's (1982) GMM and Newey and West (1987, 1994) HAC standard errors. Estimation details are analogous to the presentation in the main text.[7]

In Tables E.6 through E.14 we see that for each of the alternative models there is significant evidence of at least one form of SAD-related seasonal variation (see Panel C of each table), and the fitted seasonal differences are a poor match for the realized seasonal differences (see Panel B of each table). In contrast, Model 1 (the basic SAD model, results for which appear in Table E.15) produces fitted seasonal differences that match well the magnitudes of the realized differences, and it exhibits no significant evidence of residual seasonality. The onset/recovery variable is significant for each Treasury series and jointly across series. Similarly, the alternative models modified to include $\hat{\text{OR}}$, shown in Tables E.16 through E.24, exhibit a good match between the fitted and realized seasonal differences. They also exhibit no evidence of significant fall versus winter, September versus March, or October versus April seasonality. (The only exception is Model $12'$ for which two of the SAD-related seasonality test bootstrapped p-values are significant at the 2.9% level or above.)

E.1.c: Additional Plots for the Rolling-Window Estimations

[7]The moment conditions we use include orthogonality between the regressors and the errors, plus orthogonality between a small set of instruments and the errors. For instruments we use the constant, a lag of the CRSP value-weighted return (entire U.S. market return, including dividends), and the contemporaneous 30-day T-bill rate as suggested by Ferson and Foerster (1994). For Model 12 and Model $12'$, which are non-linear CAPM specifications, we additionally require a lag of the explanatory variables and a lag of the dependent variable as instruments.

Here we present plots of the coefficient estimates from the rolling-window estimation of Model 1 for each of the 5, 7, 10, and 20-year maturities, along with confidence intervals. Panel A, B, C, and D correspond to the 5, 7, 10, and 20-year series respectively.

E.2: Alternative Measures of SAD

In our primary analysis we use a proxy for SAD onset/recovery based on an instrumental variables approach, fitting the raw clinical onset/recovery data from Lam (1998) to the length of night, which is the environmental variable most closely associated with SAD according to medical research. This approach is described more fully in the paper. It is interesting to consider some alternatives. First we consider whether the raw onset/recovery variable fits the Treasury return seasonality as well as our instrumented version. Second we consider whether an alternative proxy for onset/recovery, the change in the length of night, is able to capture the Treasury seasonality. (We note that the correlation of the instrumented fitted value with the realized onset/recovery is .96 and the correlation of the fitted value with the change in length of night is .91.) These alternative sets of variables should be strongly predictive of the Treasury return seasonality we document if onset/recovery truly underlies the seasonal movement in returns. That is, although correlation of returns with these SAD proxies clearly does not prove that SAD influences markets, a lack of correlation would be a challenge to the SAD hypothesis.

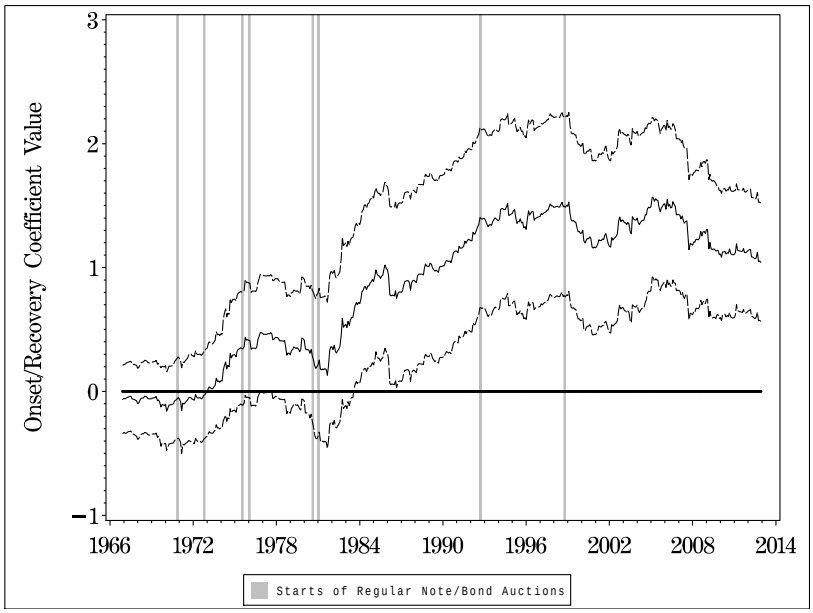
Regression results are presented in Tables E.25 and E.26. Both the measure based on raw onset/recovery rates ("ObservedOR" in Table E.25) and the change in the length of night ("ΔLengthOfNight" in Table E.26) have the expected positive sign, and both fit the Treasury return seasonality very well, in terms of economic magnitudes (see Panel B of Tables E.25 and E.26) and in terms of removing evidence of seasonality in the returns (see Panel C of Tables E.25 and E.26). In Table E.25, the observed OR variable is strongly significant for each series, with p-values less than 1%, and is strongly significant based on the joint test reported in Panel C. In Table E.26, the change in length of night is less strongly significant, with p-values for individual series and the joint test significant at the 5% level. (Note that all hypothesis tests we perform are conducted as two-sided tests.) The bootstrapped p-values confirm the strength of these results.

E.3: An Information Theoretic Comparison of the Onset/Recovery Model to Some Competitors

We show in our primary results that the onset/recovery specification is preferred to the various alternatives we consider, both on information theoretic measure grounds (the MMSC-BIC and MMSC-HQIC measures of Andrews and Lu (2001)) and on the basis of simple fit to the economic magnitude of the seasonality. More specifically, we consider all of the models and compare them to an augmented model that includes the onset/recovery variable as an explanatory variable (constrained to have the same coefficient estimate across series). In each case the augmented model dominates. Information criteria strongly favor smaller models, thus here we consider whether some relatively *more simply parameterized models* perform better than some of those we consider in our primary analysis.

For the sake of brevity, we consider a simple seasonal model plus a subset of models that seem to perform best based on results in the paper. The simple seasonal model we consider is ad hoc in that it does not offer an explanation for the nature or cause of seasonality: it is a model of dummies for each month of the year (or as we parameterize it, a constant and dummies for February through December). If we constrain each monthly dummy variable to have the same coefficient value across series (allowing the intercept to be different across series so that the mean return across different Treasury return maturities is allowed to be different) we have a fairly tightly parameterized model with 15 parameters. We call this the "Ad Hoc Model." Another pair of models we consider are Model 6 (the real-time macro factors model) and Model 5 (the model consisting of the Chen, Roll and Ross (1986) factors together with the seasonally unadjusted macro factors). In our primary analysis, these models perform best of the non-SAD alternatives

Panel A - Rolling-Window Coefficient Estimates for Model 1:
5-Year Treasury Securities



Panel B - Rolling-Window Coefficient Estimates for Model 1:
7-Year Treasury Securities

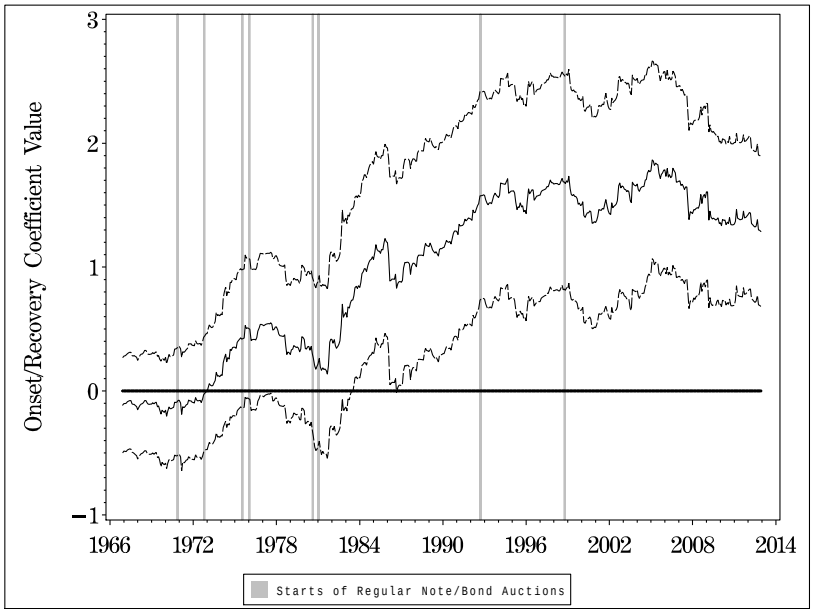
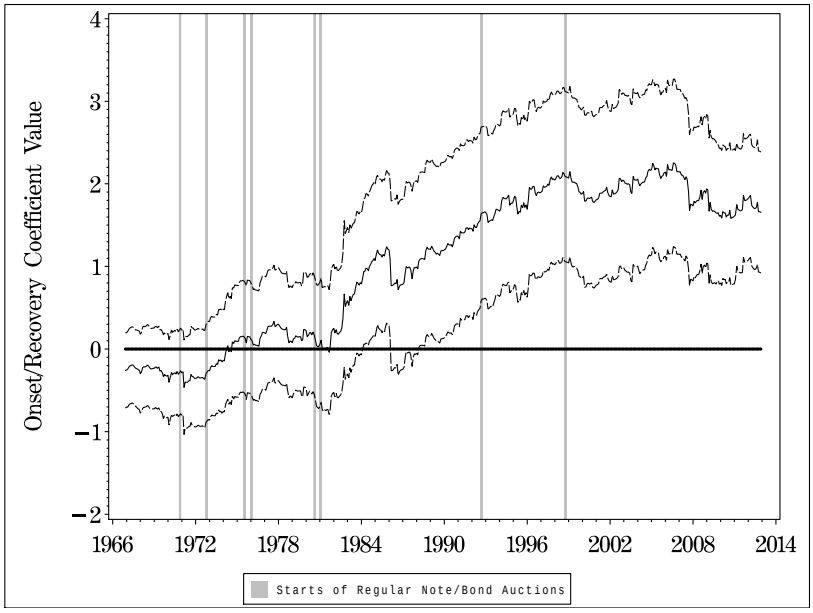


Figure E.1, continues on the next page.

Figure E.1, continued.
Panel C - Rolling-Window Coefficient Estimates for Model 1:
10-Year Treasury Securities



Panel D - Rolling-Window Coefficient Estimates for Model 1:
20-Year Treasury Securities

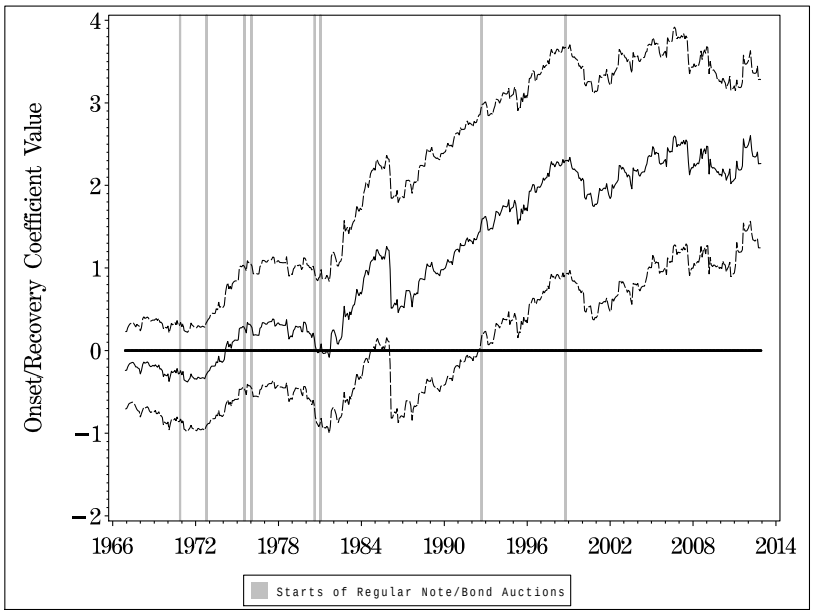


Figure E.1. See the notes to Figures 5 and 6 in the main text.

we consider. Here we restrict the explanatory variables in Model 5 and Model 6 to have the same coefficient across series to yield much more simply parameterized models, more simple even than the ad hoc dummy variable model. We call these models with constrained coefficients "Modified Model 5" and "Modified Model 6." Finally, we consider the onset/recovery variable model, with the onset/recovery variable also constrained to have the same coefficient value across Treasury return series, labeled "Modified Model 1."

We estimate each of these four models with GMM, as we do for our main results. We hold the number of moment conditions constant or near-constant across the models to keep the playing field as level as possible (since the MMSC-BIC and MMSC-HQIC information criteria heavily favor models with more moment conditions). Thus, when we compare models, we add the onset/recovery variable to the moment conditions for the model with eleven monthly dummies, and we add monthly dummy variable moment conditions to the onset/recovery model. (This leads to roughly the same number of moment conditions as Modified Model 5 and Modified Model 6.) For each model we report two information criteria designed by Andrews and Lu (2001) for application to GMM estimation in a dynamic panel setting, MMSC-HQIC and MMSC-BIC. See the paper for more details on these criteria and their properties. We also report the Bayesian Information Criterion (BIC), based on estimating the models using FIML (assuming normality).

The regression results are presented in Tables E.27 through E.30, with summarizing excerpts provided in Table E.31 to facilitate comparison. Comparisons on the basis of the information criteria uniformly come out in favor of the onset/recovery model (the last model, in Table E.31). That is, the minimum value for all of the criteria is achieved by the model that includes the onset/recovery variable with the coefficient constrained across series. Apart from this, all the model specifications leave little or no autocorrelation in the residuals, none remove ARCH effects, none are rejected by the GMM test of overidentification restrictions, and only the onset/recovery variable specification fits the seasonality well across series.

Table E.1: Summary Statistics on Excess Returns for Sub-Samples

								Seasonality test: Asymptotic p-values [Bootstrapped p-values]			
Index	Mean	Std	Min	Max	Skew	Kurt	Beta	Nonspecific Monthly	Fall vs. Winter	Sep. vs. March	Oct. vs. April
Panel A: 01/1952 - 12/1970, 228 Observations											
20-Year	-0.116	1.88	-7.70	6.95	0.141	2.29	0.026	.548	0.482	0.930	0.623
								[.252]	[.152]	[.842]	[.616]
10-Year	-0.074	1.72	-5.62	7.16	0.586	3.38	0.034	.114	.124	.839	.581
								[.252]	[.152]	[.842]	[.616]
7-Year	0.006	1.25	-3.98	7.16	1.131	5.94	0.031	.176	.486	.593	.173
								[.322]	[.502]	[.640]	[.240]
5-Year	0.023	1.04	-3.94	4.61	0.485	4.18	0.020	.103	.246	.368	**.057**
								[.202]	[.258]	[.386]	[**.090**]
Average	-0.040	1.38	-5.08	5.59	0.564	3.39	0.028	.203	.275	.747	.384
								[.340]	[.288]	[.752]	[.432]
Panel B: 01/1971 - 12/1981, 132 Observations											
20-Year	-0.274	3.09	-9.37	13.95	0.669	3.82	0.216	.154	.214	.503	.167
								[.346]	[.282]	[.576]	[.208]
10-Year	-0.136	2.38	-7.63	7.35	0.223	1.51	0.139	**.042**	.311	.656	**.047**
								[.150]	[.398]	[.718]	[**.084**]
7-Year	-0.135	2.39	-8.10	9.46	0.444	3.93	0.118	.221	.129	.542	**.083**
								[.430]	[.170]	[.568]	[.102]
5-Year	-0.122	2.09	-6.87	9.33	0.335	3.98	0.094	.126	.249	.447	.158
								[.332]	[.308]	[.510]	[.210]
Average	0.167	2.38	-7.36	9.97	0.463	3.40	0.142	.164	.215	.895	**.073**
								[.364]	[.278]	[.886]	[**.098**]
Panel C: 01/1982 - 12/1994, 156 Observations											
20-Year	0.556	3.17	-7.55	11.09	0.302	0.59	0.262	.549	**.084**	.470	**.008**
								[.700]	[.108]	[.484]	[**.026**]
10-Year	0.433	2.48	-5.85	9.45	0.316	0.75	0.204	.468	**.050**	.152	**.045**
								[.630]	[**.076**]	[.184]	[**.068**]
7-Year	0.416	1.91	-3.90	5.44	0.071	-0.25	0.150	.339	**.068**	**.061**	**.034**
								[.510]	[**.090**]	[**.082**]	[**.056**]
5-Year	0.363	1.54	-3.86	4.72	0.081	0.07	0.110	.101	**.038**	**.023**	**.079**
								[.274]	[**.068**]	[**.040**]	[.116]
Average	0.442	2.24	-4.95	6.75	0.173	0.09	0.182	.462	**.060**	.166	**.027**
								[.626]	[**.090**]	[.194]	[**.044**]
Panel D: 01/1995 - 12/2007, 156 Observations											
20-Year	0.425	2.51	-9.43	7.14	-0.468	1.09	-.092	**.098**	.242	**.004**	.404
								[.344]	[.284]	[**.024**]	[.468]
10-Year	0.269	1.95	-6.75	4.95	-0.263	0.78	-.079	.175	.319	**.014**	.389
								[.424]	[.344]	[**.030**]	[.454]
7-Year	0.292	1.58	-4.76	4.18	-0.195	0.54	-.077	.148	.314	**.015**	.541
								[.370]	[.342]	[**.032**]	[.588]
5-Year	0.228	1.24	-3.46	3.41	-0.043	0.46	-.065	.160	.438	**.015**	.584
								[.390]	[.462]	[**.036**]	[.620]
Average	0.303	1.79	-6.02	4.88	-0.301	0.74	-.078	.137	.288	**.007**	.445
								[.364]	[.324]	[**.018**]	[.488]
Panel E: 01/1971 - 12/2007, 444 Observations											
20-Year	0.263	2.942	-9.43	13.95	0.239	1.75	0.138	**.091**	**.017**	.110	**.008**
								[.160]	[**.025**]	[.122]	[**.013**]
10-Year	0.206	2.285	-7.63	9.45	0.155	1.11	0.094	**.091**	**.014**	**.067**	**.002**
								[.155]	[**.019**]	[**.083**]	[**.001**]
7-Year	0.209	1.972	-8.10	9.46	0.122	2.58	0.070	.160	**.010**	**.005**	**.004**
								[.231]	[**.014**]	[**.009**]	[**.008**]
5-Year	0.171	1.642	-6.87	9.33	0.090	3.44	0.051	.139	**.020**	**.002**	**.011**
								[.203]	[**.023**]	[**.006**]	[**.014**]
Average	0.212	2.146	-7.36	9.97	0.151	1.66	0.088	.130	**.012**	**.024**	**.004**
								[.203]	[**.015**]	[**.039**]	[**.005**]

Notes: See the notes to Table 1 in the main text.

Table E.2
Sub-Sample Analysis: 1952-1970

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.107	-0.111	-0.041	-0.016
	(0.093)	(0.088)	(0.072)	(0.055)
$\mu_{\hat{\text{OR}}}$	-0.015	-0.015	-0.015	-0.015
	(0.225)	(0.225)	(0.225)	(0.225)
R^2	0.0001	-0.0004	-0.0014	-0.0013
AR(12)	8.84	8.38	11.89	7.62
ARCH(12)	90.22^{***}	51.21^{***}	13.22	39.55^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	-.0052	-.0052	-.0052	-.0052
Realized	-.2562	-.4849	0.0314	-.1365
September-March Seasonality				
Fitted	-.0117	-.0117	-.0117	-.0117
Realized	-.2101	-.1260	-.1671	-.2256
October-April Seasonality				
Fitted	-.0074	-.0074	-.0074	-.0074
Realized	0.5291	0.5312	0.6259	0.6622
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				**<.001** [.322]
Fall vs. Winter:				.227 [.340]
September vs. March:				.382 [.494]
October vs. April:				**.010** [**.076**]
Onset/Recovery Coefficient equal to 0:				.948 [.926]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				8.14
MMSC-BIC of Tabled Model				-51.59
MMSC-HQIC of Tabled Model				-30.95
Number of Parameters				5
Number of Moment Conditions				16
Number of Observations (01/52 - 12/70)				228

Notes: See the notes to Table C.2, but note that we provide the information criteria based on the tabled model only. The model is:

$$r_{i,t} = \mu_i + \mu_{\hat{\text{OR}}}\hat{\text{OR}}_t + \epsilon_{i,t}.$$

Table E.3
Sub-Sample Analysis: 1971-1981

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.202	-0.095	-0.063	-0.064
	(0.180)	(0.134)	(0.130)	(0.120)
$\mu_{\hat{\text{OR}}}$	0.866	0.866	0.866	0.866
	(0.588)	(0.588)	(0.588)	(0.588)
R^2	-0.0004	-0.0018	0.002	0.0015
AR(12)	18.30	9.97	10.33	14.17
ARCH(12)	29.84^{***}	48.91^{***}	31.72^{***}	30.32^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.3086	0.3086	0.3086	0.3086
Realized	1.2867	0.8193	1.1485	0.7795
September-March Seasonality				
Fitted	0.6923	0.6923	0.6923	0.6923
Realized	-.2231	-.7047	-.0241	0.2842
October-April Seasonality				
Fitted	0.4403	0.4403	0.4403	0.4403
Realized	-.0777	0.8309	0.2833	-.0180
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				**<.001** [**<.001**]
Fall vs. Winter:				.158 [.410]
September vs. March:				.411 [.586]
October vs. April:				.717 [.820]
Onset/Recovery Coefficient equal to 0:				.141 [.314]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				6.62
MMSC-BIC of Tabled Model				-47.09
MMSC-HQIC of Tabled Model				-30.01
Number of Parameters				5
Number of Moment Conditions				16
Number of Observations (01/71 - 12/81)				132

Notes: See the notes to Table C.2, but note that we provide the information criteria based on the tabled model only. The model is:

$$r_{i,t} = \mu_i + \mu_{\hat{\text{OR}}}\hat{\text{OR}}_t + \epsilon_{i,t}.$$

Table E.4
Sub-Sample Analysis: 1982-1994

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.620^{***}	0.463^{***}	0.452^{***}	0.386^{***}
	(0.218)	(0.180)	(0.145)	(0.121)
$\mu_{\hat{\text{OR}}}$	1.103^{***}	1.103^{***}	1.103^{***}	1.103^{***}
	(0.300)	(0.300)	(0.300)	(0.300)
R^2	0.015	0.0242	0.0291	0.0397
AR(12)	5.57	6.54	7.67	8.16
ARCH(12)	29.92^{***}	25.35^{**}	27.64^{***}	25.98^{**}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.3932	0.3932	0.3932	0.3932
Realized	1.0453	1.0204	0.7530	0.6817
September-March Seasonality				
Fitted	0.8819	0.8819	0.8819	0.8819
Realized	0.8799	1.1223	1.0173	0.9246
October-April Seasonality				
Fitted	0.5609	0.5609	0.5609	0.5609
Realized	2.5836	1.9773	1.3580	1.0843
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				<**.001** [.820]
Fall vs. Winter:				.447 [.660]
September vs. March:				.746 [.878]
October vs. April:				.416 [.682]
Onset/Recovery Coefficient equal to 0:				<**.001** [**.006**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				8.83
MMSC-BIC of Tabled Model				-46.71
MMSC-HQIC of Tabled Model				-28.57
Number of Parameters				5
Number of Moment Conditions				16
Number of Observations (01/82 - 12/94)				156

Notes: See the notes to Table C.2, but note that we provide the information criteria based on the tabled model only. The model is:

$$r_{i,t} = \mu_i + \mu_{\hat{\text{OR}}}\hat{\text{OR}}_t + \epsilon_{i,t}.$$

Table E.5
Sub-Sample Analysis: 1995-2007

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.537^{***}	0.330^{**}	0.326^{***}	0.246^{***}
	(0.172)	(0.140)	(0.116)	(0.093)
$\mu_{\hat{\text{OR}}}$	1.002^{***}	1.002^{***}	1.002^{***}	1.002^{***}
	(0.273)	(0.273)	(0.273)	(0.273)
R^2	0.026	0.0354	0.041	0.0447
AR(12)	7.85	10.13	11.12	13.25
ARCH(12)	17.82	15.13	14.58	15.24
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.3571	0.3571	0.3571	0.3571
Realized	0.6305	0.3423	0.2854	0.1657
September-March Seasonality				
Fitted	0.8010	0.8010	0.8010	0.8010
Realized	2.2847	2.0161	1.6378	1.2777
October-April Seasonality				
Fitted	0.5095	0.5095	0.5095	0.5095
Realized	0.8658	0.6654	0.4427	0.3342
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				<**.001** [.912]
Fall vs. Winter:				**.046** [.240]
September vs. March:				**.026** [.200]
October vs. April:				.104 [.404]
Onset/Recovery Coefficient equal to 0:				<**.001** [**.018**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				14.19
MMSC-BIC of Tabled Model				-41.36
MMSC-HQIC of Tabled Model				-23.22
Number of Parameters				5
Number of Moment Conditions				16
Number of Observations (01/95 - 12/07)				156

Notes: See the notes to Table C.2, but note that we provide the information criteria based on the tabled model only. The model is:

$$r_{i,t} = \mu_i + \mu_{\hat{\text{OR}}}\hat{\text{OR}}_t + \epsilon_{i,t}.$$

Table E.6
Auction Era: Model 3 (Chen, Roll, and Ross Macro Factors)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.535	0.327	0.340	0.271
	(0.402)	(0.333)	(0.282)	(0.245)
μ_{Term}	0.016	0.020	0.010	0.018
	(0.041)	(0.034)	(0.030)	(0.024)
μ_{Default}	0.451	0.390	0.348	0.311
	(0.341)	(0.313)	(0.246)	(0.218)
μ_{IP}	-0.381**	-0.369**	-0.330***	-0.254**
	(0.178)	(0.145)	(0.117)	(0.102)
μ_{Inf}	-1.745**	-1.264**	-1.167***	-1.049**
	(0.703)	(0.535)	(0.443)	(0.412)
μ_{InfSurp}	-1.667**	-0.825	-0.540	-0.255
	(0.727)	(0.521)	(0.450)	(0.393)
R^2	0.0642	0.0534	0.0588	0.0628
AR(12)	13.43	12.53	13.18	15.94
ARCH(12)	40.85***	50.03***	54.85***	66.16***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.0560	0.0233	0.0070	0.0040
Realized	0.9713	0.7224	0.7063	0.5295
September-March Seasonality				
Fitted	-.1585	-.0850	-.0676	-.0305
Realized	1.0456	0.8931	0.9257	0.8582
October-April Seasonality				
Fitted	-.0032	-.0169	-.0311	-.0213
Realized	1.1889	1.1756	0.7169	0.4930
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.000** [**.022**]
Fall Vs. Winter:				**.018** [**.046**]
September Vs. March:				**.000** [**.001**]
October Vs. April:				.144 [.224]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				13.07
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-35.70/ -49.46
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-17.30/ -24.16
Number of Parameters				24
Number of Moment Conditions				32
Nunber of Observations (01/71 - 12/07)				444

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\text{Term}}\text{Term}_t + \mu_{i,\text{Default}}\text{Default}_t + \mu_{i,\text{IP}}\text{IP}_t + \mu_{i,\text{Inf}}\text{Inf}_t + \mu_{i,\text{InfSurp}}\text{InfSurp}_t + \epsilon_{i,t}.$$

Table E.7
Auction Era: Model 4 (Seasonally Unadjusted Macro Factors)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.712***	0.453**	0.420***	0.322***
	(0.241)	(0.186)	(0.144)	(0.120)
$\mu_{\mathrm{CPI_{SU}}}$	-1.379***	-0.843**	-0.792**	-0.614**
	(0.482)	(0.391)	(0.311)	(0.288)
$\mu_{\mathrm{IP_{SU}}}$	9.073	6.553	3.552	2.971
	(6.041)	(4.570)	(4.027)	(3.330)
$\mu_{\mathrm{PPI_{SU}}}$	-0.229	-0.169	-0.042	-0.005
	(0.198)	(0.143)	(0.134)	(0.116)
$\mu_{\mathrm{GDP_{SU}}}$	6.281	4.567	3.637	2.872
	(4.561)	(3.501)	(2.841)	(2.368)
$\mu_{\mathrm{U_{SU}}}$	4.000***	3.033***	2.006**	1.604*
	(1.489)	(1.122)	(0.960)	(0.833)
R^2	0.062	0.0418	0.0295	0.0237
AR(12)	12.25	8.20	8.22	10.93
ARCH(12)	35.97***	55.20***	55.84***	66.09***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.4323	0.2683	0.2621	0.1938
Realized	0.9500	0.7032	0.6929	0.5159
September-March Seasonality				
Fitted	0.6502	0.4695	0.3474	0.2712
Realized	1.0344	0.9104	0.9444	0.8761
October-April Seasonality				
Fitted	0.7302	0.5211	0.3810	0.3008
Realized	1.1974	1.1876	0.7220	0.4955
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.000** [**.038**]
Fall Vs. Winter:				.328 [.434]
September Vs. March:				**.001** [**.011**]
October Vs. April:				.407 [.487]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				10.53
MMSC-BIC of Tabled Model/Constrained $\hat{\mathrm{OR}}$ Term Included				-38.02/ -53.02
MMSC-HQIC of Tabled Model/Constrained $\hat{\mathrm{OR}}$ Term Included				-19.76/ -27.92
Number of Parameters				24
Number of Moment Conditions				32
Number of Observations (01/71 - 12/06)				432

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\mathrm{GDP_{SU}}}\mathrm{GDP_{SU},}_t + \mu_{i,\mathrm{PPI_{SU}}}\mathrm{PPI_{SU},}_t + \mu_{i,\mathrm{IP_{SU}}}\mathrm{IP_{SU},}_t + \mu_{i,\mathrm{U_{SU}}}\mathrm{U_{SU},}_t + \mu_{i,\mathrm{CPI_{SU}}}\mathrm{CPI_{SU},}_t + \epsilon_{i,t}.$$

Table E.8
Auction Era: Model 5 (Chen, Roll, and Ross plus Seasonally Unadjusted Macro Factors)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.522	0.320	0.291	0.221
	(0.414)	(0.343)	(0.290)	(0.250)
μ_{Term}	-0.001	0.006	-0.001	0.011
	(0.041)	(0.034)	(0.030)	(0.024)
μ_{Default}	0.416	0.364	0.374	0.342
	(0.340)	(0.311)	(0.246)	(0.216)
$\mu_{\text{CPI}_{\text{SU}}}$	-1.177	-1.014	-0.803	-0.519
	(0.960)	(0.719)	(0.596)	(0.526)
$\mu_{\text{IP}_{\text{SU}}}$	18.630***	14.404***	11.046***	8.893**
	(6.955)	(5.183)	(4.219)	(3.491)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.117	-0.096	0.028	0.058
	(0.190)	(0.145)	(0.124)	(0.108)
$\mu_{\text{GDP}_{\text{SU}}}$	9.399*	6.844*	6.397**	5.441**
	(4.946)	(3.619)	(2.995)	(2.538)
$\mu_{\text{U}_{\text{SU}}}$	1.799	1.051	0.149	0.052
	(1.635)	(1.231)	(1.039)	(0.871)
μ_{IP}	-0.658***	-0.589***	-0.512***	-0.401***
	(0.213)	(0.168)	(0.132)	(0.115)
μ_{Inf}	-0.722	-0.356	-0.592	-0.767
	(1.215)	(0.921)	(0.737)	(0.703)
μ_{InfSurp}	-0.746	0.032	-0.050	-0.058
	(1.183)	(0.895)	(0.760)	(0.697)
R^2	0.101	0.087	0.0784	0.0777
AR(12)	14.42	10.68	11.55	13.64
ARCH(12)	37.95***	51.67***	60.12***	69.35***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.4746	0.3593	0.3395	0.2559
Realized	0.9500	0.7032	0.6929	0.5159
September-March Seasonality				
Fitted	0.7379	0.5913	0.4882	0.4114
Realized	1.0344	0.9104	0.9444	0.8761
October-April Seasonality				
Fitted	0.7649	0.5462	0.4138	0.3357
Realized	1.1974	1.1876	0.7220	0.4955
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.000** [.169]
Fall Vs. Winter:				.215 [.300]
September Vs. March:				**.010** [**.025**]
October Vs. April:				.501 [.590]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				12.68
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-35.87/ -53.51
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-17.61/ -28.41
Number of Parameters				44
Number of Moment Conditions				52
Number of Observations (01/71 - 12/06)				432

Notes: See the notes to Table C.2. The model is

$$r_{i,t} = \mu_i + \mu_{i,\text{IP}}\text{IP}_t + \mu_{i,\text{Default}}\text{Default}_t + \mu_{i,\text{Term}}\text{Term}_{t-1} + \mu_{i,\text{Inf}}\text{Inf}_t + \mu_{i,\text{InfSurp}}\text{InfSurp}_t + \mu_{i,\text{GDP}_{\text{SU}}}\text{GDP}_{\text{SU},t} + \mu_{i,\text{PPI}_{\text{SU}}}\text{PPI}_{\text{SU},t} + \mu_{i,\text{IP}_{\text{SU}}}\text{IP}_{\text{SU},t} + \mu_{i,\text{U}_{\text{SU}}}\text{U}_{\text{SU},t} + \mu_{i,\text{CPI}_{\text{SU}}}\text{CPI}_{\text{SU},t} + \epsilon_{i,t}.$$

Table E.9
Model 6 Auction Era: (Real-Time Macro Factors)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.830***	0.527**	0.496**	0.349**
	(0.313)	(0.247)	(0.219)	(0.178)
μ_{USurpC}	-1.475	-0.484	-0.718	0.331
	(1.462)	(1.201)	(1.375)	(1.115)
μ_{USurpE}	3.023***	2.210***	2.151***	1.677***
	(0.872)	(0.701)	(0.589)	(0.472)
μ_{ProbC}	0.944	1.030	0.897*	0.691*
	(0.755)	(0.652)	(0.489)	(0.394)
μ_{IPSurp}	-0.056	0.010	0.003	0.074
	(0.229)	(0.185)	(0.169)	(0.131)
μ_{IP}	1.460***	1.128***	1.049***	1.137***
	(0.528)	(0.410)	(0.376)	(0.316)
μ_{U}	0.060**	0.048***	0.045**	0.050***
	(0.025)	(0.018)	(0.018)	(0.016)
$\mu_{\Delta\text{Default}}$	-0.059***	-0.038**	-0.034***	-0.024**
	(0.016)	(0.015)	(0.013)	(0.011)
μ_{Term}	-0.013	-0.002	-0.006	-0.002
	(0.050)	(0.043)	(0.037)	(0.030)
μ_{InfSurp}	-1.217	-0.451	-0.245	-0.051
	(0.794)	(0.557)	(0.482)	(0.421)
μ_{Inf}	-2.533***	-1.852***	-1.628***	-1.391***
	(0.682)	(0.513)	(0.445)	(0.378)
R^2	0.1775	0.1495	0.179	0.2075
AR(12)	9.37	11.52	10.95	12.59
ARCH(12)	29.88***	26.34***	54.14***	43.59***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.4323	0.2804	0.2366	0.2045
Realized	1.0269	0.7696	0.7583	0.5706
September-March Seasonality				
Fitted	0.0238	0.0197	0.0232	0.0299
Realized	1.0615	0.9800	1.0455	0.9777
October-April Seasonality				
Fitted	0.1450	0.0831	0.0749	0.0734
Realized	1.1511	1.1846	0.7074	0.4787
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.000** [**.071**]
Fall Vs. Winter:				**.049** [.100]
September Vs. March:				**.000** [**.001**]
October Vs. April:				.338 [.423]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				11.37
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-36.48/ -53.24
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-18.68/ -28.76
Number of Parameters				44
Number of Moment Conditions				52
Number of Observations (01/71 - 12/03)				396

Notes: See the notes to Table C.2. The model is:

$$
\begin{aligned}
r_{i,t} = {} & \mu_i + \mu_{i,U}\mathrm{U}_t + \mu_{i,\mathrm{IP}}\mathrm{IP}_t + \mu_{i,\mathrm{IPSurp}}\mathrm{IPSurp}_t + \mu_{i,\Delta\mathrm{Default}}\Delta\mathrm{Default}_t \\
& + \mu_{i,\mathrm{Term}}\mathrm{Term}_{t-1} + \mu_{i,\mathrm{ProbC}}\mathrm{ProbC}_t + \mu_{i,\mathrm{USurpC}}\mathrm{USurpC}_t + \mu_{i,\mathrm{USurpE}}\mathrm{USurpE}_t \\
& + \mu_{i,\mathrm{Jan}}D_t^{\mathrm{Jan}} + \mu_{i,\mathrm{Inf}}\mathrm{Inf}_t + \mu_{i,\mathrm{InfSurp}}\mathrm{InfSurp}_t + \epsilon_{i,t}.
\end{aligned}
$$

Table E.10
Auction Era: Model 7 (Cross Hedging)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.281	0.221	0.157	0.092
	(0.234)	(0.175)	(0.143)	(0.118)
μ_{σ^2}	0.004	0.003	0.005	0.006
	(0.009)	(0.007)	(0.006)	(0.005)
μ_{Turnover}	-1.112	-1.218*	-0.824	-0.673
	(0.857)	(0.681)	(0.580)	(0.487)
$\mu_{\text{Liquidity}}$	7.861	3.202	3.087	4.052
	(7.686)	(6.436)	(5.452)	(4.910)
R^2	0.0048	0.0075	0.0073	0.0095
AR(12)	12.24	8.81	9.57	13.34
ARCH(12)	52.08***	65.04***	65.29***	82.12***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.0155	0.0219	0.0151	0.0114
Realized	0.9713	0.7224	0.7063	0.5295
September-March Seasonality				
Fitted	-.0247	-.0182	-.0189	-.0200
Realized	1.0456	0.8931	0.9257	0.8582
October-April Seasonality				
Fitted	0.1654	0.1865	0.1253	0.1009
Realized	1.1889	1.1756	0.7169	0.4930
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.000** [**.062**]
Fall Vs. Winter:				**.040** [**.078**]
September Vs. March:				**.000** [**.000**]
October Vs. April:				.486 [.567]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				10.67
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-38.09/ -53.17
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-19.70/ -27.87
Number of Parameters				16
Number of Moment Conditions				24
Number of Observations (01/71 - 12/07)				444

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\hat{\sigma}^2}\hat{\sigma}_t^2 + \mu_{i,\text{Turnover}}\text{Turnover}_{t-1} + \mu_{i,\text{Liquidity}}\text{Liquidity}_{t-1} + \epsilon_{i,t}.$$

Table E.11
Auction Era: Model 9 (Baker-Wurgler Sentiment)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.312^{**}	0.225^{**}	0.226^{**}	0.185^{**}
	(0.134)	(0.110)	(0.091)	(0.076)
$\mu_{\text{BWSentiment}}$	0.693^{**}	0.497^{*}	0.571^{***}	0.390^{**}
	(0.342)	(0.264)	(0.219)	(0.170)
R^2	0.0136	0.0067	0.011	0.0109
AR(12)	16.28	10.65	11.33	15.81
ARCH(12)	51.67^{***}	57.77^{***}	62.97^{***}	79.88^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	-.0024	-.0018	-.0020	-.0014
Realized	0.9344	0.6973	0.6923	0.5180
September-March Seasonality				
Fitted	-.1259	-.0903	-.1038	-.0708
Realized	0.9002	0.8486	0.9138	0.8620
October-April Seasonality				
Fitted	0.0530	0.0381	0.0437	0.0298
Realized	1.1399	1.1777	0.7148	0.4960
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.000** [**.022**]
Fall Vs. Winter:				**.074** [.139]
September Vs. March:				**.000** [**.000**]
October Vs. April:				.282 [.395]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				10.28
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-38.04/ -52.56
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-19.93/ -27.66
Number of Parameters				8
Number of Moment Conditions				16
Number of Observations (01/71 - 12/05)				420

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\text{BWSentiment}}\text{BWSentiment}_{t-1} + \epsilon_{i,t}.$$

Table E.12
Auction Era: Model 10 (Michigan Consumer Sentiment)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.297^{**}	0.217^{**}	0.220^{**}	0.179^{**}
	(0.127)	(0.105)	(0.086)	(0.072)
$\mu_{\text{MSentiment}}$	0.010	0.001	0.009	0.008
	(0.034)	(0.025)	(0.023)	(0.020)
R^2	-0.0018	-0.0003	-0.0031	-0.0035
AR(12)	14.17	10.40	10.90	14.92
ARCH(12)	55.28^{***}	63.13^{***}	65.26^{***}	85.43^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	-.0083	-.0009	-.0080	-.0069
Realized	0.9713	0.7224	0.7063	0.5295
September-March Seasonality				
Fitted	0.0021	0.0002	0.0020	0.0018
Realized	1.0456	0.8931	0.9257	0.8582
October-April Seasonality				
Fitted	-.0056	-.0006	-.0054	-.0047
Realized	1.1889	1.1756	0.7169	0.4930
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.000** [**.047**]
Fall Vs. Winter:				**.044** [**.084**]
September Vs. March:				**.000** [**.003**]
October Vs. April:				.279 [.388]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				11.68
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-37.09/ -51.03
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-18.69/ -25.73
Number of Parameters				8
Number of Moment Conditions				16
Number of Observations (01/71 - 12/07)				444

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,MSentiment} MSentiment_{t-1} + \epsilon_{i,t}.$$

Table E.13
Auction Era: Model 11 (Fama-French Factors)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.491	-0.486*	-0.388	-0.331
	(0.349)	(0.291)	(0.249)	(0.223)
μ_{SMB}	-0.123**	-0.105***	-0.108***	-0.079***
	(0.048)	(0.034)	(0.027)	(0.023)
μ_{HML}	-0.041	-0.026	-0.024	-0.014
	(0.042)	(0.035)	(0.030)	(0.025)
μ_{MOM}	0.070*	0.072**	0.065**	0.052**
	(0.036)	(0.030)	(0.026)	(0.022)
μ_{Default}	0.694**	0.606**	0.531**	0.443**
	(0.343)	(0.296)	(0.250)	(0.223)
μ_{Term}	0.066	0.061*	0.048	0.045*
	(0.044)	(0.033)	(0.029)	(0.024)
$\mu_{\hat{r}_m}$	0.214***	0.165***	0.121***	0.085***
	(0.048)	(0.038)	(0.029)	(0.025)
R^2	0.0932	0.0929	0.0873	0.0768
AR(12)	14.34	10.82	11.52	12.59
ARCH(12)	62.04***	55.43***	82.51***	93.97***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.3028	0.2645	0.2597	0.1967
Realized	0.9713	0.7224	0.7063	0.5295
September-March Seasonality				
Fitted	-.2035	-.1250	-.0664	-.0291
Realized	1.0456	0.8931	0.9257	0.8582
October-April Seasonality				
Fitted	0.1107	0.1099	0.1338	0.1093
Realized	1.1889	1.1756	0.7169	0.4930
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.000** [**.014**]
Fall Vs. Winter:				.127 [.206]
September Vs. March:				**.000** [**.000**]
October Vs. April:				.481 [.538]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				8.14
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-40.62/ -53.32
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-22.22/ -28.02
Number of Parameters				28
Number of Moment Conditions				36
Number of Observations (01/71 - 12/07)				444

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\text{SMB}}\text{SMB}_t + \mu_{i,\text{HML}}\text{HML}_t + \mu_{i,\text{MOM}}\text{MOM}_t + \mu_{i,\text{Default}}\text{Default}_t + \mu_{i,\text{Term}}\text{Term}_t + \mu_{i,\hat{r}_m}\hat{r}_{m,t} + \epsilon_{i,t}.$$

Table E.14
Auction Era: Model 12 (Conditional CAPM)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
δ	-4.196***	-5.201***	-4.794***	-5.559***
	(1.164)	(1.382)	(1.092)	(1.157)
$\delta_{\widetilde{D/P}}$	-1.714	-2.294	-2.121	-1.039
	(3.837)	(4.179)	(3.639)	(3.469)
$\delta_{\tilde{r}_m}$	-0.048	-0.067	-0.090*	-0.092*
	(0.041)	(0.051)	(0.050)	(0.050)
δ_{Term90}	2.825**	2.248**	-0.768	0.218
	(1.194)	(1.126)	(1.783)	(1.332)
δ_{Default}	0.105	0.712	0.533	0.710
	(0.812)	(0.869)	(0.737)	(0.739)
R^2	0.0032	0.0011	-0.0015	-0.0053
AR(12)	19.98 *	14.04	16.12	18.18
ARCH(12)	51.94***	56.41***	64.04***	83.42***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.1166	0.0850	0.0809	0.0728
Realized	1.0226	0.7596	0.7137	0.5417
September-March Seasonality				
Fitted	0.0078	-.0036	0.0113	0.0058
Realized	1.0456	0.8931	0.9257	0.8582
October-April Seasonality				
Fitted	0.1480	0.0973	0.0524	0.0527
Realized	1.1889	1.1756	0.7169	0.4930

Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]	
Nonspecific Monthly Seasonality:	**.000** [.170]
Fall Vs. Winter:	**.003** [**.054**]
September Vs. March:	**.000** [**.008**]
October Vs. April:	.466 [.631]
Panel D: Systems Equation Information Criteria and Model Statistics	
GMM Test of Overidentification Restrictions	35.66
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included	-208.08/ -220.94
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included	-116.14/ -122.11
Number of Parameters	20
Number of Moment Conditions	60
Number of Observations (02/71 - 12/07)	443

Panel E: Seasonality in Monthly Sharpe Ratio, Averaged Across Series

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Realized	-.02	-.07	-.09	-.06	.056	.118	-.01	.152	.109	.121	.154	.079
Fitted	.036	.046	.039	.038	.047	.036	.035	.050	.039	.052	.058	.042

Notes: See the notes to Table C.2. In addition to the instruments listed in the notes to Table C.2, the instruments used to form the GMM moment conditions in this case include a single lag of the dependent variable and a single lag of the explanatory variables. The model is:

$$E_{t-1}(\tilde{r}_{i,t}) = \lambda_t \cdot \hat{\sigma}_t^2$$

$$\lambda_t = \exp(\delta_i + \delta_{i,\widetilde{D/P}}\widetilde{D/P}_t + \delta_{i,\tilde{r}_m}\tilde{r}_{m,t-1} + \delta_{i,\text{Default}}\text{Default}_t + \delta_{i,\text{Term90}}\text{Term90}_{t-1}).$$

Table E.15
Auction Era: Model 1 (SAD Onset/Recovery Model)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.314^{**}	0.231^{**}	0.234^{***}	0.191^{***}
	(0.123)	(0.101)	(0.083)	(0.069)
$\mu_{\hat{\text{OR}}}$	2.078^{***}	1.893^{***}	1.547^{***}	1.333^{***}
	(0.635)	(0.491)	(0.401)	(0.335)
R^2	0.0148	0.0192	0.0203	0.021
AR(12)	12.99	8.79	9.65	13.24
ARCH(12)	55.53^{***}	65.62^{***}	71.94^{***}	92.34^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.7406	0.6746	0.5513	0.4753
Realized	0.9713	0.7224	0.7063	0.5295
September-March Seasonality				
Fitted	1.6613	1.5133	1.2366	1.0662
Realized	1.0456	0.8931	0.9257	0.8582
October-April Seasonality				
Fitted	1.0567	0.9625	0.7865	0.6781
Realized	1.1889	1.1756	0.7169	0.4930
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.821 [.991]
Fall Vs. Winter:				.684 [.720]
September Vs. March:				.964 [.972]
October Vs. April:				.549 [.595]
SAD Onset/Recovery Coefficients Jointly 0:				**.001** [**.006**]
SAD Onset/Recovery Treasury Coefficients Jointly Equal:				**.086** [.111]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				10.32
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-38.45/ -51.92
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-20.05/ -26.62
Number of Parameters				8
Number of Moment Conditions				16
Number of Observations (01/71 - 12/07)				444

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{\hat{\text{OR}}}\hat{\text{OR}}_t + \epsilon_{i,t}.$$

Table E.16
Auction Era: Model 3′ (Chen, Roll, and Ross Macro Factors with Onset/Recovery)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.542	0.337	0.347	0.275
	(0.395)	(0.324)	(0.276)	(0.241)
$\mu_{\hat{\text{OR}}}$	2.185***	1.894***	1.630***	1.381***
	(0.591)	(0.448)	(0.369)	(0.314)
μ_{Term}	-0.001	0.006	-0.003	0.007
	(0.042)	(0.034)	(0.030)	(0.024)
μ_{Default}	0.520*	0.444	0.401*	0.355*
	(0.313)	(0.282)	(0.222)	(0.197)
μ_{IP}	-0.408**	-0.391***	-0.350***	-0.272**
	(0.181)	(0.148)	(0.121)	(0.107)
μ_{Inf}	-1.883***	-1.381**	-1.276***	-1.135***
	(0.718)	(0.549)	(0.450)	(0.420)
μ_{InfSurp}	-1.849**	-0.963*	-0.658	-0.349
	(0.749)	(0.533)	(0.461)	(0.400)
R^2	0.0832	0.0763	0.083	0.0871
AR(12)	12.56	11.82	11.81	12.86
ARCH(12)	41.88***	52.71***	61.62***	73.10***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.8317	0.6952	0.5847	0.4927
Realized	0.9713	0.7224	0.7063	0.5295
September-March Seasonality				
Fitted	1.5556	1.4031	1.2123	1.0536
Realized	1.0456	0.8931	0.9257	0.8582
October-April Seasonality				
Fitted	1.0908	0.9317	0.7842	0.6684
Realized	1.1889	1.1756	0.7169	0.4930
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]				
Nonspecific Monthly Seasonality:				.928 [.989]
Fall Vs. Winter:				.734 [.759]
September Vs. March:				.783 [.799]
October Vs. April:				.600 [.649]
Onset/Recovery Coefficients Jointly 0:				**.000** [**.001**]
Onset/Recovery Treasury Coefficients Jointly Equal:				**.045** [**.070**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				12.09
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-36.68/ -49.46
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-18.28/ -24.16
Number of Parameters				28
Number of Moment Conditions				36
Number of Observations (01/71 - 12/07)				444

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{\hat{\text{OR}}}\hat{\text{OR}}_t + \mu_{i,\text{Term}}\text{Term}_t + \mu_{i,\text{Default}}\text{Default}_t + \mu_{i,\text{IP}}\text{IP}_t + \mu_{i,\text{Inf}}\text{Inf}_t + \mu_{i,\text{InfSurp}}\text{InfSurp}_t + \epsilon_{i,t}.$$

Table E.17
Auction Era: Model 5′ (Seasonally Unadjusted Macro Factors with Onset/Recovery)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.918***	0.679***	0.614***	0.493***
	(0.240)	(0.190)	(0.148)	(0.126)
$\mu_{\hat{\text{OR}}}$	2.181***	2.402***	2.037***	1.818***
	(0.834)	(0.706)	(0.559)	(0.492)
$\mu_{\text{CPI}_{\text{SU}}}$	-1.305***	-0.766**	-0.726**	-0.550*
	(0.485)	(0.388)	(0.308)	(0.285)
$\mu_{\text{IP}_{\text{SU}}}$	6.276	3.598	1.077	0.781
	(6.151)	(4.623)	(4.058)	(3.336)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.210	-0.147	-0.024	0.010
	(0.203)	(0.146)	(0.137)	(0.119)
$\mu_{\text{GDP}_{\text{SU}}}$	-5.915	-8.838*	-7.769*	-7.263**
	(6.032)	(5.015)	(4.043)	(3.515)
$\mu_{\text{U}_{\text{SU}}}$	4.877***	3.994***	2.821***	2.327***
	(1.498)	(1.136)	(0.968)	(0.833)
R^2	0.0696	0.0596	0.0484	0.0473
AR(12)	11.84	8.19	8.42	11.23
ARCH(12)	37.49***	52.18***	58.60***	71.00***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.5756	0.4272	0.3943	0.3127
Realized	0.9500	0.7032	0.6929	0.5159
September-March Seasonality				
Fitted	1.5435	1.4562	1.1816	1.0184
Realized	1.0344	0.9104	0.9444	0.8761
October-April Seasonality				
Fitted	1.3061	1.1583	0.9199	0.7831
Realized	1.1974	1.1876	0.7220	0.4955
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.088** [.671]
Fall Vs. Winter:				.891 [.913]
September Vs. March:				.870 [.896]
October Vs. April:				.334 [.428]
Onset/Recovery Coefficients Jointly 0:				**.001** [**.001**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.185 [.251]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				10.10
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-38.44/ -53.02
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-20.19/ -27.92
Number of Parameters				28
Number of Moment Conditions				36
Number of Observations (01/71 - 12/06)				432

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{\hat{\text{OR}}}\hat{\text{OR}}_t + \mu_{i,\text{GDP}_{\text{SU}}}\text{GDP}_{\text{SU},t} + \mu_{i,\text{PPI}_{\text{SU}}}\text{PPI}_{\text{SU},t} + \mu_{i,\text{IP}_{\text{SU}}}\text{IP}_{\text{SU},t} + \mu_{i,\text{U}_{\text{SU}}}\text{U}_{\text{SU},t} + \mu_{i,\text{CPI}_{\text{SU}}}\text{CPI}_{\text{SU},t} + \epsilon_{i,t}.$$

Table E.18
Auction Era: Model 5′
(Chen, Roll, and Ross plus Seasonally Unadjusted Macro Factors with Onset/Recovery)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.601	0.421	0.381	0.301
	(0.404)	(0.334)	(0.284)	(0.243)
$\mu_{\hat{\text{OR}}}$	1.882**	2.001***	1.793***	1.622***
	(0.864)	(0.724)	(0.579)	(0.503)
μ_{Term}	-0.009	-0.001	-0.008	0.004
	(0.042)	(0.034)	(0.030)	(0.024)
μ_{Default}	0.440	0.380	0.393*	0.359*
	(0.333)	(0.296)	(0.235)	(0.207)
$\mu_{\text{CPI}_{\text{SU}}}$	-0.943	-0.780	-0.599	-0.348
	(0.956)	(0.706)	(0.583)	(0.509)
$\mu_{\text{IP}_{\text{SU}}}$	15.342**	10.934**	7.977*	6.098*
	(6.968)	(5.097)	(4.136)	(3.395)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.096	-0.076	0.046	0.073
	(0.197)	(0.149)	(0.129)	(0.112)
$\mu_{\text{GDP}_{\text{SU}}}$	-0.976	-4.262	-3.604	-3.612
	(6.457)	(5.308)	(4.315)	(3.785)
$\mu_{\text{U}_{\text{SU}}}$	2.703*	2.022*	1.027	0.853
	(1.640)	(1.222)	(1.026)	(0.843)
μ_{IP}	-0.575***	-0.499***	-0.435***	-0.333***
	(0.217)	(0.169)	(0.136)	(0.119)
μ_{Inf}	-0.739	-0.372	-0.613	-0.758
	(1.219)	(0.914)	(0.727)	(0.691)
μ_{InfSurp}	-1.070	-0.259	-0.300	-0.259
	(1.168)	(0.865)	(0.736)	(0.667)
R^2	0.1041	0.0966	0.0886	0.091
AR(12)	14.49	11.04	11.38	13.41
ARCH(12)	40.25***	50.48***	64.26***	77.31***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.5819	0.4714	0.4375	0.3467
Realized	0.9500	0.7032	0.6929	0.5159
September-March Seasonality				
Fitted	1.4796	1.3821	1.1943	1.0524
Realized	1.0344	0.9104	0.9444	0.8761
October-April Seasonality				
Fitted	1.2609	1.0727	0.8836	0.7611
Realized	1.1974	1.1876	0.7220	0.4955
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]				
Nonspecific Monthly Seasonality:				.356 [.873]
Fall Vs. Winter:				.641 [.671]
September Vs. March:				.977 [.982]
October Vs. April:				.365 [.394]
Onset/Recovery Coefficients Jointly 0:				**.007** [**.019**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.545 [.613]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				11.75
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-36.80/ -53.51
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-18.54/ -28.41
Number of Parameters				48
Number of Moment Conditions				56
Number of Observations (01/71 - 12/06)				432

Notes: See the notes to Table C.2. The model is

$$r_{i,t} = \mu_i + \mu_{\hat{\text{OR}}}\hat{\text{OR}}_t + \mu_{i,\text{IP}}\text{IP}_t + \mu_{i,\text{Default}}\text{Default}_t + \mu_{i,\text{Term}}\text{Term}_{t-1} + \mu_{i,\text{Inf}}\text{Inf}_t + \mu_{i,\text{InfSurp}}\text{InfSurp}_t$$
$$+ \mu_{i,\text{GDP}_{\text{SU}}}\text{GDP}_{\text{SU},t} + \mu_{i,\text{PPI}_{\text{SU}}}\text{PPI}_{\text{SU},t} + \mu_{i,\text{IP}_{\text{SU}}}\text{IP}_{\text{SU},t} + \mu_{i,\text{U}_{\text{SU}}}\text{U}_{\text{SU},t} + \mu_{i,\text{CPI}_{\text{SU}}}\text{CPI}_{\text{SU},t} + \epsilon_{i,t}.$$

Table E.19
Auction Era: Model 6′ (Real Time Macro Factors with Onset/Recovery)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.833***	0.537**	0.508**	0.359**
	(0.311)	(0.240)	(0.212)	(0.173)
$\mu_{\hat{\text{OR}}}$	1.744***	1.687***	1.437***	1.247***
	(0.665)	(0.513)	(0.413)	(0.342)
μ_{USurpC}	-1.400	-0.440	-0.759	0.311
	(1.456)	(1.175)	(1.376)	(1.104)
μ_{USurpE}	3.011***	2.198***	2.166***	1.684***
	(0.876)	(0.709)	(0.585)	(0.467)
μ_{ProbC}	0.987	1.074*	0.931**	0.721*
	(0.734)	(0.621)	(0.468)	(0.370)
μ_{IPSurp}	-0.003	0.055	0.045	0.110
	(0.232)	(0.187)	(0.170)	(0.130)
μ_{IP}	1.464***	1.106***	1.020***	1.119***
	(0.520)	(0.397)	(0.370)	(0.311)
μ_{U}	0.065***	0.053***	0.049***	0.054***
	(0.024)	(0.018)	(0.018)	(0.016)
$\mu_{\Delta\text{Default}}$	-0.054***	-0.034**	-0.030**	-0.020*
	(0.016)	(0.015)	(0.013)	(0.011)
μ_{Term}	-0.023	-0.012	-0.015	-0.010
	(0.051)	(0.043)	(0.037)	(0.030)
μ_{InfSurp}	-1.360	-0.573	-0.346	-0.127
	(0.838)	(0.588)	(0.508)	(0.437)
μ_{Inf}	-2.532***	-1.845***	-1.616***	-1.390***
	(0.683)	(0.518)	(0.442)	(0.380)
R^2	0.1887	0.1654	0.196	0.2253
AR(12)	9.06	10.98	9.92	10.74
ARCH(12)	30.78***	29.28***	57.61***	51.84***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	1.0302	0.8588	0.7273	0.6291
Realized	1.0269	0.7696	0.7583	0.5706
September-March Seasonality				
Fitted	1.3849	1.3368	1.1425	1.0021
Realized	1.0615	0.9800	1.0455	0.9777
October-April Seasonality				
Fitted	1.0034	0.9145	0.7812	0.6866
Realized	1.1511	1.1846	0.7074	0.4787
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]				
Nonspecific Monthly Seasonality:				.967 [1.00]
Fall Vs. Winter:				.358 [.467]
September Vs. March:				.584 [.631]
October Vs. April:				.356 [.429]
Onset/Recovery Coefficients Jointly 0:				**.002** [**.007**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.294 [.346]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				10.00
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-37.85/ -53.24
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-20.04/ -28.76
Number of Parameters				48
Number of Moment Conditions				56
Number of Observations (01/71 - 12/03)				396

Notes: See the notes to Table C.2. The model is:

$$
\begin{aligned}
r_{i,t} = {} & \mu_i + \mu_{\hat{\text{OR}}}\hat{\text{OR}}_t + \mu_{i,U}\text{U}_t + \mu_{i,\text{IP}}\text{IP}_t + \mu_{i,\text{IPSurp}}\text{IPSurp}_t + \mu_{i,\Delta\text{Default}}\Delta\text{Default}_t \\
& + \mu_{i,\text{Term}}\text{Term}_{t-1} + \mu_{i,\text{ProbC}}\text{ProbC}_t + \mu_{i,\text{USurpC}}\text{USurpC}_t + \mu_{i,\text{USurpE}}\text{USurpE}_t \\
& + \mu_{i,Jan}D_t^{Jan} + \mu_{i,Inf}Inf_t + \mu_{i,InfSurp}InfSurp_t + \epsilon_{i,t}.
\end{aligned}
$$

Table E.20
Auction Era: Model 7′ (Cross Hedging with Onset/Recovery)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.225	0.169	0.114	0.056
	(0.223)	(0.166)	(0.135)	(0.112)
$\mu_{\hat{\text{OR}}}$	2.063***	1.859***	1.561***	1.364***
	(0.654)	(0.513)	(0.413)	(0.346)
μ_{σ^2}	0.006	0.005	0.007	0.008*
	(0.009)	(0.007)	(0.005)	(0.004)
μ_{Turnover}	-0.671	-0.828	-0.498	-0.388
	(0.795)	(0.618)	(0.510)	(0.421)
$\mu_{\text{Liquidity}}$	9.169	4.457	4.076	4.904
	(7.137)	(5.924)	(5.070)	(4.517)
R^2	0.0184	0.0239	0.0254	0.0281
AR(12)	11.61	7.94	8.94	11.82
ARCH(12)	51.43***	66.13***	70.92***	87.87***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.7417	0.6763	0.5648	0.4917
Realized	0.9713	0.7224	0.7063	0.5295
September-March Seasonality				
Fitted	1.6226	1.4657	1.2274	1.0692
Realized	1.0456	0.8931	0.9257	0.8582
October-April Seasonality				
Fitted	1.1446	1.0699	0.8674	0.7494
Realized	1.1889	1.1756	0.7169	0.4930
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]				
Nonspecific Monthly Seasonality:				.932 [.994]
Fall Vs. Winter:				.571 [.625]
September Vs. March:				.993 [.994]
October Vs. April:				.334 [.416]
Onset/Recovery Coefficients Jointly 0:				**.002** [**.004**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.162 [.212]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				10.23
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-38.54/-53.17
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-20.14/ -27.87
Number of Parameters				20
Number of Moment Conditions				28
Number of Observations (01/71 - 12/07)				444

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{\hat{\text{OR}}}\hat{\text{OR}}_t + \mu_{i,\hat{\sigma}^2}\hat{\sigma}_t^2 + \mu_{i,\text{Turnover}}\text{Turnover}_{t-1} + \mu_{i,\text{Liquidity}}\text{Liquidity}_{t-1} + \epsilon_{i,t}.$$

Table E.21
Auction Era: Model 9′ (Baker-Wurgler Sentiment)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.329^{**}	0.240^{**}	0.240^{***}	0.197^{***}
	(0.131)	(0.107)	(0.088)	(0.074)
$\mu_{\hat{\text{OR}}}$	2.004^{***}	1.902^{***}	1.584^{***}	1.369^{***}
	(0.666)	(0.522)	(0.431)	(0.358)
$\mu_{\text{BWSentiment}}$	0.782^{**}	0.563^{**}	0.633^{***}	0.439^{***}
	(0.341)	(0.263)	(0.219)	(0.169)
R^2	0.0274	0.0249	0.031	0.0323
AR(12)	15.00	9.13	10.24	13.82
ARCH(12)	50.96^{***}	58.73^{***}	70.82^{***}	87.91^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.7116	0.6759	0.5624	0.4866
Realized	0.9344	0.6973	0.6923	0.5180
September-March Seasonality				
Fitted	1.4603	1.4182	1.1514	1.0151
Realized	0.9002	0.8486	0.9138	0.8620
October-April Seasonality				
Fitted	1.0791	1.0103	0.8540	0.7301
Realized	1.1399	1.1777	0.7148	0.4960
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]				
Nonspecific Monthly Seasonality:				.644 [.976]
Fall Vs. Winter:				.491 [.573]
September Vs. March:				.767 [.775]
October Vs. April:				.447 [.522]
Onset/Recovery Coefficients Jointly 0:				**.001** [**.007**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.128 [.173]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				9.57
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-38.75/ -52.56
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-20.65/ -27.66
Number of Parameters				12
Number of Moment Conditions				20
Number of Observations (01/71 - 12/05)				420

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{\hat{\text{OR}}}\hat{\text{OR}}_t + \mu_{i,\text{BWSentiment}}\text{BWSentiment}_{t-1} + \epsilon_{i,t}.$$

Table E.22
Auction Era: Model 10′ (Michigan Consumer Sentiment plus Onset/Recovery)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.312^{**}	0.231^{**}	0.233^{***}	0.190^{***}
	(0.123)	(0.101)	(0.083)	(0.069)
$\mu_{\hat{\text{OR}}}$	2.120^{***}	1.924^{***}	1.573^{***}	1.355^{***}
	(0.641)	(0.495)	(0.408)	(0.343)
$\mu_{\text{MSentiment}}$	0.015	0.006	0.014	0.012
	(0.034)	(0.026)	(0.024)	(0.020)
R^2	0.0123	0.0177	0.0161	0.0162
AR(12)	13.03	9.23	9.71	13.02
ARCH(12)	55.76^{***}	65.96^{***}	72.78^{***}	93.78^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.7429	0.6806	0.5490	0.4729
Realized	0.9713	0.7224	0.7063	0.5295
September-March Seasonality				
Fitted	1.6987	1.5401	1.2607	1.0859
Realized	1.0456	0.8931	0.9257	0.8582
October-April Seasonality				
Fitted	1.0697	0.9751	0.7921	0.6823
Realized	1.1889	1.1756	0.7169	0.4930
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]				
Nonspecific Monthly Seasonality:				.785 [.982]
Fall Vs. Winter:				.685 [.736]
September Vs. March:				.983 [.976]
October Vs. April:				.551 [.620]
Onset/Recovery Coefficients Jointly 0:				**.001** [**.004**]
Onset/Recovery Treasury Coefficients Jointly Equal:				**.077** [**.094**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				11.16
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-37.60/ -51.03
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-19.20/ -25.73
Number of Parameters				12
Number of Moment Conditions				20
Number of Observations (01/71 - 12/07)				444

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{\hat{\text{OR}}}\hat{\text{OR}}_t + \mu_{i,\text{MSentiment}}\text{MSentiment}_{t-1} + \epsilon_{i,t}.$$

Table E.23
Auction Era: Model 11′ (Fama-French Factors plus Onset/Recovery)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.524	-0.510*	-0.410*	-0.351
	(0.335)	(0.275)	(0.239)	(0.215)
$\mu_{\hat{\text{OR}}}$	1.705***	1.537***	1.273***	1.131***
	(0.607)	(0.448)	(0.367)	(0.311)
μ_{SMB}	-0.104**	-0.091***	-0.095***	-0.067***
	(0.046)	(0.033)	(0.026)	(0.022)
μ_{HML}	-0.031	-0.016	-0.016	-0.006
	(0.043)	(0.036)	(0.030)	(0.025)
μ_{MOM}	0.070*	0.070**	0.064**	0.051**
	(0.037)	(0.031)	(0.026)	(0.022)
μ_{Default}	0.732**	0.635**	0.557**	0.466**
	(0.334)	(0.285)	(0.244)	(0.218)
μ_{Term}	0.054	0.051	0.039	0.037
	(0.048)	(0.035)	(0.031)	(0.026)
$\mu_{\hat{r}_m}$	0.225***	0.174***	0.129***	0.092***
	(0.047)	(0.037)	(0.029)	(0.024)
R^2	0.1094	0.1114	0.1054	0.0957
AR(12)	13.31	9.95	10.40	11.07
ARCH(12)	69.07***	69.29***	95.30***	106.57***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.9995	0.8765	0.7561	0.6224
Realized	0.9713	0.7224	0.7063	0.5295
September-March Seasonality				
Fitted	1.4578	1.3298	1.1147	0.9860
Realized	1.0456	0.8931	0.9257	0.8582
October-April Seasonality				
Fitted	1.1224	0.9986	0.8548	0.7276
Realized	1.1889	1.1756	0.7169	0.4930
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]				
Nonspecific Monthly Seasonality:				.716 [.957]
Fall Vs. Winter:				.210 [.299]
September Vs. March:				.500 [.541]
October Vs. April:				.316 [.376]
Onset/Recovery Coefficients Jointly 0:				**.005** [**.013**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.290 [.338]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				7.90
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-40.87/ -53.32
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-22.47/ -28.02
Number of Parameters				32
Number of Moment Conditions				40
Number of Observations (01/71 - 12/07)				444

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{\hat{\text{OR}}}\hat{\text{OR}}_t + \mu_{i,\text{SMB}}\text{SMB}_t + \mu_{i,\text{HML}}\text{HML}_t + \mu_{i,\text{MOM}}\text{MOM}_t + \mu_{i,\text{Default}}\text{Default}_t + \mu_{i,\text{Term}}\text{Term}_t + \mu_{i,\hat{r}_m}\hat{r}_{m,t} + \epsilon_{i,t}.$$

Table E.24
Auction Era: Model 12′ (Conditional CAPM with Onset/Recovery)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
δ	-3.688***	-5.786***	-3.712***	-4.656***
	(1.010)	(1.397)	(0.923)	(0.904)
$\delta_{\hat{\text{OR}}}$	7.314***	11.887***	8.219***	9.399***
	(2.391)	(4.282)	(2.364)	(3.045)
$\delta_{\tilde{r}_m}$	0.365***	0.308***	0.295***	0.175***
	(0.127)	(0.113)	(0.097)	(0.066)
$\delta_{\widetilde{D/P}}$	-14.89***	-15.20**	-17.42***	-16.71**
	(5.068)	(6.153)	(5.676)	(6.543)
δ_{Term90}	-3.168	-2.540	-4.627	-3.201
	(2.276)	(2.224)	(3.101)	(2.625)
δ_{Default}	1.177**	2.013***	1.512***	2.021***
	(0.515)	(0.550)	(0.477)	(0.547)
R^2	-0.0642	-0.0675	-0.1093	-0.0454
AR(12)	28.04***	21.39**	24.76**	24.94**
ARCH(12)	44.56***	23.13**	31.62***	67.69***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.5463	0.5848	0.4507	0.3842
Realized	1.0226	0.7596	0.7137	0.5417
September-March Seasonality				
Fitted	0.7648	0.8806	0.6253	0.5943
Realized	1.0456	0.8931	0.9257	0.8582
October-April Seasonality				
Fitted	1.3107	1.5807	1.0327	0.9118
Realized	1.1889	1.1756	0.7169	0.4930

Panel C: Joint Tests and Seasonality Test P-values: Asymptotic [Bootstrapped]	
Nonspecific Monthly Seasonality:	**.000** [.459]
Fall Vs. Winter:	**.000** [**.029**]
September Vs. March:	**.001** [**.040**]
October Vs. April:	.756 [.826]
Onset/Recovery Coefficients Jointly 0:	**.012** [**.039**]
Onset/Recovery Treasury Coefficients Jointly Equal:	.138 [**.090**]
Panel D: Systems Equation Information Criteria and Model Statistics	
GMM Test of Overidentification Restrictions	34.08
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included	-209.66/ -220.94
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included	-117.73/ -122.11
Number of Parameters	24
Number of Moment Conditions	64
Number of Observations (02/71 - 12/07)	443

Panel E: Seasonality in Monthly Sharpe Ratio, Averaged Across Series												
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Realized	-.02	-.07	-.09	-.06	.056	.118	-.01	.152	.109	.121	.154	.079
Fitted	.016	.005	.000	.002	.016	.006	.007	.201	.158	.243	.067	.011

Notes: See the notes to Table C.2. In addition to the instruments listed in the notes to Table C.2, the instruments used to form the GMM moment conditions in this case include a single lag of the dependent variable and a single lag of the explanatory variables. The model is:

$$E_{t-1}(\tilde{r}_{i,t}) = \lambda_t \cdot \hat{\sigma}_t^2$$

$$\lambda_t = \exp(\delta_i + \delta_{i,\hat{\text{OR}}}\hat{\text{OR}}_t + \delta_{i,\widetilde{D/P}}\widetilde{D/P}_t + \delta_{i,\tilde{r}_m}\tilde{r}_{m,t-1} + \delta_{i,\text{Default}}\text{Default}_t + \delta_{i,\text{Term90}}\text{Term90}_{t-1}).$$

Table E.25
Alternative Measures: Observed Onset/Recovery

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.152^{*}	0.105	0.134^{**}	0.116^{**}
	(0.088)	(0.076)	(0.062)	(0.051)
$\mu_{ObservedOR}$	1.380^{***}	1.264^{***}	1.104^{***}	0.913^{***}
	(0.441)	(0.356)	(0.290)	(0.247)
R^2	0.0086	0.0115	0.013	0.0119
AR(12)	17.00	11.32	9.28	13.12
ARCH(12)	89.81^{***}	107.03^{***}	98.97^{***}	125.16^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.5139	0.4707	0.4113	0.3402
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	0.9193	0.8421	0.7357	0.6085
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	0.9555	0.8753	0.7647	0.6325
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.952 [.996]
Fall vs. Winter:				.399 [.480]
September vs. March:				.673 [.732]
October vs. April:				.658 [.714]
Onset/Recovery Coefficients Jointly 0:				**.003** [**.006**]
Onset/Recovery Treasury Coefficients Jointly Equal:				**.042** [**.056**]
Panel D: Systems Equation Information Criteria and Model Statistics				
BIC (Log Likel= -3422.59) based on FIML estimation:				11.4651
GMM Test of Overidentification Restrictions				10.34
MMSC-BIC				-41.74
MMSC-HQIC				-21.14
Number of Parameters				8
Number of Moment Conditions				16
Number of Observations (01/52 - 12/07)				672

Notes: See the notes to Table C.2. (Note that estimating the model including the constrained onset/recovery variable would introduce a high degree of multicollinearity, thus we omit the information criteria based on that expanded model.) The model is:

$$r_{i,t} = \mu_i + \mu_{i,\text{ObservedOR}}\text{ObservedOR}_t + \epsilon_{i,t}$$

Table E.26
Alternative Measures: ΔLengthOfNight

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.154^{*}	0.107	0.136^{**}	0.117^{**}
	(0.089)	(0.076)	(0.062)	(0.051)
$\mu_{\Delta\text{LengthOfNight}}$	2.418^{**}	2.130^{**}	2.060^{***}	1.676^{***}
	(1.069)	(0.861)	(0.713)	(0.601)
R^2	0.0059	0.0074	0.0107	0.0088
AR(12)	17.13	11.46	9.34	13.22
ARCH(12)	89.79^{***}	108.11^{***}	97.95^{***}	123.42^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.4060	0.3576	0.3459	0.2814
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	0.5987	0.5274	0.5101	0.4150
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	0.5627	0.4957	0.4795	0.3900
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.707 [.942]
Fall vs. Winter:				.533 [.588]
September vs. March:				.816 [.844]
October vs. April:				.263 [.318]
Onset/Recovery Coefficients Jointly 0:				**.046** [**.058**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.164 [.202]
Panel D: Systems Equation Information Criteria and Model Statistics				
BIC (Log Likel= -3423.28) based on FIML estimation:				11.4671
GMM Test of Overidentification Restrictions				10.39
MMSC-BIC				-41.70
MMSC-HQIC				-21.09
Number of Parameters				8
Number of Moment Conditions				16
Number of Observations (01/52 - 12/07)				672

Notes: See the notes to Table C.2. (Note that estimating the model including the constrained onset/recovery variable would introduce a high degree of multicollinearity, thus we omit the information criteria based on that expanded model.) The model is:

$$r_{i,t} = \mu_i + \mu_{i,\Delta\text{LengthOfNight}}\Delta\text{LengthOfNight}_t + \epsilon_{i,t}$$

Table E.27
Ad Hoc Model (Monthly Dummies)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.172	0.122	0.155	0.132
	(0.116)	(0.108)	(0.102)	(0.099)
μ_{Feb}	-0.191	-0.191	-0.191	-0.191
	(0.181)	(0.181)	(0.181)	(0.181)
μ_{Mar}	-0.272**	-0.272**	-0.272**	-0.272**
	(0.131)	(0.131)	(0.131)	(0.131)
μ_{Apr}	-0.108	-0.108	-0.108	-0.108
	(0.183)	(0.183)	(0.183)	(0.183)
μ_{May}	-0.084	-0.084	-0.084	-0.084
	(0.157)	(0.157)	(0.157)	(0.157)
μ_{Jun}	0.046	0.046	0.046	0.046
	(0.151)	(0.151)	(0.151)	(0.151)
μ_{Jul}	0.054	0.054	0.054	0.054
	(0.175)	(0.175)	(0.175)	(0.175)
μ_{Aug}	-0.022	-0.022	-0.022	-0.022
	(0.182)	(0.182)	(0.182)	(0.182)
μ_{Sep}	0.357**	0.357**	0.357**	0.357**
	(0.145)	(0.145)	(0.145)	(0.145)
μ_{Oct}	0.176	0.176	0.176	0.176
	(0.202)	(0.202)	(0.202)	(0.202)
μ_{Nov}	0.053	0.053	0.053	0.053
	(0.178)	(0.178)	(0.178)	(0.178)
μ_{Dec}	0.020	0.020	0.020	0.020
	(0.184)	(0.184)	(0.184)	(0.184)
R^2	0.0052	0.0085	0.0101	0.0106
AR(12)	17.31	11.39	9.32	13.26
ARCH(12)	91.17***	107.18***	94.11***	120.02***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.2371	0.2371	0.2371	0.2371
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	0.6287	0.6287	0.6287	0.6287
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	0.2836	0.2836	0.2836	0.2836
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				N/A [N/A]
Fall vs. Winter:				N/A [N/A]
September vs. March:				N/A [N/A]
October vs. April:				N/A [N/A]
Panel D: Systems Equation Information Criteria and Model Statistics				
BIC (Log Likel= -3422.36) based on FIML estimation:				12.55
GMM Test of Overidentification Restrictions				35.79
MMSC-BIC				-205.09
MMSC-HQIC				-109.78
Number of Parameters				15
Number of Moment Conditions				52
Number of Observations (01/52 - 12/07)				672

Notes: See the notes to Table C.2, but note we provide information criteria based on the tabled model only. The model is:

$$r_{i,t} = \mu_i + \mu_{\text{Feb}}\text{Feb}_t + \mu_{\text{Mar}}\text{Mar}_t + \mu_{\text{Apr}}\text{Apr}_t + \mu_{\text{May}}\text{May}_t$$

$$+\mu_{\text{Jun}}\text{Jun}_t + \mu_{\text{Jul}}\text{Jul}_t + \mu_{\text{Aug}}\text{Aug}_t + \mu_{\text{Sep}}\text{Sep}_t + \mu_{\text{Oct}}\text{Oct}_t + \mu_{\text{Nov}}\text{Nov}_t + \mu_{\text{Dec}}\text{Dec}_t + \epsilon_{i,t}$$

Table E.28
Modified Model 6: (Real-Time Macro Factors Constrained Across Series)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.181	0.132	0.188	0.168
	(0.146)	(0.136)	(0.126)	(0.118)
μ_{USurpC}	0.058	0.058	0.058	0.058
	(0.697)	(0.697)	(0.697)	(0.697)
μ_{USurpE}	1.039***	1.039***	1.039***	1.039***
	(0.315)	(0.315)	(0.315)	(0.315)
μ_{ProbC}	0.778***	0.778***	0.778***	0.778***
	(0.250)	(0.250)	(0.250)	(0.250)
μ_{IPSurp}	-0.052	-0.052	-0.052	-0.052
	(0.078)	(0.078)	(0.078)	(0.078)
μ_{IP}	1.247***	1.247***	1.247***	1.247***
	(0.185)	(0.185)	(0.185)	(0.185)
μ_{U}	0.060***	0.060***	0.060***	0.060***
	(0.008)	(0.008)	(0.008)	(0.008)
$\mu_{\Delta\text{Default}}$	-0.017***	-0.017***	-0.017***	-0.017***
	(0.006)	(0.006)	(0.006)	(0.006)
μ_{Term}	0.007	0.007	0.007	0.007
	(0.016)	(0.016)	(0.016)	(0.016)
μ_{InfSurp}	0.027	0.027	0.027	0.027
	(0.333)	(0.333)	(0.333)	(0.333)
μ_{Inf}	-1.292***	-1.292***	-1.292***	-1.292***
	(0.233)	(0.233)	(0.233)	(0.233)
R^2	0.1224	0.1337	0.1601	0.1956
AR(12)	17.77	15.64	14.82	17.18
ARCH(12)	39.84***	38.50***	57.68***	42.11***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.1572	0.1572	0.1572	0.1572
Realized	0.8125	0.5729	0.6853	0.4504
September-March Seasonality				
Fitted	0.0693	0.0693	0.0693	0.0693
Realized	0.8565	0.7955	0.8178	0.7509
October-April Seasonality				
Fitted	0.0576	0.0576	0.0576	0.0576
Realized	1.0951	1.2034	0.8506	0.6192
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				**<.001** [.406]
Fall vs. Winter:				**.042** [.194]
September vs. March:				**<.001** [**.006**]
October vs. April:				.116 [.284]
Panel D: Systems Equation Information Criteria and Model Statistics				
BIC (Log Likel= -2444.66) based on FIML estimation:				13.75
GMM Test of Overidentification Restrictions				36.01
MMSC-BIC				-196.73
MMSC-HQIC				-108.61
Number of Parameters				14
Number of Moment Conditions				52
Number of Observations (12/65 - 12/03)				457

Notes: See the notes to Table C.2, but note we provide information criteria based only on the tabled model. The model is:

$$r_{i,t} = \mu_i + \mu_{\text{USurpC}}\text{USurpC}_t + \mu_{\text{USurpE}}\text{USurpE}_t + \mu_{\text{ProbC}}\text{ProbC}_t + \mu_{\text{IPSurp}}\text{IPSurp}_t + \mu_{\text{IP}}\text{IP}_t + \mu_{\text{U}}\text{U}_t$$
$$+\mu_{\Delta\text{Default}}\Delta\text{Default}_t + \mu_{\text{Term}}\text{Term}_t + \mu_{\text{InfSurp}}\text{InfSurp}_t + \mu_{\text{Inf}}\text{Inf}_t + \epsilon_{i,t}$$

Table E.29
Modified Model 5:
(CRR and Seasonally Unadjusted Factors Constrained Across Series)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.077	0.026	0.066	0.054
	(0.116)	(0.109)	(0.105)	(0.102)
μ_{Term}	0.010	0.010	0.010	0.010
	(0.014)	(0.014)	(0.014)	(0.014)
μ_{Default}	0.465***	0.465***	0.465***	0.465***
	(0.126)	(0.126)	(0.126)	(0.126)
$\mu_{\text{CPI}_{\text{SU}}}$	-0.224	-0.224	-0.224	-0.224
	(0.239)	(0.239)	(0.239)	(0.239)
$\mu_{\text{IP}_{\text{SU}}}$	2.578*	2.578*	2.578*	2.578*
	(1.542)	(1.542)	(1.542)	(1.542)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.076	-0.076	-0.076	-0.076
	(0.073)	(0.073)	(0.073)	(0.073)
$\mu_{\text{GDP}_{\text{SU}}}$	0.652	0.652	0.652	0.652
	(1.177)	(1.177)	(1.177)	(1.177)
$\mu_{\text{U}_{\text{SU}}}$	0.763*	0.763*	0.763*	0.763*
	(0.442)	(0.442)	(0.442)	(0.442)
μ_{IP}	-0.234***	-0.234***	-0.234***	-0.234***
	(0.046)	(0.046)	(0.046)	(0.046)
μ_{Inf}	-0.809**	-0.809**	-0.809**	-0.809**
	(0.344)	(0.344)	(0.344)	(0.344)
μ_{InfSurp}	-0.102	-0.102	-0.102	-0.102
	(0.274)	(0.274)	(0.274)	(0.274)
R^2	0.0524	0.0588	0.0608	0.0686
AR(12)	19.74 *	15.15	14.03	19.62*
ARCH(12)	81.90***	96.75***	86.22***	99.94***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.0155	0.0155	0.0155	0.0155
Realized	0.5333	0.2928	0.4644	0.2905
September-March Seasonality				
Fitted	0.0875	0.0875	0.0875	0.0875
Realized	0.6045	0.5524	0.5604	0.4955
October-April Seasonality				
Fitted	0.0991	0.0991	0.0991	0.0991
Realized	0.9665	0.9608	0.6888	0.5531
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				**<.001** [.152]
Fall vs. Winter:				**.005** [**.054**]
September vs. March:				**.058** [.160]
October vs. April:				**.033** [.124]
Panel D: Systems Equation Information Criteria and Model Statistics				
BIC (Log Likel= -3365.99) based on FIML estimation:				12.44
GMM Test of Overidentification Restrictions				43.47
MMSC-BIC				-203.24
MMSC-HQIC				-105.80
Number of Parameters				14
Number of Moment Conditions				52
Number of Observations (01/52 - 12/06)				660

Notes: See the notes to Table C.2, but note we provide information criteria based only on the tabled model. The model is:

$$r_{i,t} = \mu_i + \mu_{\text{Term}}\text{Term}_t + \mu_{\text{Default}}\text{Default}_t + \mu_{\text{CPI}_{\text{SU}}}\text{CPI}_{\text{SU},t} + \mu_{\text{IP}_{\text{SU}}}\text{IP}_{\text{SU},t} + \mu_{\text{PPI}_{\text{SU}}}\text{PPI}_{\text{SU},t} + \mu_{\text{GDP}_{\text{SU}}}\text{GDP}_{\text{SU},t}$$
$$+\mu_{\text{U}_{\text{SU}}}\text{U}_{\text{SU},t} + \mu_{\text{IP}}\text{IP}_t + \mu_{\text{Inf}}\text{Inf}_t + \mu_{\text{InfSurp}}\text{InfSurp}_t + \epsilon_{i,t}$$

Table E.30
Modified Model 1: Onset/Recovery Constrained Across Series

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.167^{**}	0.119^{*}	0.152^{***}	0.132^{***}
	(0.082)	(0.068)	(0.056)	(0.047)
$\mu_{\widehat{\mathrm{OR}}}$	0.734^{***}	0.734^{***}	0.734^{***}	0.734^{***}
	(0.156)	(0.156)	(0.156)	(0.156)
R^2	0.0064	0.0083	0.0111	0.011
AR(12)	16.97	11.25	9.22	13.03
ARCH(12)	91.13^{***}	107.04^{***}	95.17^{***}	123.07^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.2617	0.2617	0.2617	0.2617
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	0.5871	0.5871	0.5871	0.5871
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	0.3734	0.3734	0.3734	0.3734
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.934 [.986]
Fall vs. Winter:				.750 [.804]
September vs. March:				.602 [.710]
October vs. April:				.696 [.732]
Onset/Recovery Coefficients Jointly 0:				**<.001** [**<.001**]
Panel D: Systems Equation Information Criteria and Model Statistics				
BIC (Log Likel= -3424.74) based on FIML estimation:				11.01
GMM Test of Overidentification Restrictions				38.99
MMSC-BIC				-267.00
MMSC-HQIC				-145.92
Number of Parameters				5
Number of Moment Conditions				52
Number of Observations (01/52 - 12/07)				672

Notes: See Table C.2, but note we provide information criteria based on the tabled model only. The model is:

$$r_{i,t} = \mu_i + \mu_{\widehat{\mathrm{OR}}}\widehat{\mathrm{OR}}_t + \epsilon_{i,t}$$

Table E.31
Comparison of Key Information from Tables E.26 through E.29

Model (Parameters) [Moment Conditions] Estimation Period Restrictions	BIC (MMSC-BIC) [MMSC-HQIC]	Series: 20-Year, 10-Year, 7-Year, 5-Year, Seasonal Variation P-values for Joint Test of Constant Monthly Return: Asymptotic / Bootstrapped	Pvalues on T-Tests: Asymp./Bootstrapped Magnitudes: [Realized/Fitted] Fall vs. Winter:	Sep vs. March:	Oct vs. April:
Ad Hoc Monthly Dummies (15) [52] 01/52 - 12/07 Parameters Restricted Across Series	12.55 (-205.09) [-109.78]	N/A / N/A	N/A / N/A [0.412/0.237]	N/A / N/A [0.553/0.629]	N/A / N/A [0.790/0.284]
Modified Model 6 (14) [52] 12/65 - 12/03 Parameters Restricted Across Series	13.75 (-196.73) [-108.61]	**<.001**/ .406	**.042**/ .194 [0.630/0.157]	**<.001**/**.006** [0.805/0.069]	.116/ .284 [0.942/0.058]
Modified Model 5 (14) [52] 01/52 - 12/06 Parameters Restricted Across Series	12.44 (-203.24) [-105.80]	**<.001**/ .152	**.005**/**.054** [0.395/0.015]	**.058**/ .160 [0.553/0.087]	**.033**/ .124 [0.792/0.099]
Modified Model 1 (5) [52] 01/52 - 12/07 Parameters Restricted Across Series	11.01 (-267.00) [-145.92]	.934/ .986	.750/ .804 [0.412/0.262]	.602/ .710 [0.553/0.587]	.696/ .732 [0.790/0.373]

Notes: See the notes to Table E.2.

Appendix F Sensitivity of Results to Systems of Equations Estimation and Unmodeled ARCH Effects

Test statistics such as we produce with system of equations GMM estimation can depart from their asymptotic distributions, even accounting for estimated contemporaneous correlations (as we have), and even correcting for autocorrelation and heteroskedasticity of unknown form (as we have). This is what motivates our presentation of p-values based on bootstrap resampling with data-dependent block length.[8] Here we also perform tests of seasonality, both (i) in a single equation GMM framework and (ii) in a system-equation framework using full information likelihood (FIML) and correcting for GARCH effects, instead of using GMM .

Table F.1 contains results from a single-equation GMM estimation performed on an equal-weighted average of the 5-, 7-, 10- and 20-year Treasury returns series in excess of the 30-day T-bill rate. Table F.2 contains system-equation results using FIML on the individual 5-, 7-, 10- and 20-year Treasury returns series in excess of the 30-day T-bill rate. In Table F.3 we report an estimation identical to that presented in Table F.1 except we include the onset/recovery variable in the set of explanatory variables. In Table F.4 we report an estimation identical to that presented in Table F.2, again with the onset/recovery variable included in the set of explanatory variables.

In each table we present the magnitudes of realized and fitted Treasury return seasonal variation corresponding to the seasonal periods fall versus winter, September versus March, and October versus April. As in the main body of the paper, we calculate four seasonality tests. These tests include a test for monthly variation of nonspecific form (a regression of returns on a constant and monthly dummy variables, excluding January, with the monthly dummy variables tested to be jointly zero), a test that the fall (October, November and December) and winter (January, February and March) months have mean returns that equal the annual mean return (i.e., no seasonality) against the alternative that the fall and winter have equal magnitude but oppositely signed variation in return around the annual mean return, a test that October and April have mean returns that equal the annual mean return (i.e., no seasonality) against the alternative that October and April have equal magnitude but oppositely signed variation in return around the annual mean return, and a test that September and March have mean returns that equal the annual mean return (i.e., no seasonality) against the alternative that September and March have equal magnitude but oppositely signed variation in return around the annual mean return. In the cases of Tables F.1 and F.3, in which we employ GMM estimation, we also provide bootstrapped p-values for the tests of seasonality. Finally, we present tests for autocorrelation and heteroskedasticity, and statistics such as R^2, various information criteria, and the number of parameters, moment conditions, and observations.

The average realized Treasury returns show remarkable variation over the seasons, dipping almost 80 basis points from October to April. Even the smallest seasonal movement, fall versus winter, shows the average fall Treasury return is 41.2 basis points higher than the average winter Treasury return. The model of Table F.1 has no seasonal component, so the fitted seasonal movements are, of course, identically 0. Our seasonality test results for the single equation regression of Table F.1 demonstrate that this evidence of economically meaningful seasonal variation in Treasury returns is statistically significant. The strongest rejection of the null of no seasonality is for the seasonal difference between October and April, with an asymptotic p-value of 0.1%. The bootstrapped p-values verify the evidence of seasonality. Unreported results based on nominal returns show virtually identical results. Although this single equation equal-weighted Treasury index approach does not exploit the cross-sectional variation in Treasury returns, it does reveal strong, statistically significant seasonality.

The results presented in Table F.1 also reveal strong heteroskedasticity in the residuals, with a standard LM test for ARCH of order 12 lags rejecting at conventional levels of significance. Similarly, regressions reported in the main body of the paper typically reveal strong ARCH effects. Hence in Table F.2 we explore the use of full information likelihood estimation controlling for GARCH effects. We find that incorporating a standard GARCH(1,1) specification in the variance and modeling the mean return as a constant is sufficient to remove evidence of autocorrelation and ARCH at 12 lags.

The full system-equation maximum likelihood (FIML) results reported in Table F.2 include tests for residual autocorrelation and ARCH at 12 lags, which reveal no statistically significant effects in the individual Treasury return series. Again the model does not fit the seasonality, as it contains only a constant in the mean equation, and the individual Treasury return series reveal substantial seasonal variation. The longer-maturity Treasury series tend to exhibit larger seasonal variation, although there is no monotonic seasonal pattern across the series. Overall, we find stronger evidence of seasonality relative to the GMM-based estimations (i.e., relative to both the single-equation result presented in Table F.1 and the full system-equation estimation reported in the main body of the paper), with all the seasonality tests rejecting the null of no seasonality at the

[8] We utilize bootstrap resampling techniques to determine the data-adjusted significance of the tests for seasonality including the significance of the SAD effect. We employ the block bootstrap technique of Politis and Romano (1994), using blocks of data of random length, distributed according to the geometric distribution with mean block length b. The parameter b is chosen so that block length is data-dependent. Thus we preserve the cross-sectional correlation and heteroskedasticity structure of the data, and the block structure controls for autocorrelation. We set block length to have a mean of 5 and use 1,000 resamples. We explored a range of block sizes between 2 and 10 and resampling up to 1,000 replications and found very little variation in results.

1% level.

Tables F.3 and F.4, where the models incorporate the onset/recovery variable, reveal three patterns of particular note. First, evidence of statistically significant seasonality in Treasury returns is largely or completely removed with the addition of the onset/recovery variable. Second, the onset/recovery variable coefficient is itself strongly statistically significant in both the single equation regression and the system-equation regression. Third, the bootstrapped tests of seasonality confirm that the tests produced using GMM do not appear to over-reject, with the bootstrapped probability estimates qualitatively identical to the GMM estimates. It is also interesting to note that the magnitude of the onset/recovery coefficient is larger on the average Treasury series – see $\mu_{\widehat{\mathrm{OR}}}$ in Table F.3 – than produced using FIML in the individuals series – see Table F.4. This difference likely arises because techniques that are based on maximum likelihood estimation, such as FIML, can be biased. (See, for instance, Davidson and MacKinnon (1993, p. 247) for an overview of this feature of maximum likelihood estimation.) For comparison, the GMM analysis reported in the main paper and untabulated results based on simple OLS produce the larger coefficients, confirming the bias, at least applied to these data. Further, both single equation GMM models (Tables F.1 and F.3) fail the GMM over-identification test at the 5% level, revealing some evidence of model misspecification. Additionally, the information criteria model rankings based on MMSC-BIC and MMSC-HQIC prefer the model shown in Table F.3, which incorporates onset/recovery.

Table F.1:
Single-Equation GMM Estimation on Average Treasury Series

Parameter or Statistic	Single Index Treasury Series Excess Returns
Panel A: Estimates	
μ	0.14^{**}
	(0.070)
R^2	0
AR(12)	14.73
ARCH(12)	101.23^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)	
Fall-Winter Seasonality	
Fitted	0.0000
Realized	0.4121
September-March Seasonality	
Fitted	0.0000
Realized	0.5531
October-April Seasonality	
Fitted	0.0000
Realized	0.7896
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]	
Nonspecific Monthly Seasonality:	**.089** [**.054**]
Fall vs. Winter:	**.079** [**.088**]
September vs. March:	**.070** [**.076**]
October vs. April:	**.001** [**.002**]
Panel D: Information Criteria and Model Statistics	
GMM Test of Overidentification Restrictions	6.85^{**}
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included	-6.17/ -6.93
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included	-1.02/ -1.77
Number of Parameters	1
Number of Moment Conditions	3
Number of Observations (01/1952 - 12/2007)	672

Notes: The dependent variable is the Treasury return index formed with an equal-weighted average of the 5-, 7-, 10- and 20-year Treasury returns series in excess of the 30-day T-bill rate. The model is:

$$r_t = \mu + \epsilon_t.$$

.
For further details see the notes to Table C.2, but note that the model is estimated as a single equation (not a system of equations).

Table F.2:
FIML/GARCH Estimation

Parameter or Statistic	20-year Treasury Excess Returns	10-year Treasury Excess Returns	7-year Treasury Excess Returns	5-year Treasury Excess Returns
Panel A: Estimates				
μ	0.05	0.04	0.09*	0.07*
	(0.071)	(0.045)	(0.048)	(0.041)
α	0.04	0.01	0.03	0.02*
	(0.027)	(0.006)	(0.028)	(0.014)
β	0.87***	0.82***	0.84***	0.86***
	(0.022)	(0.024)	(0.027)	(0.021)
γ	0.13***	0.21***	0.17***	0.15***
	(0.027)	(0.037)	(0.033)	(0.026)
R^2	-0.0011	-0.0011	-0.0009	-0.0012
AR(12)	17.45	12.27	10.17	14.39
ARCH(12)	10.23	8.16	6.55	10.29
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.0000	0.0000	0.0000	0.0000
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	0.0000	0.0000	0.0000	0.0000
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	0.0000	0.0000	0.0000	0.0000
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Seasonality Test P-values				
Nonspecific Monthly Seasonality:				**0.002**
Fall vs. Winter:				**0.006**
September vs. March:				**0.001**
October vs. April:				**0.007**
Panel D: Information Criteria and Model Statistics				
BIC (Log Likel= -5284.92) of Tabled Model/Constrained $\hat{OR}$ Term Included				15.8839/ 15.8623
Number of Parameters				12
Number of Observations (01/1952 - 12/2007)				672

Notes: See the notes to Table C.2, with the following exceptions: The dependent variable is the Treasury return index in excess of the 30-day T-bill rate. The system of equations is estimated with full information maximum likelihood (not GMM). The model is:

$$r_{i,t} = \mu_i + \epsilon_{i,t} \quad \epsilon_t \sim N(0, \sigma_t^2); \quad \sigma_t^2 = \alpha + \beta\sigma_{t-1}^2 + \gamma\epsilon_{t-1}^2.$$

The seasonality tests are done using FIML estimation with GARCH (not GMM). Otherwise this these tests are performed identically to that described in the main text. The information criterion we report is the standard Bayesian information criterion (BIC).

Table F.3:
Single-Equation GMM Estimation on Average Treasury Series, with Onset/Recovery

Parameter or Statistic	Single Index Treasury Series Excess Returns
Panel A: Estimates	
μ	0.15^{**}
	(0.069)
$\mu_{\widetilde{\mathrm{OR}}}$	1.05^{***}
	(0.344)
R^2	0.0096
AR(12)	13.76
ARCH(12)	100.98^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)	
Fall-Winter Seasonality	
Fitted	0.3732
Realized	0.4121
September-March Seasonality	
Fitted	0.8371
Realized	0.5531
October-April Seasonality	
Fitted	0.5324
Realized	0.7896
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]	
Nonspecific Monthly Seasonality:	.539 [.522]
Fall vs. Winter:	.827 [.828]
September vs. March:	.229 [.216]
October vs. April:	**.035** [**.034**]
Onset/Recovery Coefficients Jointly 0:	**.002** [**.008**]
Panel D: Information Criteria and Model Statistics	
GMM Test of Overidentification Restrictions	6.09^{**}
MMSC-BIC of Tabled Model	-6.93
MMSC-HQIC of Tabled Model	-1.77
Number of Parameters	2
Number of Moment Conditions	4
Number of Observations (01/1952 - 12/2007)	672

Notes: See the notes to notes to Table F.1.

Table F.4:
FIML/GARCH Estimation, with Onset/Recovery

Parameter or Statistic	20-year Treasury Excess Returns	10-year Treasury Excess Returns	7-year Treasury Excess Returns	5-year Treasury Excess Returns
Panel A: Estimates				
μ	0.05	0.04	0.09^{*}	0.07^{*}
	(0.071)	(0.045)	(0.050)	(0.041)
$\mu_{\widehat{\mathrm{OR}}}$	0.67^{**}	0.39^{*}	0.69^{***}	0.49^{**}
	(0.336)	(0.219)	(0.269)	(0.194)
α	0.04	0.01	0.06	0.02
	(0.028)	(0.007)	(0.067)	(0.016)
β	0.87^{***}	0.82^{***}	0.82^{***}	0.86^{***}
	(0.023)	(0.025)	(0.053)	(0.021)
γ	0.14^{***}	0.21^{***}	0.18^{***}	0.15^{***}
	(0.028)	(0.038)	(0.043)	(0.027)
R^2	0.0053	0.0047	0.0101	0.0088
AR(12)	16.86	11.12	9.21	13.00
ARCH(12)	9.90	8.13	6.25	8.96
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.2384	0.1388	0.2475	0.1731
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	0.5347	0.3113	0.5551	0.3884
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	0.3401	0.1980	0.3531	0.2470
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Joint Tests and Seasonality Test P-values				
Nonspecific Monthly Seasonality:				.253
Fall vs. Winter:				.892
September vs. March:				.666
October vs. April:				.440
Onset/Recovery Coefficients Jointly 0:				**<.001**
Onset/Recovery Treasury Coefficients Jointly Equal:				.801
Panel D: Information Criteria and Model Statistics				
BIC (Log Likel= -5273.87) of Tabled Model/Constrained $\widehat{\mathrm{OR}}$ Term Included				15.8898/ 15.8623
Number of Parameters				20
Number of Observations (01/1952 - 12/2007)				672

Notes: See the notes to notes to Table F.2. The model is:

$$r_{i,t} = \mu_i + \mu_{\widehat{\mathrm{OR}}}\widehat{\mathrm{OR}}_t + \epsilon_{i,t} \quad \epsilon_t \sim N(0, \sigma_t^2); \quad \sigma_t^2 = \alpha + \beta\sigma_{t-1}^2 + \gamma\epsilon_{t-1}^2.$$

Appendix G Full Set of Regression Results for Model 1 through Model 12

We report the full set of coefficient estimates and statistics from estimating Model 1 through Model 12. For each model, we conduct a joint estimation for the 20-year, 10-year, 7-year, and 5-year Treasury return series, using Hansen's (1982) GMM and Newey and West (1987, 1994) HAC standard errors. The estimation details are analogous to the presentation in the main text.[9] Tables are numbered according to model number. Summary statistics are provided in Table 1 for the variables used in Model 1 and in Appendix B in the main text for the rest of the models.

Model 1 (Table G.1): The onset/recovery variable is statistically significant for each of the Treasury series. See the paper for extensive discussion.

Model 2 (Table G.2): We see that the Debt, Auction, and FOMC dummy coefficients are insignificantly different from zero for each of the Treasury series. When we conduct seasonality tests, analogous to those conducted on the returns and discussed in the main text, we find significant evidence of fall/winter and September/March seasonality with bootstrapped p-values of .054 and .011 respectively.

Model 3 (Table G.3): We find that many of the macroeconomic asset pricing factors significantly influence Treasury returns. The default spread is strongly statistically significant, with a positive coefficient. Inflation, inflation surprise, and industrial production are all negatively related to Treasury returns, mostly significantly. Nonetheless, the seasonality tests indicate that there remains significant evidence that the CRR factors are unable to explain the seasonal cycle in Treasury returns, with bootstrapped p-values of .022 for the September/March test and .028 for the October/April test.

Model 4 (Table G.4): Of all the macroeconomic factors, only the seasonally unadjusted unemployment is significantly related to Treasury returns for all of the series, with a positive coefficient. CPI, PPI, and industrial production are negatively related to returns, significantly in some cases. GDP is insignificant with mixed coefficient signs. We find significant evidence of monthly, September/March, and October/April seasonality, with bootstrapped p-values of .002, .013, and .045 respectively.

Model 5 (Table G.5): We find similar results for the signs and significance of the macro factors relative to Model 3 and Model 4. We also continue to find evidence of monthly and October/April cyclical seasonality with bootstrapped p-values of .092 and .066 respectively.

Model 6 (Table G.6): Because of data limitations on some of the macroeconomic series, we are restricted to the period December 1965 through December 2003. In Table G.6 we see that the change in the default spread and inflation have significant negative coefficients. The Stock and Watson (1989) experimental coincident recession index (ProbC) the surprise in the change in unemployment interacted with the probability of an expansion (USurpE), industrial production, and uemployment have significantly positive coefficients. The bootstrapped p-value of .005 for the September/March seasonality test reveals evidence of cyclical variation, and the bootstrapped value of .065 reveals monthly seasonality.

[9]The moment conditions we use include orthogonality between the regressors and the errors, plus orthogonality between a small set of instruments and the errors. For instruments we use the constant, a lag of the CRSP value-weighted return (entire U.S. market return, including dividends), and the contemporaneous 30-day T-bill rate as suggested by Ferson and Foerster (1994). For Model 12, a non-linear CAPM specification, we additionally require a lag of the explanatory variables and a lag of the dependent variable as instruments.

Model 7 (Table G.7): The coefficient estimate for volatility is positive for all series, significantly for two. Liquidity is insignificantly positive and turnover is insignificantly negative for all of the series. The seasonality tests reveal significant September/March cyclicality with a bootstrapped p-value of .007.

Model 8 (Table G.8): Coefficient estimates for volatility are similar to those reported in Model 7. Now the turnover estimate is *significantly* negative and the coefficient on liquidity has become negative although it remains insignificant. The new variable in this model, the volatilty of Treasury returns, has an insignificant coefficient estimate. There remains significant evidence of cyclical seasonality in this model, with a strongly significant September/March bootstrapped p-value of .002. There is also strong evidence of monthly seasonality of nonspecific form, with a bootstrapped p-value less than .001.

Model 9 (Table G.9): The Baker-Wurgler sentiment variable has a positive significant coefficient estimate. There remains evidence of significant monthly and September/March and non-specific seasonal effects in the data, with bootstrapped p-values of .092 and .007 respectively.

Model 10 (Table G.10): The Michigan consumer sentiment variable has a coefficient estimate that is very small and insignificant. There remains evidence of significant monthly September/March and October/April seasonality, with bootstrapped p-values of .044 and .065 respectively.

Model 11 (Table G.11): Unlike the return series Fama and French use, the dependent variables in our regressions are not portfolio returns averaged over the term structure but are rather returns to an individual bond and are hence noisier and harder to explain. For each of the Treasury return series, the orthogonalized excess market return has a coefficient which is small but positive and significant, the coefficients on SMB and HML are small (significant only for SMB), the default spread has a positive and significant coefficient, and the term variable has a large positive coefficient. Momentum is positive but insignificant for almost all of the Treasury return series. There remains significant evidence of September/March seasonality with a bootstrapped p-value of .005.

Model 12 (Table G.12): We find a negative insignificant coefficient on dividend yields in excess of the risk-free rate, $\widetilde{D/P}_t$. The coefficient estimate on Default$_t$ is positive, in some cases significantly positive. The lagged market return variable has a negative significant coefficient estimate. The lagged term premium is positive, significant in some cases. Based on the bootstrapped p-values, there is evidence of a significant September/March seasonal effect. In Panel E of Table G.12 we consider seasonal variation in Sharpe ratios that arise from estimating the conditional CAPM, averaged across the four Treasury series. In the first line of that panel, labeled 'Realized', we see that the Sharpe ratios based on realized returns peak around 10% in the fall months and reach a trough in the winter months (some of the realized values are actually below 0 in that season). In the next line we consider Sharpe ratios that arise from estimating the conditional CAPM. Those Sharpe ratios do not exhibit meaningful seasonal variation, hovering between 1.9% and 4.7% over the year.

In terms of fitting magnitudes of seasonal return variation, for each of the models there is a poor match between the realized series and the fitted series (shown in Panel B of each table). Panel D of each table provides the values of information criteria. In each of Tables G.2 through G.12, the information criteria values are lowest when the constrained onset/recovery variable is added to the model, indicating that the

inclusion of onset/recovery improves model performance in each case.

Table G.1
Model 1 (Onset/Recovery)

	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Parameter or Statistic	Coeff. (Std Err)	Coeff. (Std Err)	Coeff. (Std Err)	Coeff. (Std Err)
Panel A: Estimates				
μ	.153*	.106	.135**	.116**
	(.088)	(.076)	(.062)	(.051)
$\mu_{\widehat{\mathrm{OR}}}$	1.103**	1.027***	.949***	.776***
	(.454)	(.362)	(.294)	(.243)
R^2	.0072	.0087	.0115	.0110
AR(12)	16.85	11.26	9.27	13.09
ARCH(12)	90.11***	106.68***	95.53***	122.26***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter				
Fitted	.3933	.3662	.3384	.2768
Realized	.5549	.3128	.4773	.3035
September-March				
Fitted	.8822	.8215	.7591	.6208
Realized	.6196	.5474	.5550	.4905
October-April				
Fitted	.5611	.5225	.4828	.3949
Realized	.9650	.9569	.6860	.5504
Panel C: Joint Tests and Seasonality Tests			Asymptotic P-value	[Bootstrapped P-value]
Onset/Recovery Coefficients Jointly 0:				**.016** [**.026**]
Onset/Recovery Coefficients Jointly Equal:				.153 [.188]
Nonspecific Monthly Seasonality:				.902 [.978]
Fall vs. Winter Seasonality:				.592 [.637]
September vs. March Seasonality:				.396 [.403]
October vs. April Seasonality:				.292 [.332]
Panel D: Systems Equation Information Criteria and Model Statistics				
Proportion of Monthly Seasonal Variation in Returns Explained				0.63
GMM Test of Overidentification Restrictions				10.49
MMSC-BIC of Full Model/Constant-Only Model				-41.59/ -40.82
MMSC-HQIC of Full Model/Constant-Only Model				-20.98/ -20.21
Number of Parameters				8
Number of Moment Conditions				16
Number of Observations (01/52-12/07)				672

Notes: See the notes to notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\widehat{\mathrm{OR}}}\widehat{\mathrm{OR}}_t + \epsilon_{i,t}.$$

Table G.2
Model 2 (Debt Supply, Auction, and FOMC Cycles)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.501	0.607	0.599	0.598
	(1.017)	(0.813)	(0.706)	(0.610)
μ_{Auction}	0.218	0.056	0.087	-0.045
	(0.317)	(0.256)	(0.217)	(0.169)
$\mu_{\text{DebtToGDP}}$	-0.097	-0.525	-0.474	-0.445
	(1.683)	(1.354)	(1.194)	(1.039)
μ_{FOMC}	-0.173	-0.079	-0.116	-0.151
	(0.345)	(0.276)	(0.218)	(0.173)
R^2	0.001	-0.0011	-0.0022	0.0026
AR(12)	11.16	7.87	8.78	11.55
ARCH(12)	46.88^{***}	51.88^{***}	66.52^{***}	77.88^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	-.0275	-.0166	-.0219	-.0271
Realized	1.2009	0.8691	0.7417	0.5933
September-March Seasonality				
Fitted	0.0674	0.0284	0.0433	0.0572
Realized	1.3104	1.1443	1.0892	0.9081
October-April Seasonality				
Fitted	-.0870	-.0430	-.0613	-.0787
Realized	1.4465	1.2539	0.7212	0.5315
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				<**.001** [.133]
Fall Vs. Winter:				**.011** [**.054**]
September Vs. March:				<**.001** [**.011**]
October Vs. April:				.226 [.329]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				9.05
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-37.46/ -49.98
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-20.52/ -26.68
Number of Parameters				16
Number of Moment Conditions				24
Number of Observations (01/80 - 11/07)				335

Notes: See the notes to notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\text{Auction}}\text{Auction}_t + \mu_{i,\text{DebtToGDP}}\text{DebtToGDP}_t + \mu_{i,\text{FOMC}}\text{FOMC}_t + \epsilon_{i,t}.$$

Table G.3
Model 3 (Chen, Roll, and Ross Macro Factors)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.042	-0.061	-0.037	-0.004
	(0.243)	(0.209)	(0.179)	(0.152)
μ_{Term}	-0.003	0.004	0.005	0.012
	(0.037)	(0.029)	(0.025)	(0.021)
μ_{Default}	0.791^{***}	0.646^{**}	0.571^{***}	0.472^{***}
	(0.285)	(0.264)	(0.205)	(0.180)
μ_{IP}	-0.296^{***}	-0.288^{***}	-0.220^{***}	-0.172^{***}
	(0.081)	(0.072)	(0.066)	(0.051)
μ_{Inf}	-1.502^{***}	-1.174^{***}	-0.976^{***}	-0.899^{***}
	(0.572)	(0.432)	(0.367)	(0.341)
μ_{InfSurp}	-1.097^{**}	-0.589	-0.435	-0.228
	(0.506)	(0.365)	(0.312)	(0.271)
R^2	0.0528	0.051	0.0548	0.058
AR(12)	18.14	15.21	13.00	16.30
ARCH(12)	82.75^{***}	97.15^{***}	90.72^{***}	109.36^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.0033	-.0010	0.0009	0.0013
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	-.0747	-.0467	-.0352	-.0217
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	-.0184	-.0188	-.0135	-.0099
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.002** [.160]
Fall Vs. Winter:				**.076** [.114]
September Vs. March:				**.008** [**.022**]
October Vs. April:				**.011** [**.028**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				14.43^{*}
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-37.65/ -53.89
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-17.05/ -25.55
Number of Parameters				24
Number of Moment Conditions				32
Number of Observations (01/52 - 12/07)				672

Notes: See the notes to notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\text{Term}}\text{Term}_t + \mu_{i,\text{Default}}\text{Default}_t + \mu_{i,\text{IP}}\text{IP}_t + \mu_{i,\text{Inf}}\text{Inf}_t + \mu_{i,\text{InfSurp}}\text{InfSurp}_t + \epsilon_{i,t}.$$

Table G.4
Model 4 (Seasonally Unadjusted Macro Factors)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.333^{**}	0.238^{**}	0.239^{***}	0.196^{***}
	(0.140)	(0.112)	(0.090)	(0.074)
$\mu_{\mathrm{CPI_{SU}}}$	-0.589^{*}	-0.361	-0.417^{**}	-0.320^{*}
	(0.319)	(0.266)	(0.211)	(0.194)
$\mu_{\mathrm{IP_{SU}}}$	-0.099	-0.957	-1.217	-0.771
	(3.558)	(2.925)	(2.510)	(2.052)
$\mu_{\mathrm{PPI_{SU}}}$	-0.284^{*}	-0.188	-0.064	-0.029
	(0.161)	(0.116)	(0.110)	(0.094)
$\mu_{\mathrm{GDP_{SU}}}$	0.672	-1.403	-0.060	-0.603
	(2.700)	(2.223)	(1.819)	(1.472)
$\mu_{\mathrm{U_{SU}}}$	3.174^{***}	2.941^{***}	1.188^{**}	1.235^{**}
	(0.876)	(0.742)	(0.604)	(0.499)
R^2	0.04	0.0331	0.0184	0.0173
AR(12)	17.49	12.07	9.21	13
ARCH(12)	71.98^{***}	95.17^{***}	80.92^{***}	99.88^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.0694	-.0836	0.0494	-.0142
Realized	0.5333	0.2928	0.4644	0.2905
September-March Seasonality				
Fitted	0.1468	-.0307	0.0263	-.0136
Realized	0.6045	0.5524	0.5604	0.4955
October-April Seasonality				
Fitted	0.2525	0.1111	0.0763	0.0490
Realized	0.9665	0.9608	0.6888	0.5531
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				**<.001** [**.002**]
Fall Vs. Winter:				.136 [.184]
September Vs. March:				**.005** [**.013**]
October Vs. April:				**.019** [**.045**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				13.62^{*}
MMSC-BIC of Tabled Model/Constrained $\hat{\mathrm{OR}}$ Term Included				-38.32/ -51.97
MMSC-HQIC of Tabled Model/Constrained $\hat{\mathrm{OR}}$ Term Included				-17.81/ -23.77
Number of Parameters				24
Number of Moment Conditions				32
Number of Observations (01/52 - 12/06)				660

Notes: See the notes to notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\mathrm{CPI_{SU}}}\mathrm{CPI_{SU},}_t + \mu_{i,\mathrm{IP_{SU}}}IP_{\mathrm{SU},t} + \mu_{i,\mathrm{PPI_{SU}}}\mathrm{PPI_{SU},}_t + \mu_{i,\mathrm{GDP_{SU}}}\mathrm{GDP_{SU},}_t + \mu_{i,\mathrm{U_{SU}}}\mathrm{U_{SU},}_t + \epsilon_{i,t}.$$

Table G.5
Model 5 (Chen, Roll, and Ross plus Seasonally Unadjusted Macro Factors)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.056	-0.067	-0.057	-0.021
	(0.244)	(0.210)	(0.178)	(0.152)
μ_{Term}	-0.008	-0.001	0.001	0.010
	(0.037)	(0.029)	(0.026)	(0.021)
μ_{Default}	0.750***	0.623**	0.582***	0.484***
	(0.287)	(0.268)	(0.207)	(0.182)
$\mu_{\text{CPI}_{\text{SU}}}$	-0.888	-0.716	-0.600*	-0.414
	(0.548)	(0.446)	(0.333)	(0.298)
$\mu_{\text{IP}_{\text{SU}}}$	6.364	4.462	3.857	3.309
	(4.201)	(3.399)	(2.617)	(2.111)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.179	-0.091	0.028	0.052
	(0.155)	(0.114)	(0.103)	(0.088)
$\mu_{\text{GDP}_{\text{SU}}}$	3.547	1.139	2.411	1.724
	(2.816)	(2.299)	(1.832)	(1.515)
$\mu_{\text{U}_{\text{SU}}}$	1.644*	1.765**	0.168	0.376
	(0.961)	(0.788)	(0.606)	(0.508)
μ_{IP}	-0.376***	-0.329***	-0.288***	-0.223***
	(0.102)	(0.084)	(0.069)	(0.053)
μ_{Inf}	-0.516	-0.397	-0.503	-0.619
	(0.820)	(0.611)	(0.492)	(0.477)
μ_{InfSurp}	-0.188	0.092	-0.019	-0.001
	(0.623)	(0.487)	(0.383)	(0.353)
R^2	0.0742	0.0694	0.0617	0.0632
AR(12)	18.88*	13.80	11.53	15.39
ARCH(12)	76.61***	92.90***	93.29***	108.82***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.2103	0.0498	0.1538	0.0822
Realized	0.5333	0.2928	0.4644	0.2905
September-March Seasonality				
Fitted	0.3758	0.1901	0.2286	0.1710
Realized	0.6045	0.5524	0.5604	0.4955
October-April Seasonality				
Fitted	0.3616	0.2189	0.1781	0.1431
Realized	0.9665	0.9608	0.6888	0.5531
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				<**.001** [**.092**]
Fall Vs. Winter:				.145 [.190]
September Vs. March:				**.061** [.109]
October Vs. April:				**.042** [**.066**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				14.49*
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-37.45/ -53.76
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-16.94/ -25.55
Number of Parameters				44
Number of Moment Conditions				52
Number of Observations (01/52 - 12/06)				660

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\text{Term}}\text{Term}_t + \mu_{i,\text{Default}}\text{Default}_t + \mu_{i,\text{CPI}_{\text{SU}}}\text{CPI}_{\text{SU},t} + \mu_{i,\text{IP}_{\text{SU}}}\text{IP}_{\text{SU},t} + \mu_{i,\text{PPI}_{\text{SU}}}\text{PPI}_{\text{SU},t}$$

$$+\mu_{i,\text{GDP}_{\text{SU}}}\text{GDP}_{\text{SU},t} + \mu_{i,\text{U}_{\text{SU}}}\text{U}_{\text{SU},t} + \mu_{i,\text{IP}}\text{IP}_t + \mu_{i,\text{Inf}}\text{Inf}_t + \mu_{i,\text{InfSurp}}\text{InfSurp}_t + \epsilon_{i,t}.$$

Table G.6
Model 6 (Real-Time Macro Factors)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.500*	0.267	0.344	0.211
	(0.304)	(0.237)	(0.210)	(0.171)
μ_{USurpC}	-1.713	-0.144	-0.545	0.354
	(1.573)	(1.216)	(1.266)	(1.021)
μ_{USurpE}	2.124**	1.826***	1.607***	1.219***
	(0.879)	(0.669)	(0.566)	(0.465)
μ_{ProbC}	1.425**	1.236**	1.032**	0.876**
	(0.689)	(0.592)	(0.465)	(0.367)
μ_{IPSurp}	0.055	0.081	0.029	0.082
	(0.196)	(0.159)	(0.143)	(0.110)
μ_{IP}	1.533***	1.331***	1.043***	1.173***
	(0.457)	(0.369)	(0.328)	(0.272)
μ_{U}	0.061***	0.062***	0.046***	0.051***
	(0.022)	(0.016)	(0.014)	(0.012)
$\mu_{\Delta\text{Default}}$	-0.048***	-0.026*	-0.031***	-0.020**
	(0.016)	(0.014)	(0.011)	(0.009)
μ_{Term}	-0.054	-0.032	-0.027	-0.020
	(0.049)	(0.040)	(0.033)	(0.027)
μ_{InfSurp}	-1.391*	-0.604	-0.447	-0.227
	(0.759)	(0.535)	(0.468)	(0.406)
μ_{Inf}	-2.362***	-1.761***	-1.546***	-1.343***
	(0.653)	(0.493)	(0.428)	(0.362)
R^2	0.1472	0.1389	0.1633	0.1941
AR(12)	16.10	13.50	12.29	14.11
ARCH(12)	26.63***	28.92***	50.21***	42.55***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.2981	0.1877	0.1866	0.1550
Realized	0.8125	0.5729	0.6853	0.4504
September-March Seasonality				
Fitted	0.0107	-.0010	0.0250	0.0185
Realized	0.8565	0.7955	0.8178	0.7509
October-April Seasonality				
Fitted	-.0205	-.0217	-.0051	-.0097
Realized	1.0951	1.2034	0.8506	0.6192
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				<**.001** [**.065**]
Fall Vs. Winter:				.175 [.235]
September Vs. March:				**.001** [**.005**]
October Vs. April:				.109 [.179]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				11.37
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-37.62/ -54.62
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-19.07/ -29.11
Number of Parameters				44
Number of Moment Conditions				52
Number of Observations (12/65 - 12/03)				457

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\text{USurpC}}\text{USurpC}_t + \mu_{i,\text{USurpE}}\text{USurpE}_t + \mu_{i,\text{ProbC}}\text{ProbC}_t + \mu_{i,\text{IPSurp}}\text{IPSurp}_t + \mu_{i,\text{IP}}\text{IP}_t + \mu_{i,\text{U}}\text{U}_t + \mu_{i,\Delta\text{Default}}\Delta\text{Default}_t$$
$$+\mu_{i,\text{Term}}\text{Term}_t + \mu_{i,\text{InfSurp}}\text{InfSurp}_t + \mu_{i,\text{Inf}}\text{Inf}_t + \epsilon_{i,t}.$$

Table G.7
Model 7 (Cross Hedging)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.016	0.010	0.006	-0.039
	(0.194)	(0.147)	(0.118)	(0.098)
μ_{σ^2}	0.010	0.008	0.009*	0.010**
	(0.008)	(0.006)	(0.005)	(0.004)
μ_{Turnover}	-0.873	-1.032	-0.733	-0.574
	(0.861)	(0.690)	(0.584)	(0.488)
$\mu_{\text{Liquidity}}$	5.868	3.379	1.833	2.887
	(6.329)	(5.462)	(4.551)	(4.102)
R^2	0.0048	0.0074	0.0092	0.0113
AR(12)	16.27	10.94	9.45	12.58
ARCH(12)	69.28 ***	95.97 ***	85.4 ***	100.74 ***
Return Magnitude Seasonalities				
Fall-Winter Seasonality				
Fitted	0.0141	0.0192	0.0160	0.0120
Realized	0.6646	0.4581	0.5651	0.3725
September-March Seasonality				
Fitted	-.0238	-.0182	-.0146	-.0163
Realized	0.7564	0.6525	0.6489	0.5787
October-April Seasonality				
Fitted	0.1096	0.1303	0.0953	0.0750
Realized	0.9788	0.9765	0.7191	0.5274
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.004** [.186]
Fall Vs. Winter:				.113 [.147]
September Vs. March:				**.001** [**.001**]
October Vs. April:				.261 [.316]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				8.08
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ added				-42.68/ -58.21
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ added				-22.96/ -31.10
Number of Parameters				16
Number of Moment Conditions				24
Number of Observations (08/60 - 12/07)				569

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\sigma^2}\sigma_t^2 + \mu_{i,\text{Turnover}}\text{Turnover}_t + \mu_{i,\text{Liquidity}}\text{Liquidity}_t + \epsilon_{i,t}.$$

Table G.8
Model 8 (Cross Hedging with Treasury Return Volatility)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.252	0.261	0.071	-0.110
	(0.569)	(0.384)	(0.312)	(0.252)
μ_{σ^2}	0.010	0.011	0.014	0.012
	(0.014)	(0.012)	(0.010)	(0.008)
μ_{Turnover}	-1.385**	-1.459**	-1.131**	-0.921**
	(0.700)	(0.582)	(0.508)	(0.415)
$\mu_{\text{TreasuryVol}}$	0.118	-0.069	-0.021	0.081
	(0.095)	(0.126)	(0.133)	(0.154)
$\mu_{\text{Liquidity}}$	1.582	1.023	-2.056	-1.998
	(19.96)	(15.71)	(13.13)	(10.62)
R^2	0.0092	0.0239	0.024	0.0276
AR(12)	8.41	10.17	10.35	9.7
ARCH(12)	18.41	12.82	11.04	10.17
Return Magnitude Seasonalities				
Fall-Winter Seasonality				
Fitted	0.0178	0.0027	0.0206	0.0243
Realized	0.7455	0.4450	0.3672	0.1996
September-March Seasonality				
Fitted	-.0091	-.0593	-.0263	-.0064
Realized	2.1930	1.9721	1.5871	1.2276
October-April Seasonality				
Fitted	0.4019	0.4102	0.3378	0.2804
Realized	0.8708	0.6515	0.4433	0.3577
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				<**.001** [<**.001**]
Fall Vs. Winter:				**.028** [.354]
September Vs. March:				<**.001** [**.010**]
October Vs. April:				.605 [.845]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				19.87
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ added				-82.61/ -96.75
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ added				-48.76/ -57.82
Number of Parameters				20
Number of Moment Conditions				40
Number of Observations (01/94 - 12/07)				168

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\sigma^2}\sigma_t^2 + \mu_{i,\text{Turnover}}\text{Turnover}_t + \mu_{i,\text{Liquidity}}\text{Liquidity}_t + \mu_{i,\text{TreasuryVol}}\text{TreasuryVol}_t + \epsilon_{i,t}.$$

Table G.9
Model 9 (Baker-Wurgler Sentiment)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.235^{*}	0.169	0.194^{**}	0.162^{**}
	(0.124)	(0.104)	(0.085)	(0.071)
$\mu_{\text{BWSentiment}}$	0.777^{**}	0.573^{**}	0.584^{***}	0.392^{**}
	(0.313)	(0.246)	(0.204)	(0.164)
R^2	0.0149	0.0083	0.0125	0.0107
AR(12)	21.44 **	13.40	10.66	14.43
ARCH(12)	52.98^{***}	69.40^{***}	67.56^{***}	81.84^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.0067	0.0050	0.0050	0.0034
Realized	0.7290	0.5083	0.6261	0.4145
September-March Seasonality				
Fitted	-.0960	-.0707	-.0721	-.0485
Realized	0.7257	0.6898	0.7139	0.6610
October-April Seasonality				
Fitted	0.0319	0.0235	0.0239	0.0161
Realized	1.0881	1.1964	0.8499	0.6273
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				<**.001** [**.092**]
Fall Vs. Winter:				.141 [.213]
September Vs. March:				**.001** [**.007**]
October Vs. April:				**.054** [.100]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				9.36
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-40.00/ -54.76
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-21.21/ -28.93
Number of Parameters				8
Number of Moment Conditions				16
Number of Observations (03/66 - 12/05)				478

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\text{BWSentiment}}\text{BWSentiment}_{t-1} + \epsilon_{i,t}.$$

Table G.10
Model 10 (Michigan Consumer Sentiment)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.151^{*}	0.105	0.134^{**}	0.115^{**}
	(0.091)	(0.078)	(0.064)	(0.053)
$\mu_{\text{MSentiment}}$	0.004	-0.005	0.003	0.004
	(0.034)	(0.025)	(0.024)	(0.020)
R^2	-0.0007	0.0009	-0.0009	-0.0015
AR(12)	17.79	12.44	10.42	14.24
ARCH(12)	88.72^{***}	102.92^{***}	89.02^{***}	116.40^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	-.0034	0.0042	-.0025	-.0032
Realized	0.5709	0.3232	0.4925	0.3054
September-March Seasonality				
Fitted	-.0003	0.0004	-.0003	-.0003
Realized	0.6755	0.6020	0.5807	0.5138
October-April Seasonality				
Fitted	-.0027	0.0033	-.0020	-.0025
Realized	0.9868	0.9786	0.6965	0.5569
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.010** [.259]
Fall Vs. Winter:				.163 [.207]
September Vs. March:				**.018** [**.044**]
October Vs. April:				**.039** [**.065**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				11.27
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-40.66/ -56.70
MMSC-HQIC of Tabled Model/$\hat{\text{OR}}$ Term Included				-20.15/ -28.50
Number of Parameters				8
Number of Moment Conditions				16
Number of Observations (02/53 - 12/07)				659

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\text{MSentiment}}\text{MSentiment}_{t-1} + \epsilon_{i,t}.$$

Table G.11
Model 11 (Fama-French Factors)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.562**	-0.508**	-0.410**	-0.332**
	(0.243)	(0.207)	(0.174)	(0.153)
μ_{SMB}	-0.104***	-0.078***	-0.091***	-0.067***
	(0.038)	(0.028)	(0.021)	(0.018)
μ_{HML}	-0.017	-0.002	-0.019	-0.006
	(0.040)	(0.033)	(0.027)	(0.022)
μ_{MOM}	0.029	0.031	0.037*	0.028
	(0.032)	(0.027)	(0.022)	(0.019)
μ_{Default}	0.777***	0.656***	0.586***	0.481***
	(0.286)	(0.249)	(0.210)	(0.183)
μ_{Term}	0.033	0.032	0.033	0.034
	(0.041)	(0.030)	(0.025)	(0.021)
$\mu_{\hat{r}_m}$	0.151***	0.116***	0.086***	0.061***
	(0.036)	(0.029)	(0.022)	(0.019)
R^2	0.0628	0.0609	0.0671	0.0604
AR(12)	19.10*	13.67	12.23	13.61
ARCH(12)	100.30***	93.23***	111.26***	142.50***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.2577	0.1954	0.2321	0.1648
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	-.2666	-.2032	-.1347	-.0952
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	0.0601	0.0410	0.0885	0.0659
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				**.003** [.159]
Fall Vs. Winter:				.485 [.514]
September Vs. March:				**.001** [**.005**]
October Vs. April:				.118 [.168]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				9.51
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-42.57/ -58.72
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-21.96/ -30.38
Number of Parameters				28
Number of Moment Conditions				36
Number of Observations (01/52 - 12/07)				672

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\text{SMB}}\text{SMB}_t + \mu_{i,\text{HML}}\text{HML}_t + \mu_{i,\text{MOM}}\text{MOM}_t + \mu_{i,\text{Default}}\text{Default}_t + \mu_{i,\text{Term}}\text{Term}_t + \mu_{i,r\hat{m}}r\hat{m}_t + \epsilon_{i,t}.$$

Table G.12
Model 12 (Conditional CAPM)

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
δ	-6.339***	-8.371***	-6.664***	-7.456***
	(1.442)	(3.007)	(1.127)	(1.343)
$\delta_{\widetilde{D/P}}$	-0.450	-0.997	-1.115	-0.629
	(3.969)	(6.809)	(3.833)	(3.863)
$\delta_{\tilde{r}_m}$	-0.116**	-0.164*	-0.151***	-0.159***
	(0.052)	(0.088)	(0.049)	(0.053)
δ_{Term90}	2.312*	2.850*	0.239	0.682
	(1.269)	(1.483)	(1.977)	(1.573)
δ_{Default}	1.217	2.106	1.455**	1.724**
	(0.741)	(1.345)	(0.706)	(0.732)
R^2	-0.0304	-0.0733	-0.1087	-0.1316
AR(12)	23.85**	16.26	18.43	21.85**
ARCH(12)	60.52***	18.79*	14.90	14.06
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.1310	0.1260	0.1194	0.1047
Realized	0.5553	0.3120	0.4781	0.3042
September-March Seasonality				
Fitted	0.0047	-.0025	0.0079	0.0011
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	0.1236	0.1005	0.0638	0.0573
Realized	0.9650	0.9569	0.6860	0.5504

Panel C: Seasonality Test P-values: Asymptotic / [Bootstrapped]	
Nonspecific Monthly Seasonality:	**.002** [.618]
Fall Vs. Winter:	.135 [.291]
September Vs. March:	**.007** [**.047**]
October Vs. April:	.126 [.252]
Panel D: Systems Equation Information Criteria and Model Statistics	
GMM Test of Overidentification Restrictions	37.45
MMSC-BIC of Tabled Model/Constrained $\hat{\text{O}}$R Term Included	-222.90/ -236.46
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{O}}$R Term Included	-119.89/ -125.73
Number of Parameters	20
Number of Moment Conditions	60
Number of Observations (02/52 - 12/07)	671

Panel E: Seasonality in Monthly Sharpe Ratio, Averaged Across Series												
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Realized	.021	-.030	-.040	-.070	.013	.067	.006	.040	.072	.099	.095	.025
Fitted	.024	.024	.020	.020	.023	.022	.019	.030	.020	.035	.047	.023

Notes: See the notes to Table C.2. In addition to the instruments listed in the notes to Table C.2, the instruments used to form the GMM moment conditions in this case include a single lag of the dependent variable and a single lag of the explanatory variables. The model is:

$$E_{t-1}(\tilde{r}_{i,t}) = \lambda_t \cdot \hat{\sigma}_t^2$$

$$\lambda_t = \exp(\delta_i + \delta_{i,\widetilde{D/P}}\widetilde{D/P}_t + \delta_{i,\tilde{r}_m}\tilde{r}_{m,t-1} + \delta_{i,\text{Default}}\text{Default}_t + \delta_{i,\text{Term90}}\text{Term90}_{t-1}).$$

Appendix H Weather

Hirshleifer and Shumway (2003) study index returns for 26 international stock exchanges and find a significant relationship between index returns and the amount of morning sunshine in a given exchange's location. They explain this finding in terms of misattribution: an investor who is in a good or bad mood on account of the weather may misattribute his/her feelings to investment prospects, and this could result in a link between returns and the weather.

Medical research has established that seasonal depression arises as a consequence of diminished exposure to daylight, not weather. Nevertheless, the weather in any given location can follow distinct seasonal patterns, and hence one might wonder whether seasonality in Treasury returns is related to seasonality in the weather. To address this concern, we estimate a series of models.

When we regress daily Treasury returns on temperature, cloud cover, and rainfall (all seasonally adjusted following the method of Hirshleifer and Shumway (2003)), the coefficient estimates are uniformly negative, with some significant estimates for cloud cover at standard levels of significance. When we include the onset/recovery variable in the model, the coefficient estimates on the weather variables remain negative (with some significant estimates for cloud cover and temperature), and the onset/recovery variable is positive and significant at the 5 percent level for each of the 5, 7, 10, and 20-year series. When we employ seasonally unadjusted weather data in these models instead of demeaned weather data, the results are qualitatively identical. The coefficient estimates on the weather variables are uniformly negative and occasionally sigificant, and the onset/recovery variable has a uniformly positive coefficient estimate which is significant at the 5 percent level. Thus the observed seasonal variation in Treasury returns does not appear to arise due to investors reacting to weather.

Table H.1
Daily Model with Seasonally Adjusted Weather Data

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
μ	0.021^{***}	0.013^{**}	0.015^{***}	0.013^{***}
	(0.008)	(0.006)	(0.005)	(0.004)
$\mu_{\text{CloudCover}}$	-0.007^{**}	-0.004	-0.003^{*}	-0.002
	(0.003)	(0.002)	(0.002)	(0.001)
$\mu_{\text{Temperature}}$	-0.003	-0.002	-0.002	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)
μ_{Rainfall}	-0.001	-0.001	-0.001	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)
R^2	0.0015	0.0008	0.0009	0.0007
AR(12)	31.68^{***}	21.78^{**}	27.53^{***}	22.68^{**}
ARCH(12)	148.49^{***}	312.15^{***}	214.61^{***}	294.81^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter				
Fitted	0.0001	0.0001	0.0001	0.0000
Realized	0.0343	0.0275	0.0211	0.0175
September-March				
Fitted	-.0002	-.0001	-.0001	-.0000
Realized	0.0691	0.0734	0.0640	0.0523
October-April				
Fitted	-.0001	-.0000	-.0000	-.0000
Realized	0.0735	0.0616	0.0407	0.0334
Panel C: Seasonality Test Asymptotic P-values				
Fall Vs. Winter:				.192
September Vs. March:				**.001**
October Vs. April:				.726
Panel D: Systems Equation Information Criteria and Model Statistics				
Proportion of Monthly Variation in Returns Explained				0.00
GMM Test of Overidentification Restrictions				20.55
MMSC-BIC of Full Model/Constrained $\hat{\text{OR}}$ term added				-154.15/ -177.81
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ term added				-70.48/ -81.59
Number of Parameters				16
Number of Moment Conditions				36
Number of Observations (01/1982 - 12/2007)				6215

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu + \mu_{CloudCover}\text{CloudCover}_t + \mu_{\text{Temperature}}\text{Temperature}_t + \mu_{\text{Rainfall}}\text{Rainfall}_t + \epsilon_t.$$

The explanatory variables are based on data from the National Atmospheric and Oceanic Administration (NOAA) National Climate Data Center Global Hourly Surface Data. We construct daily weather variables are by averaging all hourly weather observations between the period from 6 a.m. to 4 p.m., local time. C*loudCover* is average hourly percent of sky overcast, T*emperature* is average hourly temperature in Celsius, and R*ainfall* is average hourly precipitation in millimeters. The instruments used to form the GMM moments include the constant, a lag of the value-weighted CRSP equity index return (entire U.S. market return, including dividends), contemporaneous 30-day T-bill returns, and lags of each of the explanatory variables (in the case of this model, the CloudCover, Temperature, and Rainfall series).

Table H.2
Daily Model with Onset/Recovery and Seasonally Adjusted Weather Data

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
μ	0.021^{***}	0.014^{**}	0.015^{***}	0.013^{***}
	(0.007)	(0.006)	(0.005)	(0.004)
$\mu_{\hat{OR}}$	0.074^{**}	0.064^{**}	0.053^{**}	0.045^{**}
	(0.036)	(0.028)	(0.022)	(0.018)
$\mu_{\text{CloudCover}}$	-0.007^{**}	-0.004	-0.003^{*}	-0.002
	(0.003)	(0.002)	(0.002)	(0.001)
$\mu_{\text{Temperature}}$	-0.003	-0.002^{*}	-0.002^{*}	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)
μ_{Rainfall}	-0.001	-0.001	-0.001	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)
R^2	0.0023	0.0021	0.0022	0.0023
AR(12)	31.45^{***}	21.47^{**}	27.03^{***}	22.03^{**}
ARCH(12)	149.94^{***}	313.30^{***}	215.52^{***}	296.71^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter				
Fitted	0.0262	0.0227	0.0189	0.0159
Realized	0.0343	0.0275	0.0211	0.0175
September-March				
Fitted	0.0580	0.0504	0.0418	0.0352
Realized	0.0691	0.0734	0.0640	0.0523
October-April				
Fitted	0.0375	0.0325	0.0270	0.0228
Realized	0.0735	0.0616	0.0407	0.0334
Panel C: Seasonality Test Asymptotic P-values				
Fall Vs. Winter:				.962
September Vs. March:				**.083**
October Vs. April:				.369
Onset/Recovery Coefficients Jointly 0:				.193
Onset/Recovery Coefficients Jointly Equal:				.457
Panel D: Systems Equation Information Criteria and Model Statistics				
Proportion of Monthly Variation in Returns Explained				0.70
GMM Test of Overidentification Restrictions				20.72
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ term added				-153.97/ -153.97
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ term added				-70.30/ -70.30
Number of Parameters				20
Number of Moment Conditions				40
Number of Observations (01/1982 - 12/2007)				6215

Notes: See the notes to Table H.1.

Table H.3
Daily Model with Seasonally Unadjusted Weather Data

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
μ	0.066^{***}	0.036^{**}	0.033^{***}	0.024^{***}
	(0.020)	(0.015)	(0.012)	(0.009)
$\mu_{\text{CloudCover}_{SU}}$	-0.007^{**}	-0.004^{*}	-0.003^{*}	-0.002
	(0.003)	(0.002)	(0.002)	(0.001)
$\mu_{\text{Temperature}_{SU}}$	-0.000	-0.000	0.000	0.000
	(0.001)	(0.001)	(0.000)	(0.000)
$\mu_{\text{Rainfall}_{SU}}$	-0.001	-0.001	-0.000	-0.000
	(0.002)	(0.001)	(0.001)	(0.001)
R^2	0.0013	0.0008	0.0009	0.0008
AR(12)	31.63^{***}	21.68^{**}	27.52^{***}	22.68^{**}
ARCH(12)	148.69 ***	312.61 ***	215.14 ***	296.29 ***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter				
Fitted	-.0003	0.0010	0.0014	0.0013
Realized	0.0343	0.0275	0.0211	0.0175
September-March				
Fitted	-.0022	0.0013	0.0025	0.0026
Realized	0.0691	0.0734	0.0640	0.0523
October-April				
Fitted	0.0031	0.0023	0.0023	0.0017
Realized	0.0735	0.0616	0.0407	0.0334
Panel C: Seasonality Test Asymptotic P-values				
Fall Vs. Winter:				.335
September Vs. March:				**.002**
October Vs. April:				.873
Panel D: Systems Equation Information Criteria and Model Statistics				
Proportion of Monthly Variation in Returns Explained				0.07
GMM Test of Overidentification Restrictions				20.44
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ added				-154.25/ -177.21
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ added				-70.58/ -80.99
Number of Parameters				16
Number of Moment Conditions				36
Number of Observations (01/1982 - 12/2007)				6215

Notes: See the notes to Table H.1.

Table H.4
Daily Model with Onset/Recovery and Seasonally Unadjusted Weather Data

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
μ	0.077^{***}	0.045^{***}	0.040^{***}	0.030^{***}
	(0.020)	(0.015)	(0.012)	(0.010)
$\mu_{\hat{OR}}$	0.093^{**}	0.076^{**}	0.061^{**}	0.051^{**}
	(0.040)	(0.031)	(0.025)	(0.021)
$\mu_{\text{CloudCover}_{SU}}$	-0.007^{**}	-0.004	-0.003^{*}	-0.002
	(0.003)	(0.002)	(0.002)	(0.001)
$\mu_{\text{Temperature}_{SU}}$	-0.001	-0.001	-0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.000)
$\mu_{\text{Rainfall}_{SU}}$	-0.001	-0.001	-0.001	-0.000
	(0.002)	(0.001)	(0.001)	(0.001)
R^2	0.0021	0.0018	0.0019	0.002
AR(12)	31.40^{***}	21.42^{**}	27.09^{***}	22.16^{**}
ARCH(12)	150.28^{***}	313.71^{***}	216.15^{***}	298.37^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter				
Fitted	0.0265	0.0228	0.0189	0.0159
Realized	0.0343	0.0275	0.0211	0.0175
September-March				
Fitted	0.0569	0.0496	0.0411	0.0348
Realized	0.0691	0.0734	0.0640	0.0523
October-April				
Fitted	0.0470	0.0382	0.0310	0.0257
Realized	0.0735	0.0616	0.0407	0.0334
Panel C: Seasonality Test Asymptotic P-values				
Fall Vs. Winter:				.953
September Vs. March:				**.069**
October Vs. April:				.338
Onset/Recovery Coefficients Jointly 0:				.180
Onset/Recovery Coefficients Jointly Equal:				.294
Panel D: Systems Equation Information Criteria and Model Statistics				
Proportion of Monthly Variation in Returns Explained				0.62
GMM Test of Overidentification Restrictions				20.26
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ added				-154.43/ -154.43
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ added				-70.76/ -70.76
Number of Parameters				20
Number of Moment Conditions				40
Number of Observations (01/1982 - 12/2007)				6215

Notes: See the notes to Table H.1.

Appendix I Real-Time Macroeconomic Data: Constructing the Expected and Surprise Series

In this appendix, we detail the construction of the expected and surprise macroeconomic variables. We focus first on constructing the change in the unemployment rate series and the unemployment surprise series. We then turn to the expected and surprise industrial production growth rate series. Finally, we detail the construction of the two inflation rate surprise series.

I.1 Construction of the Change in the Unemployment Rate

Following Boyd, Hu, and Jagannathan (2005), we consider several measures of the surprise in the change in the unemployment rate, which is constructed using the realized and expected change in the unemployment rate. We will describe two different ways we estimate the *realized* unemployment rate change (one using "real-time vintage" data, which we describe below, and another using currently available, updated data) and two different ways we compute the *expected* unemployment rate change (one using real-time vintage data, and another using currently available, updated data). As the surprise in the unemployment rate change is calculated as the difference between the realized and the expected, we have available to us four distinct measures of the surprise. Below, we describe each of these four measures in detail, but first we provide some additional information about the realized and expected unemployment rate change series.

Our best estimate of the realized unemployment rate available to market participants in the past comes from the Philadelphia Federal Reserve Bank's real-time vintage unemployment rate data. (For extensive information on the real-time vintage data sets we use, see Croushore and Stark (2001).) These vintages, or snapshots, of the unemployment data contain the original, historic data which were initially announced at quarterly intervals, on the 15th day of the middle month of each quarter. Because the unemployment data were announced quarterly, any given month's unemployment rate announcement occurred 2 to 10 weeks after the month in question.[10] Thus, when we seek to estimate a particular month's *surprise* in the unemployment rate change, we cannot possibly use truly contemporaneous information about the realized rate, since it had not yet been announced at that point in time. Instead we use the nearest available subsequent realization announcement. For example, if we intend to estimate the February surprise, we use the realized February unemployment rate which is announced on May 15. We believe this use of the real-time vintage data is as close as we can come to estimating market participants' real-time information set. As an alternate estimate, we also use the most recent (latest) data revision available in 2005.

Likewise, in forming our best estimate of market participants' expected unemployment rate, we have two possibilities. Our best estimate is a real-time prediction of the unemployment rate change based on using real-time vintage data. We use the model selected by Boyd, Hu, and Jagannathan (2005), including

[10] It is worth highlighting the timing inherent in the real-time vintage series. For instance, when the original second quarter report was made available on May 15th of a given year, data for February, March, and April were announced, and revisions were made to the previous announcement which, in this example, was made in February. The February announcement included data for January, as well as December and November from the previous year. After the May report, there were no more updates in real time until the 15th of August, when the May, June and July numbers were reported and previous data were updated.

three lags of industrial production growth, one lag of the unemployment rate change, the change in the 3-month T-bill rate, and the change in the default yield spread between Baa and Aaa corporate bonds.[11] (Because the model relies on industrial production data, further details on this model are provided below, after the construction of the industrial production series has been described.) In forming a given month's prediction, we use only information available to market participants in the previous month. For example, in forming the February prediction, we use information that was available to market participants in January, as indicated in the real-time vintage series.[12] Only data available to real-time market participants were used in constructing this predicted unemployment rate, either as conditioning information to form forecasts or to estimate model parameters. The result is a series of real-time, out-of-sample predicted values, which we use as an estimate of market participants' expected unemployment rate changes. As an alternate estimate of market participants' expected unemployment rate change, we use a predicted value that comes from the Boyd, Hu, and Jagannathan model using, instead of the real-time vintage data, the most recent (latest) data revision available in 2005.

Combining these predicted series and realized series, we compute four distinct measures of the surprise in the unemployment rate change. Our first and primary method is to compute the surprise by comparing the real-time predicted rate change (based on the real-time vintage data) to the nearest available subsequent realization announcement (again using the real-time vintage data). This method comes closest to capturing the surprise market participants would have experienced, being based on very nearly the same information they would have had available during the month in question. Our second method is to compare the real-time vintage prediction to the the most recent (latest) revision available in 2005. That is, for each month, we compare our model's real-time, out-of-sample predicted value to the current best estimate of what the realized unemployment rate change was during each month in the past. This second method probably overstates the surprise, as it uses revised data to measure our forecast error, introducing data revisions into the surprise which market participants did not have access to in real time. Our third method uses the predicted value based on the most recent, currently available revision of the data available in 2005. Then the surprise is estimated by subtracting this prediction of the revised change in unemployment rate from the real-time vintage unemployment rate change. This third method probably understates the surprise, as it uses revised data in-sample to make "predictions" of real-time unrevised data. Finally, for our fourth method, we use in-sample predictions and realizations based on the most recently updated data to measure the surprise of market participants. This approach uses future information and should be able to "predict" real-time stock and Treasury returns differently than any of the previous three measures, all of which use some real-time vintage data in estimating the surprise in the unemployment rate change.[13]

[11] Boyd, Hu, and Jagannathan's choice of the model specification for the unemployment rate change was based only on data preceding 1962, so that the model was selected on a sample that pre-dates the 1965-2003 period we examine in the paper, even accounting for lags used in our model.

[12] An implication of the quarterly announcement structure of the historic unemployment rate data is that in June of a given year, for instance, construction of a real-time forecast for the July unemployment rate change can use unemployment rate data no more recent than April.

[13] One could argue that all four measures use some degree of information that may not have been fully available to market participants in real time, though we do our best to come as close as possible to replicating the information set they had at their disposal. To the extent that we are unable to completely avoid the use of some "future" information in constructing

Results we present are based on the first method for estimating surprises in the change in unemployment. Unreported robustness checks (details of which are available on request) indicate that our findings regarding the separate seasonal effect are invariant to using any of the four methods described above for measuring the surprise in the unemployment rate change.

I.2 Construction of the Growth in Industrial Production Series and its Use in Forecasting Unemployment

We estimate the surprise in the industrial production growth rate as the difference between an out-of-sample, real-time forecast of the growth in industrial production for month t and the realized month t growth in industrial production.

The original monthly industrial production data were announced monthly, unlike the quarterly announced unemployment rate data. This adds a small degree of complexity to constructing forecasts that market participants might have made in real time. For instance, when forming the unemployment rate change surprise described above, we condition on lagged industrial production growth. Hence, in June of a given year, the forecast for the July unemployment rate change can use industrial production data from May (which was known in June in real time) even though the most recently available unemployment rate change data are for April. This implies that we need to forecast the May and June change in unemployment and the June industrial production growth rate to forecast the July unemployment rate change (and hence form the July unemployment rate change surprise). Finally, we also need to forecast industrial production growth in July based on the May industrial production data so that we can form the surprise in the July industrial production growth rate.

We use the Bayesian Information Criterion (BIC) to pick the forecasting model for industrial production growth. The best model by BIC is a simple AR(13) model. We considered models incorporating lags of the change in the 3-month Treasury bill rate, the change in the corporate bond spread, and the unemployment rate change, as well as models with fewer lags of the industrial production growth, but they were less favored based on BIC. The best model removed all evidence of autocorrelation and heteroskedasticity.

Further details on the mechanics underlying estimation of the surprise in the unemployment rate change and in the industrial production growth rate are as follows. To forecast, for instance, the May change in the unemployment rate, we need the April unemployment rate change data, however, April data were not available to market participants in real time. Only information announced in February would have been available, at which time the unemployment rate data for November, December, and January would have been announced. Hence, data for January are the most recent information a market participant would have had access to in forming the May forecast during the month of April. Real-time estimates of the unemployment rate change surprise in May are therefore based on the unemployment rate change forecast made with the February vintage of real-time unemployment rate data and the April vintage of real-time industrial production data. The implication is that the unemployment rate change forecast has to be made four periods ahead. This forecast is made by rolling out the monthly unemployment rate change model,

some of our macroeconomic series, we give advantage to the macroeconomic variables in "predicting" equity and Treasury returns, which we believe prejudices our robustness check against the finding of a separate seasonal effect.

forecasting the February unemployment rate change using the February vintage unemployment rate data (which includes data only as recent as January) using this forecast to form the March forecast of the unemployment rate change (substituting the forecasted February value for the missing realized February unemployment rate change), and so on, until we make the May unemployment rate change forecast. This forecasting procedure uses April vintage industrial production data, which includes data announced only as recently as March, however, to make the May unemployment rate change forecast we need the April industrial production growth rate data. Thus we take our forecasting model for industrial production growth and make a forecast for the April industrial production growth rate, and use this forecast in place of the realized April industrial production growth, forecasting the May unemployment rate change. As we also need the May forecast for the industrial production growth rate to form the May surprise in the industrial production growth rate, we roll out our forecasting model for industrial production growth one period, using forecasted industrial production growth for April in place of realized lagged industrial production growth in the industrial production growth forecasting model.

I.3 Construction of the Inflation Surprise Series

We calculate the inflation rate surprise in two ways. First, we compare the expected inflation (calculated as described below) with the realized inflation, as measured in *real time.* (As the real-time inflation measure is only available starting in mid-1994, we splice the 1994-to-present "real-time" inflation series with the 1965-to-1994 "most-recent" inflation series to allow estimation of the macroeconomic model using several decades of data.) Second, we compare the expected inflation with the realized inflation, as measured *most recently,* taking into account data revisions. The first (real-time) measure probably understates the surprise somewhat, as market participants likely had better data available to them than we assume. The second (revised) measure probably overstates the surprise, taking into account revisions that market participants could not likely have anticipated in real time.

The expected inflation series is constructed using a time-series structural model, including a lag of the real-time unemployment change, a lag of the change in the 90-day Treasury-bill rate and an ARMA(1,1) time series specification. This model was selected as the best using the BIC criterion, choosing among models with up to 13 lags of inflation, two moving average lags, and one lag of each of the real-time unemployment change, change in the yield spread of Aaa and Baa corporate bonds, and change in the 90-day Treasury bill rate. The selected model removed all evidence of autocorrelation and heteroskedasticity at the 5 percent critical level.

Appendix J Full Set of Regression Results for Model 2′ through Model 12′

We report the full set of coefficient estimates and statistics from estimating Model 2 ′ through Model 12 ′ (i.e., Model 2 through Model 12 that have been modified to include the onset/recovery variable as an additional explanatory variable). For each model, we conduct a joint estimation for the 20-year, 10-year, 7-year, and 5-year Treasury return series, using Hansen's (1982) GMM and Newey and West (1987, 1994) HAC standard errors. The estimation details are analogous to the presentation in the main text.[14] As in Appendix G, tables are numbered according to model number.

Overall, there is strong evidence that onset/recovery is statistically significant in Models 2-12, and that its inclusion eliminates evidence of seasonal variation in the residuals. Further, based on information in Panel B of all of the tables, we can see that the fitted series do a good job of matching the magnitude of seasonal variation in the realized series. Additionally, the information criteria in Panel D reveal that the best performing model is that with the constrained onset/recovery model. In Panel E of Table J.12 we consider seasonal variation in Sharpe ratios that arise from estimating the conditional CAPM, averaged across the four Treasury series. In the first line of that panel, labeled 'Realized', we see that the Sharpe ratios based on realized returns peak around 10% in the fall months and reach a trough in the winter months (the realized values are actually below 0 in that season). In the next line we consider Sharpe ratios that arise from estimating the conditional CAPM including the onset/recovery variable as an explanatory variable, Table J.12. Those Sharpe ratios do a good job of matching the empirically observed seasonal variability. Those values peak in the fall and reach a minimum in the winter months, like the realized series.

[14]The moment conditions we use include orthogonality between the regressors and the errors, plus orthogonality between a small set of instruments and the errors. For instruments we use the constant, a lag of the CRSP value-weighted return (entire U.S. market return, including dividends), and the contemporaneous 30-day T-bill rate as suggested by Ferson and Foerster (1994). For Model 12′, a non-linear CAPM specification, we additionally require a lag of the explanatory variables and a lag of the dependent variable as instruments.

Table J.2
Model 2′: Debt Supply, Auction, and FOMC Cycles with Onset/Recovery

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.487	0.582	0.590	0.589
	(1.021)	(0.813)	(0.711)	(0.615)
$\mu_{\hat{\text{OR}}}$	2.437***	2.077***	1.704***	1.430***
	(0.773)	(0.570)	(0.467)	(0.383)
μ_{Auction}	0.245	0.081	0.110	-0.026
	(0.315)	(0.255)	(0.216)	(0.169)
$\mu_{\text{Debt}-to-GDP}$	-0.070	-0.474	-0.452	-0.425
	(1.705)	(1.371)	(1.215)	(1.057)
μ_{FOMC}	-0.170	-0.082	-0.119	-0.152
	(0.350)	(0.282)	(0.221)	(0.176)
R^2	0.0203	0.0234	0.0209	0.0259
AR(12)	12.07	9.21	10.52	12.04
ARCH(12)	47.48***	53.17***	65.68***	79.26***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.8415	0.7238	0.5852	0.4825
Realized	1.2009	0.8691	0.7417	0.5933
September-March Seasonality				
Fitted	2.0149	1.6910	1.4072	1.2009
Realized	1.3104	1.1443	1.0892	0.9081
October-April Seasonality				
Fitted	1.1534	1.0121	0.8040	0.6480
Realized	1.4465	1.2539	0.7212	0.5315
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.639 [.980]
Fall Vs. Winter:				.770 [.821]
September Vs. March:				.487 [.564]
October Vs. April:				.456 [.537]
Onset/Recovery Coefficients Jointly 0:				**.003** [**.016**]
Onset/Recovery Treasury Coefficients Jointly Equal:				**.051** [**.076**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				8.79
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-37.72/ -49.98
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-20.78/ -26.68
Number of Parameters				20
Number of Moment Conditions				28
Number of Observations (01/80 - 11/07)				335

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\hat{\text{OR}}}\hat{\text{OR}}_t + \mu_{i,\text{Auction}}\text{Auction}_t + \mu_{i,\text{DebtToGDP}}\text{DebtToGDP}_t + \mu_{i,\text{FOMC}}\text{FOMC}_t + \epsilon_{i,t}.$$

Table J.3
Model 3′: Chen, Roll, and Ross Macro Factors with Onset/Recovery

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.037	-0.055	-0.031	-0.001
	(0.240)	(0.205)	(0.175)	(0.150)
$\mu_{\hat{\text{OR}}}$	1.270***	1.114***	1.039***	0.858***
	(0.428)	(0.336)	(0.271)	(0.226)
μ_{Term}	-0.007	<.001	0.002	0.008
	(0.037)	(0.029)	(0.025)	(0.021)
μ_{Default}	0.826***	0.673***	0.598***	0.494***
	(0.270)	(0.248)	(0.191)	(0.167)
μ_{IP}	-0.301***	-0.292***	-0.224***	-0.175***
	(0.081)	(0.072)	(0.066)	(0.050)
μ_{Inf}	-1.590***	-1.248***	-1.051***	-0.957***
	(0.571)	(0.430)	(0.363)	(0.340)
μ_{InfSurp}	-1.186**	-0.662*	-0.499	-0.279
	(0.516)	(0.372)	(0.319)	(0.276)
R^2	0.0616	0.0608	0.0679	0.0703
AR(12)	17.30	14.29	11.97	15.06
ARCH(12)	80.73***	96.80***	95.88***	112.32***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.4552	0.3955	0.3706	0.3064
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	0.9345	0.8392	0.7911	0.6606
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	0.6246	0.5456	0.5124	0.4241
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.989 [.998]
Fall Vs. Winter:				.615 [.652]
September Vs. March:				.271 [.292]
October Vs. April:				.279 [.337]
Onset/Recovery Coefficients Jointly 0:				**.003** [**.004**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.126 [.154]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				13.59*
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-38.49/ -53.89
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-17.88/ -25.55
Number of Parameters				28
Number of Moment Conditions				36
Number of Observations (01/52 - 12/07)				672

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\hat{\text{OR}}}\hat{\text{OR}}_t + \mu_{i,\text{Term}}\text{Term}_t + \mu_{i,\text{Default}}\text{Default}_t + \mu_{i,\text{IP}}\text{IP}_t + \mu_{i,\text{Inf}}\text{Inf}_t + \mu_{i,\text{InfSurp}}\text{InfSurp}_t + \epsilon_{i,t}.$$

Table J.4
Model 4′: Seasonally Unadjusted Macro Factors with Onset/Recovery

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.462***	0.390***	0.368***	0.306***
	(0.140)	(0.113)	(0.092)	(0.076)
$\mu_{\hat{\text{OR}}}$	1.624***	1.920***	1.599***	1.377***
	(0.561)	(0.461)	(0.368)	(0.315)
$\mu_{\text{CPI}_{\text{SU}}}$	-0.556*	-0.322	-0.383*	-0.291
	(0.315)	(0.259)	(0.206)	(0.190)
$\mu_{\text{IP}_{\text{SU}}}$	-2.714	-3.986	-3.779	-2.952
	(3.621)	(2.945)	(2.546)	(2.062)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.265	-0.167	-0.046	-0.013
	(0.165)	(0.120)	(0.113)	(0.097)
$\mu_{\text{GDP}_{\text{SU}}}$	-6.893**	-10.32***	-7.518***	-6.993***
	(3.335)	(2.835)	(2.293)	(1.946)
$\mu_{\text{U}_{\text{SU}}}$	3.827***	3.747***	1.890***	1.804***
	(0.892)	(0.743)	(0.611)	(0.508)
R^2	0.049	0.0531	0.0396	0.0407
AR(12)	17.19	11.76	9.28	12.76
ARCH(12)	72.60***	90.88***	84.71***	101.69***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.2265	0.1019	0.2009	0.1193
Realized	0.5333	0.2928	0.4644	0.2905
September-March Seasonality				
Fitted	0.8902	0.8517	0.7584	0.6192
Realized	0.6045	0.5524	0.5604	0.4955
October-April Seasonality				
Fitted	0.7228	0.6711	0.5419	0.4501
Realized	0.9665	0.9608	0.6888	0.5531
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.332 [.743]
Fall Vs. Winter:				.858 [.872]
September Vs. March:				.394 [.427]
October Vs. April:				.715 [.757]
Onset/Recovery Coefficients Jointly 0:				**<.001** [**<.001**]
Onset/Recovery Treasury Coefficients Jointly Equal:				**.026** [**.041**]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				12.85
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-39.09/ -51.97
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-18.57/ -23.77
Number of Parameters				28
Number of Moment Conditions				36
Number of Observations (01/52 - 12/06)				660

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\hat{\text{OR}}}\hat{\text{OR}}_t + \mu_{i,\text{CPI}_{\text{SU}}}\text{CPI}_{\text{SU},t} + \mu_{i,\text{IP}_{\text{SU}}}\text{IP}_{\text{SU},t} + \mu_{i,\text{PPI}_{\text{SU}}}\text{PPI}_{\text{SU},t} + \mu_{i,\text{GDP}_{\text{SU}}}\text{GDP}_{\text{SU},t} + \mu_{i,\text{U}_{\text{SU}}}\text{U}_{\text{SU},t} + \epsilon_{i,t}.$$

Table J.5
Model 5′: Chen, Roll, and Ross plus Seasonally Unadjusted Macro Factors with Onset/Recovery

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.001	0.009	0.009	0.038
	(0.238)	(0.204)	(0.175)	(0.147)
$\mu_{\hat{\text{OR}}}$	1.284**	1.620***	1.360***	1.207***
	(0.593)	(0.486)	(0.386)	(0.333)
μ_{Term}	-0.012	-0.004	-0.002	0.007
	(0.037)	(0.029)	(0.025)	(0.021)
μ_{Default}	0.759***	0.635**	0.593***	0.490***
	(0.280)	(0.256)	(0.198)	(0.173)
$\mu_{\text{CPI}_{\text{SU}}}$	-0.825	-0.620	-0.510	-0.345
	(0.542)	(0.434)	(0.325)	(0.291)
$\mu_{\text{IP}_{\text{SU}}}$	3.251	0.497	0.504	0.329
	(4.406)	(3.542)	(2.715)	(2.188)
$\mu_{\text{PPI}_{\text{SU}}}$	-0.173	-0.083	0.033	0.056
	(0.159)	(0.118)	(0.107)	(0.092)
$\mu_{\text{GDP}_{\text{SU}}}$	-2.750	-6.805**	-4.266*	-4.209*
	(3.627)	(3.152)	(2.495)	(2.172)
$\mu_{\text{U}_{\text{SU}}}$	2.322**	2.642***	0.921	1.027*
	(0.991)	(0.811)	(0.625)	(0.526)
μ_{IP}	-0.305***	-0.237***	-0.212***	-0.155***
	(0.108)	(0.089)	(0.071)	(0.056)
μ_{Inf}	-0.462	-0.363	-0.486	-0.583
	(0.819)	(0.601)	(0.486)	(0.473)
μ_{InfSurp}	-0.280	-0.008	-0.110	-0.069
	(0.618)	(0.476)	(0.375)	(0.345)
R^2	0.0773	0.0797	0.0722	0.0755
AR(12)	18.55*	13.51	11.63	15.15
ARCH(12)	77.24***	90.06***	96.64***	111.87***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.3274	0.1946	0.2733	0.1900
Realized	0.5333	0.2928	0.4644	0.2905
September-March Seasonality				
Fitted	0.9286	0.8875	0.8128	0.6894
Realized	0.6045	0.5524	0.5604	0.4955
October-April Seasonality				
Fitted	0.7200	0.6706	0.5568	0.4782
Realized	0.9665	0.9608	0.6888	0.5531
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.812 [.950]
Fall Vs. Winter:				.774 [.800]
September Vs. March:				.289 [.346]
October Vs. April:				.699 [.757]
Onset/Recovery Coefficients Jointly 0:				**<.001** [**.002**]
Onset/Recovery Treasury Coefficients Jointly Equal:				**.090** [.123]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				13.12
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-38.82/ -53.76
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-18.31/ -25.55
Number of Parameters				48
Number of Moment Conditions				56
Number of Observations (01/52 - 12/06)				660

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\hat{\text{OR}}}\hat{\text{OR}}_t + \mu_{i,\text{Term}}\text{Term}_t + \mu_{i,\text{Default}}\text{Default}_t + \mu_{i,\text{CPI}_{\text{SU}}}\text{CPI}_{\text{SU},t} + \mu_{i,\text{IP}_{\text{SU}}}\text{IP}_{\text{SU},t} + \mu_{i,\text{PPI}_{\text{SU}}}\text{PPI}_{\text{SU},t}$$
$$+\mu_{i,\text{GDP}_{\text{SU}}}\text{GDP}_{\text{SU},t} + \mu_{i,\text{U}_{\text{SU}}}\text{U}_{\text{SU},t} + \mu_{i,\text{IP}}\text{IP}_t + \mu_{i,\text{Inf}}\text{Inf}_t + \mu_{i,\text{InfSurp}}\text{InfSurp}_t + \epsilon_{i,t}.$$

Table J.6:
Model 6′: Real-Time Macro Factors with Onset/Recovery

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.515*	0.282	0.357*	0.222
	(0.300)	(0.232)	(0.203)	(0.167)
$\mu_{\hat{OR}}$	1.470**	1.399***	1.240***	1.057***
	(0.643)	(0.479)	(0.380)	(0.314)
μ_{USurpC}	-1.653	-0.131	-0.614	0.310
	(1.562)	(1.183)	(1.261)	(1.006)
μ_{USurpE}	2.128**	1.819***	1.628***	1.233***
	(0.892)	(0.682)	(0.570)	(0.469)
μ_{ProbC}	1.473**	1.289**	1.077**	0.915***
	(0.669)	(0.563)	(0.442)	(0.344)
μ_{IPSurp}	0.121	0.138	0.082	0.129
	(0.201)	(0.161)	(0.143)	(0.110)
μ_{IP}	1.539***	1.320***	1.034***	1.171***
	(0.450)	(0.359)	(0.322)	(0.268)
μ_{U}	0.065***	0.065***	0.049***	0.054***
	(0.022)	(0.016)	(0.014)	(0.012)
$\mu_{\Delta\text{Default}}$	-0.044***	-0.023	-0.028**	-0.017*
	(0.016)	(0.014)	(0.011)	(0.009)
μ_{Term}	-0.060	-0.038	-0.032	-0.024
	(0.049)	(0.040)	(0.033)	(0.027)
μ_{InfSurp}	-1.543*	-0.740	-0.560	-0.314
	(0.790)	(0.558)	(0.488)	(0.420)
μ_{Inf}	-2.374***	-1.766***	-1.547***	-1.349***
	(0.651)	(0.492)	(0.422)	(0.361)
R^2	0.1568	0.1526	0.1788	0.2095
AR(12)	15.05	13.3	11.60	12.55
ARCH(12)	26.61***	30.58***	55.68***	48.66***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.8099	0.6736	0.6158	0.5201
Realized	0.8125	0.5729	0.6853	0.4504
September-March Seasonality				
Fitted	1.1453	1.0794	0.9810	0.8338
Realized	0.8565	0.7955	0.8178	0.7509
October-April Seasonality				
Fitted	0.7011	0.6658	0.6043	0.5097
Realized	1.0951	1.2034	0.8506	0.6192
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.998 [1.00]
Fall Vs. Winter:				.177 [.206]
September Vs. March:				.951 [.957]
October Vs. April:				.831 [.852]
Onset/Recovery Coefficients Jointly 0:				**.004** [**.009**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.306 [.330]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				10.16
MMSC-BIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-38.84/ -54.62
MMSC-HQIC of Tabled Model/Constrained $\hat{OR}$ Term Included				-20.29/ -29.11
Number of Parameters				48
Number of Moment Conditions				56
Number of Observations (12/65 - 12/03)				457

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\hat{\text{OR}}}\hat{\text{OR}}_t + \mu_{i,\text{USurpC}}\text{USurpC}_t + \mu_{i,\text{USurpE}}\text{USurpE}_t + \mu_{i,\text{ProbC}}\text{ProbC}_t + \mu_{i,\text{IPSurp}}\text{IPSurp}_t + \mu_{i,\text{IP}}\text{IP}_t$$
$$+\mu_{i,\text{U}}\text{U}_t + \mu_{i,\Delta\text{Default}}\Delta\text{Default}_t + \mu_{i,\text{Term}}\text{Term}_t + \mu_{i,\text{InfSurp}}\text{InfSurp}_t + \mu_{i,\text{Inf}}\text{Inf}_t + \epsilon_{i,t}.$$

Table J.7
Model 7′: Cross Hedging with Onset/Recovery

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.017	-0.021	-0.022	-0.060
	(0.186)	(0.141)	(0.112)	(0.093)
$\mu_{\text{OnsetOfSAD}}$	1.389***	1.249***	1.140***	0.954***
	(0.539)	(0.421)	(0.338)	(0.284)
μ_{σ^2}	0.011	0.009	0.011**	0.011***
	(0.008)	(0.006)	(0.005)	(0.004)
μ_{Turnover}	-0.563	-0.754	-0.477	-0.360
	(0.817)	(0.647)	(0.533)	(0.442)
$\mu_{\text{Liquidity}}$	7.168	4.533	2.881	3.741
	(6.038)	(5.195)	(4.346)	(3.906)
R^2	0.0134	0.0173	0.0219	0.0231
AR(12)	15.71	10.25	8.93	11.49
ARCH(12)	66.78 ***	94.42 ***	88.71 ***	103.05 ***
Return Magnitude Seasonalities				
Fall-Winter Seasonality				
Fitted	0.5026	0.4585	0.4169	0.3475
Realized	0.6646	0.4581	0.5651	0.3725
September-March Seasonality				
Fitted	1.0846	0.9785	0.8950	0.7451
Realized	0.7564	0.6525	0.6489	0.5787
October-April Seasonality				
Fitted	0.7773	0.7309	0.6431	0.5333
Realized	0.9788	0.9765	0.7191	0.5274
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.995 [1.00]
Fall Vs. Winter:				.556 [.591]
September Vs. March:				.684 [.719]
October Vs. April:				.962 [.963]
Onset/Recovery Coefficients Jointly 0:				**.009** [**.013**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.182 [.205]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				7.70
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ added				-43.05/ -58.21
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ added				-23.34/ -31.10
Number of Parameters				20
Number of Moment Conditions				28
Number of Observations (08/60 - 12/07)				569

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\hat{\text{OR}}}\hat{\text{OR}}_t + \mu_{i,\sigma^2}\sigma_t^2 + \mu_{i,\text{Turnover}}\text{Turnover}_t + \mu_{i,\text{Liquidity}}\text{Liquidity}_t + \epsilon_{i,t}.$$

Table J.8
Model 8′: Cross Hedging and Treasury Return Volatility with Onset/Recovery

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.085	0.467	0.209	-0.016
	(0.553)	(0.368)	(0.300)	(0.241)
$\mu_{\text{OnsetofSAD}}$	2.206***	1.671***	1.299***	0.963**
	(0.818)	(0.623)	(0.501)	(0.387)
μ_{σ^2}	0.011	0.013	0.015*	0.013*
	(0.013)	(0.011)	(0.009)	(0.007)
μ_{Turnover}	-1.083*	-1.238**	-0.966**	-0.801**
	(0.633)	(0.526)	(0.463)	(0.386)
$\mu_{TreasuryVol}$	0.035	-0.170	-0.111	-0.007
	(0.099)	(0.130)	(0.136)	(0.153)
$\mu_{\text{Liquidity}}$	0.613	-0.288	-3.751	-3.516
	(18.56)	(14.72)	(12.53)	(10.25)
R^2	0.0472	0.0686	0.0668	0.0657
AR(12)	9.24	10.33	10.82	9.94
ARCH(12)	17.86	14.44	12.74	10.91
Return Magnitude Seasonalities				
Fall-Winter Seasonality				
Fitted	0.8027	0.5970	0.4843	0.3676
Realized	0.7455	0.4450	0.3672	0.1996
September-March Seasonality				
Fitted	1.7464	1.2615	1.0050	0.7590
Realized	2.1930	1.9721	1.5871	1.2276
October-April Seasonality				
Fitted	1.4409	1.2010	0.9564	0.7392
Realized	0.8708	0.6515	0.4433	0.3577
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				<**.001** [<**.001**]
Fall Vs. Winter:				**.068** [.406]
September Vs. March:				**.021** [.294]
October Vs. April:				**.001** [.113]
Onset/Recovery Coefficients Jointly 0:				.111 [.380]
Onset/Recovery Treasury Coefficients Jointly Equal:				**.064** [.262]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				18.54
MMSC-BIC of Tabled Model/Constrained $\widehat{\text{OR}}$ Term Included				-82.25/ -96.75
MMSC-HQIC of Tabled Model/Constrained $\widehat{\text{OR}}$ Term Included				-48.39/ -57.82
Number of Parameters				24
Number of Moment Conditions				44
Number of Observations (01/94 - 12/07)				168

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\widehat{\text{OR}}}\widehat{\text{OR}}_t + \mu_{i,\sigma^2}\sigma_t^2 + \mu_{i,\text{Turnover}}\text{Turnover}_t + \mu_{i,\text{Liquidity}}\text{Liquidity}_t + \mu_{i,\text{TreasuryVol}}\text{TreasuryVol}_t + \epsilon_{i,t}.$$

Table J.9
Model 9′: Baker-Wurgler Sentiment with Onset/Recovery

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.251^{**}	0.182^{*}	0.206^{**}	0.172^{**}
	(0.122)	(0.102)	(0.083)	(0.069)
$\mu_{\hat{\text{OR}}}$	1.562^{**}	1.520^{***}	1.346^{***}	1.133^{***}
	(0.620)	(0.481)	(0.391)	(0.327)
$\mu_{\text{BWSentiment}}$	0.840^{***}	0.616^{**}	0.627^{***}	0.425^{**}
	(0.315)	(0.248)	(0.206)	(0.166)
R^2	0.0247	0.0216	0.0288	0.0266
AR(12)	20.26^{*}	11.94	9.60	12.44
ARCH(12)	51.76^{***}	69.02^{***}	74.07^{***}	87.47^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.5640	0.5469	0.4853	0.4076
Realized	0.7290	0.5083	0.6261	0.4145
September-March Seasonality				
Fitted	1.1451	1.1388	0.9990	0.8535
Realized	0.7257	0.6898	0.7139	0.6610
October-April Seasonality				
Fitted	0.8287	0.7980	0.7104	0.5937
Realized	1.0881	1.1964	0.8499	0.6273
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.969 [.996]
Fall Vs. Winter:				.471 [.506]
September Vs. March:				.619 [.656]
October Vs. April:				.638 [.671]
Onset/Recovery Coefficients Jointly 0:				**.003** [**.005**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.122 [.148]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				8.63
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-40.73/ -54.76
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-21.94/ -28.93
Number of Parameters				12
Number of Moment Conditions				20
Number of Observations (03/66 - 12/05)				478

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\hat{\text{OR}}}\hat{\text{OR}}_t + \mu_{i,\text{BWSentiment}}\text{BWSentiment}_{t-1} + \epsilon_{i,t}.$$

Table J.10
Model 10′: Michigan Consumer Sentiment with Onset/Recovery

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	0.160^{*}	0.112	0.141^{**}	0.121^{**}
	(0.090)	(0.077)	(0.063)	(0.052)
$\mu_{\hat{\text{OR}}}$	1.171^{**}	1.082^{***}	0.987^{***}	0.807^{***}
	(0.471)	(0.375)	(0.307)	(0.256)
$\mu_{\text{MSentiment}}$	0.009	-0.001	0.007	0.008
	(0.035)	(0.026)	(0.024)	(0.021)
R^2	0.0065	0.0097	0.01	0.0087
AR(12)	17.19	11.64	9.68	13.15
ARCH(12)	87.00^{***}	103.53^{***}	94.13^{***}	120.64^{***}
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.4101	0.3862	0.3458	0.2813
Realized	0.5709	0.3232	0.4925	0.3054
September-March Seasonality				
Fitted	0.9356	0.8652	0.7887	0.6443
Realized	0.6755	0.6020	0.5807	0.5138
October-April Seasonality				
Fitted	0.5898	0.5507	0.4973	0.4053
Realized	0.9868	0.9786	0.6965	0.5569
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.846 [.976]
Fall Vs. Winter:				.562 [.591]
September Vs. March:				.452 [.471]
October Vs. April:				.345 [.374]
SAD Onset/Recovery Coefficients Jointly 0:				**.020** [**.026**]
SAD Onset/Recovery Treasury Coefficients Jointly Equal:				.144 [.163]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				10.55
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-41.38/ -56.70
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-20.87/ -28.50
Number of Parameters				12
Number of Moment Conditions				20
Number of Observations (02/53 - 12/07)				659

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\hat{\text{OR}}}\hat{\text{OR}}_t + \mu_{i,\text{MSentiment}}\text{MSentiment}_{t-1} + \epsilon_{i,t}.$$

Table J.11
Model 11′: Fama-French Factors with Onset/Recovery

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
μ	-0.571**	-0.515**	-0.416**	-0.339**
	(0.240)	(0.203)	(0.171)	(0.150)
$\mu_{\hat{\text{OR}}}$	1.019**	0.933***	0.818***	0.706***
	(0.446)	(0.345)	(0.279)	(0.231)
μ_{SMB}	-0.095**	-0.071**	-0.084***	-0.061***
	(0.037)	(0.028)	(0.021)	(0.018)
μ_{HML}	-0.011	0.004	-0.014	-0.001
	(0.041)	(0.034)	(0.027)	(0.022)
μ_{MOM}	0.030	0.032	0.037*	0.029
	(0.032)	(0.027)	(0.022)	(0.019)
μ_{Default}	0.789***	0.664***	0.594***	0.488***
	(0.282)	(0.244)	(0.207)	(0.180)
μ_{Term}	0.030	0.029	0.031	0.031
	(0.042)	(0.030)	(0.026)	(0.022)
$\mu_{\hat{r}_m}$	0.157***	0.121***	0.091***	0.064***
	(0.036)	(0.029)	(0.022)	(0.019)
R^2	0.0714	0.0707	0.0783	0.0714
AR(12)	17.83	12.44	11.06	12.44
ARCH(12)	102.40***	97.31***	120.56***	150.49***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.6859	0.5749	0.5562	0.4364
Realized	0.5549	0.3128	0.4773	0.3035
September-March Seasonality				
Fitted	0.7342	0.6847	0.6242	0.5423
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	0.6815	0.5927	0.5598	0.4611
Realized	0.9650	0.9569	0.6860	0.5504
Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]				
Nonspecific Monthly Seasonality:				.477 [.820]
Fall Vs. Winter:				.147 [.170]
September Vs. March:				.939 [.934]
October Vs. April:				.765 [.783]
Onset/Recovery Coefficients Jointly 0:				**.040** [**.050**]
Onset/Recovery Treasury Coefficients Jointly Equal:				.503 [.534]
Panel D: Systems Equation Information Criteria and Model Statistics				
GMM Test of Overidentification Restrictions				9.07
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-43.01/ -58.72
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included				-22.41/ -30.38
Number of Parameters				32
Number of Moment Conditions				40
Number of Observations (01/52 - 12/07)				672

Notes: See the notes to Table C.2. The model is:

$$r_{i,t} = \mu_i + \mu_{i,\hat{\text{OR}}}\hat{\text{OR}}_t + \mu_{i,\text{SMB}}\text{SMB}_t + \mu_{i,\text{HML}}\text{HML}_t + \mu_{i,\text{MOM}}\text{MOM}_t + \mu_{i,\text{Default}}\text{Default}_t + \mu_{i,\text{Term}}\text{Term}_t + \mu_{i,\hat{rm}}\hat{rm}, t + \epsilon_{i,t}.$$

Table J.12
Model 12′ Conditional CAPM with SAD

Parameter or Statistic	20-Year Treasury Excess Returns	10-Year Treasury Excess Returns	7-Year Treasury Excess Returns	5-Year Treasury Excess Returns
Panel A: Estimates				
δ	-7.105**	-9.016***	-6.553***	-6.510***
	(2.787)	(2.689)	(1.075)	(1.302)
$\delta_{\hat{\text{OR}}}$	8.160	11.646**	9.405***	11.874**
	(6.363)	(5.493)	(2.923)	(5.505)
$\delta_{\tilde{r}_m}$	0.547	0.567**	0.361***	0.188*
	(0.342)	(0.285)	(0.115)	(0.104)
$\delta_{\widetilde{D/P}}$	-11.94	-9.876	-10.84*	-12.69
	(10.23)	(7.384)	(5.646)	(8.398)
δ_{Term90}	-3.383	-5.770**	-4.204**	-0.708
	(2.710)	(2.934)	(2.000)	(2.493)
δ_{Default}	2.050**	2.447***	2.019***	1.921***
	(1.000)	(0.773)	(0.512)	(0.585)
R^2	-0.0425	-0.0569	-0.0359	0.0015
AR(12)	20.90*	12.15	21.18**	24.54**
ARCH(12)	68.18***	46.98***	84.61***	119.35***
Panel B: Economic Magnitude of Seasonal Differences in Returns (Stated in Percent Returns)				
Fall-Winter Seasonality				
Fitted	0.2970	0.3244	0.3663	0.2768
Realized	0.5553	0.3120	0.4781	0.3042
September-March Seasonality				
Fitted	0.1740	0.2500	0.3591	0.4689
Realized	0.6196	0.5474	0.5550	0.4905
October-April Seasonality				
Fitted	0.8726	0.9584	0.8947	0.7303
Realized	0.9650	0.9569	0.6860	0.5504

Panel C: Joint Tests and Seasonality Test P-values: Asymptotic / [Bootstrapped]	
Nonspecific Monthly Seasonality:	**.000** [.254]
Fall Vs. Winter:	.238 [.419]
September Vs. March:	**.057** [.229]
October Vs. April:	**.039** [.141]
SAD Onset/Recovery Coefficients Jointly 0:	**.024** [**.034**]
SAD Onset/Recovery Treasury Coefficients Jointly Equal:	.737 [.754]
Panel D: Systems Equation Information Criteria and Model Statistics	
GMM Test of Overidentification Restrictions	41.28
MMSC-BIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included	-219.07/ -236.46
MMSC-HQIC of Tabled Model/Constrained $\hat{\text{OR}}$ Term Included	-116.06/ -125.73
Number of Parameters	24
Number of Moment Conditions	64
Number of Observations (02/52 - 12/07)	671

Panel E: Seasonality in Monthly Sharpe Ratio, Averaged Across Series

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Realized	.021	-.030	-.040	-.070	.013	.067	.006	.040	.072	.099	.095	.025
Fitted	.034	.001	.000	.001	.004	.002	.003	.085	.072	.168	.055	.004

Notes: See the notes to Table C.2. In addition to the instruments listed in the notes to Table C.2, the instruments used to form the GMM moment conditions in this case include a single lag of the dependent variable and a single lag of the explanatory variables. The model is:

$$E_{t-1}(\tilde{r}_{i,t}) = \lambda_t \cdot \hat{\sigma}_t^2$$

$$\lambda_t = \exp(\delta_i + \delta_{i,\hat{\text{OR}}}\hat{\text{OR}}_t + \delta_{i,\widetilde{D/P}}\widetilde{D/P}_t + \delta_{i,\tilde{r}_m}\tilde{r}_{m,t-1} + \delta_{i,\text{Default}}\text{Default}_t + \delta_{i,\text{Term90}}\text{Term90}_{t-1})$$

Appendix K Treasury Trading Volume

While we control for stock market volume (by way of a stock market turnover variable) in Models 7 & 8, one might reasonably whether seasonal patterns in Treasury security trading volume might drive seasonal patterns in Treasury returns.

Treasury market volume data are not available over a long time period. The Securities Industry and Financial Markets Association (SIFMA) has been compiling volume data on bond trading for about the past decade. Nearly all trading in the U.S. bond market takes place between broker-dealers and large institutions in a decentralized, over-the-counter (OTC) market. Daily trading volume of Treasury securities by primary dealers averaged over $500 billion over the last 5 years (SIFMA RESEARCH QUARTERLY Fourth Quarter 2012 RESEARCH REPORT).

We pulled monthly U.S. Treasury security volume data (sourced from the New York Fed and produced by SIFMA from January 2001 to February 2013) on trading volume in bills, short-term notes, medium-term notes, long-term notes, bonds, and TIPS. Given the short period of data availability, we did not perform any formal regression analysis based on these data, but in lieu of regression we tested whether the onset/recovery variable was correlated with the monthly volume data, for each Treasury security category as well as aggregated across the Treasury security categories, and in all cases we found no statistically significant correlation.

Figure K.1 contains plots of the monthly average Treasury volume for each series, and Figure K.2 contains a plot of the total of the monthly averages across all the series. There appears to be no seasonal pattern in the individual series, and for the aggregate series there may be an end of quarter decline in volume, but it does not appear to be strong, nor is it consistent throughout the year. Thus Treasury security trading volume is an unlikely channel through which the seasonal pattern in Treasury returns would emerge.

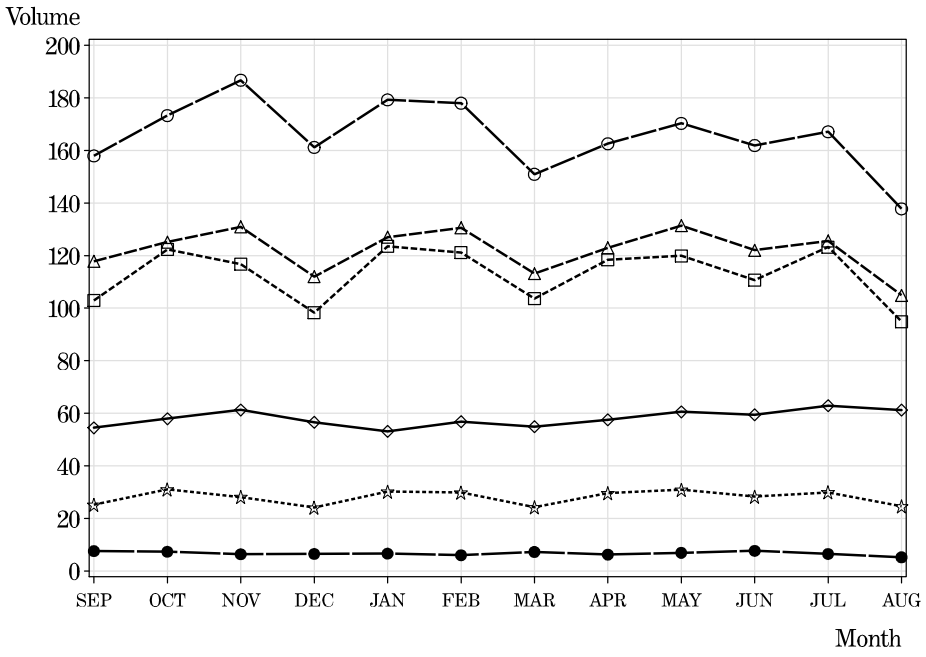


Figure K.1. Treasury securities volume traded, in billions of US dollars. Bills:⋄, Bonds:⋆, Long End, Notes:□, Notes 3-6 Yrs:△, Short End Notes:○, TIPS:●.

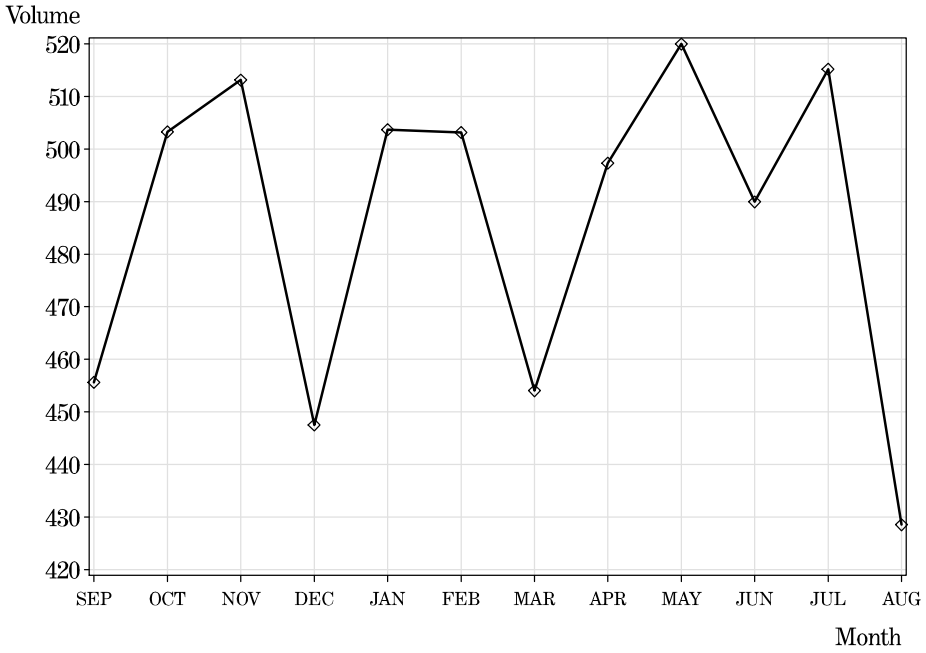


Figure K.2. Treasury securities volume traded, in billions of US dollars. Total Volume across securities:⋄.

Appendix L Evidence from Mutual Fund Flows

Are SAD-influenced investors responsible for the seasonal patterns we document in the U.S. Treasury market? While there is no individual investor database that contains information on SAD diagnoses that would allow us to tie onset/recovery directly to individual trading activity, the Investment Company Institute (ICI) provides monthly flows of funds into and out of fund categories of various levels of risk. Analysis of these flows allows us to peer into the rebalancing and investment decisions of individuals for the most part,[15] and should therefore yield insight into the timing of individuals' purchase/sale of different classes of financial assets. A powerful rejection of the time-varying risk aversion hypothesis would arise if flows did not vary according to the predictions implied by SAD; that is, if we failed to observe significantly higher-than-average (lower-than-average) flows into Treasury classes of mutual funds in the fall (winter).

We obtain the ICI monthly mutual fund flow data including the total sales, redemptions, exchanges, reinvested distributions, and end-of-month total net assets (TNA), aggregated across all funds within each investment category, during the January 1, 1984 to January 31, 2005 period. We focus our attention on the riskiest U.S. equity fund categories (aggressive growth, growth, sector, regional equity, growth and income, and income equity) and the safest U.S. fixed income fund category (taxable money market government funds, a category which is restricted to hold largely U.S. Treasuries).

Following Kamstra, Kramer, Levi, and Wermers (2012), we compute "active" net new monthly flows to sector i during month t, as a proportion of month $t-1$ total net assets, as follows:

$$Netflow_{i,t} = \frac{Sales_{i,t} - Redemptions_{i,t} + ExchangesIn_{i,t} - ExchangesOut_{i,t}}{TNA_{t-1}}.$$

The average equity mutual fund monthly flows are .61 percent of total net assets over the 21-year period we have available, with the largest outflow equaling a little over 2 percent and the largest inflow equaling just over 3.5 percent. The money market flows were much more volatile, averaging just under .5 percent but ranging between outflows as large as 6 percent to inflows as large as 8.5 percent.

Figure L.1 contains plots of the monthly average equity and money market fund flows. These plots reveal a strong seasonality in flows. Equity flows are below average in the fall and above average in the winter and early spring, a pattern also found in equity returns by KKL (2003). The lowest inflows occur in September, the early fall, and the highest inflows occur in April, the early spring. These particular months also fall outside the 90 percent confidence interval around the monthly mean flows. In contrast, money market fund flows (funds that largely hold U.S. Treasuries) are largely *above* average in the fall and *below* average in the winter and early spring, a pattern found here in Treasury market returns. The lowest inflows occur in October and November, and the largest outflows occur in March and April. These particular months fall outside the 90 percent confidence interval around the monthly mean flows.

For brevity we present only unconditional monthly mean analysis here, but as Kamstra, Kramer, Levi, and Wermers (2012) show, the seasonal patterns we document persist after controlling for various well-known features of mutual fund flows, including momentum effects (return-chasing), tax-induced patterns

[15] The ICI (2008) reports that roughly half of all U.S. households hold mutual funds, with individuals holding over three quarters of all mutual fund assets; the remainder is held by banks, trusts, and other institutional investors.

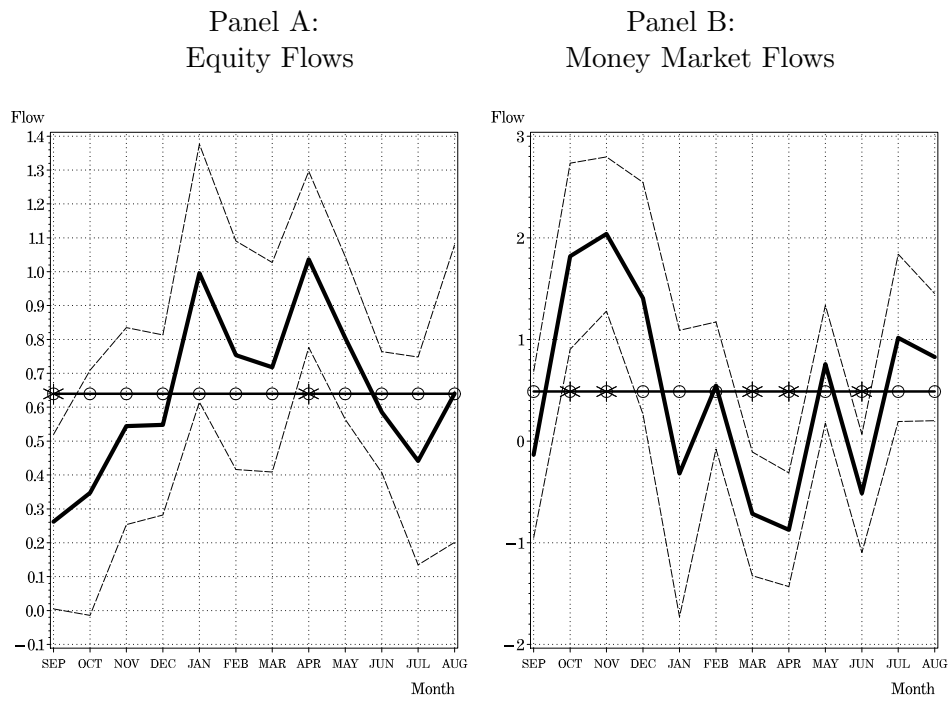


Figure L.1 The plots display monthly average fund flows as a proportion of TNA, indicated with a solid line, a 90 percent confidence interval around the monthly means (shown with light dashed lines) and the average flow throughout the year, represented by a solid line with circles – and an x mark in cases where the average return falls outside of the confidence interval. Panel A displays **equity** sector fund flows and Panel B displays **money market** sector fund flows. The data, provided by the Investment Company Institute, span January 1992 through January 2005.

(including those induced by capital gains tax overhang), and fund advertising. Further, their conditional analysis reveals onset/recovery helps explain seasonal patterns in flows, and in net exchanges between funds within a mutual fund family (which are unlikely to be driven by liquidity events such as year-end bonuses or tax-related cash flows). Altogether, mutual fund flows offer supportive evidence that individuals vary the amount they invest in equity and money market funds remarkably over the year, consistent with the SAD hypothesis.

References Cited in the Appendices C–L

Andrews, Donald W. K., and Biao Lu. 2001. "Consistent model and moment selection procedures for GMM estimation with application to dynamic panel data models." Journal of Econometrics 101: 123-164.

Boyd, John H., Jian Hu, and Ravi Jagannathan. 2005. "The Stock Market's Reaction to Unemployment News: Why Bad News is Usually Good for Stocks." Journal of Finance 60(2): 649-672.

Campbell, John Y. 1990. "Measuring the Persistence of Expected Returns." American Economic Review 80(2): 43-47.

Chen, Nai-Fu, Richard Roll, and Stephen A. Ross. 1986 "Economic Forces and the Stock Market." Journal of Business 59(3): 383-403.

Cook, Timothy, and Thomas Hahn. 1989. "The effect of changes in the federal funds rate target on market interest rates in the 1970s." Journal of Monetary Economics 24(3): 331-351.

Cook, Timothy, and Thomas Hahn. 1990. "Interest Rate Expectations and the Slope of the Money Market Yield Curve." Federal Reserve Bank of Richmond, Economic Review 76, 3-26.

Croushore, Dean, and Tom Stark. 2001. "A Real-Time Data Set for Macroeconomists." Journal of Econometrics 105(1): 111-130.

Dale, Spencer. 1993. "The Effect of Changes in Official U.K. Rates on Market Interest Rates Since 1987." The Manchester School 61: 76-94.

Davidson, Russell, and James G. MacKinnon. 1993. Estimation and Inference in Econometrics. New York, NY: Oxford University Press.

Dupont, Dominique, and Brian Sack. 1999. "Overview and Recent Developments." Federal Reserve Bulletin 85: 785-806.

Engle, Robert F. 1982. "Autoregressive conditional heteroskedasticity with estimates of the variance of UK inflation." Econometrica 50: 987-1008.

Garbade Kenneth D. 2004. "The Institutionalization of Treasury Note and Bond Auctions, 1970-75." FRBNY Economic Policy Review 10(1): 29-45.

Garbade, Kenneth D. 2007. "The Emergence of 'Regular and Predictable' as a Treasury Debt Management Strategy." FRBNY Economic Policy Review 13(1): 53-71.

Gibson, William E. 1970. "Interest Rates and Monetary Policy." Journal of Political Economy 78(3): 431-455.

Hansen, Lars Peter. 1982. "Large Sample Properties of Generalized Method of Moments Estimators." Econometrica 50: 1029-1054.

Harvey, Campbell R. 1989. "Time-varying conditional covariances in tests of asset pricing models." Journal of Financial Economics 24: 289-317.

Holland, A. Steven, and Mark Toma. 1991. "The Role of the Federal Reserve as "Lender of Last Resort" and the Seasonal Fluctuation of Interest Rates." Journal of Money, Credit and Banking 23(3): 659-676.

Investment Company Institute. 2008. Mutual Fund Fact Book: A Review of Trends and Activity in the

Mutual Fund Industry, 48th Edition.

Kamstra, Mark J., Lisa A. Kramer, and Maurice D. Levi. 2003. "Winter Blues: A SAD Stock Market Cycle." American Economic Review 93(1): 324-343.

Kamstra, Mark J., Lisa A. Kramer, Maurice D. Levi, and Russell Wermers. 2013. "Seasonal Asset Allocation: Evidence from Mutual Fund Flows." Available on SSRN: http://ssrn.com/abstract=1907904

Lam, Raymond W. 1998. "Seasonal Affective Disorder: Diagnosis and Management." Primary Care Psychiatry 4: 63-74.

MacKinnon, James G., and Halbert White. 1985. "Some Heteroskedasticity-Consistent Covariance Matrix Estimators with Improved Finite Sample Properties." Journal of Econometrics 29(3): 305-325.

Newey, Whitney K., and Kenneth D. West. 1987 "A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix." Econometrica 55(3): 703-708.

Newey, Whitney K., and Kenneth D. West. 1994. "Automatic Lag Selection in Covariance Matrix Estimation." Review of Economic Studies 61: 631-653.

Politis, Dimitris N., and Joseph P. Romano. 1994. "The Stationary Bootstrap." Journal of the American Statistical Association 89(428): 1303-1313.

Radecki, Lawrence J., and Vincent Reinhart. 1994. "The Financial Linkages in the Transmission of Monetary Policy in the United States." in National Differences in Interest Rate Transmission, Basel, Switzerland: Bank for International Settlements 393: 291-337.

Roley, V. Vance, and Gordon H. Sellon. 1995. "Monetary Policy Actions and Long Term Interest Rates." Economic Review, Federal Reserve Bank of Kansas City 80(4): 45-53.

Stock, James H., and Mark W. Watson. 1989. "New Indexes of Coincident and Leading Economic Indicators." in NBER Macroeconomics Annual, ed. by O.J. Blanchard and S. Fischer. Cambridge, MA: MIT Press.

Urich, Thomas, and Paul Wachtel. 2001. "Financial Market Responses to Monetary Policy Changes in the 1990s." Contemporary Economic Policy 19: 254-267.

White, H. 2000. "A Reality Check for Data Snooping." *Econometrica* 68(5): 1097-1126.