Portfolio Equity Premium Prediction

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Abstract

In the financial market, predicting the stock returns accurately is an important goal for every investor. However, stock returns are affected by many hidden variables and it is hard to capture the movement of stocks accurately. Many investors, therefore, prefer investing in a portfolio that contains different kinds of stocks to eliminate the unsystematic risk. CAPM provides the portfolio return by only considering the historical returns and correlation of the stocks. However, stock returns are affected by the future economic environment. This reveals the need for predicting portfolio return. Welch & Goyal(2008) tried to predict the equity premium by using various economics and individual-based factors, but most of the models failed in in-sample(IS) significance or out-of-sample R2.

This paper aims to investigate whether modeling each industrial stock equity premium separately would improve the accuracy of the portfolio equity premium prediction.

Literature Review

There are various factors to be used to forecast the stock return. Fama & French(1993) suggested using the factor of overall market, firm size, and book to market ratio to model the stock return. There are various approaches to investigate the correlation between the factors and the stock return. Connor(1995) classified the factors into macroeconomic, statistical, and fundamental; and compared the explanatory power of the factors among the 3 types. Welch & Goyal(2008) modeled the return by using macroeconomics factors and individual-based factors, like dividend yield and book to market ratio.

There are several ways to compare model performance. One of the approaches is to compare their mean absolute error(MAE)(Willmott & Matsuura, 2005; Liu, Tian & Li, 2012) or similarly, to compare their total sum of residual (Luca, 2015). Comparing their mean square error (MSE) was also used(Sacchero, Bruzzoniti, Sarzanini, Mentasti & Coenegracht, 1998; Liu, Tian & Li, 2012). Another alternative is the mean absolute percentage error(MAPE)(Liu, Tian & Li, 2012)

Data Description

1) Equity Premium
    - Industrial Equal-weighted Month-End(Year-End) Return minus 3 month Treasury Bill Rate. Connor(1995) also investigated the explanatory power of industries. Welch & Goyal(2008) also used the equity premium as a dependent variable.
    - Data Source: Holding period return(including distribution) from CRSP; 3 month Treasury Bond yield from FRED, Federal Reserve Bank of St. Louis

2) Inflation Rate
    - Monthly(annual) inflation rate(12 month moving annual rate). Customer Price Index from the Bureau of Labor Statistics. Connor(1995), Welch & Goyal(2008) investigated the explanatory power of the inflation rate.
    - Data Source: US Inflation Calculator

3) Unemployment Rate
    - Monthly(annual) US unemployment rate. Connor(1995) investigated the explanatory power of the unemployment rate.

- Data Source: FRED, Federal Reserve Bank of St. Louis

4) Price/Earnings Ratio of S&P500
    - Log of price minus Log of earning, where Earning is the 12-month moving sum. Welch & Goyal(2008) investigated the explanatory power of the earning price ratio.
    - Data Source: Earning from Robert Shiller's Website; Price from Yahoo Finance

5) Dividend Yield of S&P500
    - Log of dividend minus log of lagged price, where Dividend is the 12-month moving sum. Connor(1995), Welch & Goyal(2008) investigated the explanatory power of dividend yield.
    - Data Source: Dividend from Robert Shiller's Website; Price from Yahoo Finance

6) Risk Free Rate(3-month Treasury Bill Rate)
    - Monthly(annual) *3-Month Treasury Bill: Secondary Market Rate (TB3MS).* Welch & Goyal(2008) investigated the explanatory power of the Treasury Bill.
    - Data Source: FRED, Federal Reserve Bank of St. Louis.

7) Dividend Price Ratio of S&P500
    - Log of dividend minus log of price, where Dividend is the 12-month moving sum. Welch & Goyal(2008) investigated the explanatory power of the Dividend Price Ratio.
    - Data Source: Dividend from Robert Shiller's Website; Price from Yahoo Finance

8) Dividend Payout Ratio of S&P500
    - Log of dividend minus log of earning, where Dividend & Earning are the 12-month moving sum. Welch & Goyal(2008) investigated the explanatory power of the Dividend Payout Ratio.
    - Data Source: Robert Shiller's Website

9) Long-term Government Bond Yield
    - Monthly(annual) 30-year US Treasury Bill Yield. Linear interpolation would be used for the null value. Welch & Goyal(2008) investigated the explanatory power of the Long-term Yield.
    - Data Source: FRED, Federal Reserve Bank of St. Louis.

10) Spread Between Long-term Government Bond Yield and 3 Month Treasury Bond Yield
    - Monthly(annual) 30-year US Treasury Bill Yield minus monthly(annual) 3 month Treasury Bond Yield. Linear interpolation would be used for the null value. Welch & Goyal(2008) investigated the explanatory power of the Term Spread.
    - Data Source: 3 months & 30 year Treasury Bond yield from FRED, Federal Reserve Bank of St. Louis

11) S&P500 Stock Variance
    - Sum of the square of daily stock return. Welch & Goyal(2008) investigated the explanatory power of the Stock Variance.
    - Data Source: daily price from Yahoo Finance

12) Long Term Rate of Return
    - Monthly(annual) Return on long-term yield. Linear interpolation would be used for the null value. Welch & Goyal(2008) investigated the explanatory power of the Long Term Rate of Returns.
    - Data Source: 30 year Treasury Bond yield from FRED, Federal Reserve Bank of St. Louis

Methodology

The research would focus on using various economic and individual-based factors to predict the equal-weighted industrial stocks equity premium(including dividends) in 10 industrial sectors:

1. Agriculture, Forestry, And Fishing
2. Mining
3. Construction
4. Manufacturing
5. Transportation, Communications, Electric, Gas, And Sanitary Services
6. Wholesale Trade
7. Retail Trade
8. Finance, Insurance, And Real Estate
9. Services
10. Public Administration

All the component stocks in the S&P500(in 2019 December) would be divided into 10 classes listed above. For simplification, we would not change the stock portfolio regardless of any changes in the S&P500 throughout the period(1980-2019). The monthly(annual) data from 1980 January to 2019 December would be used. The data after 1990(after 2012 for Public Administration Class as the data are only available since 2009, and the annual performance of this class would not be investigated due to insufficiency of data) is used for out-of-sample forecasts[The splitting ratio of the data is adjusted from the ratio adopted by Welch & Goyal(2008)]. The below factors would be used to build the models:

1. Inflation Rate(inf)
2. Unemployment Rate(uem)
3. Price/Earning Ratio of S&P500(pe)
4. Dividend Yield of S&P500(dy)
5. Risk Free Rate(3-month Treasury Bill Rate)(rf)
6. Dividend Price Ratio of S&P500(dpr)
7. Dividend Payout Ratio of S&P500(dpo)
8. Long-term Government Bond Yield(lgb)
9. Spread Between Long-term Government Bond Yield and 3 Month Treasury Bond Yield(spr)

10. Stock Variance of S&P500(stv)
11. Long Term Rate of Return(ltr)

Following the method used by Welch & Goyal(2008):

$$y(t)= a0 + a1 * x(t-1)+u1(t)$$
$$x(t)= b0 + b1 * x(t-1)+u2(t)$$

where x is the factor and y is the equal-weighted equity premium.

We would test the out-of-sample(OOS) significance by the following F-test:

$$MSE\text{-}F = (T - h + 1) \times (MSEn - MSEa) / MSEa$$

where T is the total number of forecast observations, h is the degree of overlap, MSEn is the MSE of the historical mean model and MSEa is the MSE of the OLS model.

The following equations would be used to test the out-of-sample $R\ bar^2$ (OOS $R\ bar^2$) performance:

$$R^2 = 1 - (MSEa / MSEn)$$
$$R\ bar^2 = R^2 - (1-R^2) \times (T-k) / (T-1)$$

The model with both good in-sample and out-of-sample performance(significant) would be considered as a good model. Finally, we would compare the results to see if it is better to split the stocks into industrial sectors for modeling the equity premium.

Result

Monthly Result

Agriculture, Forestry, And Fishing

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.01337	0.006064			Intercept	0.01152	0.01387			Intercept	0.085	0.0422	
inf	X(t-1)	-0.250861	0.148995	0.08063	0.003824	X(t-1)	-0.18471	0.21032	0.08084	-1.006012	X(t-1)	0.9961	0.0046	1.67E-05
	Intercept	-0.01307	0.0141			Intercept	-0.007389	0.037573			Intercept	0.0643	0.0111	
uem	X(t-1)	0.29547	0.21935	0.08072	0.001701	X(t-1)	0.118146	0.505342	0.08109	-1.004372	X(t-1)	0.9888	0.0095	4.26E-06
	Intercept	-0.003178	0.025161			Intercept	0.013386	0.064869			Intercept	2.4071	0.9844	
pe	X(t-1)	0.002865	0.008449	0.08086	-0.001855	X(t-1)	-0.004965	0.0263	0.0811	-0.9997199	X(t-1)	0.2208	0.0137	2.88E-03
	Intercept	0.012705	0.034261			Intercept	0.07832	0.11121			Intercept	-3.1878	0.1431	
dy	X(t-1)	0.001997	0.009136	0.08086	-0.001996	X(t-1)	0.02421	0.03484	0.08094	-1.00268	X(t-1)	0.9761	0.0179	2.34E-03
	Intercept	0.011153	0.005734			Intercept	0.02882	0.02431			Intercept	0.0908	0.026	
rf	X(t-1)	-0.138999	0.10358	0.08072	0.001673	X(t-1)	-0.31246	0.26218	0.08062	-1.002028	X(t-1)	0.9506	0.0139	7.35E-05
	Intercept	0.011786	0.034429			Intercept	0.0776	0.11101			Intercept	-3.2081	0.1387	
dpr	X(t-1)	0.001747	0.009164	0.08087	-0.00202	X(t-1)	0.02391	0.03467	0.08095	-1.003386	X(t-1)	0.9752	0.018	2.34E-03
	Intercept	0.010535	0.009051			Intercept	0.0365	0.04608			Intercept	-0.8251	0.1112	
dpo	X(t-1)	0.006682	0.010468	0.08083	-0.001241	X(t-1)	0.04739	0.06109	0.0809	-1.010238	X(t-1)	0.9924	0.0076	2.54E-04
	Intercept	0.013561	0.008749			Intercept	0.04565	0.0393			Intercept	0.1006	0.0128	
lgb	X(t-1)	-0.128996	0.123277	0.08078	0.0001986	X(t-1)	-0.41969	0.36455	0.08066	-0.9930719	X(t-1)	0.9753	0.0171	1.91E-05
	Intercept	-0.001149	0.006726			Intercept	-0.003748	0.010893			Intercept	0.0138	0.0073	
spr	X(t-1)	0.291901	0.256104	0.08076	0.0006253	X(t-1)	0.283146	0.454147	0.08098	-1.003087	X(t-1)	0.9206	0.0361	4.52E-05
	Intercept	0.008661	0.004124			Intercept	0.002751	0.007967			Intercept	1.00E-04	1.00E-04	
stv	X(t-1)	-29.52131	16.119702	0.08059	0.0049*	X(t-1)	-13.748792	25.934227	0.08101	-0.9994713	X(t-1)	9.76E-02	0.0909	8.12E-08
	Intercept	0.004893	0.003687			Intercept	0.0004799	0.0071161			Intercept	-0.0011	0.0055	
ltr	X(t-1)	-0.164341	0.089448	0.08058	0.004945*	X(t-1)	-0.5831437	0.1769185	0.07759	-1.000307	X(t-1)	0.3798	0.0848	1.38E-03

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Mining

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.014887	0.005143			Intercept	0.0129	0.01182			Intercept	0.085	0.0422	
inf	X(t-1)	-0.218416	0.126359	0.06838	0.004141*	X(t-1)	-0.13946	0.17922	0.06889	-1.003598	X(t-1)	0.9961	0.0046	1.67E-05
	Intercept	0.001291	0.011978			Intercept	0.01347	0.03199			Intercept	0.0643	0.0111	
uem	X(t-1)	0.105345	0.186344	0.06857	-0.001425	X(t-1)	-0.11443	0.43029	0.06905	-0.9951388	X(t-1)	0.9888	0.0095	4.26E-06
	Intercept	-0.011277	0.021326			Intercept	-0.04435	0.05505			Intercept	2.4071	0.2208	
pe	X(t-1)	0.006485	0.007161	0.06853	-0.0003764	X(t-1)	0.02019	0.02232	0.06883	-1.001153	X(t-1)	0.9844	0.0137	2.88E-03
	Intercept	-0.010886	0.029049			Intercept	-0.05028	0.09475			Intercept	-3.1878	0.1431	
dy	X(t-1)	-0.005019	0.007746	0.06856	-0.001215	X(t-1)	-0.0174	0.02968	0.06897	-0.9987764	X(t-1)	0.9761	0.0179	2.34E-03
	Intercept	0.013622	0.004861			Intercept	0.05024	0.02036			Intercept	0.0908	0.0139	
rf	X(t-1)	-0.136712	0.0878	0.06842	0.002971	X(t-1)	-0.51077	0.21959	0.06752	-1.004149	X(t-1)	0.9506	0.026	7.35E-05
	Intercept	-0.011419	0.029191			Intercept	-0.06908	0.09447			Intercept	-3.2081	0.1387	
dpr	X(t-1)	-0.005153	0.00777	0.06856	-0.001173	X(t-1)	-0.02323	0.0295	0.06889	-0.9987449	X(t-1)	0.9752	0.018	2.34E-03
	Intercept	0.010379	0.00768			Intercept	0.03289	0.03925			Intercept	-0.8251	0.1112	
dpo	X(t-1)	0.003234	0.008882	0.06858	-0.001818	X(t-1)	0.03728	0.05204	0.06892	-1.007072	X(t-1)	0.9924	0.0076	2.54E-04
	Intercept	0.018215	0.007411			Intercept	0.10037	0.03244			Intercept	0.1006	0.0128	
lgb	X(t-1)	-0.161452	0.104423	0.06842	0.002901	X(t-1)	-0.89961	0.3009	0.06657	-1.013501	X(t-1)	0.9753	0.0171	1.91E-05
	Intercept	0.004801	0.00571			Intercept	0.002778	0.009286			Intercept	0.0138	0.0073	
spr	X(t-1)	0.1378	0.217434	0.06856	-0.001253	X(t-1)	0.134055	0.387165	0.06903	-0.9990885	X(t-1)	0.9206	0.0361	4.52E-05
	Intercept	0.009728	0.003505			Intercept	0.0069	0.006777			Intercept	1.00E-04	1.00E-04	
stv	X(t-1)	-16.5099	13.699996	0.06849	0.0009453	X(t-1)	-15.904621	22.061438	0.06892	-0.9977408	X(t-1)	0.0976	0.0909	8.12E-08
	Intercept	0.007528	0.003129			Intercept	0.004496	0.006057			Intercept	-0.0011	0.0055	
ltr	X(t-1)	-0.133519	0.075893	0.06837	0.004364*	X(t-1)	-0.49917	0.150579	0.06604	-0.9982446	X(t-1)	0.3798	0.0848	1.38E-03

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Construction

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.013172	0.007362			Intercept	-0.003748	0.021254			Intercept	0.085	0.0422	
inf	X(t-1)	0.108036	0.180885	0.09789	-0.001348	X(t-1)	0.311894	0.322305	0.1239	-0.9990459	X(t-1)	0.9961	0.0046	1.67E-05
	Intercept	-0.004638	0.017076			Intercept	-0.08274	0.05691			Intercept	0.0643	0.0111	
uem	X(t-1)	0.343348	0.265647	0.09775	0.001401	X(t-1)	1.3223	0.76543	0.1228	-1.090978	X(t-1)	0.9888	0.0095	4.26E-06
	Intercept	0.021777	0.03047			Intercept	0.23305	0.09737			Intercept	2.4071	0.2208	
pe	X(t-1)	-0.001736	0.010231	0.09792	-0.002036	X(t-1)	-0.08955	0.03948	0.1217	-1.018047	X(t-1)	0.9844	0.0137	2.88E-03
	Intercept	0.05598	0.04145			Intercept	0.50966	0.1646			Intercept	-3.1878	0.1431	
dy	X(t-1)	0.01055	0.01105	0.09783	-0.0001872	X(t-1)	0.15574	0.05156	0.1198	-1.03815	X(t-1)	0.9761	0.0179	2.34E-03
	Intercept	0.01799	0.006956			Intercept	0.0204	0.03749			Intercept	0.0908	0.0139	
rf	X(t-1)	-0.031263	0.125652	0.09792	-0.001966	X(t-1)	-0.07655	0.40444	0.1244	-0.995132	X(t-1)	0.9506	0.026	7.35E-05
	Intercept	0.049031	0.041665			Intercept	0.46039	0.16548			Intercept	-3.2081	0.1387	
dpr	X(t-1)	0.008665	0.011091	0.09786	-0.0008155	X(t-1)	0.13984	0.05168	0.1207	-1.036003	X(t-1)	0.9752	0.018	2.34E-03
	Intercept	0.023492	0.01096			Intercept	-0.0242	0.07075			Intercept	-0.8251	0.1112	
dpo	X(t-1)	0.008649	0.012675	0.09788	-0.001119	X(t-1)	-0.05082	0.0938	0.1242	-0.9934332	X(t-1)	0.9924	0.0076	2.54E-04
	Intercept	0.01545	0.01061			Intercept	-0.002698	0.060584			Intercept	0.1006	0.0128	
lgb	X(t-1)	0.01885	0.14944	0.09792	-0.002063	X(t-1)	0.154294	0.562019	0.1243	-0.9985592	X(t-1)	0.9753	0.0171	1.91E-05
	Intercept	0.010685	0.008149			Intercept	0.00547	0.0167			Intercept	0.0138	0.0073	
spr	X(t-1)	0.272333	0.310286	0.09784	-0.0004807	X(t-1)	0.46525	0.69627	0.1241	-0.9990308	X(t-1)	0.9206	0.0361	4.52E-05
	Intercept	0.01763	0.00501			Intercept	0.01354	0.01223			Intercept	1.00E-04	1.00E-04	
stv	X(t-1)	-8.34861	19.58399	0.0979	-0.001715	X(t-1)	0.87391	39.81837	0.1244	-0.994826	X(t-1)	0.0976	0.0909	8.12E-08
	Intercept	0.015915	0.004436			Intercept	0.01223	0.01064			Intercept	-0.0011	0.0055	
ltr	X(t-1)	-0.334998	0.107607	0.09694	0.01786***	X(t-1)	-1.10395	0.26463	0.1161	-0.9965756	X(t-1)	0.3798	0.0848	1.38E-03

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Manufacturing

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.018194	0.003787			Intercept	0.016923	0.009907			Intercept	0.085	0.0422	
inf	X(t-1)	-0.15724	0.093055	0.05036	0.003866*	X(t-1)	-0.104278	0.150238	0.05775	-1.001596	X(t-1)	0.9961	0.0046	1.67E-05
	Intercept	0.0005189	0.0088029			Intercept	-0.02024	0.02665			Intercept	0.0643	0.0111	
uem	X(t-1)	0.2029596	0.1369424	0.05039	0.002497	X(t-1)	0.43017	0.35842	0.05752	-1.041673	X(t-1)	0.9888	0.0095	4.26E-06
	Intercept	0.01099	0.015716			Intercept	0.035358	0.046233			Intercept	2.4071	0.2208	
pe	X(t-1)	0.00072	0.005277	0.05051	-0.002057	X(t-1)	-0.009896	0.018744	0.0578	-0.9989702	X(t-1)	0.9844	0.0137	2.88E-03
	Intercept	0.030226	0.021384			Intercept	0.12474	0.07881			Intercept	-3.1878	0.1431	
dy	X(t-1)	0.004591	0.005703	0.05047	-0.0007367	X(t-1)	0.03568	0.02469	0.05736	-1.00759	X(t-1)	0.9761	0.0179	2.34E-03
	Intercept	0.016389	0.003583			Intercept	0.03847	0.01724			Intercept	0.0908	0.0139	
rf	X(t-1)	-0.077335	0.064717	0.05043	0.0008945	X(t-1)	-0.30981	0.18599	0.05719	-1.001149	X(t-1)	0.9506	0.026	7.35E-05
	Intercept	0.027647	0.021494			Intercept	0.10953	0.07883			Intercept	-3.2081	0.1387	
dpr	X(t-1)	0.003892	0.005721	0.05048	-0.001125	X(t-1)	0.03081	0.02462	0.05749	-1.007253	X(t-1)	0.9752	0.018	2.34E-03
	Intercept	0.017996	0.00565			Intercept	0.04245	0.03283			Intercept	-0.8251	0.1112	
dpo	X(t-1)	0.006187	0.006535	0.05046	-0.0002165	X(t-1)	0.04209	0.04352	0.05764	-1.01224	X(t-1)	0.9924	0.0076	2.54E-04
	Intercept	0.016423	0.005468			Intercept	0.03649	0.02809			Intercept	0.1006	0.0128	
lgb	X(t-1)	-0.051475	0.077047	0.05048	-0.00116	X(t-1)	-0.2397	0.26062	0.05766	-0.9922943	X(t-1)	0.9753	0.0171	1.91E-05
	Intercept	0.007621	0.004196			Intercept	0.001414	0.007687			Intercept	0.0138	0.0073	
spr	X(t-1)	0.250032	0.159762	0.05038	0.003023	X(t-1)	0.552417	0.320506	0.05715	-1.011388	X(t-1)	0.9206	0.0361	4.52E-05
	Intercept	0.015235	0.002576			Intercept	0.013613	0.005655			Intercept	1.00E-04	1.00E-04	
stv	X(t-1)	-18.43508	10.067814	0.05033	0.004898*	X(t-1)	-22.497984	18.407859	0.0575	-0.9973946	X(t-1)	0.0976	0.0909	8.12E-08
	Intercept	0.012796	0.002296			Intercept	0.010448	0.004941			Intercept	-0.0011	0.0055	
ltr	X(t-1)	-0.141146	0.05569	0.05017	0.01122**	X(t-1)	-0.521305	0.122837	0.05387	-0.9985547	X(t-1)	0.3798	0.0848	1.38E-03

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Transportation, Communications, Electric, Gas, And Sanitary Services

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.012614	0.002974			Intercept	0.01125	0.006896			Intercept	0.085	0.085	
inf	X(t-1)	-0.066699	0.073081	0.03955	-0.0003496	X(t-1)	-0.017941	0.104577	0.0402	-0.9929516	X(t-1)	0.9961	0.0422	1.67E-05
	Intercept	0.0004622	0.0068984			Intercept	-0.0003215	0.0186012			Intercept	0.0643	0.0111	
uem	X(t-1)	0.1611026	0.1073145	0.03949	0.002616	X(t-1)	0.1450546	0.2501772	0.04015	-0.9958945	X(t-1)	0.9888	0.0095	4.26E-06
	Intercept	0.018671	0.012311			Intercept	0.05389	0.0319			Intercept	2.4071	0.2208	
pe	X(t-1)	-0.002788	0.004134	0.03956	-0.001142	X(t-1)	-0.01781	0.01293	0.03988	-0.9905785	X(t-1)	0.9844	0.0137	2.88E-03
	Intercept	0.023849	0.016759			Intercept	0.10078	0.05459			Intercept	-3.1878	0.1431	
dy	X(t-1)	0.003592	0.004469	0.03956	-0.0007411	X(t-1)	0.02843	0.0171	0.03974	-0.991623	X(t-1)	0.9761	0.0179	2.34E-03
	Intercept	0.011362	0.002811			Intercept	0.008358	0.012119			Intercept	0.0908	0.0139	
rf	X(t-1)	-0.02133	0.050785	0.03958	-0.001726	X(t-1)	0.021426	0.130725	0.0402	-0.99216	X(t-1)	0.9506	0.026	7.35E-05
	Intercept	0.02179	0.016845			Intercept	0.09987	0.0545			Intercept	-3.2081	0.1387	
dpr	X(t-1)	0.003034	0.004484	0.03956	-0.001136	X(t-1)	0.02805	0.01702	0.03974	-0.9923455	X(t-1)	0.9752	0.018	2.34E-03
	Intercept	0.0102037	0.0044322			Intercept	0.003284	0.022888			Intercept	-0.8251	0.1112	
dpo	X(t-1)	-0.000322	0.005126	0.03958	-0.002088	X(t-1)	-0.009358	0.030343	0.04019	-0.9919324	X(t-1)	0.9924	0.0076	2.54E-04
	Intercept	0.011097	0.004287			Intercept	0.006661	0.019585			Intercept	0.1006	0.0128	
lgb	X(t-1)	-0.009939	0.060408	0.03958	-0.00204	X(t-1)	0.033908	0.181685	0.0402	-0.9921639	X(t-1)	0.9753	0.0171	1.91E-05
	Intercept	0.00854	0.003295			Intercept	0.010453	0.005408			Intercept	0.0138	0.0073	
spr	X(t-1)	0.087351	0.125462	0.03956	-0.001079	X(t-1)	-0.011521	0.225474	0.0402	-0.9924768	X(t-1)	0.9206	0.0361	4.52E-05
	Intercept	0.01192	0.00202			Intercept	0.0121	0.003925			Intercept	1.00E-04	1.00E-04	
stv	X(t-1)	-12.72263	7.89631	0.03948	0.003328	X(t-1)	-16.636387	12.77776	0.03992	-0.9924735	X(t-1)	0.0976	0.0909	8.12E-08
	Intercept	0.010316	0.001807			Intercept	0.009965	0.003592			Intercept	-0.0011	0.0055	
ltr	X(t-1)	-0.063221	0.043841	0.0395	0.002253	X(t-1)	-0.22434	0.089296	0.03916	-0.9930682	X(t-1)	0.3798	0.0848	1.38E-03

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Wholesale Trade

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.015984	0.003648			Intercept	0.018239	0.009557			Intercept	0.085	0.0422	
inf	X(t-1)	-0.125605	0.089631	0.0485	0.002012	X(t-1)	-0.113566	0.144927	0.05571	-0.9941639	X(t-1)	0.9961	0.0046	1.67E-05
	Intercept	-0.001628	0.008466			Intercept	-0.0104	0.02579			Intercept	0.0643	0.0111	
uem	X(t-1)	0.218417	0.131704	0.04846	0.003648*	X(t-1)	0.30604	0.34692	0.05567	-1.003894	X(t-1)	0.9888	0.0095	4.26E-06
	Intercept	0.0109708	0.0151238			Intercept	0.014572	0.044676			Intercept	2.4071	0.2208	
pe	X(t-1)	0.0003234	0.0050785	0.0486	-0.002088	X(t-1)	-0.001087	0.018113	0.05585	-0.9924723	X(t-1)	0.9844	0.0137	2.88E-03
	Intercept	0.025756	0.020582			Intercept	0.08207	0.07646			Intercept	-3.1878	0.1431	
dy	X(t-1)	0.00371	0.005489	0.04858	-0.001137	X(t-1)	0.02203	0.02395	0.05565	-0.9932427	X(t-1)	0.9761	0.0179	2.34E-03
	Intercept	0.01395	0.003451			Intercept	0.03058	0.01674			Intercept	0.0908	0.0139	
rf	X(t-1)	-0.047802	0.062333	0.04857	-0.0008624	X(t-1)	-0.21145	0.18058	0.05553	-0.9937519	X(t-1)	0.9506	0.026	7.35E-05
	Intercept	0.02412	0.020686			Intercept	0.06762	0.07642			Intercept	-3.2081	0.1387	
dpr	X(t-1)	0.003265	0.005506	0.04859	-0.001358	X(t-1)	0.01744	0.02387	0.05573	-0.9929232	X(t-1)	0.9752	0.018	2.34E-03
	Intercept	0.015681	0.005439			Intercept	0.04787	0.03163			Intercept	-0.8251	0.1112	
dpo	X(t-1)	0.00476	0.006291	0.04857	-0.0008947	X(t-1)	0.04831	0.04194	0.05554	-1.000113	X(t-1)	0.9924	0.0076	2.54E-04
	Intercept	0.014327	0.005263			Intercept	0.04063	0.02708			Intercept	0.1006	0.0128	
lgb	X(t-1)	-0.037357	0.074157	0.04859	-0.001564	X(t-1)	-0.27124	0.2512	0.05558	-0.9989235	X(t-1)	0.9753	0.0171	1.91E-05
	Intercept	0.009055	0.004045			Intercept	0.008201	0.007499			Intercept	0.0138	0.0073	
spr	X(t-1)	0.130632	0.154017	0.04857	-0.0005874	X(t-1)	0.211286	0.312642	0.05575	-0.9924318	X(t-1)	0.9206	0.0361	4.52E-05
	Intercept	0.01476	0.00247			Intercept	0.014941	0.005438			Intercept	1.00E-04	1.00E-04	
stv	X(t-1)	-24.61731	9.65673	0.04828	0.01137**	X(t-1)	-27.265845	17.701589	0.0553	-0.9925672	X(t-1)	0.0976	0.0909	8.12E-08
	Intercept	0.011748	0.002219			Intercept	0.01142	0.00492			Intercept	-0.0011	0.0055	
ltr	X(t-1)	-0.078595	0.05383	0.0485	0.002362	X(t-1)	-0.38405	0.12231	0.05364	-0.9931521	X(t-1)	0.3798	0.0848	1.38E-03

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Retail Trade

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.015102	0.004556			Intercept	0.02217	0.01265			Intercept	0.085	0.0422	
inf	X(t-1)	0.047274	0.111944	0.06058	-0.001722	X(t-1)	0.01735	0.19189	0.07376	-1.029772	X(t-1)	0.9961	0.0046	1.67E-05
	Intercept	-0.01055	0.01051			Intercept	-0.02493	0.03387			Intercept	0.0643	0.0111	
uem	X(t-1)	0.43812	0.16343	0.06014	0.01278***	X(t-1)	0.6596	0.4556	0.07311	-0.9876239	X(t-1)	0.9888	0.0095	4.26E-06
	Intercept	0.041167	0.01882			Intercept	0.12097	0.05829			Intercept	2.4071	0.2208	
pe	X(t-1)	-0.00833	0.006319	0.06048	0.00154	X(t-1)	-0.03993	0.02363	0.07288	-1.036887	X(t-1)	0.9844	0.0137	2.88E-03
	Intercept	0.081358	0.025497			Intercept	0.25746	0.09899			Intercept	-3.1878	0.1431	
dy	X(t-1)	0.017362	0.006799	0.06018	0.01142**	X(t-1)	0.07357	0.03101	0.07205	-1.024421	X(t-1)	0.9761	0.0179	2.34E-03
	Intercept	0.0141	0.004302			Intercept	0.03032	0.02223			Intercept	0.0908	0.0139	
rf	X(t-1)	0.059675	0.077705	0.06055	-0.000859	X(t-1)	-0.08128	0.23975	0.07373	-1.02575	X(t-1)	0.9506	0.026	7.35E-05
	Intercept	0.077419	0.025645			Intercept	0.2404	0.09913			Intercept	-3.2081	0.1387	
dpr	X(t-1)	0.016275	0.006826	0.06023	0.009705**	X(t-1)	0.06801	0.03096	0.07229	-1.01798	X(t-1)	0.9752	0.018	2.34E-03
	Intercept	0.023305	0.006776			Intercept	0.019357	0.042009			Intercept	-0.8251	0.1112	
dpo	X(t-1)	0.008456	0.007837	0.06052	0.0003434	X(t-1)	-0.005083	0.055692	0.07376	-1.031091	X(t-1)	0.9924	0.0076	2.54E-04
	Intercept	0.009129	0.006552			Intercept	0.01887	0.03594			Intercept	0.1006	0.0128	
lgb	X(t-1)	0.116565	0.092316	0.06049	0.001242	X(t-1)	0.04037	0.33337	0.07376	-1.024665	X(t-1)	0.9753	0.0171	1.91E-05
	Intercept	0.013581	0.005043			Intercept	0.017807	0.009899			Intercept	0.0138	0.0073	
spr	X(t-1)	0.138861	0.192041	0.06056	-0.0009992	X(t-1)	0.303893	0.41273	0.07359	-1.015016	X(t-1)	0.9206	0.0361	4.52E-05
	Intercept	0.018536	0.003095			Intercept	0.025966	0.007218			Intercept	1.00E-04	1.00E-04	
stv	X(t-1)	-16.54777	12.096293	0.06047	0.00182	X(t-1)	-25.4	23.495769	0.0734	-1.027675	X(t-1)	0.0976	0.0909	8.12E-08
	Intercept	0.016271	0.002756			Intercept	0.022409	0.006418			Intercept	-0.0011	0.0055	
ltr	X(t-1)	-0.160195	0.066854	0.06023	0.009823**	X(t-1)	-0.575334	0.159561	0.06998	-1.027075	X(t-1)	0.3798	0.0848	1.38E-03

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Finance, Insurance, And Real Estate

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.015869	0.003866			Intercept	0.018374	0.008694			Intercept	0.085	0.0422	
inf	X(t-1)	-0.112177	0.094981	0.0514	0.0008254	X(t-1)	-0.095653	0.131837	0.05068	-0.9907102	X(t-1)	0.9961	0.0046	1.67E-05
	Intercept	-0.003547	0.008961			Intercept	-0.008579	0.023445			Intercept	0.0643	0.0111	
uem	X(t-1)	0.254489	0.139398	0.0513	0.004857*	X(t-1)	0.296672	0.315321	0.0506	-0.9977299	X(t-1)	0.9888	0.0095	4.26E-06
	Intercept	0.01402	0.0160169			Intercept	0.05983	0.04039			Intercept	2.4071	0.2208	
pe	X(t-1)	-0.000603	0.0053784	0.05147	-0.00207	X(t-1)	-0.01909	0.01638	0.0505	-0.9962764	X(t-1)	0.9844	0.0137	2.88E-03
	Intercept	0.045917	0.021753			Intercept	0.14004	0.06878			Intercept	-3.1878	0.1431	
dy	X(t-1)	0.009033	0.005801	0.05134	0.002972	X(t-1)	0.03987	0.02155	0.05006	-0.9969623	X(t-1)	0.9761	0.0179	2.34E-03
	Intercept	0.012571	0.003657			Intercept	0.02125	0.01529			Intercept	0.0908	0.0139	
rf	X(t-1)	-0.00775	0.066054	0.05147	-0.002068	X(t-1)	-0.09297	0.16495	0.05072	-0.9929756	X(t-1)	0.9506	0.026	7.35E-05
	Intercept	0.040383	0.021877			Intercept	0.12011	0.06894			Intercept	-3.2081	0.1387	
dpr	X(t-1)	0.007534	0.005823	0.05138	0.001408	X(t-1)	0.03351	0.02153	0.05027	-0.9954169	X(t-1)	0.9752	0.018	2.34E-03
	Intercept	0.019277	0.005753			Intercept	0.0135213	0.0289272			Intercept	-0.8251	0.1112	
dpo	X(t-1)	0.008911	0.006654	0.05138	0.001658	X(t-1)	0.0006427	0.0383491	0.05079	-0.9927712	X(t-1)	0.9924	0.0076	2.54E-04
	Intercept	0.010005	0.005574			Intercept	0.007879	0.024741			Intercept	0.1006	0.0128	
lgb	X(t-1)	0.034773	0.078542	0.05146	-0.001685	X(t-1)	0.048778	0.22952	0.05078	-0.9925528	X(t-1)	0.9753	0.0171	1.91E-05
	Intercept	0.007907	0.00428			Intercept	0.006871	0.006787			Intercept	0.0138	0.0073	
spr	X(t-1)	0.197468	0.162986	0.0514	0.0009779	X(t-1)	0.351632	0.282991	0.05046	-0.9904733	X(t-1)	0.9206	0.0361	4.52E-05
	Intercept	0.015426	0.002614			Intercept	0.015165	0.004965			Intercept	1.00E-04	1.00E-04	
stv	X(t-1)	-27.63516	10.218434	0.05108	0.01304***	X(t-1)	-19.08492	16.163117	0.05049	-0.9929133	X(t-1)	0.0976	0.0909	8.12E-08
	Intercept	0.012067	0.002351			Intercept	0.012563	0.004442			Intercept	-0.0011	0.0055	
ltr	X(t-1)	-0.0782	0.057024	0.05137	0.001839	X(t-1)	-0.377433	0.110432	0.04843	-0.9934621	X(t-1)	0.3798	0.0848	1.38E-03

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Services

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.023534	0.004325			Intercept	0.02446	0.01064			Intercept	0.085	0.0422	
inf	X(t-1)	-0.201262	0.106269	0.05751	0.005383*	X(t-1)	-0.17449	0.16137	0.06203	-1.000467	X(t-1)	0.9961	0.0046	1.67E-05
	Intercept	0.008826	0.010076			Intercept	0.002361	0.02886			Intercept	0.0643	0.0111	
uem	X(t-1)	0.13221	0.15675	0.05768	-0.0006041	X(t-1)	0.169772	0.388154	0.06229	-1.007913	X(t-1)	0.9888	0.0095	4.26E-06
	Intercept	0.007719	0.017957			Intercept	0.003372	0.049851			Intercept	2.4071	0.2208	
pe	X(t-1)	0.00316	0.00603	0.05771	-0.00152	X(t-1)	0.004637	0.020212	0.06232	-0.9958209	X(t-1)	0.9844	0.0137	2.88E-03
	Intercept	0.030893	0.024448			Intercept	0.06248	0.08553			Intercept	-3.1878	0.1431	
dy	X(t-1)	0.003719	0.006519	0.0577	-0.001413	X(t-1)	0.01499	0.0268	0.06225	-1.000926	X(t-1)	0.9761	0.0179	2.34E-03
	Intercept	0.02082	0.004094			Intercept	0.05779	0.01832			Intercept	0.0908	0.0139	
rf	X(t-1)	-0.089458	0.073961	0.05764	0.0009676	X(t-1)	-0.48748	0.19765	0.06078	-1.000555	X(t-1)	0.9506	0.026	7.35E-05
	Intercept	0.026016	0.024573			Intercept	0.04556	0.08544			Intercept	-3.2081	0.1387	
dpr	X(t-1)	0.002406	0.006541	0.05772	-0.001812	X(t-1)	0.00965	0.02669	0.0623	-0.999651	X(t-1)	0.9752	0.018	2.34E-03
	Intercept	0.023341	0.006456			Intercept	0.05577	0.0353			Intercept	-0.8251	0.1112	
dpo	X(t-1)	0.007996	0.007466	0.05765	0.0003074	X(t-1)	0.05513	0.04679	0.06197	-1.01167	X(t-1)	0.9924	0.0076	2.54E-04
	Intercept	0.021144	0.006249			Intercept	0.06988	0.02993			Intercept	0.1006	0.0128	
lgb	X(t-1)	-0.063956	0.088047	0.05769	-0.0009892	X(t-1)	-0.52086	0.27761	0.06142	-0.9900209	X(t-1)	0.9753	0.0171	1.91E-05
	Intercept	0.011096	0.004796			Intercept	0.003361	0.008261			Intercept	0.0138	0.0073	
spr	X(t-1)	0.270178	0.182636	0.05759	0.00248	X(t-1)	0.647947	0.344444	0.06142	-1.012088	X(t-1)	0.9206	0.0361	4.52E-05
	Intercept	0.018993	0.002947			Intercept	0.016975	0.006103			Intercept	0.0976	1.00E-04	
stv	X(t-1)	-17.05386	11.520088	0.05759	0.002486	X(t-1)	-20.14695	19.868573	0.06207	-0.9968844	X(t-1)	0.0909	1.00E-04	8.12E-08
	Intercept	0.016669	0.002624			Intercept	0.013974	0.005267			Intercept	-0.0011	0.0055	
ltr	X(t-1)	-0.160704	0.063649	0.05734	0.01112**	X(t-1)	-0.597852	0.130958	0.05743	-0.9976979	X(t-1)	0.3798	0.0848	1.38E-03

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Public Administration

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.01258	0.01013			Intercept	0.01189	0.02245			Intercept	0.0133	0.0166	
inf	X(t-1)	0.34648	0.51655	0.05493	-0.004492	X(t-1)	0.4645	0.92041	0.06802	-0.9528993	X(t-1)	0.9608	0.0461	3.18E-05
	Intercept	0.004791	0.015575			Intercept	0.03223	0.30869			Intercept	0.0926	0.0032	
uem	X(t-1)	0.214965	0.231371	0.05484	-0.001113	X(t-1)	-0.11751	3.28109	0.06835	-0.9713905	X(t-1)	0.9233	0.0682	3.01E-06
	Intercept	0.19445	0.05478			Intercept	0.19552	0.07355			Intercept	3.4609	0.7772	
pe	X(t-1)	-0.05852	0.01815	0.05283	0.07094***	X(t-1)	-0.05875	0.02447	0.06184	-0.9807518	X(t-1)	0.9798	0.0256	2.97E-02
	Intercept	0.029048	0.312857			Intercept	-0.4033	0.5751			Intercept	-3.8716	0.0655	
dy	X(t-1)	0.002693	0.080022	0.05504	-0.008187	X(t-1)	-0.1085	0.1469	0.06765	-0.9625696	X(t-1)	0.8734	0.0968	2.47E-03
	Intercept	0.022145	0.006018			Intercept	0.007254	0.026438			Intercept	9.00E-04	5.00E-04	
rf	X(t-1)	-0.671745	0.642055	0.05479	0.0007687	X(t-1)	14.33743	23.797258	0.06788	-0.9842809	X(t-1)	0.9142	0.0756	6.32E-08
	Intercept	0.34804	0.31678			Intercept	-0.408	0.5963			Intercept	-3.8857	0.0578	
dpr	X(t-1)	0.08409	0.08083	0.05479	0.0006687	X(t-1)	-0.1094	0.152	0.06768	-0.9641938	X(t-1)	0.856	0.1017	2.41E-03
	Intercept	-0.02383	0.01626			Intercept	-0.02686	0.0243			Intercept	-0.3481	0.8721	
dpo	X(t-1)	-0.04643	0.01703	0.05343	0.04971***	X(t-1)	-0.05033	0.02225	0.06248	-0.9812064	X(t-1)	0.9826	0.0222	3.15E-02
	Intercept	0.01546	0.02572			Intercept	0.09672	0.1179			Intercept	0.0393	0.0044	
lgb	X(t-1)	0.09446	0.77865	0.05503	-0.008075	X(t-1)	-1.81537	2.81652	0.06782	-1.024236	X(t-1)	0.9336	0.0655	4.40E-06
	Intercept	0.009662	0.012604			Intercept	0.1114	0.1204			Intercept	0.0385	0.0039	
spr	X(t-1)	0.327743	0.429184	0.0549	-0.003401	X(t-1)	-2.2203	2.9468	0.06762	-1.032558	X(t-1)	0.9244	0.0702	4.17E-06
	Intercept	0.020461	0.006384			Intercept	0.02972	0.01742			Intercept	2.00E-04	2.00E-04	
stv	X(t-1)	-22.98833	47.899087	0.05498	-0.006297	X(t-1)	-55.65626	77.10102	0.06768	-0.9757742	X(t-1)	0.3351	0.1806	2.44E-08
	Intercept	0.018266	0.004948			Intercept	0.0219	0.0133			Intercept	-0.0128	0.0149	
ltr	X(t-1)	-0.063945	0.095949	0.05494	-0.00454	X(t-1)	0.05928	0.2628	0.06829	-0.9718119	X(t-1)	0.4709	0.1615	1.84E-03

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Summary of Monthly Result

Industrial Sector	In-sample Significant Factor
1. Agriculture, Forestry, And Fishing	Stock Variance of S&P500*, Long Term Rate of Return*
2.Mining	Inflation rate*, Long Term Rate of Return*
3.Construction	Long Term Rate of Return***
4.Manufacturing	Inflation Rate*, Stock Variance of S&P500*, Long Term Rate of Return**
5.Transportation, Communications, Electric, Gas, And Sanitary Services	NIL
6.Wholesale Trade	Unemployment Rate*, Stock Variance of S&P500**
7.Retail Trade	Unemployment Rate***, Dividend Yield of S&P500**, Dividend Price Ratio of S&P500**, Long Term Rate of Return**
8. Finance, Insurance, And Real Estate	Unemployment Rate*, Stock Variance of S&P500***
9.Services	Inflation Rate*, Long Term Rate of Return**
10.Public Administration	Price/Earning Ratio of S&P500***, Dividend Payout Ratio of S&P500***

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

In In-sample Regression, we can see that different sector might have different significant factors(or no significant factors). It shows that modeling the monthly equity premium for different industrial sectors individually may improve the accuracy of prediction in In-sample regression. However, all the factors among all the industries are insignificant in the out-of-sample regression. This means that these factors are not good predictors for predicting the monthly industrial equity premium.

Annual Result

Agriculture, Forestry, And Fishing

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.11674	0.06675			Intercept	-0.01275	0.13655			Intercept	0.0639	0.0265	
inf	X(t-1)	-2.27845	1.7598	0.2389	0.01749	X(t-1)	-0.58043	2.24177	0.2158	-1.261655	X(t-1)	0.7251	0.2684	6.41E-04
	Intercept	-0.087	0.1489			Intercept	-0.09394	0.35162			Intercept	0.0711	0.0094	
uem	X(t-1)	2.1326	2.3068	0.2415	-0.003839	X(t-1)	0.68994	4.64351	0.2165	-1.235872	X(t-1)	0.608	0.2592	1.52E-04
	Intercept	-0.23132	0.28401			Intercept	0.2634	0.7967			Intercept	2.4294	0.118	
pe	X(t-1)	0.09398	0.09538	0.2412	-0.0007654	X(t-1)	-0.1249	0.3236	0.2145	-1.198709	X(t-1)	0.5244	0.2721	3.43E-02
	Intercept	-0.18514	0.34039			Intercept	0.16362	1.48148			Intercept	-3.0657	0.1023	
dy	X(t-1)	-0.06313	0.09239	0.2428	-0.01423	X(t-1)	0.06713	0.48119	0.2165	-1.219257	X(t-1)	0.707	0.2471	1.24E-02
	Intercept	0.11429	0.05893			Intercept	-0.007238	0.23001			Intercept	0.1001	0.0264	
rf	X(t-1)	-1.65341	1.09022	0.237	0.03308	X(t-1)	-0.411413	2.526244	0.2164	-1.251625	X(t-1)	0.7764	0.2354	4.67E-04
	Intercept	0.050602	0.366881			Intercept	0.5253	1.4832			Intercept	-3.1948	0.0989	
dpr	X(t-1)	0.001248	0.097516	0.2443	-0.02702	X(t-1)	0.1786	0.4658	0.2146	-1.252667	X(t-1)	0.7154	0.2131	1.10E-02
	Intercept	0.1625	0.1007			Intercept	-0.1419	0.4511			Intercept	-0.7376	0.0523	
dpo	X(t-1)	0.1474	0.1178	0.2393	0.0147	X(t-1)	-0.136	0.6115	0.216	-1.209807	X(t-1)	0.2251	0.4005	1.33E-02
	Intercept	0.1459	0.09252			Intercept	-0.1139	0.4218			Intercept	0.1057	0.0101	
lgb	X(t-1)	-1.5827	1.33271	0.2398	0.01068	X(t-1)	0.675	3.944	0.2163	-1.218088	X(t-1)	0.5652	0.272	2.25E-04
	Intercept	-0.01719	0.06649			Intercept	-0.07211	0.10066			Intercept	0.0201	0.0064	
spr	X(t-1)	2.8932	2.48692	0.24	0.009215	X(t-1)	1.54924	3.75201	0.2142	-1.206445	X(t-1)	-0.2168	0.7342	3.57E-04
	Intercept	2.12E-04	5.47E-02			Intercept	1.20E-01	7.53E-02			Intercept	1.00E-04	3.00E-04	
stv	X(t-1)	3.79E+02	3.23E+02	0.2399	0.009896	X(t-1)	-1.34E+03	4.69E+02	0.1475	-1.218162	X(t-1)	-0.018	0.3182	1.10E-08
	Intercept	0.04257	0.03843			Intercept	-0.04166	0.06004			Intercept	-0.0019	0.0482	
ltr	X(t-1)	-0.25536	0.20683	0.2394	0.01361	X(t-1)	-0.62659	0.3535	0.1801	-1.200987	X(t-1)	-0.1836	0.3446	2.79E-02

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Mining

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.18864	0.05733			Intercept	0.1896	0.105			Intercept	0.0639	0.0265	
inf	X(t-1)	-4.28534	1.51152	0.2052	0.1563***	X(t-1)	-3.9015	1.7233	0.1659	-1.533071	X(t-1)	0.7251	0.2684	6.41E-04
	Intercept	0.05103	0.13959			Intercept	0.2846	0.3356			Intercept	0.0711	0.0094	
uem	X(t-1)	0.07124	2.16262	0.2264	-0.027	X(t-1)	-4.0072	4.4314	0.2066	-1.100065	X(t-1)	0.608	0.2592	1.52E-04
	Intercept	-0.54179	0.24757			Intercept	-0.9678	0.7252			Intercept	2.4294	0.118	
pe	X(t-1)	0.20246	0.08314	0.2102	0.1148**	X(t-1)	0.3896	0.2946	0.1953	-1.219888	X(t-1)	0.5244	0.2721	3.43E-02
	Intercept	-0.45421	0.30608			Intercept	-2.349	1.204			Intercept	-3.0657	0.1023	
dy	X(t-1)	-0.13925	0.08308	0.2183	0.04545	X(t-1)	-0.76	0.391	0.1759	-1.22387	X(t-1)	0.707	0.2471	1.24E-02
	Intercept	0.14334	0.05303			Intercept	0.38	0.1716			Intercept	0.1001	0.0264	
rf	X(t-1)	-2.12536	0.98106	0.2133	0.08858**	X(t-1)	-4.5383	1.8849	0.1615	-1.660934	X(t-1)	0.7764	0.2354	4.67E-04
	Intercept	-0.27729	0.33557			Intercept	-2.2581	1.2471			Intercept	-3.1948	0.0989	
dpr	X(t-1)	-0.08895	0.08919	0.2235	-0.0001424	X(t-1)	-0.7062	0.3917	0.1804	-1.11709	X(t-1)	0.7154	0.2131	1.10E-02
	Intercept	0.19642	0.09193			Intercept	0.1126	0.4533			Intercept	-0.7376	0.0523	
dpo	X(t-1)	0.17825	0.10751	0.2185	0.06916	X(t-1)	0.1716	0.6145	0.2171	-1.166982	X(t-1)	0.2251	0.4005	1.33E-02
	Intercept	0.18026	0.08441			Intercept	0.7275	0.3171			Intercept	0.1057	0.0101	
lgb	X(t-1)	-1.97574	1.21594	0.2188	0.04138	X(t-1)	-7.0217	2.9655	0.1627	-1.195028	X(t-1)	0.5652	0.272	2.25E-04
	Intercept	-0.03013	0.06033			Intercept	-0.08298	0.09534			Intercept	0.0201	0.0064	
spr	X(t-1)	3.92324	2.25646	0.2177	0.05055*	X(t-1)	3.73359	3.55386	0.2029	-1.130992	X(t-1)	-0.2168	0.7342	3.57E-04
	Intercept	-0.03449	0.04726			Intercept	-0.06596	0.10823			Intercept	1.00E-04	3.00E-04	
stv	X(t-1)	746.2006	279.01508	0.2073	0.1393**	X(t-1)	440.55812	674.09461	0.2119	-1.157891	X(t-1)	-0.018	0.3182	1.10E-08
	Intercept	0.05601	0.03633			Intercept	-0.01155	0.06682			Intercept	-0.0019	0.0482	
ltr	X(t-1)	0.04082	0.1955	0.2263	-0.02582	X(t-1)	-0.44879	0.39344	0.2005	-1.1469	X(t-1)	-0.1836	0.3446	2.79E-02

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Construction

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.05595	0.12549			Intercept	-0.2848	0.3245			Intercept	0.0639	0.0265	
inf	X(t-1)	2.96361	3.30875	0.4493	-0.005231	X(t-1)	5.6937	5.3267	0.5127	-0.9695856	X(t-1)	0.7251	0.2684	6.41E-04
	Intercept	0.2069	0.2798			Intercept	0.1494	0.8966			Intercept	0.0711	0.0094	
uem	X(t-1)	-0.9447	4.3344	0.4538	-0.02571	X(t-1)	-1.8806	11.8408	0.5519	-1.101787	X(t-1)	0.608	0.2592	1.52E-04
	Intercept	0.0396	0.5345			Intercept	2.3893	1.8445			Intercept	2.4294	0.118	
pe	X(t-1)	0.03676	0.1795	0.4539	-0.02586	X(t-1)	-0.9703	0.7492	0.4966	-1.059959	X(t-1)	0.5244	0.2721	3.43E-02
	Intercept	-0.4672	0.6285			Intercept	-1.1	3.76			Intercept	-3.0657	0.1023	
dy	X(t-1)	-0.1681	0.1706	0.4483	-0.0007654	X(t-1)	-0.361	1.221	0.5495	-1.118821	X(t-1)	0.707	0.2471	1.24E-02
	Intercept	0.1776	0.1127			Intercept	-0.212	0.5811			Intercept	0.1001	0.0264	
rf	X(t-1)	-0.7157	2.0852	0.4534	-0.02377	X(t-1)	2.5683	6.3821	0.5467	-1.041454	X(t-1)	0.7764	0.2354	4.67E-04
	Intercept	0.10338	0.68193			Intercept	3.574	3.577			Intercept	-3.1948	0.0989	
dpr	X(t-1)	-0.01194	0.18125	0.4541	-0.02691	X(t-1)	1.121	1.123	0.5174	-1.286772	X(t-1)	0.7154	0.2131	1.10E-02
	Intercept	0.17871	0.19102			Intercept	-1.091	1.075			Intercept	-0.7376	0.0523	
dpo	X(t-1)	0.03877	0.22339	-0.02619	-0.02619	X(t-1)	-1.512	1.457	0.5148	-1.079127	X(t-1)	0.2251	0.4005	1.33E-02
	Intercept	0.15079	0.17522			Intercept	-1.1127	0.9882			Intercept	0.1057	0.0101	
lgb	X(t-1)	-0.04342	2.52403	0.4541	-0.02702	X(t-1)	10.6553	9.2407	0.5069	-1.157316	X(t-1)	0.5652	0.272	2.25E-04
	Intercept	0.07205	0.12489			Intercept	-0.06664	0.25657			Intercept	0.0201	0.0064	
spr	X(t-1)	3.48331	4.67156	0.4507	-0.01182	X(t-1)	4.05563	9.56337	0.546	-1.116236	X(t-1)	-0.2168	0.7342	3.57E-04
	Intercept	0.07325	0.10207			Intercept	0.01311	0.28237			Intercept	1.00E-04	3.00E-04	
stv	X(t-1)	620.49208	602.68479	0.4477	0.001576	X(t-1)	-25.10421	1758.74543	0.5529	-1.130928	X(t-1)	-0.018	0.3182	1.10E-08
	Intercept	0.15339	0.07184			Intercept	0.008735	0.178466			Intercept	-0.0019	0.0482	
ltr	X(t-1)	0.40496	0.38661	0.4475	0.002551	X(t-1)	0.718137	1.050755	0.5354	-1.141305	X(t-1)	-0.1836	0.3446	2.79E-02

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Manufacturing

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.10711	0.06084			Intercept	0.1024	0.2063			Intercept	0.0639	0.0265	
inf	X(t-1)	-0.52861	1.60413	0.2178	-0.02402	X(t-1)	-1.1275	3.3862	0.3259	-1.165792	X(t-1)	0.7251	0.2684	6.41E-04
	Intercept	0.1074	0.1344			Intercept	0.7798	0.4517			Intercept	0.0711	0.0094	
uem	X(t-1)	-0.2687	2.0829	0.2181	-0.02657	X(t-1)	-9.9285	5.9645	0.278	-0.9626773	X(t-1)	0.608	0.2592	1.52E-04
	Intercept	0.23502	0.25577			Intercept	-0.5588	1.1983			Intercept	2.4294	0.118	
pe	X(t-1)	-0.04893	0.0859	0.2172	-0.0181	X(t-1)	0.2458	0.4867	0.3227	-1.109962	X(t-1)	0.5244	0.2721	3.43E-02
	Intercept	-0.10499	0.30412			Intercept	-4.1544	1.5902			Intercept	-3.0657	0.1023	
dy	X(t-1)	-0.05346	0.08255	0.2169	-0.01552	X(t-1)	-1.3652	0.5165	0.2324	-1.177532	X(t-1)	0.707	0.2471	1.24E-02
	Intercept	0.15742	0.05229			Intercept	0.4053	0.3182			Intercept	0.1001	0.0264	
rf	X(t-1)	-1.6143	0.96749	0.2104	0.04484	X(t-1)	-4.1788	3.4946	0.2993	-1.569896	X(t-1)	0.7764	0.2354	4.67E-04
	Intercept	-0.19243	0.32422			Intercept	-2.0203	2.1322			Intercept	-3.1948	0.0989	
dpr	X(t-1)	-0.07568	0.08618	0.2159	-0.006057	X(t-1)	-0.6491	0.6697	0.3084	-1.008858	X(t-1)	0.7154	0.2131	1.10E-02
	Intercept	-0.06019	0.08779			Intercept	-0.1291	0.6827			Intercept	-0.7376	0.0523	
dpo	X(t-1)	-0.19079	0.10266	0.2086	0.06065*	X(t-1)	-0.2377	0.9255	0.3269	-1.057793	X(t-1)	0.2251	0.4005	1.33E-02
	Intercept	0.15675	0.08332			Intercept	0.4933	0.6168			Intercept	0.1057	0.0101	
lgb	X(t-1)	-1.04607	1.20015	0.2159	-0.006364	X(t-1)	-4.2645	5.7673	0.3164	-1.080569	X(t-1)	0.5652	0.272	2.25E-04
	Intercept	-0.008822	0.05702			Intercept	-0.05946	0.14406			Intercept	0.0201	0.0064	
spr	X(t-1)	4.560463	2.132822	0.2058	0.08592**	X(t-1)	5.46957	5.36956	0.3065	-1.038342	X(t-1)	-0.2168	0.7342	3.57E-04
	Intercept	0.07594	0.04961			Intercept	-0.23945	0.09024			Intercept	1.00E-04	3.00E-04	
stv	X(t-1)	122.26632	292.92565	0.2176	-0.02221	X(t-1)	2330.2391	562.08435	0.1767	-1.069566	X(t-1)	-0.018	0.3182	1.10E-08
	Intercept	0.09761	0.03111			Intercept	0.04274	0.10062			Intercept	-0.0019	0.0482	
ltr	X(t-1)	0.52646	0.16739	0.1938	0.1896***	X(t-1)	0.67306	0.59239	0.3018	-1.08889	X(t-1)	-0.1836	0.3446	2.79E-02

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Transportation, Communications, Electric, Gas, And Sanitary Services

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.15621	0.07453			Intercept	0.001104	0.080766			Intercept	0.0639	0.0265	
inf	X(t-1)	-1.2503	1.96516	0.2668	-0.01591	X(t-1)	1.122991	1.325954	0.1276	-0.9743371	X(t-1)	0.7251	0.2684	6.41E-04
	Intercept	-0.06057	0.1626			Intercept	0.1549	0.2145			Intercept	0.0711	0.0094	
uem	X(t-1)	2.85435	2.51906	0.2638	0.007416	X(t-1)	-1.2907	2.8329	0.1321	-1.009851	X(t-1)	0.608	0.2592	1.52E-04
	Intercept	0.16506	0.31586			Intercept	0.5727	0.4579			Intercept	2.4294	0.118	
pe	X(t-1)	-0.01617	0.10608	0.2682	-0.02638	X(t-1)	-0.2094	0.186	0.1233	-1.003676	X(t-1)	0.5244	0.2721	3.43E-02
	Intercept	-0.05692	0.37506			Intercept	-0.10323	0.9149			Intercept	-3.0657	0.1023	
dy	X(t-1)	-0.04761	0.1018	0.2675	-0.02099	X(t-1)	-0.05284	0.29716	0.1337	-1.022717	X(t-1)	0.707	0.2471	1.24E-02
	Intercept	0.20027	0.06427			Intercept	0.0243	0.1417			Intercept	0.1001	0.0264	
rf	X(t-1)	-2.00559	1.18905	0.2585	0.0463	X(t-1)	0.4043	1.5569	0.1334	-1.000746	X(t-1)	0.7764	0.2354	4.67E-04
	Intercept	0.092339	0.402884			Intercept	0.46	0.9138			Intercept	-3.1948	0.0989	
dpr	X(t-1)	-0.006687	0.107085	0.2683	-0.02692	X(t-1)	0.126	0.287	0.1322	-1.024695	X(t-1)	0.7154	0.2131	1.10E-02
	Intercept	0.08952	0.11279			Intercept	-0.3217	0.2388			Intercept	-0.7376	0.0523	
dpo	X(t-1)	-0.0352	0.1319	0.268	-0.02505	X(t-1)	-0.5232	0.3237	0.1144	-1.007729	X(t-1)	0.2251	0.4005	1.33E-02
	Intercept	0.236	0.1013			Intercept	-0.1435	0.2494			Intercept	0.1057	0.0101	
lgb	X(t-1)	-1.8781	1.4589	0.2625	0.017	X(t-1)	1.9246	2.332	0.1279	-1.015053	X(t-1)	0.5652	0.272	2.25E-04
	Intercept	0.03762	0.07258			Intercept	0.04286	0.06235			Intercept	0.0201	0.0064	
spr	X(t-1)	3.65454	2.71492	0.262	0.02092	X(t-1)	0.86681	2.32417	0.1327	-1.01702	X(t-1)	-0.2168	0.7342	3.57E-04
	Intercept	0.07802	0.06048			Intercept	0.02515	0.06628			Intercept	1.00E-04	3.00E-04	
stv	X(t-1)	326.26662	357.12374	0.2653	-0.00437	X(t-1)	280.33558	412.83612	0.1298	-1.019955	X(t-1)	-0.018	0.3182	1.10E-08
	Intercept	0.12049	0.04245			Intercept	0.05882	0.04202			Intercept	-0.0019	0.0482	
ltr	X(t-1)	0.23827	0.22844	0.2644	0.002308	X(t-1)	0.236	0.24741	0.1261	-1.023166	X(t-1)	-0.1836	0.3446	2.79E-02

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Wholesale Trade

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.1067	0.04795			Intercept	0.01863	0.11174			Intercept	0.0639	0.0265	
inf	X(t-1)	-1.00467	1.26414	0.1716	-0.009789	X(t-1)	0.35146	1.83451	0.1766	-1.000886	X(t-1)	0.7251	0.2684	6.41E-04
	Intercept	-0.05052	0.10454			Intercept	-0.1102	0.2819			Intercept	0.0711	0.0094	
uem	X(t-1)	2.02131	1.61957	0.1696	0.01446	X(t-1)	1.9834	3.723	0.1735	-1.070076	X(t-1)	0.608	0.2592	1.52E-04
	Intercept	0.04585	0.20381			Intercept	0.8405	0.5825			Intercept	2.4294	0.118	
pe	X(t-1)	0.01004	0.06844	0.1731	-0.02643	X(t-1)	-0.3278	0.2366	0.1568	-0.9817393	X(t-1)	0.5244	0.2721	3.43E-02
	Intercept	-0.04705	0.24186			Intercept	0.28858	1.20767			Intercept	-3.0657	0.1023	
dy	X(t-1)	-0.03348	0.06565	0.1725	-0.01986	X(t-1)	0.08186	0.39225	0.1765	-1.023039	X(t-1)	0.707	0.2471	1.24E-02
	Intercept	0.12253	0.04183			Intercept	0.04593	0.18814			Intercept	0.1001	0.0264	
rf	X(t-1)	-1.13821	0.77385	0.1683	0.02971	X(t-1)	-0.10524	2.06639	0.177	-1.035741	X(t-1)	0.7764	0.2354	4.67E-04
	Intercept	0.1856	0.25933			Intercept	1.3074	1.1254			Intercept	-3.1948	0.0989	
dpr	X(t-1)	0.02944	0.06893	0.1727	-0.02199	X(t-1)	0.3995	0.3535	0.1628	-1.084221	X(t-1)	0.7154	0.2131	1.10E-02
	Intercept	0.12316	0.07235			Intercept	-0.309	0.3451			Intercept	-0.7376	0.0523	
dpo	X(t-1)	0.0603	0.08461	0.1719	-0.01312	X(t-1)	-0.4749	0.4679	0.1653	-1.006787	X(t-1)	0.2251	0.4005	1.33E-02
	Intercept	0.14158	0.06572			Intercept	-0.2402	0.3284			Intercept	0.1057	0.0101	
lgb	X(t-1)	-1.04654	0.94665	0.1703	0.005813	X(t-1)	2.629	3.0705	0.1684	-1.020879	X(t-1)	0.5652	0.272	2.25E-04
	Intercept	0.02876	0.04703			Intercept	-0.01355	0.07868			Intercept	0.0201	0.0064	
spr	X(t-1)	2.14114	1.75924	0.1697	0.01251	X(t-1)	2.66399	2.93285	0.1674	-1.013179	X(t-1)	-0.2168	0.7342	3.57E-04
	Intercept	0.01506	0.03691			Intercept	-0.001013	0.08841			Intercept	1.00E-04	3.00E-04	
stv	X(t-1)	501.21533	217.9529	0.1619	0.1014**	X(t-1)	311.15291	550.667482	0.1731	-1.026643	X(t-1)	-0.018	0.3182	1.10E-08
	Intercept	0.07578	0.02778			Intercept	0.0367	0.05884			Intercept	-0.0019	0.0482	
ltr	X(t-1)	0.02287	0.1495	0.1731	-0.02638	X(t-1)	0.06959	0.34645	0.1765	-1.028512	X(t-1)	-0.1836	0.3446	2.79E-02

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Retail Trade

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.05862	0.06858			Intercept	-0.1748	0.2107			Intercept	0.0639	0.0265	
inf	X(t-1)	0.7741	1.8081	0.2455	-0.02196	X(t-1)	3.6978	3.4584	0.3329	-0.9114813	X(t-1)	0.7251	0.2684	6.41E-04
	Intercept	0.07719	0.15173			Intercept	0.867	0.482			Intercept	0.0711	0.0094	
uem	X(t-1)	0.08804	2.35056	0.2461	-0.02699	X(t-1)	-11.473	6.365	0.2967	-0.9924995	X(t-1)	0.608	0.2592	1.52E-04
	Intercept	0.02235	0.28967			Intercept	1.2665	1.2461			Intercept	2.4294	0.118	
pe	X(t-1)	0.02045	0.09728	0.246	-0.0258	X(t-1)	-0.5097	0.5062	0.3355	-1.068632	X(t-1)	0.5244	0.2721	3.43E-02
	Intercept	-0.1938	0.34203			Intercept	-2.7768	2.2177			Intercept	-3.0657	0.1023	
dy	X(t-1)	-0.07554	0.09284	0.2439	-0.008973	X(t-1)	-0.9084	0.7203	0.3241	-1.19764	X(t-1)	0.707	0.2471	1.24E-02
	Intercept	0.12713	0.06043			Intercept	-0.1376	0.3766			Intercept	0.1001	0.0264	
rf	X(t-1)	-1.07507	1.11805	0.2431	-0.001988	X(t-1)	1.7853	4.1367	0.3543	-1.004253	X(t-1)	0.7764	0.2354	4.67E-04
	Intercept	0.112746	0.369572			Intercept	-0.0192	2.4818			Intercept	-3.1948	0.0989	
dpr	X(t-1)	0.008037	0.098231	0.2461	-0.02684	X(t-1)	-0.01129	0.77949	0.359	1.145828	X(t-1)	0.7154	0.2131	1.10E-02
	Intercept	0.11738	0.10338			Intercept	-1.3041	0.5533			Intercept	-0.7376	0.0523	
dpo	X(t-1)	0.04388	0.1209	0.2457	-0.02338	X(t-1)	-1.8138	0.7502	0.265	-1.068214	X(t-1)	0.2251	0.4005	1.33E-02
	Intercept	0.1491	0.0942			Intercept	-0.474	0.6741			Intercept	0.1057	0.0101	
lgb	X(t-1)	-1.0521	1.357	0.2441	-0.01061	X(t-1)	4.6571	6.3037	0.3458	-1.142161	X(t-1)	0.5652	0.272	2.25E-04
	Intercept	0.04338	0.06773			Intercept	0.01139	0.16869			Intercept	0.0201	0.0064	
spr	X(t-1)	1.80132	2.53354	0.2445	-0.01318	X(t-1)	0.28079	6.28763	0.359	-1.145684	X(t-1)	-0.2168	0.7342	3.57E-04
	Intercept	-0.02411	0.0504			Intercept	-0.1608	0.1605			Intercept	1.00E-04	3.00E-04	
stv	X(t-1)	885.83618	297.55564	0.2211	0.1714***	X(t-1)	1459.1428	999.9217	0.3144	-1.147213	X(t-1)	-0.018	0.3182	1.10E-08
	Intercept	0.0873	0.03803			Intercept	0.01405	0.07579			Intercept	-0.0019	0.0482	
ltr	X(t-1)	0.35042	0.20466	0.2369	0.04837*	X(t-1)	1.44278	0.44623	0.2274	-1.190913	X(t-1)	-0.1836	0.3446	2.79E-02

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Finance, Insurance, And Real Estate

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.12184	0.06542			Intercept	-0.2056	0.1537			Intercept	0.0639	0.0265	
inf	X(t-1)	-2.01771	1.72474	0.2342	0.009606	X(t-1)	1.4493	2.5238	0.2429	-2.206349	X(t-1)	0.7251	0.2684	6.41E-04
	Intercept	0.1333	0.1465			Intercept	0.4703	0.3304			Intercept	0.0711	0.0094	
uem	X(t-1)	-1.1891	2.2693	0.2376	-0.01946	X(t-1)	-8.1079	4.3639	0.2034	-1.988402	X(t-1)	0.608	0.2592	1.52E-04
	Intercept	-0.4474	0.268			Intercept	-0.38	0.9183			Intercept	2.4294	0.118	
pe	X(t-1)	0.1717	0.09	0.2276	0.06495*	X(t-1)	0.1017	0.373	0.2473	-2.486928	X(t-1)	0.5244	0.2721	3.43E-02
	Intercept	-0.57704	0.31737			Intercept	-2.1849	1.5129			Intercept	-3.0657	0.1023	
dy	X(t-1)	-0.17381	0.08614	0.2264	0.07478*	X(t-1)	-0.6681	0.4914	0.2211	-2.430156	X(t-1)	0.707	0.2471	1.24E-02
	Intercept	0.17354	0.05395			Intercept	-0.12533	0.26421			Intercept	0.1001	0.0264	
rf	X(t-1)	-2.76699	0.99804	0.217	0.1496***	X(t-1)	-0.06068	2.90187	0.2486	-2.461591	X(t-1)	0.7764	0.2354	4.67E-04
	Intercept	-0.4028	0.3499			Intercept	-2.0882	1.5505			Intercept	-3.1948	0.0989	
dpr	X(t-1)	-0.1235	0.093	0.233	0.01968	X(t-1)	-0.6156	0.487	0.2243	-2.196389	X(t-1)	0.7154	0.2131	1.10E-02
	Intercept	0.12092	0.09975			Intercept	-0.6316	0.4823			Intercept	-0.7376	0.0523	
dpo	X(t-1)	0.07813	0.11666	0.237	-0.01473	X(t-1)	-0.688	0.6538	0.231	-2.339878	X(t-1)	0.2251	0.4005	1.33E-02
	Intercept	0.27501	0.08334			Intercept	0.3011	0.4554			Intercept	0.1057	0.0101	
lgb	X(t-1)	-3.41771	1.20054	0.216	0.1575***	X(t-1)	-4.0966	4.2587	0.2336	-2.440386	X(t-1)	0.5652	0.272	2.25E-04
	Intercept	0.01184	0.06539			Intercept	-0.06163	0.11081			Intercept	0.0201	0.0064	
spr	X(t-1)	2.16776	2.44584	0.236	-0.005676	X(t-1)	-3.6454	4.1302	0.2358	-2.520898	X(t-1)	-0.2168	0.7342	3.57E-04
	Intercept	-0.01756	0.0514			Intercept	-0.2635	0.1082			Intercept	1.00E-04	3.00E-04	
stv	X(t-1)	636.24269	303.486	0.2255	0.08202**	X(t-1)	1092.9147	674.1376	0.2119	-2.449247	X(t-1)	-0.018	0.3182	1.10E-08
	Intercept	0.06274	0.03736			Intercept	-0.1312	0.07989			Intercept	-0.0019	0.0482	
ltr	X(t-1)	0.27319	0.20106	0.2327	0.02178	X(t-1)	0.34233	0.47039	0.2397	-2.471536	X(t-1)	-0.1836	0.3446	2.79E-02

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Services

	In-Sample					Out-of-sample								
	Y(t)=Intercept+X(t-1)					Y(t)=Intercept+X(t-1)					X(t)=Intercept+X(t-1)			
		Estimate	Standard Error	Residual Standard error	adjusted R square		Estimate	Standard Error	Residual Standard error	R bar square		Estimate	Standard Error	sigma^2
	Intercept	0.1986	0.0801			Intercept	-0.134	0.1676			Intercept	0.0639	0.0265	
inf	X(t-1)	-2.5318	2.1118	0.2867	0.01138	X(t-1)	0.8284	2.7512	0.2648	-2.119631	X(t-1)	0.7251	0.2684	6.41E-04
	Intercept	0.2774	0.1782			Intercept	0.1263	0.4247			Intercept	0.0711	0.0094	
uem	X(t-1)	-2.5263	2.7603	0.289	-0.004291	X(t-1)	-2.9338	5.6087	0.2614	-2.091961	X(t-1)	0.608	0.2592	1.52E-04
	Intercept	-0.4803	0.3295			Intercept	1.0929	0.8819			Intercept	2.4294	0.118	
pe	X(t-1)	0.2035	0.1106	0.2798	0.05897*	X(t-1)	-0.4829	0.3582	0.2375	-2.099051	X(t-1)	0.5244	0.2721	3.43E-02
	Intercept	-0.8731	0.3754			Intercept	-1.8177	1.7027			Intercept	-3.0657	0.1023	
dy	X(t-1)	-0.2713	0.1019	0.2677	0.1382**	X(t-1)	-0.5615	0.553	0.2488	-2.210408	X(t-1)	0.707	0.2471	1.24E-02
	Intercept	0.22401	0.06913			Intercept	-0.04322	0.28265			Intercept	0.1001	0.0264	
rf	X(t-1)	-2.51658	1.27891	0.2781	0.07027*	X(t-1)	-0.5543	3.10435	0.2659	-2.301315	X(t-1)	0.7764	0.2354	4.67E-04
	Intercept	-0.6313	0.421			Intercept	1.1678	1.7797			Intercept	-3.1948	0.0989	
dpr	X(t-1)	-0.2008	0.1119	0.2803	0.05523*	X(t-1)	0.3959	0.559	0.2574	-2.353592	X(t-1)	0.7154	0.2131	1.10E-02
	Intercept	0.127679	0.122978			Intercept	-0.8392	0.4771			Intercept	-0.7376	0.0523	
dpo	X(t-1)	0.009761	0.143819	0.2922	-0.0269	X(t-1)	-1.0273	0.6468	0.2285	-2.097847	X(t-1)	0.2251	0.4005	1.33E-02
	Intercept	0.3061	0.1076			Intercept	-0.4528	0.5007			Intercept	0.1057	0.0101	
lgb	X(t-1)	-2.9477	1.5505	0.279	0.06437*	X(t-1)	3.4319	4.6821	0.2568	-2.232808	X(t-1)	0.5652	0.272	2.25E-04
	Intercept	0.06475	0.08021			Intercept	-0.1747	0.117			Intercept	0.0201	0.0064	
spr	X(t-1)	2.53047	3.00034	0.2895	-0.007655	X(t-1)	4.4161	4.3596	0.2489	-2.159787	X(t-1)	-0.2168	0.7342	3.57E-04
	Intercept	0.03195	0.06345			Intercept	-0.1563	0.1322			Intercept	1.00E-04	3.00E-04	
stv	X(t-1)	730.08685	374.63807	0.2783	0.06858*	X(t-1)	535.7612	823.1533	0.2588	-2.222567	X(t-1)	-0.018	0.3182	1.10E-08
	Intercept	0.1242	0.0459			Intercept	-0.09184	0.08538			Intercept	-0.0019	0.0482	
ltr	X(t-1)	0.3185	0.247	0.2859	0.01716	X(t-1)	0.38272	0.50267	0.2561	-2.240207	X(t-1)	-0.1836	0.3446	2.79E-02

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Summary of Annual Result

Industrial Sector	In-sample Significant Factor
1. Agriculture, Forestry, And Fishing	NIL
2.Mining	Inflation Rate***, Price/Earning Ratio of S&P500**, Risk Free Rate(3-month Treasury Bill Rate)**, Spread Between Long-term Government Bond Yield and 3 Month Treasury Bond Yield*, Stock Variance of S&P500**
3.Construction	NIL
4.Manufacturing	Dividend Payout Ratio of S&P500*, Spread Between Long-term Government Bond Yield and 3 Month Treasury Bond Yield**, Long Term Rate of Return***
5.Transportation, Communications, Electric, Gas, And Sanitary Services	NIL
6.Wholesale Trade	Stock Variance of S&P500**
7.Retail Trade	Stock Variance of S&P500***, Long Term Rate of Return*
8. Finance, Insurance, And Real Estate	Price/Earning Ratio of S&P500*, Dividend Yield of S&P500*, Risk Free Rate(3-month Treasury Bill Rate)***, Long-term Government Bond Yield***, Stock Variance of S&P500**
9.Services	Price/Earning Ratio of S&P500*, Dividend Yield of S&P500**, Risk Free Rate(3-month Treasury Bill Rate)*, Dividend Price Ratio of S&P500*, Long-term Government Bond Yield*, Stock Variance of S&P500*

#Significance levels at 90%,95% and 99% are indicated with *,** and *** respectively

Similar to the monthly result, in in-sample regression, there are different significant factors(or no significant factors) in different industrial sectors. Modeling the annual equity premium separately might possibly improve the accuracy of prediction in in-sample regression. Same as the monthly result, there are no factors that are significant in the out-of-sample regression. It reveals that these factors are not good predictors for predicting the annual industrial equity premium.

Conclusion

Our research shows that, in In-sample regression, different industries have different significant factors(or no significant factors). Therefore, modeling the equity premium for different industrial stocks separately might improve the accuracy of prediction in in-sample regression. Also, we found that some factors can better predict the equity premium in monthly frequency and some factors can better predict the equity premium in annual frequency in in-sample regression.

However, our results match the results found in Welch & Goyal(2008) that most of the factors do not have good performance in both In-sample and Out-of-sample tests. This means that none of the mentioned factors are good predictors to model the monthly and annual equal-weighted industrial equity premium.

There are some limitations to our research. Firstly, the period of data is not long enough. Because we only investigate the stock components in S&P500 at the time 31st December 2019, if we take a very long period, most of the stocks might not be included at the beginning period. The result might be different if a longer period was taken instead. Secondly, as mentioned above, the stocks we picked for the whole research was unchanged. However, the stock components in S&P500 keep changing over time. Thus, if we keep track of the components of the S&P500 and modify our portfolio by that, the result might be different. Thirdly, the accuracy of the prediction of the factors may affect the final result. To model the industrial equity premium, we also have to forecast the predictors. Therefore, it is very critical to have an accurate prediction of the predictors. Our result might vary if we could improve the forecasting accuracy of the predictors.

For further research, one can try to model the industrial equity premium with the portfolio updated when the stock components of S&P500 changed. This can make the data more representative and a longer time period can be taken for the research. Also, one can try to model the independent variable in other methods, rather than the AR(1) model, to see whether the result can be improved. Lastly, we only test some of the predictors mentioned in Welch & Goyal(2008), other mentioned predictors can also be tested for their suitability of modeling the industrial equity premium.

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