NASDAQ, COLCAP Colombia Exchange Rate. 2011-2014

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Abstract

Here, a relationship between Colombian and USA Stock Markets was found. Also a relationship between both stock markets and exchange rate between Colombian Peso and USA Dollar, since 2011 to 2014. From NASDAQ Composite Index selected have selected 10 stocks. From Colombia stock market Index, COLCAP, used 38 stocks. For a longer time the stocks will change and the relationships could do it. In conclusion based on volatility, data scale, data frequency. We recommend to explore Signal Analysis Techniques to understand the auto variation, bias or effect of: date to star, quantity of data; frequency to measure the data sets, quantity of data

Keywords
NASDAQ Stock Market, COLCAP Stock Market, Colombian Peso Exchange Rate, Logistic Trade, Public Policy

1. Introduction
Some authors have found direct or inverse relationships between exports and imports of Colombia, their employment rate and the exchange rate between the local currency and the international reference currency, the US Dollar, USD. However, there is information that may be present or can be obtained from the stock economic instruments of both countries and can be associated to understand for a time their link to the exchange rate. Some financial instruments are taken here and this uses pearson's correlation index as an easy-to-interpret and usable statistician to identify the amount of information and the type of relationship between the exchange rate and the stock market activity of the two countries. This uses 1,097 daily log data between 2011-10-11 and 2014-10-10 for 38 COLCAP instruments and 10 NASDAQ instruments

1.1 Objectives
Identify the relationship between of selected NASDAQ, the quote on the technology stock market in the United States, with the Representative Market Rate, TRM, or exchange rate between the Colombian peso, COP, and the US dollar, USD; officially publicized by the Colombian Government through the Bank of the Republic of Colombia.
Also identify the relationship between the listing on the Colombian stock market, COLCAP of some instruments with the Representative Market Rate, TRM or exchange rate between the Colombian peso, COP, and the US dollar,

2. Literature Review
Murcia and Rojas (Murcia & Rojas, 2014) describe the dynamics of the exchange rate between the Colombian peso and the United States dollar from 2009 to 2013, this modeling in the short term the micro interactions of agents in a scenario of imperfect information and from the perspective of obtaining the best strategic positioning. It finds greater importance for international market factors than for local markets in defining this exchange rate.
Li et al. (Li et al., 2018) identifies the effect of international financial and economic flows on the exchange rate with monthly data from 1996 to 2015, 20 years, for 53 countries including Argentina, Brazil, Colombia, Mexico and Peru; Situation changing by the different compositions of inputs and capital of each industry, according to Casas (Casas, 2020); for this group the most important flow is that of the bond market. Gantman and Dabos (Gantman & Dabós,

2018) find that this effect increases with the opening of markets for 101 countries for the period 1960 to 2011. (Johnson & Soenen, 2003)
Following the line of the classic economy Peláez y Sierra (Pelaez S. & Sierra S., 2016) identify an increase in employment for 59 industrial sectors in Colombia due to the increase in the exchange rate, a situation contrary to the findings of Santillán (Santillán-Salgado et al., 2019) and Hising et al. (Hsing et al., 2011) who finds that Colombia's behavior is different from that of Argentina, Brazil, Mexico and Peru, they find that to the increase in the exchange rate causes a decreases in employment rates
Bernal (Bernal Torres et al., 2016) identifies the flow of imports and exports, the peace process, infrastructure, external debt, the quality and quantity of agricultural activity in Colombia as determinants of the exchange rate in Colombia. In this case we have two causal ways. Form TRM to economy and form the economy to TRM.
Colombian Exporters for their trade activity will prefer the formal financial system support based on countries with flexible strong economic financial development , and therefore the change of the country with better financial development (Liu & Lu, 2019) and for financial systems located in more democratic societies than those controlled by tycoons and local powers because they generate Morck et al risk (Morck et al., 2011); in turn the privatization and deconcentration of the power banking of tycoons and families is associated and caused by the political availability of the government to be accountable to its citizens, (Boehmer et al., 2005),movements that in turn prevent banking crises (Boyd et al., 2019) which in turn affect the exchange rate (Doma-& Martinez Peria, 2003) and the security and stability of the Bond market (Tebaldi et al., 2018)(Hove et al., 2017),as well as institutional strength (Ojeda-Joya & Sarmiento, 2018).
Lopez (Lopez, 2018) identifies the most affecting factors in long-term returns as :" the growth rate of home loans, the real exchange rate and the returns of the S&P500 index" for data between 1995 and 2017. There is also evidence of weekly cycling affecting the exchange rate and share value (Gómez-González & Melo Velandia, 2014). The effect of the day of the week on the exchange rate has been identified for Argentina, Brazil, Colombia, Mexico, Peru and also Chile., (Santillán Salgado et al., 2019)

3. Methods

First the log values of 1,097 daily data was obtained between 2011-10-11 through 2014-10-10 for 38 COLCAP instruments and 10 NASDAQ instruments and the TRM. Pearson's correlation coefficient is obtained, statistically significant values at 95% are identified between: TRM and NASDAQ instruments and NASDAQ instruments among themselves; then between the TRM the NASDAQ instruments and 38 COLCAP instruments.

4. Data Collection

First, TRM or COP vs. USD exchange rate. Second, selected NASDAQ instruments are 10: Apple, Microsoft, Google, China Mobile, Facebook, Samsung, Intel, IBM, Amazon, Cisco.
Colombian Stock Market Index, COLCAP, instruments are 38: Bcolombia; Bvc; Chocolates; Cnec; Conconcret; Corficolcf; Ecopetrol; Bse; Enka; Etb; Success; Fabricato; Grupoaval; Gruposura; Interbolsa; Isa; Isagen; Miners; Nutresa; Odinsa; Pazrio; Pfaval; Pfavta; Pfbcolom; Pfcarpak; Pfcemargos; Pfdavvnda; Pfgruposura; Pfhelmbank; Pmgc; Prec; Sie; Tablemac; Bbvacol; West; Inverargos; Bogota; Colinvers
Table 1 resumes principal descriptive statistics for each one: TRM, NASDAQ Stocks, COLCAL Selected Stocks. Here is Mod, or most frequent value; Max or maximum value; Min or minimum value; Mean or average of data; Std. Dev. or Standard Deviation; the next is the Mean divided by their Standardized Deviation; after this is their inverse. The CV or Variation coefficient; after have 3 coefficients to identify the functional form: Pearson´s Correlation; Kurtosis, Asymmetry; with theses have a tendency description in reference to data, an to reference to normal distribution probability function with kurtosis and asymmetry.
In this way is possible to compare in magnitude and tendency and functional form to this
49 data sets. “N. to Norm.” indicates near to normality function distribution by “*” to Kurtosis and asymmetry coefficients with deviation less than 0,6 simultaneously; “Sig. Ten.” abbreviates Statistical significant tendency between each dataset and the date of the day; an simultaneous increase in the date and the stock is showed with “+” at statistical p-value of, 0,05; an simultaneous positive increase in the date and negative increases in the stock market price is showed with “-”; an increase in the date and random or non-simultaneous increases or decreases in the stock market, all this using Pearson´s Correlation Coefficient.

Table 1. Descriptive statistics for the Retail Trade Index variables

Statistic/ Stock	Mod	Max	Min	Mean	Std. Dev.	M/ S. D.	P. C.C. TRM	P. C.C.(t)	Kurtos is C.	Asym. C.	N to Nor.	Sig. Ten.
Trm	1.798	2.055	1.755	1.869	76	24,7	1,00	0,60	-0,6	0,4	*	+
Apple	25	35	19	25	4	7,2	0,64	0,39	1,2	1,1		+
Microsoft	21	26	15	21	3	7,7	0,22	0,81	-1,0	0,0		+
Google	238	407	173	276	61	4,5	0,49	0,88	-0,9	0,2		+
China mobile	86	103	52	77	13	5,9	-0,07	0,39	-0,9	0,1		+
Facebook	27	48	24	33	6	5,9	0,56	0,87	-0,5	0,7		+
Samsung	187	216	173	193	9	21,3	-0,59	-0,29	-0,4	0,3	*	
Intel	335	606	270	422	106	4,0	0,71	0,96	-1,4	0,3		+
Ibm	55	65	42	53	4	13,7	0,60	0,05	0,2	0,2	*	
Amazon	-	79	-	34	24	1,4	-0,39	0,95	-1,1	0,1		+
Cisco	1.300	1.500	800	1.206	185	6,5	0,03	0,65	-0,5	-0,7		+
Bcolombia	26.600	30.700	21.400	27.066	1.858	14,6	-0,54	-0,31	0,6	-0,7		
Bvc	30	37	19	27	4	6,7	-0,77	-0,79	-1,0	0,1		-
Chocolates	27.000	28.700	20.300	24.597	2.531	9,7	0,49	0,87	-1,4	-0,3		+
Cnec	1.335	14.740	468	5.991	4.634	1,3	0,67	0,92	-1,4	0,3		+
Conconcret	1.400	1.555	1.030	1.340	109	12,3	0,47	0,52	0,1	-0,5	*	+
Corficolcf	34.000	41.180	30.140	35.978	2.443	14,7	0,57	0,81	-0,8	0,3		+
Ecopetrol	5.300	5.850	2.920	4.445	770	5,8	-0,82	-0,70	-1,3	0,0		-
Eeb	1.400	1.725	968	1.353	211	6,4	0,60	0,89	-1,1	-0,3		+
Enka	7	14	6	9	2	4,9	0,34	0,30	0,0	0,8		
Etb	400	606	370	439	50	8,8	0,16	-0,03	1,0	1,3		
Éxito	33.000	37.040	22.800	30.159	3.256	9,3	-0,21	0,42	-0,6	-0,3	*	+
Fabricato	72	94	10	47	35	1,3	-0,69	-0,85	-1,9	0,2		-
Grupo aval	1.265	1.435	1.130	1.274	76	16,7	0,28	0,62	-0,8	0,1		+
Grupo sura	31.000	44.300	29.100	35.181	3.692	9,5	0,26	0,73	-0,9	0,2		+
Inter bolsa	980	2.500	980	1.415	606	2,3	-0,44	-0,84	-1,3	0,8		-
Isa	11.200	11.940	7.330	9.698	1.209	8,0	-0,54	-0,74	-0,9	0,2		-
Isagen	2.500	3.320	1.985	2.669	350	7,6	0,52	0,89	-1,1	0,1		+
Mineros	4.000	5.800	2.730	3.952	855	4,6	-0,61	-0,94	-1,3	0,2		-
Nutresa	27.000	28.700	20.300	24.597	2.531	9,7	0,49	0,87	-1,4	-0,3		+
Odinsa	8.700	10.400	7.240	8.810	609	14,5	-0,69	-0,61	-0,4	0,1	*	-
Pazrio	20	35	6	19	8	2,5	-0,55	-0,87	-1,1	0,1		-
Pfaval	1.280	1.455	1.130	1.281	76	16,9	0,27	0,60	-0,7	0,1		+
Pfavta	4.060	4.705	3.105	4.048	331	12,2	-0,33	-0,08	-0,6	-0,3		
Pfbcolom	27.300	31.460	22.220	27.725	1.865	14,9	-0,52	-0,24	0,4	-0,6		
Pfcarpak	5.170	5.270	2.000	4.140	1.014	4,1	-0,63	-0,88	-1,1	-0,6		-
Pfcemargos	8.160	11.480	7.580	8.890	1.015	8,8	0,52	0,84	-0,2	1,1		+
Pfdavvnda	22.000	32.400	19.340	23.910	3.175	7,5	0,33	0,86	0,1	0,9		+
Pfgruposura	33.440	43.600	30.620	36.310	3.031	12,0	0,18	0,67	-1,1	0,1		+
Pfhelmbank	509	578	274	477	75	6,3	0,17	0,70	1,2	-1,6		+
Pmgc	21.000	51.000	9.130	20.836	8.595	2,4	0,04	-0,45	1,3	1,2		-
Prec	38.500	54.700	27.380	39.513	5.434	7,3	-0,78	-0,68	0,0	0,5	*	-
Sie	9.000	12.620	8.000	9.676	809	12,0	0,06	-0,28	1,1	0,8		
Tablemac	8	11	7	9	1	6,8	-0,52	-0,84	-1,3	0,4		-
Bbvacol	270	380	215	267	32	8,4	0,43	0,71	1,8	1,2		+
Occidente	40.000	40.800	28.220	35.196	4.568	7,7	0,69	0,92	-1,8	0,0		+
Inverargos	21.000	24.100	15.000	19.856	2.302	8,6	0,23	0,76	-1,3	-0,1		+
Bogota	69.000	73.500	47.300	60.210	8.872	6,8	0,66	0,93	-1,8	-0,1		+
Colinvers	4.800	6.500	3.800	5.265	706	7,5	0,31	0,87	-1,0	-0,3		+

5. Results and Discussion

5.1 Numerical Results

Table 1 lists Pearson's correlation coefficients between the 10 selected NASDAQ instruments and the TRM or COP/USD ratio. There it is observed that 7 of the 10 values are statistically corelationated with TRM,with p<0,05. Two with negative relationship: Samsung and IBM. There are also multiple positive and negative relationships between NASDAQ variables: Determination coefficient is showed in this table with staistical modeled information.

Table 2**.** Correlation between NASDAQ and TRM instruments

Pearson´s R / R^2(Up)	*TRM*	*Google*	*Apple*	*Microsoft*	*China Mobile*	*Facebook*	*Samsung*	*Intel*	*Amazon*	*IBM*	Cisco
TRM		*0,41*	*0,05*	*0,24*	*0,00*	*0,32*	*0,35*	*0,51*	*0,36*	*0,15*	0,00
Google	**0,64**		0,04	0,43	0,07	0,52	0,16	0,84	0,75	0,00	0,38
Apple	0,22	0,20		0,14	0,37	0,55	0,01	0,17	0,18	0,02	0,01
Microsoft	**0,49**	**0,66**	**0,37**		0,01	0,54	0,02	0,62	0,44	0,00	0,25
China Mobile	-0,07	0,26	0,61	0,12		0,32	0,00	0,10	0,23	0,15	0,04
Facebook	**0,56**	**0,72**	**0,74**	**0,73**	**0,56**		0,08	0,76	0,70	0,00	0,13
Samsung	**-0,59**	**-0,40**	-0,12	-0,14	0,02	-0,28		0,13	0,15	0,09	0,02
Intel	**0,71**	**0,92**	**0,41**	**0,79**	0,32	**0,87**	**-0,36**		0,84	0,01	0,32
Amazon	**0,60**	**0,87**	**0,43**	**0,66**	**0,47**	**0,84**	**-0,38**	**0,91**		0,00	0,30
IBM	**-0,39**	-0,06	0,15	0,02	**0,38**	0,02	0,30	-0,12	0,04		0,04
Cisco	0,03	**0,62**	-0,12	**0,50**	0,20	**0,36**	0,14	**0,56**	**0,54**	0,19	

Table 3. Correlation Count is between NASDAQ and COLCAP instruments

Action Counting	*TRM*	*Apple*	*Microsoft*	*Google*	*China Mobile*	*Facebook*	*Samsung*	*Intel*	*IBM*	*Amazon*	*Cisco*
Positive	13	8	19	19	7	20	10	20	6	21	19
Negative	14	4	11	14	2	11	6	13	1	13	11
Total	27	12	30	33	9	31	16	33	7	34	30
Proportion, %	71	32	79	87	24	82	42	87	18	89	79

Table 2 summarizes: the number of positive relationships between the column variable with the 38 row variables in Table 3.So the TRM is positively related to 13 of the 38 COLCAP instruments and conversely to 14 of the 38 instruments, added up to 27 out of 38 and is a ratio of 71%. In Table 3 COLCAP instruments are associated with NASDAQ instruments as follows: Amazon 89%, Google 87%, Intel 87%, Facebook 82%, Cisco 79% Microsoft 89%. The count data of Table 3 is in Table 4 and its summary as rows is in Table 4. Table 4 relates the NASDAQ instruments directly associated with the quote of the 38 COLCAP instruments. There it is affected between 18% and 91% by these instruments. Without a unique identification of relationships between the two types of instruments, in some cases positive in other negative.

Coul be noted that correlationship is based in used data, quantitiy of data, detail level. elsecase the causality estimation could be affected. In this case two option may be usefull: signal techniques like Wavelet desocmposition, espectral potence; or statistical procedures like granger causality, partial correlation ; among others. This changes in correlation, and causality are based in: changes in socio political actions: public policy changes in international trade, fiscal policy, monetary policy; relathionships bewteen conuntries, wars, changes on deman production, distribution sysms, and anothers like God Acts, climate effects, biological effects etc.

Table 4. Pearson Correlation Coefficients From COLCAP to NASDAQ.

	TRM	*Apple*	*Micro soft*	*Google*	*China Mobile*	*Face book*	*Sam sung*	*Intel*	*IBM*	*Amazon*	*Cisco*
Bcolombia	**-0,54**	-0,01	-0,15	**-0,53**	-0,10	-0,31	**0,46**	**-0,43**	**0,46**	**-0,34**	-0,06
Bvc	**-0,77**	-0,24	**-0,59**	**-0,78**	-0,18	**-0,67**	**0,60**	**-0,83**	0,31	**-0,80**	-0,33
Chocolates	**0,49**	0,18	**0,80**	**0,76**	0,11	**0,66**	-0,24	**0,81**	0,11	**0,78**	**0,67**
Cnec	**0,67**	**0,36**	**0,77**	**0,88**	0,22	**0,81**	**-0,40**	**0,95**	-0,21	**0,88**	**0,54**
Conconcret	**0,47**	0,33	**0,48**	**0,45**	0,06	**0,48**	-0,25	**0,59**	-0,16	**0,50**	0,30
Corficolcf	**0,57**	**0,38**	**0,80**	**0,77**	0,22	**0,74**	**-0,38**	**0,80**	0,13	**0,73**	**0,45**
Ecopetrol	**-0,82**	**-0,53**	**-0,65**	**-0,64**	-0,08	**-0,76**	**0,53**	**-0,79**	0,32	**-0,67**	-0,08
Eeb	**0,60**	0,21	**0,80**	**0,82**	0,16	**0,70**	**-0,35**	**0,86**	0,05	**0,82**	**0,58**
Enka	**0,34**	**0,73**	0,22	0,15	0,39	**0,56**	-0,21	**0,37**	-0,09	**0,36**	-0,18
Etb	0,16	**0,66**	0,05	-0,12	0,19	0,29	-0,15	0,04	0,02	0,01	**-0,45**
Éxito	-0,21	-0,25	0,30	0,31	0,17	0,07	0,18	0,21	**0,55**	**0,36**	**0,73**
Fabricato	**-0,69**	-0,18	**-0,83**	**-0,82**	0,06	**-0,68**	0,29	**-0,86**	0,13	**-0,75**	**-0,55**
Grupoaval	0,28	0,32	**0,80**	**0,43**	0,08	**0,55**	-0,04	**0,53**	0,29	**0,48**	**0,42**
Gruposura	0,26	0,28	**0,75**	**0,50**	0,13	**0,57**	-0,03	**0,61**	0,33	**0,62**	**0,58**
Interbolsa	**-0,44**	0,09	**-0,71**	**-0,78**	-0,05	**-0,50**	0,15	**-0,77**	-0,11	**-0,74**	**-0,80**
Isa	**-0,54**	0,11	**-0,67**	**-0,72**	0,04	**-0,48**	0,10	**-0,73**	0,10	**-0,62**	**-0,66**
Isagen	**0,52**	0,24	**0,65**	**0,91**	**0,36**	**0,74**	**-0,38**	**0,87**	-0,07	**0,87**	**0,64**
Mineros	**-0,61**	**-0,35**	**-0,77**	**-0,85**	**-0,39**	**-0,82**	**0,37**	**-0,89**	0,00	**-0,90**	**-0,55**
Nutresa	**0,49**	0,18	**0,80**	**0,76**	0,11	**0,66**	-0,24	**0,81**	0,11	**0,78**	**0,67**
Odinsa	**-0,69**	-0,18	**-0,46**	**-0,64**	-0,06	**-0,51**	**0,62**	**-0,68**	**0,39**	**-0,65**	-0,20
Pazrio	**-0,55**	-0,09	**-0,76**	**-0,85**	-0,17	**-0,64**	**0,37**	**-0,82**	-0,03	**-0,82**	**-0,61**
Pfaval	0,27	0,32	**0,80**	**0,39**	0,08	**0,54**	-0,03	**0,51**	0,29	**0,46**	**0,39**
Pfavta	-0,33	**-0,48**	-0,08	-0,06	-0,13	-0,31	**0,45**	-0,13	0,16	-0,14	0,33
Pfbcolom	**-0,52**	0,04	-0,08	**-0,48**	-0,05	-0,25	**0,48**	**-0,37**	**0,47**	-0,28	-0,02
Pfcarpak	**-0,63**	**-0,59**	**-0,64**	**-0,78**	**-0,54**	**-0,89**	**0,43**	**-0,88**	0,07	**-0,92**	**-0,36**
Pfcemargos	**0,52**	**0,65**	**0,71**	**0,68**	**0,50**	**0,88**	**-0,42**	**0,82**	-0,03	**0,84**	**0,35**
Pfdavvnda	0,33	**0,50**	**0,73**	**0,62**	**0,41**	**0,76**	-0,12	**0,76**	0,21	**0,82**	**0,58**
Pfgruposura	0,18	0,21	**0,70**	**0,43**	0,10	**0,49**	0,05	**0,53**	**0,38**	**0,56**	**0,59**
Pfhelmbank	0,17	0,05	**0,45**	**0,67**	**0,37**	**0,48**	0,04	**0,58**	0,26	**0,66**	**0,76**
Pmgc	0,04	0,29	-0,32	**-0,36**	-0,13	-0,12	-0,30	-0,29	**-0,35**	**-0,37**	**-0,69**
Prec	**-0,78**	-0,05	**-0,47**	**-0,69**	0,07	**-0,48**	**0,50**	**-0,71**	0,27	**-0,68**	-0,26
Sie	0,06	**0,49**	-0,17	-0,25	0,09	0,09	-0,26	-0,14	-0,25	-0,21	**-0,62**
Tablemac	**-0,52**	-0,16	**-0,83**	**-0,72**	0,00	**-0,61**	0,19	**-0,78**	-0,10	**-0,73**	**-0,61**
Bbvacol	**0,43**	**0,70**	**0,49**	**0,54**	**0,62**	**0,80**	-0,08	**0,69**	0,13	**0,73**	0,28
Occidente	**0,69**	0,30	**0,86**	**0,88**	0,16	**0,80**	**-0,37**	**0,91**	-0,06	**0,84**	**0,56**
Inverargos	0,23	0,09	**0,72**	**0,59**	0,15	**0,49**	-0,02	**0,64**	0,32	**0,66**	**0,72**
Bogota	**0,66**	0,30	**0,88**	**0,85**	0,15	**0,80**	-0,31	**0,91**	-0,02	**0,84**	**0,58**
Colinvers	0,31	0,20	0,72	**0,75**	**0,34**	**0,65**	-0,13	**0,76**	0,28	**0,81**	**0,77**

Table 5. Count of Pearson Correlation Coefficients From COLCAP to NASDAQ by Category

COLCAP	*Positive Count*	*Negative Count*	*Total Count*	*Proportion*	*position*
Mineros	1	9	10	91	1
Pfcarpak	1	9	10	91	2
Pfcemargos	9	1	10	91	3
Cnec	8	1	9	82	4
Corficolcf	8	1	9	82	5
Isagen	8	1	9	82	6
Pfdavvnda	9	-	9	82	7
Bvc	1	7	8	73	8
Ecopetrol	1	7	8	73	9
Eeb	7	1	8	73	10
Odinsa	2	6	8	73	11
Pazrio	1	7	8	73	12
Bbvacol	8	-	8	73	13
Occidente	7	1	8	73	14
Chocolates	7	-	7	64	15
Fabricato	-	7	7	64	16
Gruposura	7	-	7	64	17
Interbolsa	-	7	7	64	18
Isa	-	7	7	64	19
Nutresa	7	-	7	64	20
Pfgruposura	7	-	7	64	21
Pfhelmbank	7	-	7	64	22
Prec	1	6	7	64	23
Tablemac	-	7	7	64	24
Bogota	7	-	7	64	25
Colinvers	7	-	7	64	26
Bcolombia	2	4	6	55	27
Conconcret	6	-	6	55	28
Enka	6	-	6	55	29
Grupoaval	6	-	6	55	30
Pfaval	6	-	6	55	31
Inverargos	6	-	6	55	32
Pfbcolom	2	3	5	45	33
Pfavta	2	2	4	36	34
Pmgc	-	4	4	36	35
Éxito	3	-	3	27	36
Etb	1	1	2	18	37
Sie	1	1	2	18	38

5.2 Graphical Results

Figure 1 and Figure 2 describes 10 selected NASDAQ stocks Price. Variance, volatility are present in each stock and for TRM. Figure 3 an Figure 4 Shows dispersions between TRM-Intel stock, and TRM- Google Stock using logarithmic relationship. Multiple functional forms could be explored, and therefore selected. In this way Figure 3 and Figure 4 are based on Figure 1.Multiple patterns could be explored with a displacement of correlation coefficient Figure 5 was made using 400 days for TRM, itself or an stock price, Beginning in 2013-03-07.

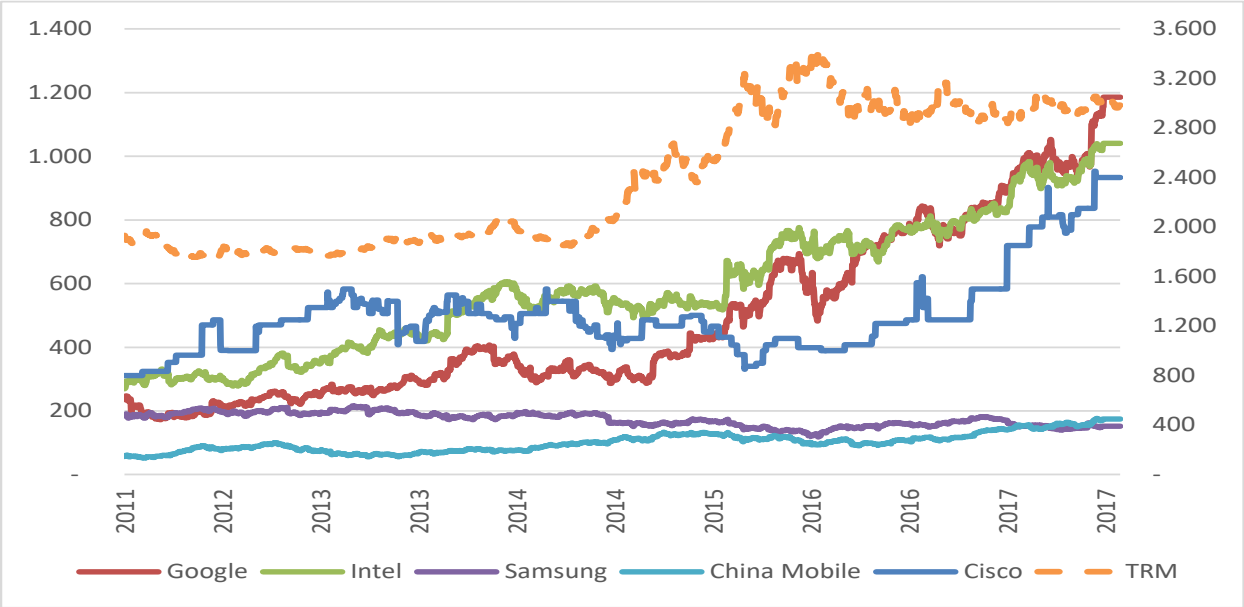

Figure 1. Selected NASDAQ stocks Price and TRM

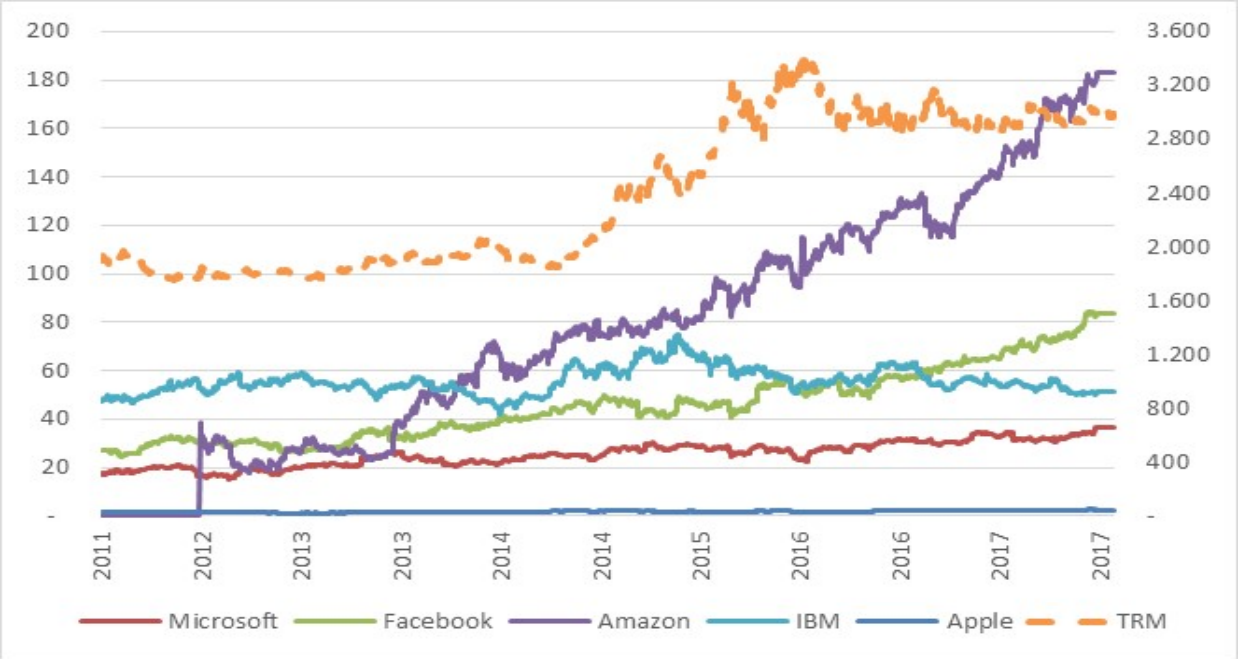

Figure 2. Another Selected NASDAQ stocks Price and TRM

This show changes based in the initial point, quantity of data. Their effect must be studied based on signal analysis techniques or another data knowledge based technology. One main reason is the effect in the selection of star point or the quantity of lagged data selected, or the data quantity to be taken to obtain their performance measurement. Eventually this tree conditions could be critical, or temporal to produce an accurate estimator, or in order to consider the changing effects in nature or society. In Brief the star point, the conditions to measure could change current results based in the variability in the data used an their scale, or star point selected

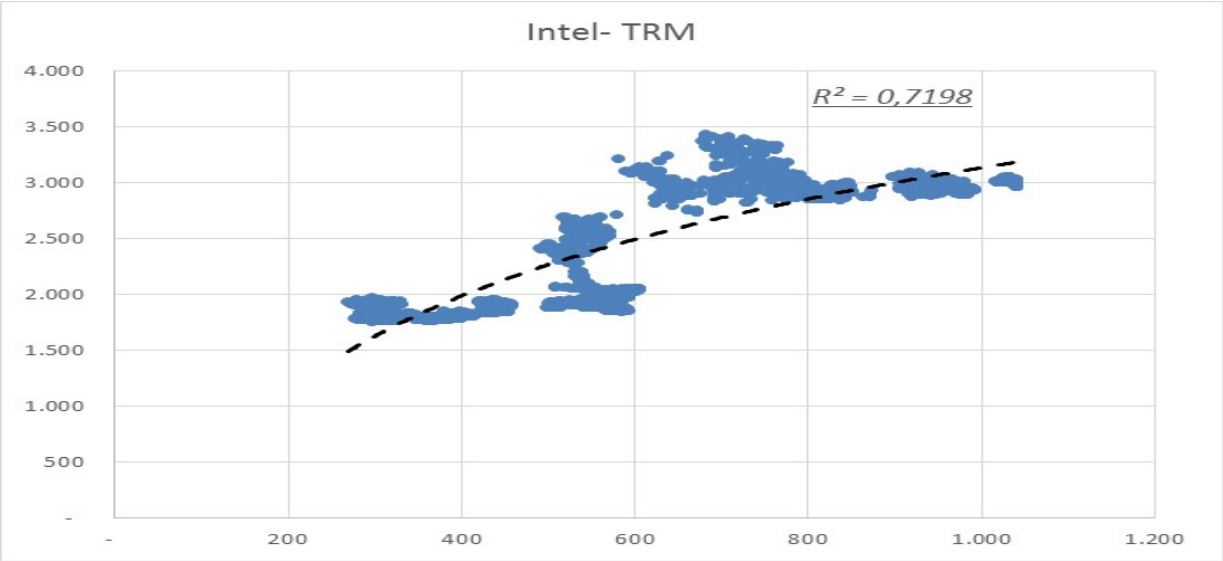

Figure 3. Dispersion between TRM and Intel

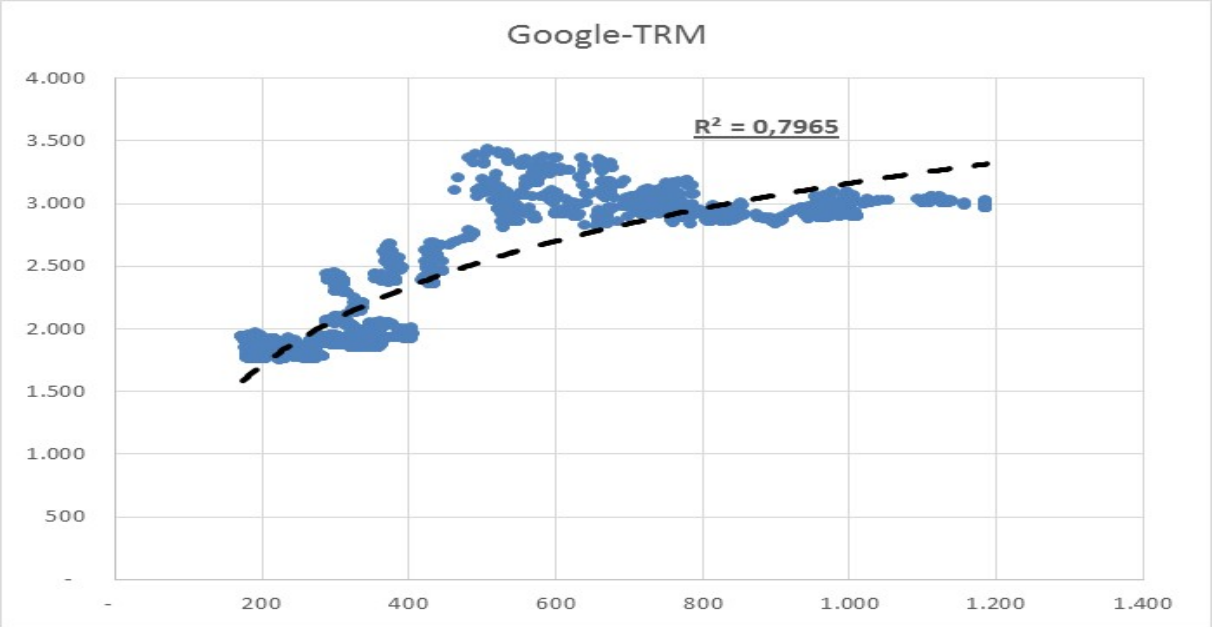

Figure 4. Dispersion between TRM and Google

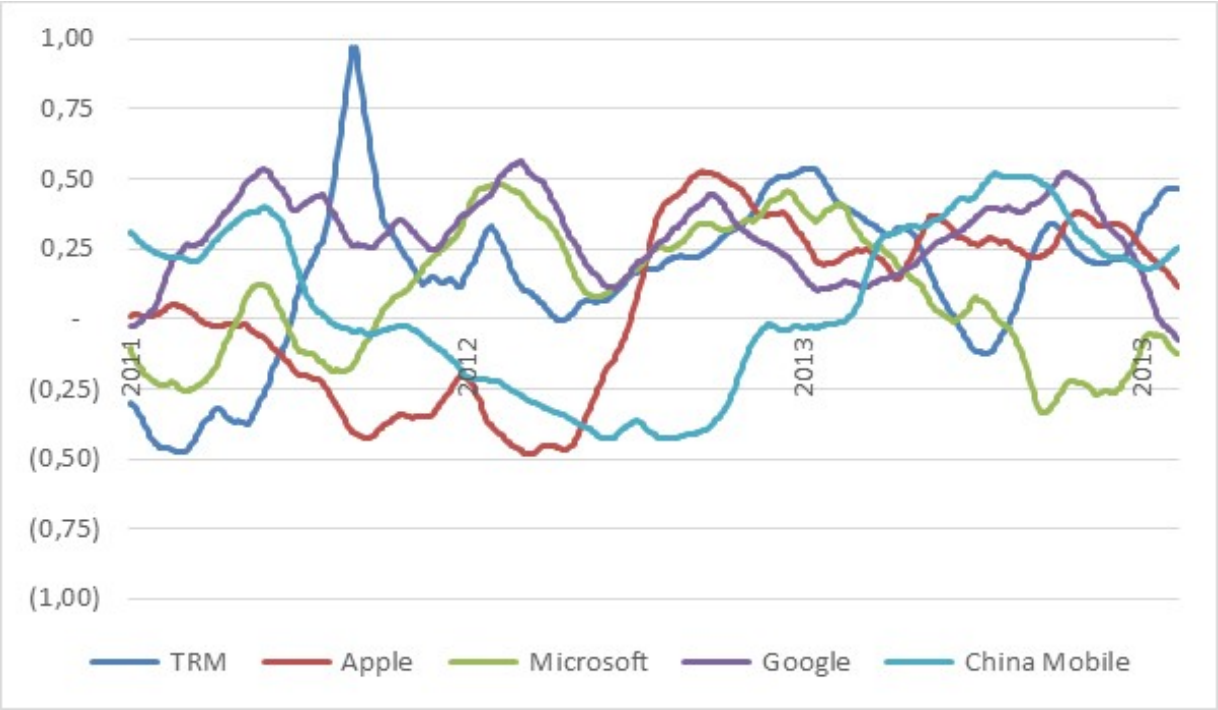

Figure 5. Evolution between 400 TRM data and 4 NASDAQ Stocks

5.3 Proposed Improvements

A larger set of data could be taken depending on a larger theoretical or reference framework in the literature.
This could be proposed by annual time intervals to have an evolution in the relationship of variables.The ways to improve the presented text could include: signal analysis techniques to include, identification of causality using Grangers Causality statistical test, Neural networks, to identify que set points of the data, changes in performance measurement, Cyclicity, among others.

5.4 Validation

No prior assumptions are made regarding the functional way to obtain correlation coefficients, the exercise could be made with monthly data since 1995 for some actions of both indices. And could be compared or expand to use Signal analysis procedures like : spectral power, wavelet analysis, Fourier analysis to find components in frequency or stability over the data

6. Conclusion

The representative market rate is associated with U.S. stock activity to varying degrees for different NASDAQ index instruments:
Colombia's representative market rate, or COP, USD exchange rate is associated whit the activity in NASDAQ and COLCAP.
The relationship between each pair of stocks could vary based in the inter competence in a sector. Mergers, acquisitions, OPA´S could change this relations.
This study could be extended to 1980 to 2020 to include inter or intra annual effects and will use another stock market index like S&P or DAX

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