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Can broker–dealer client surveys provide signals for debt investing?

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A B S T R A C T

We use a novel data set to study return predictability in debt markets. The data are collected from J.P. Morgan's periodic surveys on its clients' outlook for changes in US Treasury yields and corporate credit spreads. We document that simple signals constructed from such surveys predict excess returns on debt portfolios formed on the basis of duration (2-years minus zero) or credit quality (BBB minus AAA). A linear trading strategy placing equal weight on Treasury and Credit signals has an annualized Information Ratio equal to 1.18, before transaction costs. We also show that predictability is likely to stem from private information possessed by survey respondents rather than from risk premia.

1. Introduction

The Expectation Hypothesis states that the forward curve is equal to the expected path of the short term rate plus time invariant risk premia, and implies that excess returns on (default-free) bond portfolios are unpredictable. Most of the existing literature on predictability in bond returns refutes the Expectation Hypothesis by showing that bond yields, or functions of bond yields, can forecast excess returns of bond portfolios.[1] Recently, researchers have turned their attention to "unspanned" factors that may forecast excess bond returns and yet cannot be obtained as functions of contemporaneous bond yields (Duffee, 2009; Wright and Zhou, 2009). Along this line of research, we forecast excess returns of bond portfolios using previously unexplored predictive variables. Our novel forecasting variables come from client surveys regularly conducted by J.P. Morgan (a major dealer in US debt markets) and reported to institutional clients in J.P. Morgan's research website and publications such as *US Fixed Income Markets Weekly*.

We study two types of client surveys: Treasury Surveys and Credit Surveys. In Treasury Surveys, J.P. Morgan asks clients whether they are "long, neutral, or short duration". In Credit Surveys, J.P. Morgan inquires whether clients' outlook for corporate credit spreads is "positive, neutral, or negative". Both Treasury and Credit Surveys report the percentage of respondents in each category. Treasury Surveys are weekly; Credit Surveys were conducted semimonthly until May 2006 and monthly thereafter. Relative to the most of the literature on return predictability in equity or bond markets, the fact that we use Client Surveys to forecast excess returns represents an advantage of our work. The advantage is that it is less likely that our results are attributable to (collective) data snooping because the relation between forecasted and forecasting variables is straightforward, as survey respondents are asked to reveal their opinion about future returns of bond portfolios.[2]

We show that J.P. Morgan client surveys contain information about future excess returns of bond portfolios. Treasury Surveys forecast excess returns on a default-free zero-cost portfolio formed on the basis of duration (2-year minus zero), and Credit Surveys forecast excess returns on a zero-cost portfolio formed on the basis of credit quality (BBB minus AAA). Results are robust to the

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[1] See Fama and Bliss (1987), Campbell and Shiller (1991), Cochrane and Piazzesi (2005), Sarno et al. (2007), Almeida and Vicente (2008), Brown et al. (2008), and Kessler and Scherer (2009). Most of these papers are not explicitly framed in terms of predictability of excess bond returns but fit this interpretation.

[2] Foster et al. (1997) indicate that most studies documenting return predictability ought to be taken with a grain of salt because commonly computed standard errors may be downward biased. This may happen because a large number of researchers are collectively (and independently) searching for evidence of predictive power, while the profession only reports successful specifications and does not take into account all possible trials with different forecasting variables made by the collection of researchers. Foster et al. (1997) quote Freedman (1983): "… in a world with a large number of unrelated variables and no clear a priori specification, uncritical use of standard methods will lead to models that appear to have a lot of explanatory power." See Kelly and Meschke (2010) for the refutation of a widely cited claim of return predictability based on time of the year.

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inclusion of other predictive variables such as the level of yields, the slope of the yield curve, the Cochrane-Piazzesi factor, and the Baa–Aaa credit spread. We also show that the predictability of excess returns we uncover is economically significant, and is likely to stem from private information possessed by survey respondents rather than from risk compensation.

2. Data

We collected survey reports between August 2002 and November 2009. There are a total of 370 Treasury Surveys and 122 Credit Surveys.[3] Treasury Surveys are very regular, only skipping the last week of December each year, whereas Credit Surveys have a considerable number of gaps.

Treasury Surveys contain client outlooks for US Treasury yields of unspecified maturity. J.P. Morgan reports the percentage of survey respondents that are "long, neutral, or short duration". Following J.P. Morgan, we construct an index by dividing the sum of shorts plus neutrals by the sum of longs plus neutrals. We take the log of such ratio to overcome its innate skewness.[4] We label the log of the ratio *Treasury Signal*. Note that a positive *Treasury Signal* indicates that survey respondents are on average bearish about US Treasuries, and a negative *Treasury Signal* indicates bullishness. The bear or bull signal is stronger as *Treasury Signal* departs from zero. Fig. 1 shows a plot of *Treasury Signal* over time.

$$Treasury\ Signal = Log\left(\frac{Shorts + Neutrals}{Longs + Neutrals}\right)$$

Credit Surveys contain client outlooks for corporate credit spreads, broadly defined. J.P. Morgan reports the percentage of survey respondents whose credit spread outlook is "positive, neutral, or negative". The broker–dealer then creates an index by dividing the sum of negatives plus neutrals by the sum of positives plus neutrals. We take the log of the ratio and label it *Credit Signal*. A positive *Credit Signal* means that clients expect corporate credit spreads to widen. Fig. 2 shows a plot of *Credit Signal* over time.[5]

$$Credit\ Signal = Log\left(\frac{Negative + Neutrals}{Positive + Neutrals}\right)$$

We investigate whether *Treasury Signal* and *Credit Signal* contain information about future returns of zero-cost debt portfolios. The Treasury zero-cost portfolio invests in the Bank of America Merrill Lynch US Treasury Current Two-Year Index, with funds financed by rolling overnight Treasury General Collateral repos. Therefore, the Treasury zero-cost portfolio is long a default-free portfolio with duration approximately equal to 2 years, and short a default-free portfolio with duration equal to zero.[6] The Credit zero-cost portfolio is long the Bank of America Merrill Lynch 1–3-year BBB Corporate Bond Index, and short the Merrill Lynch 1–3-year AAA Corporate Bond Index. Data on BofA ML indices and GC repo rates are from Datastream.[7]

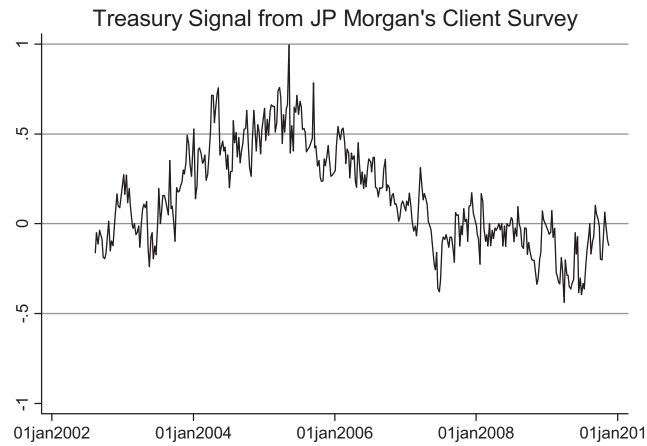

Fig. 1. Treasury Signal.

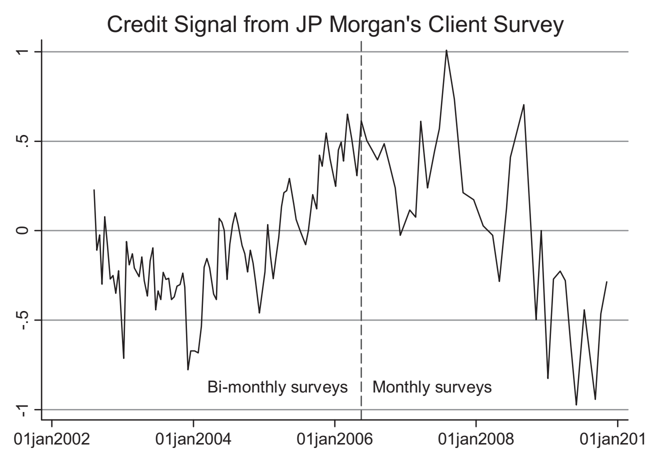

Fig. 2. Credit Signal.

Table 1 contains summary statistics of the main variables in the paper. On average, *Treasury Signal* and *Credit Signal* are close to but not quite equal to zero. The average *Treasury Signal* is 0.148, and the average *Credit Signal* is −0.053. There is substantial time variation in both *Treasury Signal* and *Credit Signal*, while the latter is considerably more volatile than the former: The standard deviation of *Treasury Signal* and *Credit Signal* are 0.279 and 0.373, respectively. The first order autocorrelation coefficients of *Treasury Signal* and *Credit Signal* are 0.91 and 0.78, respectively.

For a holding period of one week after each Treasury Survey, the average return on the Treasury zero-cost portfolio in our sample period is 2.59 basis points per week, and the standard deviation is 25.67 basis points per week. For a two-week holding period, the average and standard deviation of returns on the Treasury zero-cost portfolio are respectively 4.48 and 35.25 basis points per two-weeks. For a holding period of two-weeks after each Credit survey, the average return of the Credit zero-cost portfolio is 3.24 basis points per two-weeks, and the standard deviation is 74.48 basis points per two-weeks. Using compounding, the annualized two-week returns of the Treasury and Credit zero-cost portfolios are respectively 117 and 85 basis points. We do not compute returns over a one week horizon after Credit Surveys because these surveys are either semimonthly (before May 2006) or monthly (after May 2006), as opposed to Treasury Surveys which are carried out on a weekly basis throughout our sample period.

[3] J.P. Morgan facilitates data collection by occasionally releasing reports containing a large number of past surveys. For example, in May 14, 2007 J.P. Morgan released a report containing results of weekly Treasury Surveys from May 8, 2006 to May 14, 2007.

[4] The neutral ratio is 1, and, though ratios are bounded below by 0, they do not have an upper bound.

[5] The *Treasury Signal* and *Credit Signal* data used in this paper will be available on the corresponding author's website.

[6] The BofA ML Current Two-year Treasury Index represents the return of investing in on-the-run 2-year Treasuries. Each on-the-run security is held until the next auction of 2-year Treasuries. At that point in time, when the current "on-the-run" security held on the portfolio becomes "off-the-run", the "old" security is sold and proceeds are used to buy the newly issued 2-year bond. We show that our results are robust to using a broader index containing off-the-run Treasuries.

[7] The Datastream codes are MLUTC2Y (Treasury), Y70516 (O/N GC repo), ML3A1T3 (AAA), and ML3B1T3 (BBB).

Table 1
Summary statistics.

	Mean	St. Dev.	N
Treasury signal			
Original	0.148	0.279	370
Moving average 2	0.148	0.273	369
Moving average 4	0.149	0.267	367
$R_{2yr} - R_{O/Nrepo}$			
One week	2.59	25.67	370
Two-weeks	4.48	35.25	369
Four weeks	7.88	50.33	367
Credit signal			
Original	−0.053	0.373	122
Moving average 2	−0.052	0.352	121
$R_{1/3yr\ BBB} - R_{1/3yr\ AAA}$			
Two-weeks	3.24	74.48	122
Four weeks	14.76	108.76	121
2yr yield	2.86	1.39	370
O/N repo rate	2.51	1.77	370
Baa–Aaa spread	1.11	0.57	122

The table contains summary statistics of the main variables in the paper. *Treasury Signal* and *Credit Signal*, and its moving averages, are constructed from J.P. Morgan client surveys, as described in the text. $R_{2yr} - R_{O/N\ repo}$ is the excess return of a zero-cost portfolio which is long the BofA ML Current Two-year US Treasury Index with funds financed by rolling over funds in the overnight US Treasury General Collateral Repo market. $R_{1/3yr\ BBB} - R_{1/3yr\ AAA}$ is the excess return of a zero-cost portfolio which is long the BofA ML 1–3-year BBB Corporate Bond Index and short the BofA ML 1–3-year AAA Corporate Bond Index. Zero-cost portfolio returns are for different holding period horizons measured from the most recent Treasury Survey or Credit Survey (for $R_{2yr} - R_{O/N\ repo}$ and $R_{1/3yr\ BBB} - R_{1/3yr\ AAA}$, respectively), and are expressed in basis points. *2yr yield* is the yield-to-maturity of a 2-year Treasury bond, in percent. *O/N repo rate* is the overnight Treasury general collateral repo rate. *Baa–Aaa spread* is the difference between the yield-to-maturity of Baa and Aaa corporate bonds. The sample period is from August 2002 to November 2009.

3. Predictability regressions

We run regressions to verify whether *Treasury Signal* predicts returns on the Treasury zero-cost portfolio, and whether *Credit Signal* predicts returns on the Credit zero-cost portfolio. We add control variables to our forecasting regressions to ensure that any information contained in Treasury or Credit Surveys is not subsumed by other predictive variables.

We study predictability over one, two, and four weeks following each Treasury Survey; and over two and four weeks following each Credit Survey. We use moving averages of *Treasury Signal* and *Credit Signal* when studying multiperiod forecast horizons. For example, in the regression that forecasts returns on the Treasury zero-cost portfolio over the two-weeks after each Treasury Survey, we use the average between the latest two Treasury Surveys as the predicting variable. The idea is that each signal observation is noisy, and thus averaging out recent weeks may increase the signal-to-noise ratio.[8]

The regression using *Treasury Signal* to forecast one-week Treasury zero-cost portfolio returns has 370 observations, while the regression using *Credit Signal* to forecast two-weeks Treasury zero-cost portfolio returns has 122 observations. Ignoring time gaps between Credit Surveys, the regression using *Credit Signal* has 85 semimonthly observations from August 2002 to May 2006, and 37 monthly observations thereafter.

3.1. Treasury regressions

In addition to *Treasury Signal*, we add the following variables to the regressions forecasting returns on the Treasury zero-cost portfolio: the level of the 2-year yield, the slope of the beginning of the Treasury Yield Curve (2-year yield minus O/N GC repo rate), the Cochrane-Piazzesi factor, and lagged returns on the Treasury zero-cost portfolio.[9] Thus, our full specification for a forecasting horizon of k weeks is:

$$\begin{aligned}(R_{2yr} - R_{O/N\ repo})_{t,t+k} = \beta_0 &+ \beta_1 Treasury\ Signal_t + \beta_2\ 2yr\ Yield_t \\ &+ \beta_3(2yr\ Yield - O/N\ repo)_t + \beta_4 CP\ factor_t \\ &+ \beta_5(R_{2yr} - R_{O/N\ repo})_{t,t-k} + \varepsilon_t\end{aligned}$$

Table 2 presents our results. In Columns (1) and (2) we study predictability over the week following each Treasury Survey. Since Treasury Surveys are conducted on a weekly basis, these regressions use non-overlapping return intervals. In Columns (1) and (2), we report Newey–West standard errors with five lags for the Treasury Survey. The choice of lag length is dictated by the formula $floor\left[4 \times \left(\frac{T}{100}\right)^{\frac{2}{9}}\right]$ from Newey and West (1994). The formula assigns five lags for Treasury Survey data ($T = 370$). In Columns (3)–(6) we use overlapping return intervals to study predictability over longer horizons (two and four weeks), and add lags to the Newey–West formula to account for the overlapping.[10]

Results in Columns (1), (3) and (5) of Table 2 show that *Treasury Signal* contains information about future returns on the Treasury zero-cost portfolio. The coefficient on *Treasury Signal* is at least two standard deviations from zero in all columns. Its negative sign shows that returns move in the direction predicted by J.P. Morgan clients: Returns tend to be positive when clients are "long" duration, and negative when clients are "short" duration. The R-squareds and slope coefficients rise with the horizon, reaching 0.072 and −50.21 in Column (5). This slope coefficient is economically significant. Since the standard deviation of the 4-week moving average of *Treasury Signal* is 0.267, the slope coefficient in Column (5) implies that a one-standard deviation change in the predictive variable corresponds to an excess return of $0.267 \times 50.21 = 13.41$ basis points over the subsequent 4-week period, which amounts to 26.6% of a standard deviation of 4-week returns of the treasury zero-cost portfolio (equal to 50.33 basis points).

Results in Columns (2), (4), and (6) of Table 1 show that the significance of *Treasury Signal* is robust to the inclusion of other variables that may also have forecasting power for returns on the Treasury zero-cost portfolio. In fact, the inclusion of these additional variables increase coefficient estimates and t-statistics on the *Treasury Signal* variables for all forecasting horizons. Therefore, we conclude that Treasury Surveys contains information that is orthogonal to the alternative predictive variables.

3.2. Credit regressions

In addition to *Credit Signal*, we add the level of the Baa–Aaa corporate credit spread and lagged returns on the regressions forecasting returns on the Credit zero-cost portfolio. Thus, our full regression specification is:

$$\begin{aligned}(R_{1/3yr\ BBB} - R_{1/3yr\ AAA})_{t,t+k} = \gamma_0 &+ \gamma_1 Credit\ Signal_t \\ &+ \gamma_2(\text{Baa—Aaa Spread})_t \\ &+ \gamma_3(R_{1/3yr\ BBB} - R_{1/3yr\ AAA})_{t,t-k} + \eta_t\end{aligned}$$

[8] All of our conclusions are robust to using only the latest *Treasury Signal* or *Credit Signal* rather than moving averages.

[9] Data on the 2-year constant maturity Treasury yield and on Baa and Aaa corporate bond yields are from the Federal Reserve's website. The Cochrane-Piazzesi factor (2005) is a linear combination of 1–5-year forward rates which predicts quarterly excess returns on longer-term bonds. The forward rates are from Gurkaynak et al. (2007).

[10] In untabulated regressions, we double the number of lags in the Newey–West covariance matrix in all of our regressions in Tables 1 and 2. The coefficients on *Treasury Signal* and *Credit Signal* (and their moving averages) remain statistically significant.

Table 2
Treasury regressions.

Dep. var: $R_{2yr} - R_{O/N\ repo}$	One week		Two weeks		Four weeks	
	(1)	(2)	(4)	(5)	(5)	(6)
Treasury Signal	−9.35**	−16.67**				
	(−2.00)	(−2.43)				
Treasury Signal Moving Average (MA 2)			−25.47***	−40.37***		
			(−3.03)	(−3.39)		
Treasury Signal Moving Average (MA 4)					−50.21***	−85.76***
					(−3.06)	(−3.63)
2yr yield		1.46		3.10		8.96
		(0.89)		(1.04)		(1.54)
2yr yield–O/N repo rate		4.69		6.93		16.04
		(0.95)		(0.83)		(0.98)
CP factor		−0.01		1.80		5.39
		(−0.00)		(0.47)		(0.79)
Lagged excess returns		−0.04		0.02		0.14
		(−0.67)		(0.24)		(1.41)
Constant	3.97	−0.58	8.27***	2.39	15.40**	−1.86
	(2.41)	(−0.08)	(2.65)	(0.18)	(0.18)	(−0.08)
R^2	0.011	0.021	0.039	0.053	0.072	0.118
N	370	370	369	369	367	367
Lags in Newey–West VC matrix	5	5	6	6	8	8

The table contains results of regressions forecasting returns of a zero-cost portfolio long the BofA ML Current Two-year US Treasury Index with funds financed by rolling over funds in the overnight US Treasury General Collateral Repo market (i.e., $R_{2yr} - R_{O/N\ repo}$). Zero-cost portfolio returns are for holding period horizons ranging from one week to four weeks, and are expressed in basis points. The main dependent variables are *Treasury Signal* and its moving averages, constructed from weekly J.P. Morgan Client Surveys, as described in the text. The sample period is from August 2002 to November 2009. *T*-statistics are based on Newey–West standard errors.
* Correspond to statistical significance at the 10% level.
** Correspond to statistical significance at the 5% level.
*** Correspond to statistical significance at the 1% level.

Table 3
Credit regressions.

Dep. van: $R_{1/3yr\ BBB} - R_{1/3yr\ AAA}$	Two weeks		Four weeks	
	(1)	(2)	(3)	(4)
Credit signal	−30.42**	−44.41**		
	(−2.09)	(−2.19)		
Credit Signal Moving Average (MA 2)			−84.87**	−75.64**
			(−2.43)	(−2.19)
Baa–Aaa spread		−25.62		24.58
		(−1.19)		(0.78)
Lagged excess returns		−0.18		0.01
		(−1.54)		(0.21)
Constant	1.63	29.75	10.34	−15.15
	(0.33)	(1.43)	(1.34)	(−0.53)
R^2	0.023	0.072	0.076	0.090
N	122	122	121	121
Lags in Newey–West VC matrix	4	4	5	5

The table contains results of regressions forecasting returns of a zero-cost portfolio long the BofA ML 1–3-year BBB Corporate Bond Index and short the BofA ML 1–3-year AAA Corporate Bond Index. Zero-cost portfolio returns are for two-week and four-week holding period horizons, and are expressed in basis points. The main dependent variables are *Credit Signal* and its moving average, constructed from weekly J.P. Morgan client surveys, as described in the text. The sample period is from August 2002 to November 2009. *T*-statistics are based on Newey–West standard errors.
*, **, and *** Correspond to statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 3 presents our results. In Columns (1) and (2) we study predictability over the two-week period following each Credit Survey. Since Treasury Surveys are conducted on a semimonthly or monthly basis, these regressions always use non-overlapping returns. As in Treasury regressions, we report Newey–West standard errors with lag length determined by the formula from Newey and West (1994). The formula assigns four lags for Treasury Survey data. In Columns (3) and (4) we study predictability over longer the four weeks after each Credit Survey, and thus use overlapping return intervals when Credit Surveys conducted in a semimonthly basis (before May 2006). We add one lag to the Newey–West formula to account for the overlapping.

Results reported in Columns (1) and (3) of Table 2 show that *Credit Signal* contains information about future returns on the Credit zero-cost portfolio. The coefficients on *Credit Signal* are at least two standard deviations away from zero in both columns. Its negative sign show that future returns on the Credit zero-cost portfolio tend to confirm the expectations of Credit Survey participants: Returns tend to be positive when clients' outlook for credit spreads is positive, and tend to be negative when clients' outlook is negative. As before, *R*-squares and slope coefficients are larger for the longer forecasting horizon. The *R*-square of Column (3) is as high as 0.090. Since the standard deviation of the moving average of *Credit Signal* is 0.352, results in Column (3) which imply that a one-standard deviation change in the predictive variable corresponds to an excess return of $0.352 \times 84.87 = 29.87$ basis points over the subsequent 4-week period. This is economically significant, since it corresponds to 27.5% of a one-standard deviation

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change in the 4-week returns of the Credit zero-cost portfolio (equal to 108.76 basis points). Results in Columns (2) and (4) show that *Credit Signal* remains significant after the inclusion of other variables that may predict returns on the Credit zero-cost portfolio.

4. More on the economic significance of predictability

Our results in the previous section indicate that *Treasury Signal* and *Credit Signal* forecast future returns in the Treasury and Credit zero-cost portfolios, respectively. In both cases, future returns tend to confirm expectations of J.P. Morgan survey respondents. Moreover, by showing that one-standard deviation changes in *Treasury Signal* and *Credit Signal* are associated with 0.266 and 0.275 standard deviation change in future returns (respectively), the previous section indicates that the predictability we document is economically significant. In this section we turn to an alternative way to measure the economic significance of return predictability based on J.P. Morgan client surveys. We do this by estimating the Information Ratio of a trading strategy based on the Surveys.

Let the returns on the Treasury and Credit zero-cost portfolios be denoted by r_t^T and r_t^C, respectively. Since these are zero-cost portfolios, the returns may also be called excess returns. Let the normalized Treasury signal and the normalized *Credit Signal* be z_t^T and z_t^C, respectively. These normalized signals are the (raw) signals previously defined minus their averages, divided by their standard deviations. Thus, the normalized signals have zero mean and unit variance.

Consider forming a managed zero-cost portfolio with positions in Treasury and Credit zero-cost portfolios, based on signals provided by J.P. Morgan client surveys. Specifically, consider a linear trading strategy that attributes equal weight $K > 0$ to each of the normalized signals. The return on the managed zero-cost portfolio is:

$$r_t^P = -Kz_{t-1}^T r_t^T - Kz_{t-1}^C r_t^C$$

The signs are negative because positive Treasury signal and *Credit Signal* indicate low future returns in the Treasury and the Credit zero-cost portfolios. Note that the signals are lagged relative to the returns: we first observe the signals and form portfolios, then we compute returns over the subsequent weeks.

Since $E(z_{t-1}^T) = E(z_{t-1}^C) = 0$, the expected return on the managed zero-cost portfolio is:

$$E(r_t^P) = -K\left[Cov(z_{t-1}^T, r_t^T) + Cov(z_{t-1}^C, r_t^C)\right]$$

and the variance of the returns is:

$$Var(r_t^P) = K^2\left[Var(z_{t-1}^T r_t^T) + Var(z_{t-1}^C r_t^C) + 2Cov(z_{t-1}^T r_t^T, z_{t-1}^C r_t^C)\right]$$

The Information Ratio of the managed zero-cost is defined as:

$$IR \equiv \frac{E(r_t^P)}{\sqrt{Var(r_t^P)}} = -\frac{Cov(z_{t-1}^T, r_t^T) + Cov(z_{t-1}^C, r_t^C)}{\sqrt{Var(z_{t-1}^T r_t^T) + Var(z_{t-1}^C r_t^C) + 2Cov(z_{t-1}^T r_t^T, z_{t-1}^C r_t^C)}}$$

We estimate the Information Ratio of the managed zero-cost portfolio outlined above. Note that the *IR* does not depend on *K*, and thus can be estimated without loss of generality. We need equal periodicity in the Treasury and the Credit portfolios in order to compute the covariance term and choose four-week returns for our analysis. As in the previous Section, we use the moving average of the four most recent Treasury Signals to forecast returns on the Treasury zero-cost portfolio over the subsequent four weeks; and the moving average of the two most recent Credit Signals to forecast returns on the Credit zero-cost portfolio over the subsequent four weeks. We use all the available data to estimate the moments entering the *IR* formula.

In order to compute the covariance term in the *IR* formula, we match the Treasury and Credit time series. The two series were matched by choosing Treasury Survey dates that were as close as possible to Credit Survey dates (the average distance between matched dates is 2.14 calendar days), thus mitigating the error when computing the covariance between Treasury and Credit zero-cost portfolio returns.

Expressing returns in basis points, and substituting the estimated variances and covariances in the Information Ratio formula gives:

$$IR = -\frac{13.41 + 29.87}{\sqrt{(46.03)^2 + (125.79)^2 + 2(-294.80)}} = 0.328$$

We find an Information Ratio of 0.328 for four-week returns, which corresponds to an annualized Information Ratio of $0.328 \times \sqrt{13} = 1.18$. The annualized *IR* of the Treasury and Credit strategies alone are $(13.41 \div 46.03) \times \sqrt{13} = 1.05$ and $(29.87 \div 125.79) \times \sqrt{13} = 0.86$, respectively. The greater Information Ratio of the combined strategy is due to a diversification effect arising from the negative correlation (−0.05) between each strategy's returns. Grinold and Kahn (1995) assert that an annual *IR* above 1 is "exceptional". Note, in particular, that the *IR* of the Treasury trading strategy (1.05) is much larger than the *IR* of the Treasury zero-cost portfolio for the same four-week holding period, which, using data from Table 1, is $(7.88 \div 50.33) \times \sqrt{13} = 0.56$. Therefore, we confirm our previous conclusion that the economic significance of predictability based on J.P. Morgan client surveys is large.

4.1. Transaction costs

The Information Ratio calculated above is before any transaction costs are accounted for. In this section we estimate bid-ask and price impact costs for a portfolio manager running a $ 50 million fund dedicated to implementing the Treasury leg of trading strategy.[11]

We calculate that the Treasury strategy, when implemented by a $ 50 million dollar dedicated fund, incurs a total of 4.23 basis points per four weeks in bid-ask and price impact costs. Bid-ask costs amount to 2.36 basis points. These bid-ask costs are incurred at three instances: 1.84 basis points at the monthly rebalancing of the BofA ML Current Two-year Index, as the Index switches from the "old" to the new on-the-run security just after each 2-year Treasury auction (see footnote 6), 0.34 basis points at the rebalancing of the strategy itself, as the size of the position in the on-the-run bond is adjusted after each survey, and 0.38 basis points at the repo leg of the strategy. Price-impact costs add to 1.87 basis points, and are mostly due to the sale of the "old" bonds at the monthly rebalancing of the Index (1.80 basis points). Appendix A has details on the transaction cost calculations.

Accounting for bid-ask costs and price impact costs in the Treasury trading strategy reduces the excess return of the four-week strategy from 13.42 basis points each four weeks to 13.42 − 4.23 = 9.19 basis points. Therefore, the annualized Information Ratio of the Treasury trading strategy after transaction costs is $(9.19 \div 46.03) \times \sqrt{13} = 0.72$, down from 1.05 before transaction costs.

[11] Note that dealers in Treasury markets incur in very little transaction costs, and that any portfolio manager incurs in transactions costs in the normal course of his business. Therefore, the predictability we document in Section 3 is likely to have economic value even if transaction costs destroyed excess returns of a hypothetical fund dedicated to mechanically exploring the predictability.

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Table 4
Further Treasury regressions – off-the-run.

Dep. var: $R_{1/3yr} - R_{O/N\ repo}$	One week		Two week		Four week	
	(1)	(2)	(4)	(5)	(5)	(6)
Treasury Signal	−7.82**	−14.72***				
	(−1.93)	(−2.41)				
Treasury Signal Moving Average (MA 2)			−21.22***	−35.17***		
			(−2.98)	(−3.39)		
Treasury Signal Moving Average (MA 4)					−44.07***	−74.93***
					(−3.11)	(−3.64)
2yr yield		1.32		2.78		7.52
		(0.94)		(1.10)		(1.50)
2yr yield–O/N repo rate		4.05		5.80		12.86
		(0.93)		(0.80)		(0.90)
CP factor		0.12		1.78		4.74
		(0.07)		(0.54)		(0.80)
Lagged excess returns		−0.05		0.02		0.12
		(−0.80)		(0.25)		(1.25)
Constant	3.33***	−0.46	6.95***	2.17	13.38**	−0.17
	(2.36)	(−0.07)	(2.62)	(0.19)	(2.57)	(−0.01)
R^2	0.010	0.022	0.038	0.055	0.074	0.117
N	370	370	369	369	367	367
Lags in Newey–West VC matrix	5	5	6	6	8	8

The table contains results of regressions forecasting returns of a zero-cost portfolio long the BofA ML 1–3 years US Treasury Index with funds financed by rolling over funds in the overnight US Treasury General Collateral Repo market. Zero-cost portfolio returns are for holding period horizons ranging from one week to four weeks, and are expressed in basis points. The sample period is from August 2002 to November 2009. *T*-statistics are based on Newey–West standard errors.
* Correspond to statistical significance at the 10% level.
** Correspond to statistical significance at the 5% level.
*** Correspond to statistical significance at the 1% level.

Table 5
Further Treasury regressions – futures.

Dep. var: Price change in 2yr T-note futures	One week		Two weeks		Four weeks	
	(1)	(2)	(4)	(5)	(5)	(6)
Treasury Signal	−0.076*	−0.162**				
	(−1.65)	(−2.26)				
Treasury Signal Moving Average (MA 2)			−0.239***	−0.405***		
			(−2.74)	(−3.14)		
Treasury Signal Moving Average (MA 4)					−0.513***	−0.883***
					(−3.04)	(−3.45)
2yr yield		0.013		0.030		0.091
		(0.75)		(0.98)		(1.44)
2yr yield–O/N repo rate		0.046		0.092		0.222
		(0.90)		(0.99)		(1.20)
CP factor		0.003		0.010		0.028
		(0.15)		(0.22)		(0.35)
Lagged excess returns		−0.108*		−0.054		0.088
		(−1.71)		(−0.79)		(0.89)
Constant	0.040***	0.010	0.094***	0.019	0.191***	−0.050
	(2.58)	(0.12)	(3.12)	(0.13)	(3.19)	(−0.18)
R^2	0.0130	0.028	0.030	0.053	0.072	0.119
N	370	370	369	369	367	367
Lags in Newey–West VC matrix	5	5	6	6	8	8

The table contains results of regressions forecasting changes in 2yr T-note futures prices. Price changes are for horizons ranging from one week to four weeks. Price changes are calculated for the nearest maturity contract if the initial date is at least six weeks before that contract's expiration, and for the second nearest maturity contract if the initial date is less than six weeks before the expiration of the nearest maturity contract. Daily settlement prices are used. The sample period is from August 2002 to November 2009. *T*-statistics are based on Newey–West standard errors.
* Correspond to statistical significance at the 10% level.
** Correspond to statistical significance at the 5% level.
*** Correspond to statistical significance at the 1% level.

4.2. Implementation flexibility

It is important to note that the calculations in Section 4.1 ignore the flexibility that portfolio managers may have in implementing a trading strategy based on Treasury Surveys. Such strategy can be implemented not only using on-the-run Treasury securities (as in the BofA ML Current Two-year Index), but also using a wide set of financial instruments whose pay-offs depend on the short-end of the risk-free term structure. To illustrate this flexibility, Tables 4 and 5 repeat the Treasury regressions of Table 2 using off-the-run securities (namely, the BofA ML 1–3 year Treasury Index) and 2-yr T-note future contracts at the Chicago Board of Trade.[12]

[12] The implementation of the strategy in 2-year Treasury futures assumes that positions are opened in the nearest maturity contract until six weeks before that contract's expiration, and therefore closed at least two-weeks before the contract's expiration. If the nearest contract expires in less than six weeks, positions are opened in the second nearest maturity contract. This circumvents liquidity issues as the contracts approach maturity (see Ma et al., 1992).

Table 4 shows that *Treasury Signal* forecasts returns of a zero-cost Treasury portfolio based on off-the-run securities, and Table 5 shows that *Treasury Signal* forecasts price changes in the futures market.[13] These results not only confirm those of Table 2, but also demonstrate that, at any point in time, a portfolio manager has the flexibility of implementing the Treasury strategy in different financial instruments. Before transaction costs, implementing the Treasury strategy in off-the-run Treasuries or 2-yr T-note futures generates (annualized) Information Ratios of 1.04 and 1.02, respectively. These Information Ratios are very close to 1.05, the previously calculated *IR* using on-the-run Treasuries. The flexibility of implementing the Treasury trading strategy in different financial instruments may allow a more cost-effective implementation of the strategy, as managers may choose financial instruments in order to minimize trading costs and mitigate the transaction volume limitations highlighted by Mercer et al. (2009) portfolio.

5. The likely source of predictability

An interesting question is whether the predictability we document is due to risk compensation or to private information possessed by survey respondents.[14,15] Admittedly, this is a hard question to answer because we cannot get into respondents heads and find out how they formed their judgement. However, several pieces of indirect evidence point towards private information.

The first argument for predictability arising from private information is conceptual, and comes from the nature of the specific question being asked in the Treasury Survey (i.e., whether respondents are neutral, long, or short duration). Survey respondents would tend to be indifferent towards shortening or lengthening the duration of their portfolios if they thought that any potential change in their expected returns would be matched by an offsetting change in their risk exposure. Therefore, if respondents are willing to alter their portfolios, and if returns move in the direction consistent with them achieving higher returns, this suggests that they possess private information about future returns.

The second argument for information-based predictability comes from the lack of predictability for returns on longer-term bond portfolios. We repeat the analysis in Table 1 using the US Treasury Current Ten-Year Index, rather than the Current Two-Year Index. We find that the coefficients on *Treasury Signal* (and its moving averages) are negative but neither statistically nor economically significant in all specifications in Table 1. For example, the *t*-statistics of the coefficient on *Treasury Signal* in Column (5) is −0.57 when we use the Current Ten-Year Index rather than the Current Two-Year Index. That coefficient implies that a one-standard deviation change in the four-week moving average of *Treasury Signal* is associated with a mere 0.06 standard deviation change in the returns of the Ten-Year Index, compared to a 0.27 standard deviation change in the returns of the Two-Year Index documented before. Since it is unlikely that risk premia in the term structure would affect 2-year yields but not 10-year yields, it is unlikely that the predictability we document is due to risk compensation. Or, to put it differently, the results in Cochrane and Piazzesi (2005) indicate that risk premia in the default-free term structure has a one-factor structure, and that longer-term bonds have higher exposure to this single-factor. Therefore, if the predictability we document was due to risk exposure, one would expect higher risk compensation using the Ten-Year than using the Two-year Index. This is not what we find, therefore our evidence is not consistent with a reasonable conjecture about risk premia in the term structure.

The third piece of evidence suggesting that return predictability is due to private information rather than risk comes from the contemporaneous correlation between *Treasury Signal* and the Cochrane and Piazzesi (2005) factor, a popular proxy for risk premia in the term structure also used by Cooper and Priestley (2009) and Ludvigson and Ng (2009). This correlation is equal to 0.52 and statistically significant at the 1% level. However, the correlation would be negative if the predictability we document was due to risk. This because a high Cochrane-Piazzesi factor signals high returns for lengthening duration, while a high *Treasury Signal* signals low returns for extending duration. To the extent that the Cochrane-Piazzesi is a good proxy for risk premia in the term structure, the positive correlation we find is strong evidence against a risk-based explanation.

Finally, the last argument for information-based predictability has to do with the lack of correlation between *Treasury Signal* and *Credit Signal*. After we match these time series as in the previous section, we find that their contemporaneous correlation is just 0.12, not statistically significant at the 10% level. So, it is unlikely that *Treasury Signal* and *Credit Signal* forecast excess returns on bond portfolios because they are picking up some sort of variation in aggregate risk aversion in debt markets.

5.1. On sharing private information

Given that we find evidence suggesting that return predictability based on surveys stems from information rather than from risk exposure, we must address the issue of why market participants would be willing to share their information by participating in J.P. Morgan's Client Surveys. There are at least three, non-mutually exclusive, reasons why it may make sense for an investor with private information to be willing to share it, as we explain below.

The first reason has to do with noise attenuation, and the fact that survey respondents are able to see survey results ahead of general market participants. Assuming that the private information signal of each individual survey respondent is noisy (i.e., nobody knows the future), survey respondents benefit from observing the average signal across all survey respondents. The average signal is more precise than each individual signal, as idiosyncratic variation is dampened by averaging. This average signal is disseminated only to J.P. Morgan clients, so general market participants do not have access to it in a timely fashion. Moreover, it is even possible that survey respondents get to see survey results before non-survey respondents that are also J.P. clients. This is because survey respondents receive a "heads-up" e-mail as soon as survey results are uploaded to J.P. Morgan's research website.

The second reason why it may make sense to share private information is because survey respondents may have already built their desired portfolio positions before participating on the survey, while prices have not fully adjusted yet. It is plausible to think that risk aversion or funding constraints limit the size of the position of informed survey respondents, so that they are either not willing or not able to trade even though market prices have not fully reflected their private information. In that case, they would want their information to be disseminated as quickly as possible. The quicker it is incorporated in market prices, the quicker is the profit for the informed survey respondent.

[13] Note that a position in the futures market is leveraged ("zero-cost") by design, as the cash flow of entering a position is zero. Thus, the profit (price change between two points) is equivalent to a excess return. Our calculations are based on daily settlement prices.

[14] Green (2004), Brandt and Kavajecz (2004), and Mizrach and Neely (2008) find microstructure evidence of private information trading in US Treasury markets. See, however, contrary arguments in Chatrath et al. (2009) and Griffiths et al. (2010).

[15] One of the reasons why distinguishing between risk and private information matters is because it affects the interpretation of our results as tests of the Expectation Hypothesis. To wit, if the Expectation Hypothesis is stated in terms of public information only, or in terms of the information set of the "marginal investor", evidence that some market participants are able to forecast bond returns on the basis of their private information does not represent a rejection of the Expectation Hypothesis.

The third reason why informed clients may be willing to participate in J.P. Morgan client surveys is because they see their participation as part of an ongoing relationship with J.P. Morgan, which is not only a major dealer in US debt markets, but also a major provider of global financial services such as asset custody, financing, and securities lending. More specifically, it is possible that participating in periodic surveys helps build a "good customer" reputation, and such reputation may lead to lower fees. [16]

6. Conclusion

We show that J.P. Morgan client surveys contain information about future excess returns in debt markets. Future returns on Treasury and Credit zero-cost portfolios tend to confirm the forecasts of survey respondents in the weeks following the surveys. Return predictability is both economically and statistically significant. Information in the surveys is not subsumed by other variables that may forecast excess returns in debt markets, such as the slope of the yield curve and the Baa–Aaa corporate credit spread. We present some evidence that predictability is likely to be due to private information possessed by survey respondents, rather than due to compensation for risk exposure. Future research may investigate whether this potential private information is about monetary policy or about liquidity shocks affecting debt markets.

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Appendix A. Bid-ask and price impact costs of Treasury Strategy

A.1. Rebalancing of ML index

In assessing the bid-ask cost at the monthly rebalancing of the Index, it is important to realize that bonds that have gone off-the-run very recently are more liquid than bonds that have gone off-the-run a long time before. Pasquariello and Vega (2009) show in their Table 4 that the residual bid-ask spread differential for on- and off-the-run 2-year notes (as fraction of midprice) is 0.0064%, on average, but smaller in days immediately following a Treasury auction. For example, the liquidity differential is just 0.0024% (0.0064–0.0040%) one day after the auction, and is 0.0040% (0.0064–0.0024%) two days after the auction. Table 1 in Pasquariello and Vega (2009) shows that the average bid-ask spread of the 2-year on-the-run security as a fraction of its midquote price is 0.008%. Therefore, using Pasquariello and Vega's (2009) aforementioned Table 4 results, we calculate that the bid-ask cost of rebalancing the index each month just after each Treasury auction amounts to 1.84 basis points (0.008% + 0.008% + 0.0024%), assuming buying at the quoted ask and selling at the quoted bid. This is a conservative assumption, as trades may happen inside the quoted bid-ask spread, or tend to occur after a narrowing of the quoted bid-ask spread, as discussed by Goldreich et al. (2005).

We calculate the price impact costs of rebalancing the Index using results from Brandt and Kavajecz (2004). In their Table 4, these authors report that a one-standard deviation order flow imbalance (purchases less sales) is associated with a -0.96 basis points yield change in the 2-year on-the-run Treasury, and a -0.95 basis points yield change in a 2-year just off-the-run Treasury. Using a conservative modified duration equal to 2, the percent price increases associated with a one-standard deviation order flow imbalance are 1.92 and 1.90 basis points for on- and off-the-run Treasuries, respectively. Table 1 in Brandt and Kavajecz (2004) shows that the standard deviation of order flow imbalance is $594 million for on-the-run 2-year Treasuries, and $116 million for "just off-the-run" 2-year Treasuries. According to their definition, a security is just off-the-run when there are one or two new issues of similar maturities auctioned since being issued, therefore the $116 million standard deviation applied to order flow imbalance in two different just off-the-run. bonds, the "old" bond and the "old–old" one. Assuming, conservatively, that this imbalance is uniformly distributed across the "old" bond and the "old–old" bonds, we get an order flow imbalance standard deviation of $58 million for the "old" bond only. Therefore, for a trade of $50 million, the total price impact of rebalancing the BofA ML Current Two-year Index after each monthly auction is $(50 \div 594)1.92 + (50 \div 58)1.90 = 1.80$ basis points.

A.2. Adjustment

Using the time series of the normalized *Treasury Signal* (z_t^T in our Section 4 notation), we calculate the, on average, the position is changed by each four weeks (i.e., 0.42 is the average of $|z_{t+1}^T - z_t^T|$). This adjustment is performed with "on-the-run" securities, since the rebalancing from off to on-the-run securities happens at each monthly auction. Therefore, using the average on-the-run bid-ask cost of 0.008% from Pasquariello and Vega (2009), we calculate the average bid-ask cost of adjusting the position every four weeks in response to Treasury signal to be $0.42 * 0.008\% = 0.34$ basis points. Using the Brandt and Kavajecz (2004) results discussed above, we calculate that the price impact of adjusting the position is $0.42(50 \div 594)1.92 = 0.07$ basis points.

A.3. Repo

Following Duarte et al. (2006), we assume that the repo bid-ask spread is 10 basis points per year. So, in order to account for bid-ask spread in the repo side, we must add five basis points per year to the financing rate when funds are borrowed, and subtract five basis points per year to the lending rate when funds are lent. All in all, this amounts to reducing the excess returns of the Treasury trading strategy by $5 \div 13 = 0.38$ basis points, as there are 13 four-week periods in 1 year.

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[16] For example, Blackwell and Winters (1997) provide evidence that firms can reduce their costs of capital by establishing and maintaining close ties to a particular bank.

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