Adeel Yusuf[a], afaq$_5$70[b]

[a]*National University of Sciences and Technology, Pakistan*
[b]*Affiliation not available*

Abstract

The modern portfolio theory explains the optimal portfolio concepts. The theory explains that investors will invest on the basis of maximizing their profit for their tolerated level of risk or determination of percentage of acids in a portfolio such that it fulfils the given objective, maximize return for a tolerated risk. Product complexity is directly related to the risk in export. This paper focused towards the detection of the export commodities in which investor can have the maximize profit by controlling the risk and later by using the past trade data, gravitational theory and complexity factor our system will predict and optimize the export of a country. The approach is tested for varying datasets and comparative analysis is performed that reflects the effectiveness of the proposed system.

Keywords: Export, Portfolio Theory, Product Complexity , gravitational Theory, Textile

Introduction

Countries do not remain in isolation, they have to import commodities to fulfil their requirement either they are not produced in the country or in the shortage and in return they export the commodities/goods which are surplus in the country or as a trade off their import Also export they are related to the economic development and increase in Gross domestic product (GDP). Generalized knowledge of trade is classified on Harmonized Systems (HS) also knows as Harmonised coding of Trade data. Further classified 6 digit level i.e. First two digit represents "**Chapters**" . the second two digits designates "Heading" and the last two digits designates "Sub Heading". HS code 010410 , for example indicates Chapter 01 (live animals), Heading 04 (*live sheep and goats*), and Subheading 10 (*live sheep's*). Countries applying HS worldwide to control and monitor of commodities used for collection of taxes, tariff customs, collection of international trade statistics, transport tariff & statistics etc. [1]

During the recent few years, According to the World Trade Statistical Review 2017 [2] by World Trade Organisation (WTO)

Trade indicators such as export orders and container throughput in major ports were up in the first quarter of 2017, suggesting stronger trade growth for the year, but the presence of significant risk factors also point to the possibility of less positive outcomes.

1.Due to continuing weakness in the global economy and low commodity prices the volume of world merchandise trade slowed down to 1.3% in 2016 as compared to the previous 2.6% in 2016. This had a negative impact on global import demand

2.The world GDP growth since 1980 was 2.8% but ever since it has dropped down to 2.6 in 2016 from the previous 2.7 in 2015, which is way below the average.

3. Investment spending has been further weekend due to the slowdown in world trade, due to it being the most trade intensive component of import demand.

4.The merchandise exports have fallen by 3.3% to US $15.46 trillion in 2016, although the merchandise trade had a slight increase in terms of volume in 2016.

5. The weakest services component of 2016 was transport, which gives a reflection of fluctuations in merchandise trading, the recorded quarterly growth of commercial services trade was just 0.1 % in value terms in 2016 adding up to a total of US $4.77 trillion.

6. The economies of developed countries stayed weak throughout 2016 although the developing countries imports had a good recovery in the second quarter from the 3% drop in the first quarter but they managed to recover their previous level by the end of the year.

7. There were several risk factors present in 2016 which pointed to the possibility of less positive outcomes, although trade indicators such as export orders were up during the first quarter of 2017

The most important thing Is to identify the gaps and optimize the system that leads towards the better result that is, increase in trade with GDP, For this problem,The modern portfolio theory explains the optimal portfolio concepts The optimal portfolio theory was presented by Harry Markowitz[1]in 1952. The theory explains that investors will invest on the basis of maximizing their profit for their tolerated level of risk or determination of percentage of acids in a portfolio such that it fulfills the given objective, maximize return for a tolerated risk and it clarifies us that it is practicable for different portfolios that have changing levels of risk and return. Every investor must choose aspects that how much risk they can afford to have furthermore expanded their portfolio as showed by this choice. The graph underneath shows that how the optimal portfolio works. At the center of the curve the ideal risk portfolio is resolved to be some place since you go out on a limb for a lower incremental return as you go higher up the bend. though, generally safe return portfolios are immaterial on the grounds that one can accomplish a comparative return by putting resources into a risk free resource.

Risk mitigation, Estimating long term sales growth and Generating large amounts of cash are the main objective of product complexity and these information are essential to identify the gaps , predicting the future graphs and optimize them with integrating portfolio theory. Product Complexity is the quality or state of being composed of two or more separate or analyzable items, parts, or symbols categorized into Multiplicity and Relatedness of the product. Number of components, Extent of interaction and Degree of product novelty are the factors representing Product Complexity. There is a growing emphasis on product design. The results of product in portfolio are more different and targeted to a more refined market segment. Using Theory Performs Frontier (TPF)[] and Transaction Cost Economics(TCE) [] as theoretical framework propositions can be constructed that, when tested will advance the theoretical understanding of the impacts of the product complexity on operations.

Product complexity has direct and indirect impacts on trade. It is the state of possessing a multiplicity of elements manifesting relatedness. Meaning to assemble a product, each and every part is required. Hence the more parts in a product the greater the risk of discrepancies.

As we increase the product complexity of a product we also tend to increase the lifecycle cost of that product. Several researchers have found that there is an increase in the direct costs due to the increase in product complexity. The more complex a certain product is the more costly and complicated it becomes, which increases the direct costs associated with production and development, Eg the Time, product analysis etc.The more complex and lengthy a product life cycle is the more time it takes for the company to develop the product and the greater the risk of mistakes because the number of functions increase as the complexity increases. Not only is the productions cycle increased with product complexity but so is the cost, quality, services and customer satisfaction. The set up costs become higher hence the need for more training and capital. There will be a significant increase in the material costs and labor costs. There are also several indirect costs associated with product complexity. Figuring them out tend to be more difficult. They may include 1. Increasing difficulty of balancing the assembly lines and product scheduling. 2. The need for higher quality control arises because we are increasing the components of the product so each and every one needs to be checked. 3. Decrease in flexibility during development and manufacturing .Other factors that can be included are Time and Capital spent on training, Loss of economies of scale, Inventory holding costs, Time and Capital spent on training and learning etc

The test dataset utilized for this work is the database of United Nations International Trade Statistics. Annual international trade statistic data including details of commodities category with partner country are provided to United Nation Static Division (UNSD) by more than 170 countries. It is the biggest repository of International Trade data. According to policy on use of comtrade data clause 3 & 16 by United Nation Department of Economic and Social Affairs Statistic division are permissible. It contains more than 3 billion trade data record since 1962.

BACKGROUND/ RELATED WORK:

Li Xia , Guo Yaomei and Song Weiwei have Forecasted Textile and Garment Exports Based on Holt Model in 2010 [4]. They Predicted China Export Using export data from 1992 to 2008 to predict 2009 and 2010 and by using Trade data 1992 to 1999 they predicted 2000 and 2001 for verifying prediction accuracy. If verified Using export data till 2008 predict 2009 and 2010 and verify error in an allowed range Similarly Pedro Uribe, C. G. de Leeuw and H. Theil [5] have done information approach to the prediction of inter-regional Trade flows in 1966. They have separated the world into n areas and took add up to exports

to and add up to imports from every locale and connected RAS method and the forecast methodology to import and fare information of the years 1938, 1948, 1951-52 and 1959-60 of the accompanying 8 districts i.e. North America ,Latin America, Germany ,Other E.E.C. nations ,) United Kingdom Other E.F.T.A. nations ,Communist nations and Rest of the world.

Fanxing Kong, Xia Li, Yingchun Liu and Yingbo Qin forecast china export by Applying GM(1,1) model. They have taken the trade data from 1999 to 2008 to verify the model and showed the prediction accuracy of the model is better. They predicted for the next three to five years and find out garment still grow rapidly in three to five years. Garments of china not only enhance in quality but also enlarge the investment in design, quality, brand to compete the garment industry.

Zhang Dabin, Zhu Hou, Zhang Jingguang forecast custom export of China based on Grey theory. They have utilized the Hubei Province China export data from 2000 to 2008 and predicted 2009, they showed GM model can forecast export of Hubei Province better than econometric model, Financial crisis on global economy has effect these years however Chinese government can export trade by changing policies and accommodate enterprises and provide opportunities to investor to invest and build friendly relationship with main industries of developed countries.

Yan Xie and Yan Xie forecast of the total volume of trade based on optimized genetic algorithm on grey modelling. Advancement of outside exchange of any nation's monetary development is critical. The import-send out exchange has the vital advancement impact to the nation's financial improvement, and it is of incredible essentialness for defining logically the technique and the strategy of the planned improvement between assets, condition and economy that to adequately estimate the aggregate sum of import and send out exchange. A technique in view of hereditary calculation streamlining displaying process is presented in this paper. This technique makes full utilization of the benefits of the Grey model estimate and qualities of hereditary calculation to discover worldwide enhancement. So the model presented is more precise. As per information from an area, the GM (1, 1) show for anticipating the aggregate volume of import-send out exchange was given in view of the dark framework speculations and hereditary calculation. The outcome shows that the model can be utilized as the aggregate volume of import-send out exchange a successful device for guaging.They have taken the trade data of one of the china province from 1989 to 2004 and predicted 2005 to 2007 they have decreased the error from 33.68%,43.61%,51.10% to 6.82%,2.40,9.04 for the year 2005,2006,2007 accordingly. In end they gave the conclusion If the parameters u and a of grey model is optimised by genetic algorithm , GM(1,1) model accuracy for medium and long term increased.

Chi-Chen Wang, Yi-Hsien Tu, Hsien-Lun Wong gives the comparison between MFTS and traditional time series modelling to forecast china exports and later on they have applied the same techniques on the export of Taiwan. They have taken the data from state administration of foreign exchange from January 1995 to October 2002, They have predicted MFTS prediction is more accurate for short term forecasting than traditional time series while one variable MFTS model perform better forecasting accuracy than multi vari-

able. They have applied the data on ARIMA, ARMA Two Factor model, Heuristic model and Markovitz model and give a comparative analysis on all these models. Heuristic model shows the best forecasting result followed by Markowitz model. MFTS proposed includes three models: Two factor model, Heuristic model, and Markov model. In China export data they have taken the data from January 1995 to October 2002, subdivided into January 1998 to October 2002 and January 2000 to October 2002 and provided the comparison in divided form to give a forecasting analysis on long term as well as short term. In other paper writer have taken the Taiwan trade data from January 1990 to April 2007 and subdivided into 3 categories. (II) August 1998 to April 2007 (III) December 2002 to April 2007 (IV) February 2005 to April 2007.The MSE value of ARIMA model is the lowest in (III and IV), the MFTS model performs better prediction ARIMA model has better forecasting ability in long-term period MFTS model performs better prediction ability for a short-term data than long-term.

Li Xia , Guo Yaomei and Song Weiwei have Forecasted Textile and Garment Exports Based on Holt Model in 2010 [4]. They Predicted China Export Using export data from 1992 to 2008 to predict 2009 and 2010 and by using Trade data 1992 to 1999 they predicted 2000 and 2001 for verifying prediction accuracy. If verified Using export data till 2008 predict 2009 and 2010 and verify error in an allowed range Similarly Pedro Uribe, C. G. de Leeuw and H. Theil [5] have done information approach to the prediction of inter-regional Trade flows in 1966. They have separated the world into n areas and took add up to exports to and add up to imports from every locale and connected RAS method and the forecast methodology to import and fare information of the years 1938, 1948, 1951-52 and 1959-60 of the accompanying 8 districts i.e. North America ,Latin America, Germany ,Other E.E.C. nations ,) United Kingdom Other E.F.T.A. nations ,Communist nations and Rest of the world.

To comprehend example of exchange a globalized world, business analysts tend to utilize the gravity model. This was first displayed in 1962 by Jan Tinbergen, who suggested that the span of reciprocal exchange streams between any two nations can be approximated by utilizing the 'gravity equation', which is gotten from Newton's theory of gravitation. Relative size is dictated by the present GDP, and financial vicinity is controlled by profession costs – the all the more monetarily "distant" the more prominent the trade costs. Thomas Chaney in 2011[7] gives the brief explanation on the Gravity Equation in International trade, similar papers regarding gravity model have been written [8][9] Despite all no previous work with respect to export opportunity decision based on predictive return vs risks has been carried out.

PROPOSED ALGORITHM /

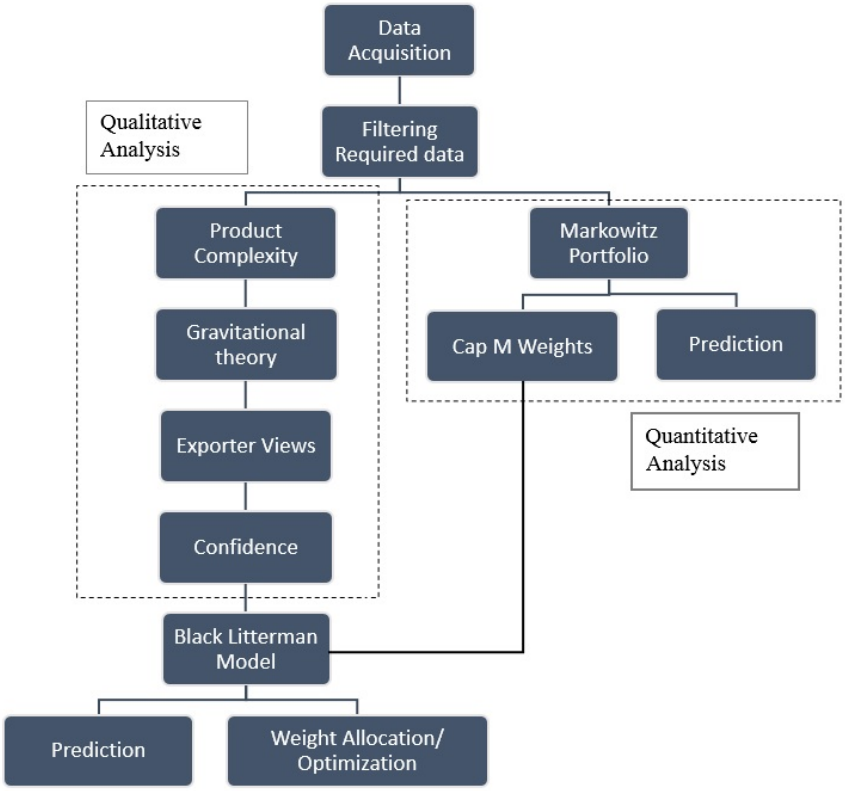

Figure 1: This is a caption

Suppose there are **N** commodities let r_{ct} be the return at time t on a invested as per dollar in a commodity ; let d_{ct} be the rate of return of commodity **C** at time t ; Let W_c be the weight-age of investment in commodity **C**. Then the overall return **R** of the portfolio is:

$R = \sum_{(t=1)}^{[} ?] \sum_{((c=1)}^{N} d_{ct} r_{ct} W$

$R = \sum_{(c=1)}^{N} W_c \sum_{(t=1)}^{[} ?] d_{ct} r_{ct}$

$R_c = \sum_{(t=1)}^{[} ?] d_{ct} r_{ct}$ ***is the return of*** c^{th} ***commodity***

Therefore $R = \Sigma X_c R_c$ ***, In this equation*** X_c ***and*** R_c ***are independent. Since*** $X_c \geq 0$ ***for all*** C ***and*** $\Sigma X_c = 1$ ***for maximize return.***

$\sum_{(a=1)}^{K} X_{c_a} = 1$

For several investment amount a= 1, ... , K for maximum returns.

Let X ***be the random variable, suppose*** X ***series of finite number value*** $x_1, x_2, ..., x_N$ ***, Suppose the probability that*** $X = x_1$ ***be*** p_1 ***and*** $X = x_2$ ***be*** p_2***.***

Τηε Εξπεςτεδ αλυε ορ μ(μεαν) οφ X ***δεφινεδ ας:***

$E = p_1 x_1 + p_2 x_2 + \ldots \cdots + p_N x_N$

The Variance of X defined as:

$V = p_1(x_1 - E)^2 + p_2(x_2 - E)^2 + [?] \ldots\ldots\cdots + p_N(x_N - E)^2$

V is the average square deviation of X from its m mean, we can calculate standard deviation as $s = \sqrt{V}$and the coefficient of variation, $\frac{}{E}$

Suppose $Y_1, Y_2, \ldots\ldots\ldots, Y_N$ are a number of random variable , If Y is the weighted sum of Y_i then,

$Y = a_1Y_1 + a_2Y_2 + [?] \ldots\ldots\ldots + a_nY_N$

$E(Y) = a_1E(Y_1) + a_2E(Y_2) + [?] \cdots + a_NE(Y_N)$

Above equation is Expected value of the weighted sum of random variable, proof b

For variance we define co-variance s_{ij} between $Y_i\&Y_j$ as:

$s_{ij} = E[Y_i - E(Y_i)][Y_j - E(Y_j)]$

The co-variance between two random variable is equal to the correlation r_{ij} times the standard deviation of two variable

$s_{ij} = r_{ij}s_is_j$

Variance of weighted sum is:

$V(Y) = \sum_{(i=1)}^{N} a_i^2V(W_i) + 2\sum_{(i=1)}^{N}\sum_{(i>1)}^{N} a_ia_js_{ij}$

We know Y_i is s_{ii} then,

$V(Y) = \sum_{(i=1)}^{N}\sum_{(j=1)}^{N} a_ia_js_{ij}$

Let R_c is the return on the c^{th} commodity .Let m_c be the expected value of R_c . s_{cs} = co-variance between $R_c\&R_s$

s_{cc} = variance of R_c ; $W_c =$ percentage weight-age of investor of R_c then, $R = \Sigma R_cW_c$

The R_c similarly R are random variable and return (R) on the portfolio is a weighted sum of $R\&R_c$. W_c are the percentage of investment. $\Sigma W_c = 1$ shows sum of all investment is equal to 1. Therefore Expected Return & Variance of the portfolio is:

$E = \sum_{(c=1)}^{N} W_cm_c$

$V = \sum_{(c=1)}^{N}\sum_{(s=1)}^{N} s_{cs}W_cW_s$

IMPLEMENTATION AND RESULTS:

We have extracted the data of 10 years of Pakistan export, We have seen that more than of 50% of Pakistan export is textile, We have extracted the required data, After that we have applied filters to extract the top 27 commodity of Pakistan textile,We have extracted the data of 10 years of the top 27 Pakistan textile commodities.

After extraction we have use our algorithm to calculate the return of the specified years and predict the future returns from the past returns and product complexity factors. The Top Export Commodities are :

Commodities exported by Pakistan to wold Data of last 10 years:

#	Product Code	Description
1	620342	MENS, BOYS TROUSERS & SHORTS, OF COTTON, NOT KNIT TRADE
2	520512	Cotton yarn ¿85% single uncombed 714-232 dtex,not ret
3	630260	Toilet or kitchen linen, of cotton terry towelling
4	620462	Womens, girls trousers & shorts, of cotton, not knit
5	630231	Bed linen, of cotton, nes
6	630221	Bed linen, of cotton, printed, not knit
7	611020	Pullovers, cardigans etc of cotton, knit
8	520942	Denim cotton ¿85% ¿200g/m2
9	611592	Hosiery nes, of cotton, knit
10	630210	Bed linen, of textile knit or crochet materials
11	520812	Plain weave cotton, ¿85% 100-200g/m2
12	610910	T-shirts, singlets and other vests, of cotton, knit
13	630710	Floor & dish cloths, dusters, etc, textile material
14	610510	Mens, boys shirts, of cotton, knit
15	610342	Mens, boys trousers & shorts, of cotton, knit
16	520912	Twill weave cotton, ¿85% ¿200g/m2, unbleached
17	520932	Twill weave cotton, ¿85% ¿200g/m2, dyed
18	520522	Cotton yarn ¿85% single combed 714-232 dtex,not retai
19	551341	Woven plain ¿85% polyester + cotton, ¡170g/m2 printed
20	611610	Gloves impregnated or coated with plastic,rubber, kni
21	630232	Bed linen, of manmade fibres, nes
22	630222	Bed linen, of manmade fibres, printed, not knit
23	570110	Carpets of wool or fine animal hair, knotted
24	520100	Cotton, not carded or combed
25	520511	Cotton yarn ¿85% single uncombed ¿714 dtex,not retail
26	520532	Cotton yarn ¿85% multiple uncomb 714-232 dtex,not ret
27	610462	Womens, girls trousers & shorts, of cotton, knit

Table 1: This is a caption

Commodities	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006
620342	133173561811928680909711537790.9	960191726.7	101048038081251542	6.7	745905240.4	778950266.1	673360133.8	491990025.6		
520512	113110118812645543981492970024123553043186709970	8.1	699455761.3	559747589.6	455664257.3	492391383.6	494968137.1			
630260	922757730.9	11970369.1	875382916.3	836284835	870677805.2	779785816.6	695722891.3	708975237	590268216.5	532640627.4
620462	858619748.1	801194853.3	737419177.5	696323297.4	492903494.5	383046342.7	319603423.2	321786090.7	301805648	313878123.4
630231	724780316	786339308.7	664658938.7	591545614.9	752807409.3	616041066.3	565372907.6	598452941.2	564674912.8	514339089.2
630221	571560935.4	581987204.8	372584712.8	460713804.9	485993233.9	424764790	371568513.8	406697908.2	398367938.3	299188216
611020	506200781.2	517129419.6	438980647	411459543.4	444154530.2	370614822.1	344191295.8	367595379.6	400288826.7	451279169.5
520942	405691693.2	409462151.2	427876670.3	212038955.8	367196950.6	278998551.7	231595033.3	170798144.3	147361566.2	127958412
611592	310416447.9	304296367.2	298594001.1	230747836.2	263186090	288599547.2	247539592	241705325.6	209029222.7	202735337.7
630210	300248670	289099872.9	244669865.6	224711586.7	273900513.3	274641895.3	253707393.9	246261013.3	203987281.1	199092825.9
520812	275329729.8	313516402	314942346.7	272671555.1	286988853.1	192458261.6	182237965	200282426.3	175180278.8	149750938.9
610910	274168018.9	250696596.5	263715783.5	259177269.4	309822334.3	299575795.1	269279402.6	300509245.6	262971599.1	263721993.7
630710	252424914.9	228353353.1	229138262.9	229311343.2	226139356.3	189558051.1	151186531.5	188862508.6	180890288.5	173802018.7
610510	227669376.9	245504966.9	225463003.6	249229271.6	328440956.9	279756967.1	213568088.7	277414445.1	322269540.3	299787508.2
610342	194296815.7	148760846.8	94031690.57	86098747.91	91568184.23	71083198.14	62721515.94	54135390.97	47271152.65	46601758.68
520912	180201307.6	220354685.1	260785867.3	248256795.4	235507936.9	145479978.1	102703694.2	121638903.9	98556744.89	105751765.8
520932	151815261.7	138185864.2	156960118.4	82268335.34	130617002.6	89547939.65	52872880.63	69115786.74	88798554.62	85253547.89
520522	136891771.2	172338360.3	188884220.8	92866817.3	267739815.2	258359766.7	215275752.6	234424132.9	233106051.9	229004207.4
551341	136544738.1	191354099.3	195381258.2	165825542	189203228.3	156790282.2	140227494.5	186453188.4	173496692.1	143382062.5
611610	135894708.4	130374048.2	109708621.9	91072662.66	127150077.4	95280308.17	59359249.8	85892655.87	67675539.57	54434855.81
630232	126799188.5	146383559.5	132680001.5	124661782.6	140551875.9	97426114.27	140559560.9	126271188.5	128025028.5	124366413
630222	121701628.9	248265149.5	180695579	168646824.5	211277939.2	173270512.2	151980133.2	144467460.6	135371584	140007057.4
570110	121553512.9	155431095	152122427.5	155822687.6	169220716.5	160205024.2	170524125.5	240577083.1	276544946.9	275131400.9
520100	120322588.9	195801772.3	230378435.1	126126337	364516610.2	249820648.9	180553306.6	138553221.8	86321356.52	67709701.21
520511	117736848.9	107297698.5	213498433.3	317013455.4	256793055.7	187968331.5	176426109.7	146200308.4	169064577.6	154701892.1
520532	116549675.2	184851776.2	183273816.6	163149717.3	213848247.3	204969858.2	154388786.1	187730433.7	169557768.2	166598974.2
610462	114339115.3	118010782.5	101217792.5	92019236.11	97530983.78	64585360.41	56373308.38	62533055.6	59422028.88	53362919.63

Table 2: This is a caption

Results

Conclusion

The conclusion should reinforce the major claims or interpretation in a way that is not mere summary. The writer should try to indicate the significance of the major claim/interpretation beyond the scope of the paper but within the parameters of the field. The writer might also present complications the study illustrates or suggest further research the study indicates is necessary.

Reference

1. World Customs Organization
2. https://www.wto.org/english/res_e/statis_e/wts2017_e/wts2017_e.pdf
3. **E.g.,J. V. Uspensky,** *Introduction to mathematical Probability* **(New York: McGraw-Hill, 1937), chapter 9, pp. 161-81.**