Will the Julius Baer Election Notes Perform as Advertised?

Executive Summary—**In January 2020, Julius Baer (JB) Group Ltd. issued a pair of structured notes advertised to have differing performance dependent on the results of the U.S. 2020 presidential election[1]. The portfolios underlying these notes each consist of a basket of 15 stocks, with one expected to outperform the other depending on if President Trump, a Republican, wins reelection or is unseated by the challenging Democrat.**

In this paper we examine the JB Group's claim of differing expected performance of these two portfolios. To this end, we first examine the quantitative differences between the portfolios based on a set of fundamental, macroeconomic, and political features. We found that the portfolios do not perform as advertised in historical back test. We also found evidence that the Republican portfolio performance is correlated with oil price, and the Democratic portfolio is more immune to U.S. trade policy. An analysis of political donation data shows that the Republican portfolio on average has donated more to Democratic candidates in the 2020 election cycle than has the Democratic portfolio. Additionally, companies in the Republican portfolio generally have their headquarters in locations that vote much more heavily Democrat. Finally, we present evidence that the Republican portfolio constituent companies provide better health insurance than companies in the Democratic portfolio.

To predict the performance of the two portfolios conditioned on the results of the 2020 election, we incorporated some of these features into linear and ensemble machine learning models. We use the linear model to gain insight into our feature set, and we use the superior out-of-sample performance of the machine learning model to forecast portfolio returns. Under our best predictions, we found the spread between the two portfolios to favor the Republican portfolio in both election results. Additionally, we predict that a Democratic victory will favor both portfolios. However, in the framework of our model, these spreads are shown to not be statistically significant. Therefore, we cannot bolster the claims made by JB Group and have evidence to the contrary.

We use the same machine learning model to suggest portfolios that will perform as expected conditioned on a Republican or Democratic victory in 2020. After rearrangement of the assets in the JB structured notes, our model predicts spreads consistent with what is advertised of these portfolios. That is, a Democratic portfolio will perform better if a Democrat is elected rather than a Republican, and a Democratic portfolio will outperform a Republican portfolio in the case of a Democratic election victory. Likewise, the analogous case is predicted for a Republican portfolio. Finally, we propose novel portfolios with assets taken from the S&P 500 that will achieve the desired spreads with higher confidence.

[1]https://www.bloomberg.com/news/articles/2020-01-14/a-swiss-bank-is-selling-rich-clients-an-exotic-u-s-election-bet

1. The Julius Baer Structured Notes

The constituent assets of the JB Group Ltd. structured notes can be found in Table 1. These two portfolios are advertised to have differing performance based on the results of the 2020 U.S. Presidential Election. We will refer to the structured note that is expected to outperform the other conditioned on a 2020 Republican victory as the "Republican portfolio", and likewise for the "Democratic portfolio". Furthermore, in our analysis we will take these structured notes to be an equal weighting of a long position in each of the constituent companies.

Julius Baer Structured Notes

Democratic Portfolio		Republican Portfolio	
Asset	Ticker	Asset	Ticker
Exelon	EXC	Honeywell	HON
Ford	F	Alphabet Inc.	GOOG
Aptiv PLC	APTV	ConocoPhillips	CP
Constellation	STZ	Marathon Oil	MRO
Estee Lauder	EL	Citigroup	C
SunPower	SPWR	Salesforce	CRM
Coca-Cola	KO	Qualcomm	QCOM
Walmart	WMT	Gilead Sciences	GILD
Home Depot	HD	Amazon	AMZN
NextEra Energy	NEE	Chevron	CVX
CSX	CSXT	Facebook	FB
McDonald's	MCD	Merck & Co.	MRK
Simon Property	SPG	PayPal Holdings	PYPL
First Solar	FSLR	American Express	AXP
Norfold Southern	NS	Visa	V

TABLE 1: Constituent assets of the JB structured notes.

2. Quantitative Differences

We found significant quantitative differences between the two JB portfolios. In historical analysis of the portfolios, using portfolios built with companies present at the time, we found only three presidential elections since President Carter's election in 1976 where the portfolios performed as advertised. These were the 1992, 2008, and 2016 elections. An analysis of daily return spreads between the two portfolios and major news stories since 2016 suggested portfolio correlations with oil prices and U.S. trade policy worries. These hypotheses were given evidence with analysis of monthly returns correlation with oil prices and analysis of international revenue percentage. We found little crossover in industry classifications of the portfolios, with the Republican portfolio dominating in the energy and financial sectors, and the Democratic portfolio dominating in the utility and

Election Cycle	President Taking Power	Spread	D Portfolio % Return	R Portfolio % Return
1976	Jimmy Carter [D]	+0.58% R	3.08% (6)	3.67% (5)
1980	Ronald Reagan [R]	+8.99% D	35.67% (6)	26.68% (6)
1984	Ronald Reagan [R]	+11.34% D	29.05% (9)	17.71% (7)
1988	George H.W. Bush [R]	+13.40% D	42.13% (9)	28.73% (7)
1992	Bill Clinton [D]	+21.11% D	36.16% (9)	15.06% (9)
1996	Bill Clinton [D]	+20.62% R	16.21% (12)	36.83% (9)
2000	George W. Bush [R]	+1.66% D	8.91% (12)	7.24% (10)
2004	George W. Bush [R]	+11.29% D	20.17% (12)	8.88% (10)
2008	Barack Obama [D]	+7.91% D	−28.26% (14)	−36.17% (12)
2012	Barack Obama [D]	+15.68% R	15.43% (15)	31.11% (13)
2016	Donald Trump [R]	+16.68% R	8.26% (15)	24.94% (15)

TABLE 2: Historical performance of the Democratic and Republican portfolios. Spread refers to the difference in yearly returns between the two portfolios starting from the closest date to January 21st of the listed year. Green years indicate a matching election victory and spread direction. Numbers in parenthesis next to returns represent the number of companies present in the portfolio at that time.

consumer staples sectors. An analysis of headquarters location and location partisanship showed that the Republican portfolio was located in Democratic stronghold states, where Democrat partisanship has been steadily increasing since 1988. In an analysis of political donations, we found that both portfolios have donated more to Democratic candidates over the years. Additionally, we found statistical evidence that the Republican portfolio has donated more to Democratic candidates than the Democratic portfolio has in the 2020 election cycle. Finally, we found evidence that the Republican portfolio contains companies with higher rated healthcare than the Democratic portfolio.

2.1. Historical Performance

Yearly historical performance for each portfolio in every election cycle since President Carter is shown in Table 2. The Democratic and Republican portfolios were reconstructed each election cycle based on an equal weighting of companies that were present at the time. We will continue to use this reconstruction method as needed throughout this report when we historically analyze these portfolios. Time frames were chosen to start on the nearest date to January 29th with one year duration for presidential election years.

In the 11 presidential election cycles analyzed, there were 5 Democrat and 6 Republican victories. Out of all Democrat victories, the Democratic portfolio outperformed the Republican portfolio in 40% of cases. Out of all Republican victories, the Republican portfolio outperformed the Democratic portfolio in 17% of cases.

While the Republican portfolio outperformed the Democratic portfolio in the most recent presidential election in 2016, it also outperforms the Democratic portfolio in the 2012 election when President Obama [D] was elected for his second term. In fact, in only three cases has the dominating portfolios name

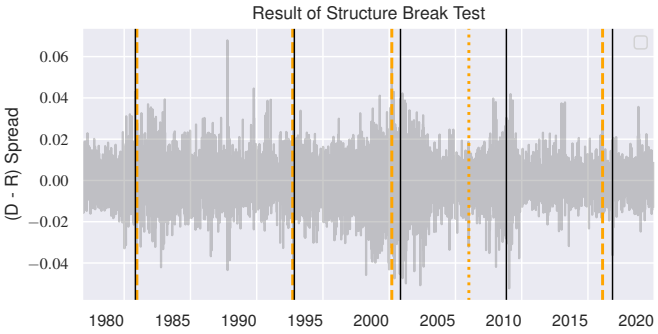

Fig. 1: Structural break test result. Solid lines represent election dates with a party switch. Orange dashed lines are break points close to an election. The orange dotted line is a break point far from any election.

matched the elected presidents party: President Clinton's first election in 1992, President Obama's second election in 2008, and President Trump's election in 2016.

To test if the two portfolios are sensitive to presidential elections, we conducted structural break tests [1] on historical daily spreads between the two JB portfolios. We chose the time period for a single test to be eight years long with one presidential election in the middle and we assumed one break point in each test. The results can be found in Figure 1. The break points in the years 1980, 1992, 2000, and 2016 are close to election dates, indicating that historically some election cycles have had daily impacts on the spreads between the two portfolios.

2.2. News Effects in the Current Presidency

We analyzed the time period between November 9th, 2016 and January 29th, 2020 for significant differences in daily returns between the Democratic and Republican portfolios. Historical daily summaries of financial

Date	Spread	News
11/9/16	+3.63% R	President Trump elected.
11/30/16	+2.29% R	Oil prices rise; Trump proposes fiscal stimulus measures.
12/7/16	+2.06% D	Trump intends to reduce drug prices.
2/17/17	+2.10% D	Trump proposes tax cuts and infrastructure plans.
10/10/18	+2.15% D	Concerns of rising interest rate and slowing global growth.
10/24/18	+3.57% D	Tech sector declines; Concerns of slowing global growth.
11/12/18	+2.26% D	Oil prices decline; Tariff worries.
12/26/18	+2.48% R	Strong retail sales; Oil prices rise; Tech stocks gain.
6/3/19	+2.25% D	Tech giants investigated against antitrust laws.

TABLE 3: Daily return spreads and major news stories between the two portfolios on select dates between November 9th, 2016 to January 29th, 2020. Days were included if the spread between the two portfolios exceeded 2%. Blue or red highlighting indicates whether the Democratic or Republican portfolio outperformed, respectively.

news from Zacks Investment Research[2] allowed us to analyze news snapshots from when the spread of daily returns between the portfolio was substantial. Dates with daily return spreads between the two portfolios of over 2.00% are shown in Table 3 along with the major news stories of that day.

The relative returns compared with the news suggest that the Republican portfolio reacts positively to increasing oil price, and the Democratic portfolio is more immune to trade concerns. We quantify these suggested relationships by analyzing mean monthly correlation with oil prices and mean internationalization for both portfolios.

2.3. Oil Price Correlation

A company's sensitivity to oil prices is quantified by the correlation of monthly returns with monthly oil prices. Shown in Figure 2 is each company's correlation with oil prices along with portfolio averages. The time period analyzed was from a company's inception to January 2020, with data taken from the Federal Reserve Bank of St. Louis[3].

On average, companies in the Republican portfolio have stronger correlation with oil price than those in the Democratic portfolio. This significance is confirmed by a Welch's t-test on the means, which give a p-value of 0.04. The three companies most strongly correlated with oil price are Conoco Phillips, Marathon Oil, and Chevron, which are all part of the Republican portfolio. The three companies least correlated with oil price are Walmart, Home Depot, and Coca-Cola, which are all part of the Democratic portfolio.

[2]https://www.zacks.com

[3]https://www.stlouisfed.org

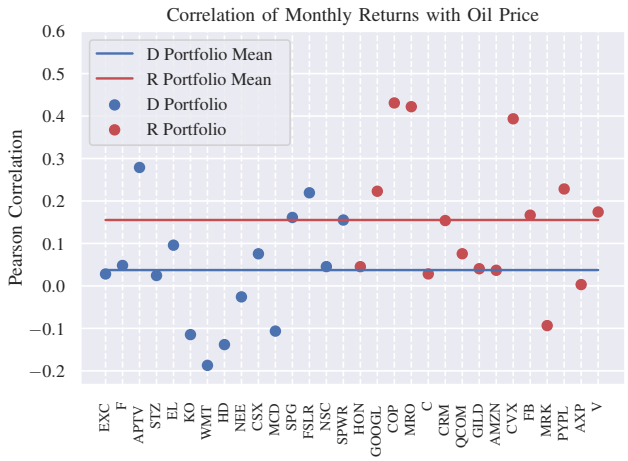

Fig. 2: Correlation of monthly returns with oil price for companies.

2.4. Internationalization

We quantify a company's internationalization by its proportion of overseas revenue in a fiscal year. Shown in Figure 3 is each company's internationalization level in fiscal year 2018 along with the Democratic and Republican portfolio means.

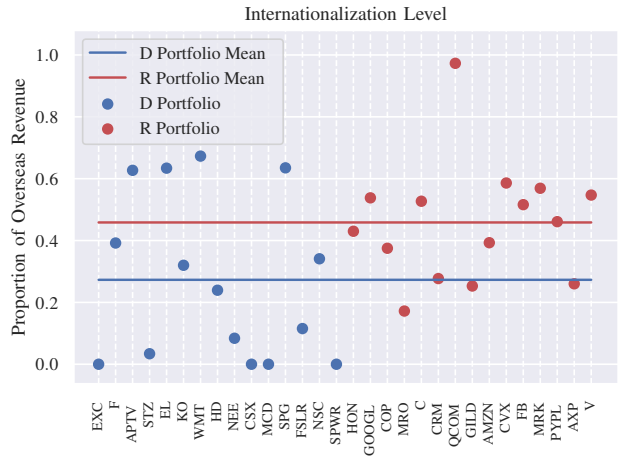

Fig. 3: Internationalization levels of companies.

The Republican and Democratic portfolios have mean internationalization levels of 45% and 27%, respectively. t-test results give evidence the difference in means is significant, with a p-value of 0.04. These results suggest that the Democratic portfolio is less internationalized and less sensitive to United States trade policy.

2.5. Sector Distribution

The sector distribution of each portfolio was analyzed using the GICS of each constituent company,

Fig. 4: GICS industry classifications of companies.

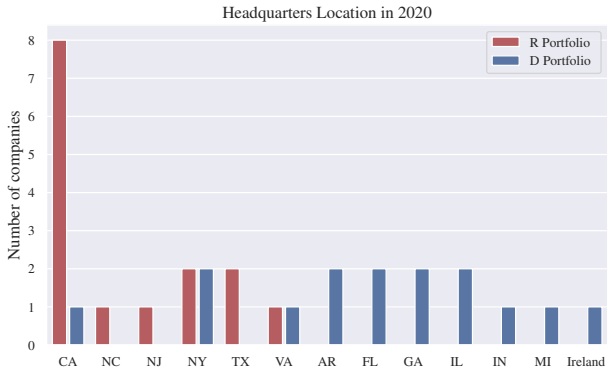

Fig. 5: Headquarters locations of companies in 2020.

with results in Figure 4.

Overall, there is relatively little crossover in industries between the two portfolios, with 73% of the Republican and 53% of the Democratic portfolios being invested in mutually unique sectors. Nearly half (47%) of the Republican portfolio is invested in the energy and financial sectors, while the Democratic portfolio contains no assets in these sectors. Likewise, nearly half (47%) of the Democratic portfolio is invested in the utility and consumer staples sectors, while the Republican portfolio is not at all. Both portfolios are 13% invested in the information technology sector.

2.6. Headquarters Location and PVI

The Cook Partisan Voting Index (PVI) is a measure of the relative partisanship of a state as compared with the nation[4]. For a particular party and election cycle, the PVI is calculated by comparing the most recent vote share to the average of the last two elections. We analyzed the two portfolios with respect to this measure by comparing constituent company headquarters locations with PVI. Company headquarters locations as of 2020 are shown in Figure 5.

[4]https://en.wikipedia.org/wiki/Cook_Partisan_Voting_Index

Over half (53%) of companies in the Republican portfolio have their headquarters in California. Headquarters of companies in the Democratic portfolio are dispersed, with no more than 13% in any particular state. One company, Aptiv PLC has its headquarters outside of the United States in Dublin, Ireland.

For the companies with headquarters in the United States, we analyzed each portfolio by averaging the PVI of the constituent company's 2020 headquarters' state. PVI data was taken from the Cook Political Report[5]. Figure 6 shows the average PVI for each portfolio at each presidential election cycle since 1988. The PVI we use is measured on Democrat partisanship, i.e. the percentage of votes for the Democratic candidate over the national average. A positive PVI indicates Democrat leaning, while a negative PVI indicates a Republican leaning.

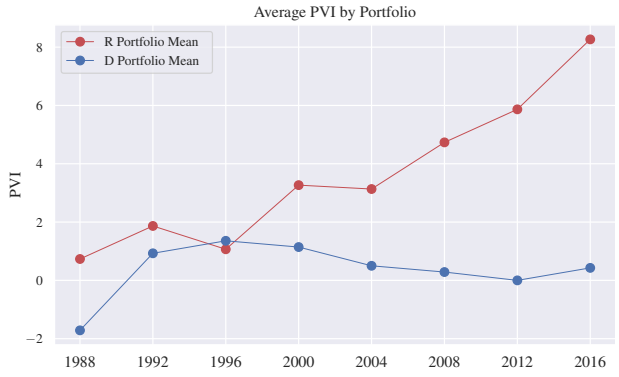

Fig. 6: Portfolio averaged PVI from 1998 to 2016 for each presidential election cycle. PVI for each company was taken to be the PVI of each company's headquarters' state.

Since 2000, the Republican portfolio on average has constituent company headquarters in locations that support the Democratic candidate more than the national average. This is an increasing trend since 2004, with the PVI growing at ∼55% per election cycle. Likewise, the Democratic portfolio with respect to this measure has shown relative non-partisanship through the years with a neutral average PVI and no clear upward or downward trend.

2.7. Political Donations

Using data from the Center for Responsive Politics (CRP)[6], we gathered political donations data of each company in the portfolios. Political donations by a company are defined to include donations made by the organization's political action committee (PAC),

[5]https://cookpolitical.com/index.php/pvi-0

[6]https://www.opensecrets.org

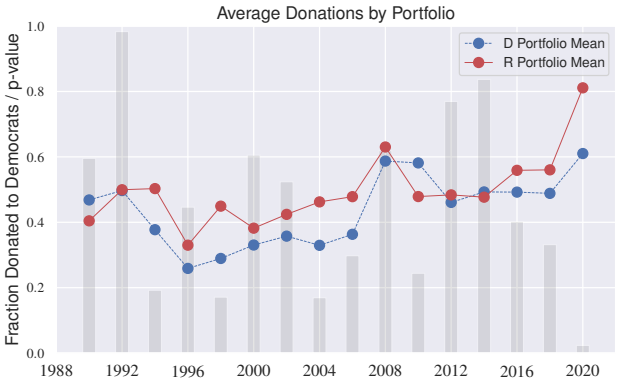

Fig. 7: Average political donations by portfolio for every presidential and midterm election cycle since 1988. Bars are the Welch's t-test p-value for the null hypothesis of equal means of the JB portfolios.

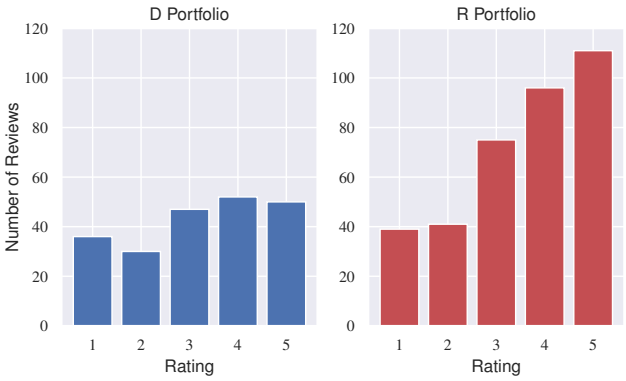

Fig. 8: Health insurance ratings for companies in the JB portfolios.

employees or owners of the company, and those individuals immediate family members. Portfolio averaged donations are shown in Figure 7, where donation partisanship for a particular election cycle is defined to be the percent of donations made to Democratic candidates out of total donations to both Republican and Democratic candidates. Portfolio averages are computed by an equal weighting of the constituent company's fraction donated to Democrats. Data for the 2020 election cycle consists of all donations made as of January 2020.

Some salient features emerge from these time series. On average, both portfolios from 1988 to 2006 generally donated more to Republican candidates. In 1996, the year President Clinton was elected for his second term, both portfolios donated most heavily to Republicans, with 78% donated to Republicans by the Democratic portfolio and 67% donated to Republicans by the Republican portfolio. Since 1996, both portfolios are shown to be trending toward donating a higher percentage to Democratic candidates. With respect to donations to Democratic candidates, 2020 thus far has been the most partisan year on record with 61% donated to Democrats by the Democratic portfolio and 81% donated to Democrats by the Republican portfolio.

There is not enough evidence to conclude different average donations of the portfolios with the exception of the 2020 election cycle. In the 2020 election cycle, a p-value of 0.024 gives evidence that the Republican portfolio has, as of January 2020, donated a higher percentage to Democratic candidates as compared with the Democratic portfolio.

2.8. Health Insurance Ratings

Under the conjecture that opinions on healthcare may be related to overall political affiliation of a company, we collected ratings of employee supplied healthcare from all companies in the two portfolios. Ratings data was taken from Glassdoor[7] from 2014 to the present. Glassdoor allows company employees to rate their health insurance from 1 to 5. The Republican portfolio has about 3000 reviews for company healthcare plans while the Democratic portfolio has 1300 reviews. Because of this imbalance, we applied a square root transformation to the number of reviews in each rating 1 to 5. A histogram of the transformed ratings for each portfolio is shown in Figure 8.

The Democratic portfolio has an average company healthcare rating of 3.23, while the Republican portfolio has an average rating of 3.55. The statistical significance of the difference between the means is supported by a t-test with a p-value of 0.006. These results suggest that the companies in the Republican portfolio issue better overall health care plans to their employees.

3. Expected Performance

To assess how the two JB portfolios will perform under a Republican or Democrat victory in the 2020 election, we constructed models to predict asset returns relative to the S&P 500 based on political, fundamental, and macroeconomic features. The set of assets we used for training are the yearly constituent companies of the S&P 500 since 1990. The starting year 1990 was chosen based on the availability of political donation and returns data. Our target variable is an asset's dividend adjusted yearly return from January 29$^{\text{th}}$ relative to the S&P 500. This return period was chosen

[7] https://www.glassdoor.com

to correspond to the term of the JB structured notes. The set of features we use are named and described in Table 4. After removal of missing data, our training set had a total of 10457 observations.

We built a linear model based on the standalone features and first order cross terms in Table 4, backward selecting significant features with p-values <0.1 [2]. Our linear model uses 231 variables including the intercept and achieves an adjusted R^2 of 19.69%.

We also built a stacked machine learning model to predict the quantile of relative returns based on the distribution of relative returns for any given year. All features in Table 4 were used. Compared with a random guess of quantile for a given asset and year, the stack model improved 26.5% out-of-sample with performance measured by distance from predicted quantile to correct quantile. This is an improvement over the linear model, which improved 24.7% in-sample over a random guess by the same performance metric.

We use both models to predict the performance of the JB structured notes in the 2020 Presidential Election. We define intended performance by two measures. Considering the Democratic portfolio as an illustrative example, the Democratic portfolio should outperform the Republican portfolio in the case of a Democratic election victory in 2020. Additionally, the Democratic portfolio should show better performance if a Democrat gets elected rather than a Republican. Both the linear model and stack model show that there is no evidence the portfolios will perform in this way, and there is weak evidence to the contrary.

3.1. Linear Model and Feature Significance

Our linear model includes features from Table 4 in addition to first order cross terms as independent variables. We selected these features for a mix of fundamental, macroeconomic, and political indicators. Fundamental features were chosen for their similarity to the Barra Risk Factors [3]. These features have been shown empirically to have explanatory power in asset cross sectional returns, and we include them to help discriminate non-political effects. Some macroeconomic features such as *GDP* were chosen to help alleviate outlier behavior in the 2001 and 2008 recessions. Others, such as *OilPrice* and *DollarIndex* were chosen based on inferences gained from Figures 2 and 3, respectively. All fundamental and macroeconomic data was taken from Bloomberg. We also include political donations in our feature set using data taken from the Center for Responsive Politics (CRP). Specifically, we include *DlogDonation* and *RlogDonation* along with *D%Donation* in light of the work by Cooper, Gulen and Ovtchinnikov [4], where political participation was shown to affect stock returns in election years.

Feature	Description
EffTaxRate	The effective tax rate a company pays. (OLY)
Beta	The beta against S&P 500. (OLY)
$Beta^3$	The cube of *Beta*. (OLY)
Momentum	The adjusted lag return. (OLY)
Profit	Simple average of ROE and ROA. (ELY)
Liquidity	Ratio of the traded volume to the market capitalization. (OLY)
Size	Log transformation of market capitalization. (ELY)
$Size^3$	The cube of *Size*. (OLY)
Value	Simple average of PE and PB ratio. (ELY)
Dividend	The dividend rate. (OLY)
Leverage	Ratio of total debt to total equity. (ELY)
Volatility	Simple average of 90D and 360D return standard deviation. (OLY)
Growth	Simple average of net income, EPS, sales and cashflow growth. (OLY)
OilPrice	Growth rate of the price of oil against the previous year's price of oil on the last trading day closest to January 29th.
InterestRate	First order difference of the 10 year treasury yield against the previous year's yield on the last trading day closest to January 29th.
DollarIndex	Annual growth rate of the U.S. dollar index on the last trading day closest to January 29th.
CPI	First order difference of the consumer price index growth rate against previous year's December value.
GDP	First order difference of the GDP growth rate against the previous year's Q3 value.
Unempl	First order difference of the unemployment rate against the previous year's December unemployment rate.
D%Senate	Percent of the senate seats occupied by Democrats at the start of the year.
D%House	Percent of house seats occupied by Democrats at the start of the year.
D%Donation	Percent of political donations made to Democratic candidates.
DlogDonation	Log of the dollar amount donated to Democratic candidates.
RlogDonation	Log of the dollar amount donated to Republican candidates.
GICS*	Ten indicators representing the industry, save one to avoid multicolinearity.
XtY*	Four indicators active only if it is an election year where X is the party of the incumbent president and Y is the party of the incoming president. X and Y both belong to {R,D}.

TABLE 4: Description of features used for any given asset and year. ELY: variable calculated at the end of the lag year. OLY: variable calculated over the entire lag year. * indicates dummy variable.

In our linear model with n continuous variables and m dummy variables, we assumed an observation took

Significant Features in Panel Least Squares Regression											
Standalone Variables			Election & Fundamental Cross Terms			Election & Sector Cross Terms			Donation & Election/Sector Cross Terms		
Variable	Coef	t-stat	Variable	Coef	t-stat	Variable	Coef	t-stat	Variable	Coef	t-stat
DtD	−0.29	−7.40***	*DtR∗Volatility*	−0.09	5.90***	*DtR∗ConsumerCyclical*	−0.17	−4.37***	*DlogDonation∗RtD*	−0.08	−4.96***
DtR	0.20	6.70***	*RtD∗Momentum*	0.09	5.44***	*DtD∗Financial*	0.15	4.27***	*D%Donation∗Energy*	−0.31	−3.21***
Liquidity	0.30	6.22***	*DtR∗Momentum*	−0.09	−5.31***	*RtR∗Energy*	0.22	3.02**	*RlogDonation∗Technology*	−0.03	−2.65**
Momentum	0.27	6.20***	*RtR∗Liquidity*	−0.09	−4.89***	*DtR∗ConsumerNoncyclical*	−0.10	−2.94**	*D%Donation∗DtR*	−0.11	−2.54*
Profit	0.14	3.70***	*DtD∗Size*^{3}	0.07	4.83***	*RtD∗Energy*	−0.13	−2.56*	*D%Donation∗ConsumerCyclical*	−0.07	−2.51*
Technology	0.07	3.64***	*RtD∗Size*	0.46	4.06***	*DtR∗Communications*	−0.13	−2.47*	*DlogDonation∗Energy*	0.06	2.27*
RlogDonation	−0.13	−3.28**	*RtD∗Liquidity*	0.07	3.88***	*RtR∗Communications*	−0.16	−2.45*	*DlogDonation∗RtR*	0.04	2.15*
Energy	0.13	3.23**	*RtD∗Size*^{3}	−0.44	−3.86***	*RtD∗Financial*	−0.08	−2.09*			
Volatility	−0.13	−2.39*	*DtR∗Beta*	−0.05	−3.21**	*RtR∗BasicMaterials*	0.15	2.05*			
ConsumerCyclical	−0.33	−2.14*	*DtD∗EffTaxRate*	0.03	2.93**	*DtR∗Financial*	0.07	2.02*			

TABLE 5: Select significant features in least squares regression. p-value 0 - 0.01: ***, 0.01 - 0.05: **, 0.05 - 0.1: *.

the functional form of

$$y = \beta_0 + \sum_{i=1}^{n} \beta_i^x x_i + \sum_{i=1}^{n} \sum_{j=1}^{i} \beta_{i,j}^{xx} x_i x_j + \sum_{j=1}^{m} \beta_j^d d_j + \sum_{j=1}^{m} \sum_{k=j+1}^{m} \beta_{j,k}^{dd} d_i d_j + \sum_{i=1}^{n} \sum_{j=1}^{m} \beta_{i,j}^{xd} x_i d_j + \varepsilon(0, \sigma^2),$$

where x_i is the i^{th} continuous variable, d_i is the i^{th} dummy variable, β are constant coefficients, y is our target of log returns relative to the S&P 500, and ε is a normally distributed random variable with mean 0 and variance σ^2. All continuous variables are standardized and winsorized at 5% and 95% quantiles.

Table 5 shows select features from the ordinary least squares regression with backward selection and their significance. The features shown are the most germane to the purpose of the model - predicting relative returns based on the political climate. We found that many of the political features crossed with fundamental and macroeconomic features were significant.

The standalone features *DtD* and *DtR*, which are dummy variables representing an election year in which the incumbent president is reelected, are shown to be significant. The negative coefficient of *DtD* indicates that all else being equal, the reelection of a Democratic president will have a negative effect on relative returns. The positive coefficient of *DtR* suggests the opposite, i.e. the defeat of an incumbent Democrat by a Republican will have a positive effect on relative returns.

Some election and sector cross terms showed significance as well. We found that *RtR∗Energy* and *RtD∗Energy* have a positive and negative coefficient in the regression respectively. This suggests that the energy sector reacts positively to the reelection of a Republican and negatively to the defeat of an incumbent Republican by a Democratic. We also found evidence of under performance in the consumer sector during a White House party switch from Democratic to Republican, and under performance of the communications sector when a Republican wins election, regardless of the previous party in the White House. Another sector sensitive to election results is the financial sector. The model suggests that a switch from a Republican to Democratic president will result in negative relative returns, while a switch from a Democratic to Republican president will result in positive relative returns.

The donation and election cross terms provide explanation of how political donations affect relative returns during election years. *DlogDonation∗RtD* and *DlogDonation∗RtR* are shown to be significant. Contrary to one's intuition, all else being equal, companies with a higher absolute monetary contributions to Democrats have lower relative returns when a Democrat replaces a Republican, and have higher relative returns when an incumbent Republican is reelected. The fraction of donations made to Democratic candidates, on the other hand, gives a more intuitive result. *D%Donation∗DtR* is shown to have a negative effect on relative returns if an incumbent Democrat is defeated by a Republican.

Linear model summary

		5 Quantiles		10 Quantiles	
R^2	Adj. R^2	L^1	L^2	L^1	L^2
21.46%	19.69%	1.24	1.65	2.56	3.31

TABLE 6: Performance of the linear model. The model has 10,457 observations and 231 backward selected variables. L^1 and L^2 are the in-sample mean absolute error and square root of mean squared error.

Performance of the linear model with backward selection can be found in Table 6. To compare performance with our machine learning model, we transform the relative returns into quantiles for each year and include a modified version of L^1 and L^2 distances as performance metrics. L^1 is the mean absolute error from predicted quantile to correct quantile, and L^2 is the square root of mean squared error. These measures have better penalization mechanisms than the simple accuracy score for stocks misclassified with large error.

3.2. Stack Model

Ensemble methods are commonly used to boost predictive accuracy by combining the predictions of

Stack Model Accuracy

	5 Quantiles		10 Quantiles	
Model	L^1	L^2	L^1	L^2
Stack Model	1.20	1.56	2.50	3.16
Random Forest	1.32	1.81	2.91	3.85
Gradient Boosting	1.34	1.80	3.03	3.95
Discriminant Analysis	1.36	1.80	2.92	3.80
Light GBM	1.39	1.86	2.98	3.87
XGBoost	1.41	1.89	2.93	3.81
Support Vector Classifier	1.45	1.92	3.19	4.11
AdaBoost	1.45	1.93	3.19	4.13
KNeighbors Classifier	1.48	1.92	3.10	3.98
Gaussian Naïve Bayes	1.48	1.93	3.19	4.07
Neural Network	1.52	1.99	2.99	3.93
Random Guess	1.60	2.00	3.40	4.06

TABLE 7: Stack model and constituent classification models with their L^1 and L^2 distance errors on the test set. Stack Model prediction is a weighted average of the classification model predictions.

multiple otherwise unrelated machine learning models [5], [6]. The idea is to combine so-called "weak" learners into one stacked model, resulting in a final ensemble that can have a higher prediction power. Using this method, we combined different multi-class classification models into one stack model to predict the relative returns quantile for a given asset and year. We chose to use discrete quantiles instead of continuous returns since we are chiefly interested in the relative performance between assets. Using quantiles preserves this relationship while being more forgiving in respect to the prediction accuracy. Scores were given to each individual member of our stack model based on their out-of-sample performance in a validation partition of our data set. Our stack model takes the accuracy score based weighted average of single model predictions to form the final quantile prediction. The detailed methodology for creating our stack model is as follows:

1) Discretize the asset returns relative to the S&P 500 into n quantiles year by year, so that the number of observations per quantile is balanced.
2) Randomly split the data set to form the training, validation, and test sets, with each taking 60%, 20%, and 20% of the observations, respectively.
3) Train 13 individual models using the training set and select the 10 best models based on their accuracy score in the validation set.
4) Determine weights of individual models by rank ordering their accuracy scores. A model with rank r out of 10 is assigned a weight $w_r = (11-r)/55$.
5) Evaluate the performance of the stack model with the test set.

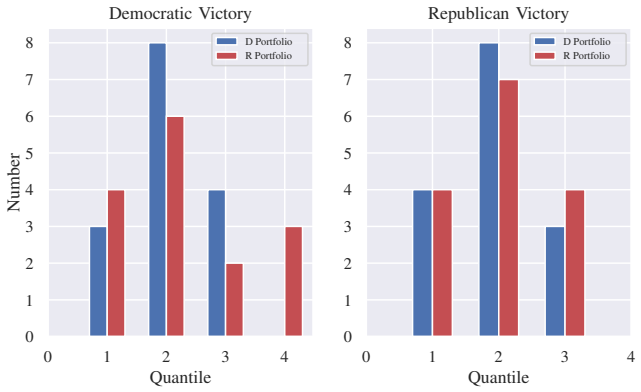

Fig. 9: 5 quantile stack model performance predictions.

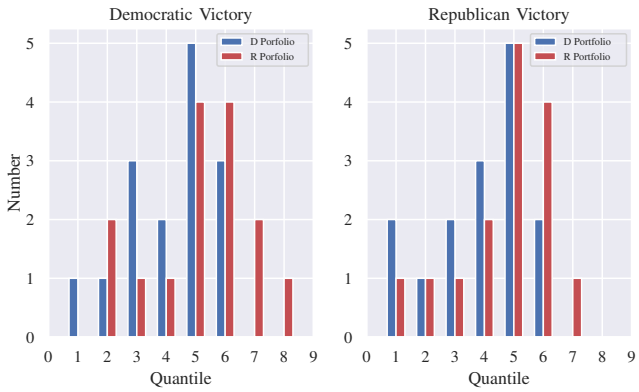

Fig. 10: 10 quantile stack model performance predictions.

To demonstrate robustness, we built two stack models that use 5 and 10 quantile classifications. From Table 7, we see that both stack models perform better than any of the individual constituent models and about 26% better than a random guess under L^1 and L^2 measures. These performance metrics refer to the total average distance error, measured by the same L^1 and L^2 norms as in the linear model, of observations' predicted quantile and actual quantile. Any individual model's performance in the test set is similar to its performance in the validation set, which suggests minimal overfitting.

3.3. Performance Predictions of the JB Portfolios

Using the linear and stack models, we predict the performance of the JB structured notes in the cases of a Democratic and Republican victory in 2020. Figures 9 and 10 show the performance predictions of the two portfolios using the 5 quantile and 10 quantile stack models, respectively. A comparison of the two models in Figure 11 shows that both predict the same outcomes, indicating robustness of the result. The stack models predict both portfolios will perform better if a Democratic wins election, and that the Republican

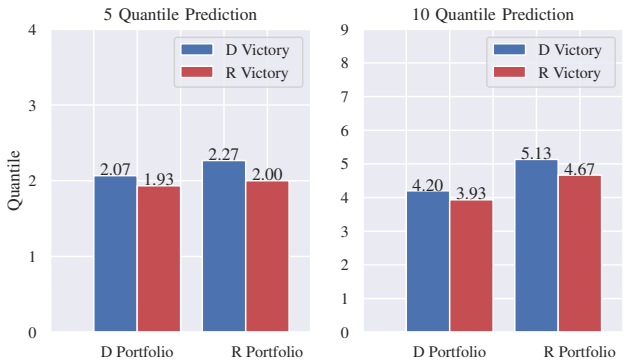

Fig. 11: Comparison of the 5 and 10 quantile model predictions.

portfolio will outperform the Democratic portfolio under both election results.

We use one tailed t-tests to measure the strength of the spread results. In our t-tests we use the alternative hypotheses that the portfolio spreads will perform as expected in relation to each other and across election results. For example, the Democratic portfolio should outperform the Republican portfolio in the case of Democratic victory, and the Democratic portfolio should have better performance under a Democratic victory as compared with a Republican victory. The analogous case should be true for the Republican portfolio.

Table 8 shows the performance predictions of the 10-quantile stack model and linear model. Both the linear and stack model do not give evidence of the advertised performance in any scenario, according to t-test results. The linear model even predicts the opposite of the advertised performance horizontally and vertically.

4. Proposed Structured Notes

We propose two new sets of structured notes that have expected performance closer to the intended design of the original JB portfolios. One set of notes reshuffles the 30 companies in the JB portfolios and another novel set uses companies taken from the S&P 500. Since the stack models have better performance out-of-sample than the linear model does in-sample, and the stack model's results are robust across the 5 quantile and 10 quantile versions, we chose to use the 10 quantile stack model as our method for predicting relative asset returns. Our methodology for creating these new notes stays the same. First, we rank order all assets based on their difference in performance in the case of a Democrat victory in 2020 and a Republican victory in 2020. Next, we select the top 15 as the new Republican portfolio, and the bottom 15 as the new Democratic portfolio. The reshuffled JB portfolios and novel portfolio both exhibit clear performance differences in both election outcomes.

Linear Regression Model Predictions

2020 Election Victor

	Democrat	Republican	Spread	t-stat
D Portfolio % Returns	$-24.9 \pm 9.2\%$	$-20.3 \pm 12.6\%$	4.6%	-0.95
R Portfolio % Returns	$-14.3 \pm 10.4\%$	$-30.5 \pm 14.5\%$	16.3%	-2.53
Spread	10.6%	10.3%		
t-stat	-3.70	-2.57		

Stack Model (10 Quantile) Predictions

2020 Election Victor

	Democrat	Republican	Spread	t-stat
D Portfolio Quantile	4.2 ± 1.8	3.9 ± 1.6	0.3	$+0.46$
R Portfolio Quantile	5.1 ± 1.5	4.7 ± 1.6	0.4	-0.75
Spread	0.9	0.8		
t-stat	-1.55	$+1.23$		

TABLE 8: Performance predictions of the JB structured notes in the 2020 election. Spread cell color indicates direction. Blue favors Democratic type, red favors Republican type. p-value 0 - 0.01: ***, 0.01 - 0.05: **, 0.05 - 0.1: *.

4.1. Rearranged JB Notes

Assets in the JB structured notes were rearranged to better approximate the desired performance. The new notes can be found in Table 9. We found that 40% of companies in each original portfolio would be better suited in the opposite portfolio. Predicted performance can be found in Table 10.

Under this arrangement, we predict the spreads to be consistent in both directions. In the framework of our model, we have 90% confidence that the Democratic portfolio will react better to a Democratic victory than a Republican victory, and 90% confidence that the Republican portfolio will outperform the Democratic portfolio in the case of a Republican victory. We have less than 90% confidence in all other spreads.

4.2. Novel Portfolios

Assets in the S&P 500 were ranked ordered according to performance in the cases of a Republican and Democratic victory in 2020. We believe the portfolios found in Table 11 have the highest likelihood of achieving election dependent performance.

The only company from the original JB portfolios that appears in the novel portfolios is Qualcomm. Originally in the Republican portfolio, it is now in the novel Democratic portfolio. Recall that significant features in our linear regression model (Table 5) suggested that

Rearranged JB Structured Notes

Democratic Portfolio		Republican Portfolio	
Asset	Ticker	Asset	Ticker
Qualcomm	QCOM	Norfolk Southern	NSC
Amazon	AMZN	Simon Property	SPG
Salesforce	CRM	SunPower	SPWR
Facebook	FB	Ford Motor	F
Marathon Oil	MRO	Constellation	STZ
Paypal	PYPL	CSX	CSX
Exelon	EXC	Honeywell	HON
Aptiv PLC	APTV	Alphabet	GOOGL
Estee Lauder	EL	Conoco Phillips	COP
Coca-Cola	KO	Citigroup	C
Walmart	WMT	Gilead Sciences	GILD
Home Depot	HD	Chevron	CVX
NextEra Energy	NEE	Merk & Co.	MRK
McDonalds	MCD	American Express	AXP
First Solar	FSLR	Visa	V

TABLE 9: Rearranged JB notes. Companies highlighted with purple have switched portfolios.

Rearranged JB Notes Predictions

	2020 Election Victor			
	Democrat	Republican	Spread	t-stat
D Portfolio Quantile	4.8 ± 2.0	3.8 ± 1.9	1.0	$+1.30^{*}$
R Portfolio Quantile	4.5 ± 1.4	4.8 ± 1.3	0.3	$+0.56$
Spread	0.3	1.0		
t-stat	$+0.43$	$+1.63^{*}$		

TABLE 10: Performance predictions of the rearranged JB notes. p-value 0 - 0.01: ***, 0.01 - 0.05: **, 0.05 - 0.1: *.

Novel Portfolios

Democratic Portfolio		Republican Portfolio	
Asset	Ticker	Asset	Ticker
Intuitive Surgical	ISRG	Whirlpool	WHR
Kraft Heinz	KHC	CH Robinson	CHRW
Brown-Forman	BF/B	Celanese	CE
Entergy	ETR	DXC Technology	DXC
Lam Research	LRCX	E-Trade	ETFC
MGM Resorts	MGM	Kimco Realty	KIM
Qualcomm	QCOM	Lincoln National	LNC
Hanesbrands	HBI	Union Pacific	UNP
Apple	AAPL	Corning	GLW
Boston Scientific	BSX	Alliance Data	ADS
NiSource	NI	News Corp	NWSA
ONEOK	OKE	Omnicom Group	OMC
Alexion	ALXN	Snap-on	SNA
AMD	AMD	Abiomed	ABMD
Becton Dickinson	BDX	Noble Energy	NBL

TABLE 11: Novel portfolios created for election dependent performance with assets taken from the S&P 500.

Novel Portfolios Predictions

	2020 Election Victor			
	Democrat	Republican	Spread	t-stat
D Portfolio Quantile	5.7 ± 2.5	3.3 ± 2.7	2.4	$+2.56^{***}$
R Portfolio Quantile	2.7 ± 1.6	4.9 ± 2.2	2.2	$+3.11^{***}$
Spread	3.0	1.6		
t-stat	$+3.99^{***}$	$+1.73^{**}$		

TABLE 12: Performance predictions for the novel portfolios. p-value 0 - 0.01: ***, 0.01 - 0.05: **, 0.05 - 0.1: *.

a Republican president would benefit the energy and financial sectors. The stack model may have also found this relationship, as the novel Republican portfolio includes the energy company Nobel Energy and financial companies Lincoln National and E-Trade.

In the framework of our model, we have 95% confidence that the Republican portfolio will outperform the Democratic portfolio under a Republican victory. For all other cases, we have 99% confidence that the spread will be consistent with expectations.

5. Conclusions

While we found substantial quantitative differences between the Julius Baer notes, we found no quantitative evidence that the portfolios will have the election dependent performance they advertise. In our best predictions, the Republican portfolio will outperform the Democratic portfolio in both election scenarios, and both portfolios will perform better in absolute terms if a Democratic challenger unseats President Trump. We do not have confidence, however, that these predicted spreads are statistically significant. We suggest a rearrangement that our model predicts will have the correct spreads in each direction, but only in two of the four spreads do we have 90% confidence that the spread is significant. As an alternative to the JB notes, we suggest our novel portfolios in which we have 99% confidence that three of the spreads will perform as expected, and 95% confidence that the final spread will perform as expected.

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