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Energy security and economic development in large energy user countries

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ABSTRACT

It is widely acknowledged that economic development and energy complement each other, and global economies are consuming enormous amounts of energy to achieve economic growth. One of the prime concerns of policy makers is to ensure energy security in the country for sustainable development. This study examines the short and long run impact of energy security risk on GDP in large energy user countries. A panel Auto Regressive Distributed Lag (ARDL) approach is applied using the data from 1996 to 2020 for 23 countries. The results indicate that increasing energy security risk, in the long run, is negatively associated with all the countries' economic development. However, political globalization and foreign direct investment positively contribute to economic development. Thus, this study recommends that these countries focus more on attracting foreign investment, particularly in renewable energy to avoid uncertainty and long-term sustainability. In addition, there is a pressing need to expand the worldwide political role.

KEYWORDS Energy insecurity; Political globalization; Economic growth; Sustainability; ARDL

INTRODUCTION

Global economies are experiencing significant energy consumption in order to achieve long-term economic growth (Zhang et al., 2018). However, the issue is not just to fulfil expanding demand but also to reduce dependency on dwindling fossil fuels, which have negative socioeconomic consequences. The volatile price dynamics of fossil fuels and the expanding demand-supply imbalance in power need the development of cost-effective, environmentally friendly, and dependable energy alternatives. As a result of these causes, there is a growing interest in creating renewable resources. Global policymakers have mainly understood the importance of the link between energy and economic advancement. As a result, it is widely acknowledged that economic development and energy complement each other (Nawaz and Alvi 2018).

Energy security is multifaceted and can be defined as the uninterrupted availability of energy sources at sufficient quantities and economical prices that align with a country's economic and social development. Economic and Social progress of a nation can be accelerated by the better provision of energy in any economy. It is the main input involved in almost every economic activity. GDP and consumption/production of energy are interrelated because social and economic development of any nation is determined by energy level. Growth in the level of GDP always demands an increase in the energy level (Cicea, *et al*., 2021). Increased energy consumption leads to increase in economic activities which lead to industrial growth and ultimately increase in GDP. Along with the availability of energy sources, the timely investments in energy supplies stimulate economic growth of a country. This implies that the country's economic growth is positively related to the energy security which is evident by many studies (Le et al., 2019; Asafu, 2000; Aqeel and Butt, 2001). The energy crisis of 1970's brought many regions on the verge of energy insecurity due to energy price hike which slowed down their economic growth. The energy insecurity has been a growing concern in Asian economies in the past decade. Population growth accompanied with rapid urbanization are the main factors pushing the demand for energy in this region (Kong, 2015). The rising oil demand in India and China has been aggravating the energy insecurity conditions in these regions (Le et al., 2019). For most developing countries, energy insecurity is a blazing issue where the depleting fossil fuel reserves and the low capacities of transferring to alternative energy options causes impediments in growth and economic activities (Le & Park,2021). Such situations force these countries to rely on energy imports from other countries, further restricting economic activities and growth within the economy (Ahuja, 2009). On the contrary, energy insecurity and low energy supplies will inevitably force the countries to alter their energy consumption structure (Le and Ngyuyen, 2019; Wang et al., 2018). For example, in the wake of energy insecurity caused by the energy shortages and depletion of fossil fuel reserves, Japan spurred its production through the development of green energy technology to achieve economic growth as well as sustainable development (Venhammar, 2017).

Globalization is basically the extension of worldwide linkages among countries. It can be of mainly three types: economic, social and political. Therefore, now a days it is a multidimensional phenomenon which has some pros and cons for developing and developed countries. Globalization creates opportunities for economic development and growth but also generates problems of inequality, poverty etc. Flow of factors of production among nations and trade may generate opportunities for some countries while act as negative externalities for others (Akhter, S., 2013). Kilic (2015) conducted study on globalization and growth taking 74 developing countries and discovered that economic growth is significantly affected by political and economic globalization. The rate of globalization has increased in recent years with political and economic stability further facilitating it. Political globalization is the growth of political systems across the world. An improved fiscal policy within countries and international trade agreements between them further intensifies globalization. Political globalization among nations can increase financial integration and international trade which helps in overall growth of the economy. There is a negative relationship between political instability and GDP growth. The political instability of many developing nations is highlighted as one of the reasons why these nations have not benefited from globalization as much as the emerging countries. Because political instability is related to government inabilities which in turn cannot handles the consequences of globalization like immigration and inequalities. Political globalization can create channels for financial openness among nations which could enhance GDP growth of developing countries.

Foreign Direct Investment is the long-term participation of any country in management, technology transfer or in the form of business in any other country. Financial sector of any economy plays a dominant role in sustainable development of a country through financial development. Financial development shows increase in foreign direct investment. Financial development leads towards increase in the flow of FDI which in turn enhance growth. Financial development enhances the financial and capital markets which in turn increase the consumption of energy (Zhang, 2011). Financial development in any economy attracts FDI and lead towards technological innovations which may help in overall growth of an economy. FDI acts as a consistent source that helps in increasing domestic production capacities, increase investment by providing finance and can uplift technologies (Sirin, 2017). Growth process of any country can be accelerated by FDI by creating employment opportunities, exchange of skills and knowledge. FDI increase real GDP and growth process by many ways: by providing financial resources, by transferring technologies from developed to developing countries, by increasing foreign exchange reserves/balance of payment, by reducing imports and by increasing domestic investment and savings.

Good governance is said to be "the best set of all regulations, laws, practices and processes that influence the functioning of a regulatory framework and the market" (Hancher et al., 2004, p.340). Government effectiveness can help market

forces and legislative framework in making successful policies. Effective government can promote more productive investment, can increase effective division of labor and implement economic and social policies more efficiently than the unstable government. Government effectiveness is helpful in the economies where the market forces are weak and can increase the environment of efficiency in markets by private sector which can accelerate economic growth by accumulating more capital, proper allocation of resources and can guarantee productivity growth by new technological processes (Aljarallah, 2020). An effective government can accelerate the growth of any economy by maintaining competition, income equality, provision of public goods and services. Better governance will attract foreign direct investment, which can solve the balance of payment and increase real GDP (**Okafor**, 2012**)**.

The sources of energy offer the drive for social and economic growth, and the security of energy sources plays an essential role in the security of the country (Löschel et al., 2010). Changes in a country's politics and economics, both domestically and internationally, may significantly affect that nation's energy infrastructure. The majority of countries' energy systems have developed toward a low-carbon, clean, efficient, and safe direction as their economies have entered the New Normal. This represents an internationalized energy supply, slower energy consumption growth, accelerated energy structure adjustment, a greater proportion of clean energy, and other new normal situations. This development takes place against the backdrop of the global development of a low-carbon economy. The previous conflicts has resulted in a rise in global geopolitical threats and has negatively impacted the energy security of the majority of the nations in Europe. However, the rapid growth of the shale gas revolution in the United States has also influenced the energy market (Fang et al., 2018).

Given the importance of energy security and economic development, the present study examines the short and long run impact of energy security risk on GDP in large energy user countries. A panel Auto Regressive Distributed Lag (ARDL) approach is applied using the data from 1996 to 2020 for 23 countries. In the long run, the results indicate that increasing energy security risk is negatively associated with all the countries' economic development. However, political globalization and foreign direct investment positively contribute to economic development.

This study is organized as follows; we have started with the introduction following by section 2, about research method, section 3 is about result and discussion and section 4 conclude the study and give recommendations.

RESEARCH METHOD

2.1. Unit root

Before the estimation, the data requires to be checked for the unit roots. To check the stationarity, the Cross sectionally Augmented Dickey Fuller (CADF) unit root test for panel data is applied to all the variables and find out the order of integration for each variable.

2.2. Auto Regressive Distributed Lag Model (ARDL)

After the panel unit root has been determined, the variables are tested whether they have a long-run cointegration. The study employs the panel Auto Regressive Distributed Lag Model (ARDL) model proposed by Pesaran et al., (1999) and Pesaran and Smith (1995). They combined the Autoregressive (AR) and Distributed Lag (DL) models for cointegration. The ARDL model has many advantages. It produces parameter estimates consistent with the long-term coefficients irrespective of whether these variables are integrated of order (0) or (1).

The estimation model for the ARDL is given below:

$$\Delta lGDP_{it} = \delta_0 + \sum_{i=1}^{k} \delta_1 \Delta ES + \sum_{i=0}^{p} \delta_2 \Delta lPG_{it} + \sum_{i=0}^{q} \delta_3 \Delta FDI \sum_{i=0}^{r} \delta_4 \Delta GE_{it} + \emptyset ES_{it} + \emptyset lPG_{it} + \emptyset FDI_{it} + \emptyset GE_{it} + \mu_{it} \quad (1)$$

Where, *GDP* is the gross domestic product, *ES* the energy security *PG* is the political globalization, *FDI* is the foreign direct investment and *GE* is the government effectiveness

In the dynamic model the error correction term (ECT) specifies the speed of adjustment toward equilibrium. It shows how quickly a variable diverge or converge towards equilibrium. The coefficient with a negative and statistically significant sign assures restoration and convergence towards equilibrium.

$$\Delta lGDP_{it} = \delta_0 + \sum_{i=1}^{k} \delta_1 \Delta ES + \sum_{i=0}^{p} \delta_2 \Delta lPG_{it} + \sum_{i=0}^{q} \delta_3 \Delta FDI \sum_{i=0}^{r} \delta_4 \Delta GE_{it} + \lambda_1 ECM_{t-1} + \mu_{it} \quad (2)$$

The symbol lambda denotes the coefficient of ECM, and its negative and significant sign indicates the existence of a stable long-run relationship.

2.3. Data and Variable description

This study uses the data of GDP for the 23 large energy user countries from the year 1996 to 2020. The data of GDP at constant US Dollars (2015) is obtained from the World Development Indicators (WDI), World Bank. Energy is essential for a society's economic growth, and energy security is vital for any nation's socioeconomic sustainability (Matsumoto and Shiraki, 2017; Nawaz and Alvi, 2018). In this study, we used the energy security risk index as a proxy for energy insecurity. The information is given by the U.S. Chamber of Commerce and Global Institute of Energy for the years 1996 to 2020. High energy security risk score shows higher energy's volatility and insecurity. Foreign direct investment is import for economic growth and development. This study takes the FDI as an independent variable and the data is taken from the World Development Indicators, World Bank. Good governance promotes social and economic policies, leads to higher economic growth and bad governance hindrance the economic development. This study takes the government effectiveness as an independent variable and the data is obtained from Worldwide Governance Indicators, World Bank. Political globalization is used in this study, and it is measured by the number of embassies in other countries, international organizations membership, UN Security Council missions' meeting membership, and the number of treaties signed with other countries.

RESULTS AND DISCUSSION

We have stated this section with the descriptive analysis. Table 1 shows the descriptive results of Energy security risk index and GDP per capita of 23 large energy user countries. The average level of ES in these countries is 12.28 from year 1996 to 2000. The highest average among these countries is of South Korea having 23.14 and the smallest average is of Norway having 2.58. The descriptive results of other variables are provided in Appendix Table A1. The average level of political globalization among these countries is 88.376, the highest of France and the lowest of New Zealand. Government effectiveness is of average 1 among these countries. The highest level of government effectiveness is in Denmark and the lowest is in Indonesia, which clears the picture of development in both countries.

The Panel Unit root results of the dependent and independent variables are mentioned in table 2. The results indicate that all the variables are stationary at level with 1% of significance except for GDP and Government Effectiveness which become stationary after taking the first difference.

Table 3 reports the long run estimates of co-integration among Gross domestic product and independent variables, Energy Security Risk Index, Political Globalization, Foreign Direct Investment and Government effectiveness. The Error correction results for all the regions confirm the existence of short run relationship among the variables. The coefficient of ECM is negative as well as significant which indicates convergence towards long run equilibrium. The coefficient of log of Energy security risk index is negative and significant in the long run which means that in the long run 1 percent increase in Energy Security Risk decreases GDP by 0.53 percent. In contrast, the result for short run indicates insignificant. The coefficient of Political Globalization, Foreign Direct Investment and Government effectiveness have positive relationship with GDP such that an increase in these variables increases economic activity by 0.07, 0.83 and 0.09 percent, respectively.

Table 1: Descriptive Statistics

	ES				**GDP per capita**			
	Mean	Min.	Max.	SD	Mean	Min.	Max.	SD
Australia	6.40	4	10	2.02	41757	19527	68157	16927.27
Brazil	15.66	11	23	3.51	7381.60	2839.49	13245.39	3315.06
Canada	5.76	3	7	1.23	38064.69	21024.59	52669.09	11329.48
China	17.04	8	21	4.18	4381.28	709	10434.78	3466
Denmark	5.47	3	12	1.90	49951.67	30743.55	64322.06	12122.48
France	11.49	9	15	1.84	35128.16	22419.69	45519.29	7720.931
Germany	9.46	7	14	2.35	37742.34	23628.33	48023.87	8600.078
India	19.96	16	22	1.64	1099.55	399.95	2100.75	594.12
Indonesia	12.16	6	19	3.76	2293.12	463.95	4135.20	1310.38
Italy	17.22	12	21	2.53	30689.04	20137.59	40944.91	6367.21
Japan	17.48	12	22	3.16	38838.09	32423.76	49145.28	4177.47
Mexico	3.73	2	11	2.74	8407.58	4412.12	10928.92	1768.73
Netherland	18.29	15	22	2.42	43121.16	26214.49	57879.94	10876.41
New Zealand	3.49	2	5	0.86	30128.14	13641.10	44572.89	11036.46
Norway	2.58	0.67	7	2.23	68440.38	34788.36	102913.45	23405.64
Poland	12.04	10	15	1.62	10059.78	4123.14	15742.45	4326.87
South Africa	16.46	13	20	2.29	5723.19	2797.09	8810.93	1749.81
South Korea	23.14	22	24	0.60	21411.68	8281.69	33436.92	7836.18
Spain	13.83	10	19	2.64	25088.04	14730.79	35510.72	6638.75
Thailand	23.58	22	24	0.64	4340.56	1845.83	7817.009	1960.44
Turkey	16.86	13	21	2.72	8022.94	3053.95	12614.78	3281.55
UK	3.89	1	11	3.37	38590.28	24438.53	50653.26	7612.02
US	6.44	1.00	10.00	2.89	47200.81	29967.71	65279.53	10514.84

Table 2: Panel Unit Root Results

Variable	**CADF Z[t-bar]**	
	I (0)	**I (1)**
GDP per capita	-0.744 (0.228)	-4.403 (0.000)
Energy Security Risk	-2.384 (0.009)	-
Political Globalization	-4.127 (0.000)	-
FDI	-2.957 (0.002)	-
Government Effectiveness	-1.097 (0.136)	-9.740 (0.000)

Note: P-values are reported in parenthesis and show significance at 5 percent.

Table 3: Panel ARDL results

Dependent Variable: Economic Activity (GDP)	**Long run Estimates**		**Short run Estimates**	
Independent Variable	Coefficient	t-Statistic (P-value)	Coefficient	t-Statistic (P-value)
LES	-0.536	-5.24 (0.00)		
D(LES)	-	-	-0.011	-0.123 (0.90)
Political Globalization	0.072	6.55 (0.00)		
D (Political Globalization)	-	-	0.021	2.243 (0.02)
LFDI	0.829	13.74 (0.00)		
D(LFDI)	-	-	0.008	0.533 (0.59)
Government Effectiveness	0.094	0.52 (0.60)		
D(Government Effectiveness)	-	-	0.011	0.205 (0.83)
C	-	-	0.196	2.352 (0.01)
Co-Integration Eq.	-0.050727			
P Value	0.0365			
S.E. Of Regression	0.099490			

Note: P-values are reported in parenthesis and show significance at 5 percent.

CONCLUSION

Global economies use a lot of energy to achieve long-term economic growth. However, the challenge is not just meeting rising demand, but also reducing reliance on depleting fossil fuels, which has severe social effects. The unpredictable price dynamics of fossil fuels and the growing power demand-supply mismatch.

It is common information that economic growth and energy consumption go hand in hand. At the same time, it is also completely obvious that economies worldwide are using vast quantities of energy to accomplish economic growth. To guarantee the continued and sustainable growth of the nation, one of the primary concerns of decision-makers is the nation's energy security. This research investigates the short-term and long-term effects of energy security risk on GDP in nations with high energy use. The data for 23 nations are put into a panel Auto Regressor Distributed Lag (ARDL) technique, and the time period from 1996 to 2020 is used. According to the findings, an increase in the risk to energy security has a long-term, negative association with economic growth in every country.

On the other hand, political globalization and direct investment from other countries are both contributing in a favourable way to economic growth. Accordingly, the findings of this research suggest that these nations place a greater emphasis on luring outside investment, particularly in the field of renewable energy, to reduce the likelihood of future uncertainty and ensure its long-term viability. In addition, there is an urgent need to broaden the political role played on a global scale.

The world's top worry now is energy security, which is on the global agenda. Over the past four decades, the world's emphasis has shifted from imported, costly energy supplies to less-priced renewable energy sources that also provide socioeconomic and environmental sustainability. Diversification of energy resources and the best possible use of indigenous resources should be part of any national policy.

The European Union (EU) and other countries around the world are still susceptible to disruptions of the energy system that originate either from the outside or from within. These disruptions can be brought on by a variety of factors, including those that are economic, technical, or geopolitical in nature (Augutis et al., 2017). This is outlined not only in the previously stated strategies but also in the strategic initiatives. In order to improve our energy security, we need to make decisions that will lessen our reliance on certain types of fuel, energy suppliers, and transportation routes. On the other hand, key papers with a high strategic value highlight the significance of energy security in the context of the energy sector of a contemporary society.

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APPENDIX

Table A1: Descriptive Statistics

			Pol. Glob.			Govt. Effect.		
	Mean	Min.	Max.	SD	Mean	Min,	Max.	SD
Australia	87	83	89	1.74	1.70	1.53	2.01	0.114
Brazil	87	83	92	2.84	-0.11	-0.45	0.20	0.15
Canada	91	90	92	0.78	1.83	1.71	1.99	0.09
China	86.22	77.47	91.88	4.21	0.09	-0.35	0.48	0.23
Denmark	92.23	90.73	93.34	0.72	2.01	1.76	2.35	0.18
France	97.39	95.99	98.49	0.74	1.50	1.25	1.78	0.14
Germany	96.48	94.98	97.72	0.86	1.64	1.42	1.88	0.133
India	88.65	81.22	93.50	3.58	-0.036	-0.206	0.28	0.119
Indonesia	81.94	74.88	89.39	4.58	-0.28	-0.705	0.18	0.24
Italy	96.18	91.68	98.65	2.12	0.57	0.19	0.87	0.19
Japan	84.42	79.26	88.73	2.79	1.43	0.91	1.86	0.29
Mexico	77.15	68.34	87.82	6.45	0.19	-0.16	0.36	0.11
Netherland	94.59	92.05	97.01	1.62	1.89	1.69	2.09	0.124
New Zealand	75.25	69.64	77.56	2.193	1.77	1.59	1.96	0.09
Norway	87.94	85.72	90.02	1.30	1.91	1.83	2.08	0.06
Poland	91.013	89.30	93.27	1.06	0.59	0.373	0.75	0.10
South Africa	82.93	57.72	91.48	9.29	0.51	0.19	1.02	0.21
South Korea	85.63	74.57	92.19	4.93	0.97	0.36	1.25	0.27
Spain	94.47	91.31	96.94	2.11	1.27	0.80	1.88	0.37
Thailand	76.79	65.80	81.76	4.72	0.28	0.06	0.45	0.09
Turkey	89.73	84.15	93.50	2.73	0.13	-0.26	0.41	0.18
UK	96.64	95.83	97.65	0.50	1.69	1.39	1.93	0.16
US	92	92	93	0.25	1.48	1.22	1.92	0.18

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Impact of Exchange Rate Volatility on Pakistan's Trade

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ABSTRACT This study investigates the effects of exchange rate volatility on trade between Pakistan and its major trading partners on the basis of imports and exports. The import and export models are estimated by using the fixed effects econometric technique to assess the impact of exchange rate volatility on trade. The empirical findings indicate that the exchange rate volatility has a significant impact on exports to UK, Netherland and USA. Moreover, the exchange rate volatility has a significant impact on Pakistan's imports from UK, USA and China. However, with other countries, this study reveals an insignificant impact of exchange rate volatility on trade. The positive impact of exchange rate on imports is disadvantageous for Pakistan, however this can be inverted if the domestic market provides suitable substitutes that can compete with the essential imports. Also, higher import duties have to be imposed on non-essential products. In regard to the exchange rate volatility impact on trade, it can be concluded that the least or no impact of exchange rate volatility is possibly related to the rising availability of financial instruments that hedge against the exchange rate risk, besides the increasing share of intra-industry trade.

KEYWORDS: Exchange rate; Trade balance; Fixed effects**;** Financial-instruments; Pakistan

INTRODUCTION

Exchange rate volatility is the size of changes in currency value, which further refers to the amount of risk and uncertainty. High exchange rate volatility means that the currency price is changing severely over a short time period, while low exchange rate volatility means that the currency value is changing infrequently and it behaves as a stable currency. Economists and policy-makers believe that when the exchange rate volatility increases, it reduces the international trade. That is because of the uncertainty of the future profits that a firm gain from international trading. Based on this proposition, a plethora of studies have been conducted to analyze the impact of exchange rate volatility on trade. Several empirical studies have failed to establish a significant link between exchange rate volatility and international trade; whether it is on bilateral or on an aggregate basis (Daly, 1998; De Vita and Abbott, 2004; Rey, 2006). However, some studies have found a significant relationship between the exchange rate volatility and trade (Vergil, 2002; Doganlor, 2002; Kemal, 2005; Mustafa and Nishat, 2005; Chit et al., 2010; Nuroglu and Kunst, 2012; Lubinga and Kiiza, 2013; Srinivasan and Kalaivanib, 2013).

In the case of Pakistan, Kemal (2005) found a positive impact of exchange rate volatility on exports and a negative impact on imports. Whereas Alam and Ahmad (2011) have shown no impact of exchange rate volatility on imports of Pakistan. Oskooee and Hegerty (2007) concluded that the impact of exchange rate on trade is undetermined. Mustafa and Nishat (2004) analyzed the effect of exchange rate on export growth and find that volatility has a significant negative effect with respect to major trading

partners. However, in a study conducted by Fofanah (2020) the results are insignificant between exchange rate volatility and trade, which fail to support the position that excessive volatility has a pronounced effect.

Although several studies were conducted to analyze the impact of exchange rate volatility on trade, they have not proved fruitful in reaching a unique conclusion. This could be related to the fact that the previous empirical findings are country and time specific. Several studies have analyzed the impact of exchange rate volatility on trade in developed countries, but few have been conducted in developing countries like Pakistan. Taking this into consideration, along with the fluctuations in Pakistan's exchange rate in recent years, this study contributes to the empirical debate in literature on the relationship between exchange rate volatility and trade of Pakistan with its top five trading partners. The modelling approach of this study considers the demand side of trade, which has never been addressed in the literature in the context of Pakistan. The objective of this paper is to find the impact of bilateral exchange rate volatility on Pakistan's trade with its major trading partners, with respect to exports and imports.
The paper is organized as follows; Section II begins with details related to data and research methodology, Section III presents the results and analysis, and concluding statements are provided in the last Section IV.

RESEARCH METHODOLOGY

Theoretical Model
Mundell Fleming Model

This paper is following the concepts of Robert Mundell and J. Marcus Fleming (1962). They extend the IS-LM macroeconomic concepts in international trade. They have noticed that monetary and fiscal policies are two main arms of demand management and have different relative impacts on internal and external balance. Their condition of the modelling is for a small open economy and the prices are fixed for the home country, as well as abroad. Mundell-Fleming model portrays the relationship between an economy, exchange rate, interest rate, GDP and the trade balance.

If we notice on the IS equation:

$$Y = C(y-t) + I(r) + G + NX(e) \quad \ldots(1)$$

where,

C= consumption
y-t = income minus tax
I = interest rate
G = government spending
$NX(e)$ = Net export

Now we explain further the NX, then we come to know that:

$$NX = NX(e, Y, Y*) \quad \ldots(2)$$

This shows that net export is the function of exchange rate (e), GDP (y) and GDP of foreign countries (Y*). This study will implement this conceptual modelling for the case of Pakistan.

In the case of floating exchange rate, Mundell-Fleming model explains that in a small open economy, the expansionary monitory policy shifts the LM curve to the right. This LM curve shift lowers the exchange rate and increases net exports. However, in contractionary monitory policy, the appreciation of exchange rate lowers exports and further complete crowding out, via exports. According to the Mundell-Fleming model, an appreciation of the exchange rate would increase import demand and decrease export demand, and vice-versa.

In the expansionary fiscal policy, aggregate spending and national income would be raised by higher government spending and lower tax rates, hence rising imports and worsening the trade balance, and vice-versa for the fiscal contraction. In expansionary monetary policy, rise in money supply and banks' lending would drop the interest rate, which increases spending and national income, as well as worsening the trade balance, the opposite case applies to the monetary contraction.

The volatility of the exchange rate is considered important variable in the economy. De Grauwe (1988) mentioned that exporters have become unhappy universally by the volatility of the exchange rates, but some may decide that they would be better off

exporting more. That particular case reveals the dominance of income effects over substitution effects, resulting in a positive relationship between exchange rate volatility and the volume of trade.

Empirical Model

The data used in this study have both the cross-sectional and time-series characteristics. Therefore, the Panel or Pooled Least Square (with fixed effects) technique seems to be appropriate to study the impact of exchange rate volatility on Pakistan's trade. If the random effect model is estimated, then the cross-sectional effects are combined with error, but if these effects correlated with some explanatory variables, then the estimations and coefficients will be biased. However, this type of bias does not exist in fixed effect model due to unobservable error component, which is constant and does not vary with time (Greene, 2005).

The conventional fixed effect models provide the intercept terms for each panel only, however the pooled least square method allows you to identify the country effects separately in the panel for all variables of interest. According to the above theoretical backgrounds, the following empirical models are estimated by the Pooled Least Square with fixed effect.

Export equation

$$EX_{it} = \alpha_0 + \alpha_{1i} GDP^*_{it} + \alpha_{2i} ER_{it} + \alpha_{3i} Vol_{it} + u_{it} \quad \ldots(3)$$

Import equation

$$IMP_{it} = \beta_0 + \beta_{1i} GDP_{it} + \alpha_{2i} ER_{it} + \alpha_{3i} Vol_{it} + \varepsilon_{it} \quad \ldots (4)$$

where,
EX = Exports of Pakistan
IMP = Imports of Pakistan
*GDP** = Foreign GDP Growth in
GDP = GDP Growth of Pakistan in

ER = Bilateral Real Exchange Rate

Vol= Bilateral Exchange Rate Volatility

i= It shows the cross-section units (*i = 1, 2, 3, 4, 5).*

t= Time

This modelling was brought to cover the demand side of trade. This approach was chosen since there are no previous study conducted in Pakistan. Under this approach, the demand function is identified by assuming that the demand for exports in the trading partners' economies depends on the level of their economic activity. Likewise, in the import model, where Pakistan's economic activity depends on the import demand. This will support a policy suggestion of increasing the demand for exports and decreasing demand for imports.

RESULTS AND DISSCUSSION

Unit Root Test

By using Levin et al. (2002), Breitung (2005) and Im et al. (2003), the results of the pool unit root test show that GDP growth and volatility of exchange rate in both export and import models are stationary at level, whereas export, import and exchange rate are stationary at first difference in both models.

Ho: There is unit root
Ha: There is no unit root

Table 1: Unit Root Test

Unit Root Test (Levin, Lin & Chu) For Export Model		
Variables	**Level**	**First Difference**
Export	-1.35 (0.08)	-5.34 (0.00)
GDP Growth	-7.32 (0.00)	-
Exchange Rate	0.07 (0.52)	-4.16 (0.02)
Exchange Rate Volatility	-4.48 (0.00)	-

Unit Root Test (Levin, Lin & Chu) For Import Model		
Variables	**Level**	**First Difference**
Import	0.63 (0.73)	-6.59 (0.00)
GDP Growth	-6.28 (0.00)	-
Exchange Rate	0.07 (0.52)	-5.98 (0.00)
Exchange Rate Volatility	-5.88 (0.00)	-

P-values are given in parenthesis

Pooled Least Square Results

This study, as mentioned earlier, calls in the 'Pooled Least Square' technique to estimate the parameters of equation (5) & (6).

Export Model Interpretation & Discussion

The exchange rate volatility has insignificant impact on exports of Pakistan in the case of Afghanistan, Italy, China, Spain, Bangladesh and UAE. Our results are in line with Mukhtar and Malik (2010) and Kemal and Qadir (2005). However, the volatility in the case of USA, Netherland, Belgium and UK is significant and negative. This finding is in line with Mustafa and Nishat (2004). For every 1 unit increase in Pakistan's exchange rate volatility, it implies 0.11 and 0.13 unit decrease in exports of Pakistan towards USA and UK respectively. Similarly, if 1 unit increases in Pakistan's exchange rate volatility with Belgium and Netherland, it decreases 0.53 and 0.29 units in Pakistan's exports to Belgium and Netherland, respectively.

Pakistan's exports to USA, UK, Belgium and Netherland include cloth, leather and their articles. The results reveal that Pakistan's textile producers and exporters are risk averse as they prefer to sell their products in the local market rather than the foreign markets if the exchange rate volatility increases. Pakistan's exports to China, Italy and UAE include mainly stones, pearls, cereals and cotton. These products are not affected from the exchange rate volatility as Pakistan's export of stones and precious pearls is significantly increasing since the last decade, moreover, Pakistan has a large number of skilled jewelry craftsmen and cheap men power, which made Pakistan one of the top leading gem producing country in the world. The Pakistan Gems and Jewelry Development Company (PGJDC) was established by the Ministry of Industries & Production and under this umbrella, numerous private-sector stakeholders are also playing an essential role in the pursuit of making Pakistan a central hub for stones, pearls and jewelry trading. Therefore, it can be concluded that Pakistan's major export of these products are not affected by exchange rate volatility.

When a firm engages in trading business, it observes the long-term profitability prospects in its business., considering that when the exchange rate is volatile, the firm would be unable to get the precise estimations of the domestic value of its foreign sales. Also, when an exporting firm is risk averse, an increase in exchange rate volatility will reduce the volume of its trade. As a result, the negative impact of exchange rate volatility can be associated with that discussed channel. If the volatility

increases, risk averse exporters will choose to export less, and allocate fewer resources to the exporting sector (Gonzaga and Terra, 1997).

With the increase in foreigner's income, Pakistan's exports increase in the case of Afghanistan, Belgium, Netherland, UK, Spain, Bangladesh and USA, but not in the case of Italy, China and UAE. If China's GDP increases by 1 unit, Pakistan's exports to China decrease by 0.49 unit. If there is 1 unit increase in GDP growth of UAE, there is 0.52 unit decrease in Pakistan's export to UAE. Also, 1 unit increase in GDP growth of Italy decreases Pakistan's exports by 0.27 units. This implies that if the GDP of these particular countries grows, their demand for imports from Pakistan becomes less. Once consumers have already owned most of the luxuries of life such as televisions, cars and computers, an increase in their income tend to be spent more on services and healthcare rather than products.[1] This situation can be illustrated in China, UAE and Italy as our results show.

Moreover, a rise in income might encourage some countries to spend proportionately more on physical goods. In this case, when income increases, the demand of imports also decreases. Oskooee and Hegerty (2007) clarified that the negative impact that occurs when output (GDP) rises is due to producing substitutes for imports. When a country's GDP increases, it means that more production is taking place locally, and consumers demand less of the foreign goods as their necessities are being fulfilled by the local producers, thus, imports of foreign goods would be reduced. The other explanation is that the Pakistani goods might be considered as inferior goods in China and UAE. Pakistan exports cotton, cereals, raw hides, skins, leather, ores, slag, ash and vegetable saps to China, while Pakistan exports cereals, textile articles, stones and pearls to the UAE. Since consumers in China and UAE are demanding these products less when their income is increasing, then these goods are considered inferior in China and UAE.

In actual fact, Pakistan's exports to China and many other countries are limited in range for many decades. Accordingly, it is recommended that Pakistan expands its exports and emphasize on research and development to improve its range of products. Besides, Pakistan should shift from exporting primary commodities and simple manufacturer to high value-added products. China's demand is significant for rice, jewelry, copper waste and articles of leather, but Pakistan contributes by less than 1% to China's imports of these product lines.

On the other hand, our results show a different situation in countries like USA, UK, Bangladesh, Spain, Netherland, Belgium, and Afghanistan. Regarding Pakistan's export to USA, 1 unit increase in USA GDP growth implies 0.32 unit increase in Pakistan's export to USA. In the case of Pakistan's export to UK, 1 unit increase in GDP growth of UK, increases exports by 0.17 unit. Also, 1 unit increase in GDP growth of Bangladesh, increases Pakistan's export by 0.34 units. Pakistan's export increases by 0.19 unit per 1 unit increase in GDP of Spain. A 1 unit increase in Netherland GDP increases Pakistan's export by 0.20 units. For every 1 unit increase in GDP of Belgium increases Pakistan's exports by 0.06 unit but it is insignificant. Furthermore, Pakistan's export increases by 0.89 units per 1 unit increase in GDP of Afghanistan.

The results demonstrate the positive relationship between the GDP of these countries and Pakistan's export, so the raise in their income increases the demand of Pakistan's export, hence an expansion of exports in the current account of Pakistan would occur. Regarding Srinivasan and Kalaivani (2013), foreign country's GDP has a significant negative impact on exports in the short run but a positive impact in the long run. Pakistan's exports to USA, Afghanistan, Spain, Netherland and UK include leather, textile and their articles. These exports are gaining importance and facing high demand in the mentioned countries. The number of Pakistani who have settled in the UK has been increasing. As a result, consumer goods such as ethnic furniture, Muslim's special textile, goods and other luxurious items are highly demanded by Pakistani diaspora in higher income brackets, and by other communities. In fact, clothing is considered one of the highest demanding products that is growing rapidly every year in the world trade (World Trade Statistical Review, 2019).

Accordingly, an argument can be made about the different effects of the foreign economic growth on Pakistan. On one side, the growth in these foreign countries could be advantageous for Pakistan's economy as it means that the market for its exports is growing. On the other side, growth in other countries could be disadvantageous for Pakistan when it starts to compete with its exports.

The results of the bilateral exchange rates and the bilateral exports show that if there is 1 unit increase in Pakistan's exchange rate with the Chinese currency, there is 0.58 unit increase in Pakistan's export to China. In the case of Pakistan's export to USA; if there is 1 unit increase in Pakistan's exchange rate with the USA's currency, there is 0.61 percent increase in export. The

[1] An Economist Intelligence Unit briefing paper commissioned by DHL Asia Pacific

results of Pakistan's export to UAE show that 1 unit increase in Pakistan's currency with the UAE's currency, increases export by 0.10 units. For every 1 unit increase in Pakistan's currency with the UK's currency, there is 0.32 units increase in export. Also, 1 unit increase in the exchange rate of Pakistan with Bangladesh, increases Pakistan's exports by 0.25 units. Pakistan's exports to Spain increase by 0.14 units for every 1 unit increase in exchange rate of Pakistan with Spain. Moreover, 1 unit increase in Pakistan's exchange rate with Netherland, increases exports by 0.02 units. One unit increase in Pakistan's exchange rate with Italy will also increase exports of Pakistan by 0.14. There is an increase of 0.44 units of Pakistan's exports to Belgium per 1 unit increase in Pakistan's exchange rate with Belgium. The results of Pakistan's export to Afghanistan show that 1 unit increase in Pakistan's currency with the Afghanistan currency, increases export by 0.15 units.

Table 2: Pooled Least Square Results

	Export Model									
Variables/ Countries	Afghanistan	Belgium	China	Italy	Netherland	UAE	UK	USA	Spain	Bangladesh
Constant	2.23* (10.7) [0.00]	2.23* (10.7) [0.00]	2.23* (10.7) [0.00]	2.23* (10.7) [0.00]	2.23* (10.7) [0.00]	2.23* (10.7) [0.00]	2.23* (10.7) [0.00]	2.23* (10.7) [0.00]	2.23* (10.7) [0.00]	2.23* (10.7) [0.00]
ER Vol	1.15 (0.29) [0.77]	-0.53* (-2.75) [0.04]	-2.91 (-0.14) [0.88]	-0.18 (-0.015) [0.98]	-0.029* (-11.5) [0.00]	1.73 (0.62) [0.53]	-0.013* (-7.23) [0.00]	-0.11* (-12.1) [0.00]	-1.67 (-0.33) [0.73]	-2.41 (-1.89) [0.05]
Exchange Rate	0.015* (7.76) [0.04]	0.044* (2.37) [0.01]	0.058* (2.07) [0.02]	0.014* (1.89) [-0.00]	0.002* (1.87) [0.00]	0.10* (4.38) [0.00]	0.032* (1.18) [0.00]	0.061* (2.26) [0.00]	0.14* (3.21) [0.00]	0.25* (3.36) [0.00]
GDP Growth	0.089* (3.31) [0.00]	0.006 (0.03) [0.97]	-0.049* (-3.90) [0.00]	-0.27* (-3.59) [0.00]	0.020 (0.11) [0.90]	-0.52* (-3.29) [0.00]	0.017* (8.80) [0.00]	0.032* (3.05) [0.00]	0.019* (12.1) [0.00]	0.034* (2.73) [0.01]

	Import Model									
Variables/ Countries	China	Iran	Japan	Malaysia	Saudi Arabia	Singapore	UAE	USA	Kuwait	India
Constant	4.76* (26.1) [0.00]	4.76* (26.1) [0.00]	4.76* (26.1) [0.00]	4.76* (26.1) [0.00]	4.76* (26.1) [0.00]	4.76* (26.1) [0.00]	4.76* (26.1) [0.00]	4.76* (26.1) [0.00]	4.76* (26.1) [0.00]	4.76* (26.1) [0.00]
ER Vol	0.33* (4.61) [0.00]	0.049 (0.80) [0.42]	0.06 (0.39) [0.69]	0.024 (0.57) [0.56]	0.022 (0.75) [0.45]	2.00 (1.97) [0.05]	0.54* (2.11) [0.03]	0.38* (5.25) [0.00]	-0.016 (-0.04) [0.96]	0.84 (0.02) [0.98]
Exchange Rate	1.57* (10.1) [0.00]	0.082* (2.42) [0.01]	0.13* (2.12) [0.03]	-0.29* (-2.76) [-0.01]	0.23* (4.20) [0.00]	0.77* (9.01) [0.00]	0.62* (6.85) [0.00]	1.92* (4.14) [0.00]	0.52* (5.38) [0.00]	1.56* (3.07) [0.00]
GDP Growth	-0.62* (-4.68) [0.00]	0.015* (7.76) [0.04]	1.09* (2.17) [0.03]	0.13* (7.41) [0.00]	0.61* (11.7) [0.00]	-0.15* (-4.85) [0.00]	0.36* (6.86) [0.00]	1.94* (11.7) [0.00]	0.46* (4.73) [0.00]	-0.16* (-10.3) [0.00]

T-Stats are given in parenthesis ( )

P-Values are given in parenthesis [ ]

Accordingly, Pakistan's exchange rate showed that it has a significant positive impact on export. Since the Pakistani currency is depreciating with its major bilateral trading country's currency, the exported products are becoming cheaper for foreign buyers so the export of the country increases when the currency loses its value. If the exchange rate rises for the home country; as a real depreciation; the households in the domestic country can get less foreign products and services in exchange for a unit of domestic products and services. Thus, a unit of foreign products would give more of domestic product, resulting in domestic households buying less foreign products while foreign households buying relatively more domestic products.

Import Model Interpretation & Discussion

Exchange rate volatility has a positive but insignificant relationship with Pakistan's imports from Iran, Japan, Malaysia, Saudi Arabia, Singapore, Kuwait and India. Similarly, Alam and Ahmad (2011) found insignificant impact of exchange rate volatility on Pakistan's imports. The reason is that, Pakistan's economy is dollar economy and its exports and imports depend upon dollar value. So that bilateral exchange rate may indicate no effect on trade (Mustafa and Nishat, 2004). Exchange rate volatility has also insignificant impact on Pakistan's imports because Pakistan import mostly included essential products. These goods are in crucial needs of Pakistan that should have import in every condition as no alternative of these imported products are producing in Pakistan. Koray and Lastrapes (1989), and Gagnon (1993) also find insignificant effects. Graphical analysis from statistical data showed that Pakistan has faced a sharp exchange rate volatility after 2007. As a result, our study couldn't capture any significant impact before 2007, as our study covers the period from 1984 when the currency was slightly stable. But in the case of USA, UAE and China, exchange rate volatility shows significant positive relationship. Hence, 1 unit increase in Pakistan's exchange rate volatility with China, increases Pakistan's imports by 0.33 units. Also, 1 unit increase in Pakistan's exchange rate with UAE, increases Pakistan's imports by 0.54 units. Then, there is 0.54 units increase in Pakistan's imports per 1 unit increase in Pakistan's exchange rate with USA. The results reveal that their importers besides the exporters of these countries are risk-seeker.

The results show a negative relationship between the GDP growth of Pakistan and imports from China, Singapore, and India. Regarding the imports from China, 1 unit increase in GDP growth of Pakistan reduces imports from China by 0.62 units. Imports from Singapore is reduced by 0.15 units for every 1 unit increase in GDP growth of Pakistan. Then, 1 unit increase in GDP growth of Pakistan reduces imports from India by 0.16. These results indicate that the goods that are being imported from China, Singapore and India are inferior goods. These results support a study conducted by Taghaviet al., (2012) in Iran.

However, the GDP growth of Pakistan shows a positive impact on imports from the rest of the countries. The UAE results declare that 1 unit increase in Pakistan's GDP causes 0.36 units increase in imports from UAE. Similarly, 1 unit increase in GDP increases 0.61 units of Pakistan's imports from Saudi Arabia. In the case of Pakistan's imports from USA; 1 unit increase in GDP causes 1.94 units increase in imports. Also, there is 0.46 unit increase in imports from Kuwait for every 1 unit increase in Pakistan's GDP. The imports from Malaysia increase by 0.13 units per 1 unit increase in GDP. There is 1.09 units increase in imports from Japan, and 0.15 units increase in imports from Iran for every 1 unit increase in GDP. Thus, Pakistan's GDP growth shows a positive impact on imports from Saudi Arabia, Kuwait, UAE, USA, Japan, Iran, and Malaysia. Pakistan is mainly importing mineral fuels, oils, and distillation products from UAE, Kuwait, and Saudi Arabia. Besides, Pakistan is importing heavy machinery from Japan and USA. Since these products are considered the basic necessity of the country, the rise in income would increase the demand of such products. Our results are supported by Mishra (2012) and Mehta (2015) who also found a positive impact of GDP on country's imports.

The results of bilateral imports and bilateral exchange rate are as follow, for every 1 unit increase in exchange rate; there is 1.57 units increase in Pakistan's imports from China. Another 1.92 units increase in Pakistan's imports from USA per 1 unit increase in exchange rate. In the case of UAE, 1 unit increase in exchange rate causes 0.62 units increase in Pakistan's imports from UAE. Also, 1 unit increase in exchange rate causes 0.23 units increase in imports from Saudi Arabia and 1.56 units increase in imports from India. Then, imports from Kuwait increase by 0.52 units per 1 unit increase in exchange rate. One unit increase in Pakistan's exchange rate causes 0.77 units increase in imports from Singapore, 0.82 units increase in imports from Iran and 0.13 unit**s** increase in imports from Japan.

Since our results show that exchange rate has a positive significant impact on Pakistan's import, it confirms the Marshall-Lerner condition, which states that currency devaluation improves the balance of trade when the demand of the long run exports and imports is elastic (Bahmani et al., 2013). In reality, Pakistan's imports are inelastic, which explains the positive impact of exchange rate on imports in our results. Furthermore, this positive impact of exchange rate on imports can be linked to the fact that when exchange rate increases; i.e. currency depreciates; exports would increase. Since the increase in export means an

increase in production, there is a need to increase imports of capital and raw materials that are required in the production process. In fact, the depreciation of the national currency hadn't affect the amount of imports in Pakistan. Accordingly, Pakistan's imports are found to be necessary goods that cannot be stopped or substituted by the local products. The disadvantageous of imports are not always certain as imports have many advantageous. Imports play a crucial role in the investment environment and the industrial development, which enhance economic growth.

Moreover, the **positive relationship between the exchange rate and imports implies that imports help in enhancing exports, because when the existing stock of exports is** insufficient**, more production is needed, which mainly requires imported capital** from the other countries (Kemal and Qadir, 2005).

CONCLUSION

The main contribution of this study is to provide an empirical debate on the relationship between exchange rate and its volatility on export and import. Pakistan has its major exports to Afghanistan, Belgium, Italy, Netherland, United States of America, United Kingdom, Bangladesh, Spain, United Arab Emirates and China. Whereas the major imports of Pakistan are from China, Iran, Japan, Malaysia, Saudi Arabia, Singapore, UAE, USA, Kuwait and India. The study was conducted on these major countries by using a statistical technique known as the "Pool Least Square" with fixed effects. The yearly data was taken from the period 1984 to 2015, whereas the exchange rate volatility was calculated on monthly basis with standard deviation.

The results were found from the two models; one with export as a dependent variable and the other with import as a dependent variable. In the export model, the GDP growth of every trading partner and the exchange rate has a significant impact on Pakistan's exports to its major trading partners. However, the exchange rate volatility has insignificant impact on exports except in the case of USA, Netherland and UK, which indicates that the exported products to Netherland, USA and UK have price elasticity factor. Our results are in line with the findings of Gotur (1985), Solakoglu (2005), De Vita and Abbott (2004), Mustafa and Nishat (2004), Hondroyiannis et al. (2008), Boug and Fagereng (2010) and Rey (2006). These results are insignificant, which is more comprehensible when compared to other studies, as Pakistan's exchange rate remained stable (with few exception points) during the study period (1984-2015).

In the import model, GDP growth has a significant negative impact on Pakistan's import from China, India and Singapore. However, it is significant positive with the rest of the selected countries. Since Pakistan imports large amount of mineral fuels and oils from Saudi Arabia, Kuwait, UAE and Iran, which rises with the increase in growth. The exchange rate has a significant impact, but the exchange rate volatility has an insignificant impact on Pakistan's imports from its major trading partners, except the USA, China and the UK.

The positive impact of exchange rate on imports is unfavorable for Pakistan. This impact could be changed if the domestic market provides suitable substitutes that can compete with the essential imports. Pakistan's high imports are due to high machinery imports and this might eventually be transformed into building exports. Nevertheless, there should be certain policies to discourage the luxurious imports until Pakistan expands its exports base. As a result, higher import duties have to be imposed on non-essential products.

In regard to the exchange rate volatility impact on trade, it can be concluded that the least or no impact of exchange rate volatility is possibly related to the increasing availability of financial instruments that hedge against the exchange rate risk, besides the increasing share of intra-industry trade.

To conclude, the present study shows different results for different countries, hence it is suggested that policy-makers should create and implement different policies for different trading partners according to their trade relationships with Pakistan, as well as taking the present analysis into consideration.

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Examining People's Behavioral Responses to COVID-19: The Role of Socioeconomics, Risk Perceptions, and Media in Pakistan

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ABSTRACT This study examines people's behavioral responses to COVID-19 in Pakistan. A survey instrument is designed to collect data on demographic characteristics, perception about COVID-19, and motivation to avoid it, the socio-economic impact of COVID-19, and their views about the policy responses. The survey collected responses from 404 individuals of different age groups. The data is analyzed through descriptive statistics and a logistic regression model to study human behavior to deal with the COVID-19. It is revealed that families' dependence on earners is the main obstacle for social distancing and isolation. The results indicate that people with high socio-economic conditions, perceived Severity, and social pressure are more likely to adopt social distancing and go to isolation. It is also revealed that people with lower socio-economic conditions face economic hardship due to shrinking work opportunities. Thus, the study recommends the government to manage the diversion of resources to sustain individuals' lives through a targeted approach and use expansionary fiscal and monetary policies as a prudential option.

KEYWORDS: Pandemic; Social Distancing; Isolation; Income; Governance System; Human Behavior

INTRODUCTION

The COVID-19 pandemic has led to a dramatic loss of human life worldwide and presents an unprecedented challenge to public health, food systems, and the world of work. The economic and social disruption caused by the pandemic is devastating: tens of millions of people are at risk of falling into extreme poverty, while the number of undernourished people, currently estimated at nearly 690 million, could increase by up to 132 million by the end of the year [1]. Countries dealing with existing humanitarian crises or emergencies are particularly exposed to the effects of COVID-19. Responding swiftly to the pandemic while ensuring humanitarian and recovery assistance reaches those most in need is critical. As the number of deaths increases, evidence regarding people's psychological reactions to this global public health crisis becomes increasingly important because it provides insights that could help policy-makers and practitioners improve health communication, promote preventive behaviors, and provide social and emotional support to those in need [2-3].

An epidemic is defined as an outbreak of a disease that occurs over a wide geographic area and affects an exceptionally high population. In contrast, the term pandemic relates to geographic spread and describes a disease that affects a whole country or the entire world. Pandemic resulted in adverse effects in severe illness, high mortality, and destructions until centuries. The

novel coronavirus disease 2019 (COVID-19) was an outbreak worldwide, and just after a few days, it was declared as Public Health Emergency on 30th January 2020 by the World Health Organization (WHO).

Pandemics' risk has risen over the past century due to increased international travel and migration, urbanization, intense natural degradation, and land development reforms [4-5]. Two of the top countries challenged by Covid-19 are the next neighbors to Pakistan, i.e., China and Iran. The COVID-19 started from China, widely spread in Iran. Pandemic is large-scale infectious disease outbreaks that can dramatically increase morbidity and mortality over a vast geographic region. It can cause substantial socio-economic and political instability. Many of the statistical analyses of prior pandemic data have identified possible causes of trends of mortality. Research by Chowell found that mortality rates in the UK during the 1918 pandemic were 30-40 percent higher in towns and cities than in people living in remote rural areas [6]. It is found that the frequency of infectious waves in the UK in 1918 correlated with social and economic status, age trends, possibly due to previous immunity among certain age groups [7].

Coronavirus creates significant threats to human health, as well as to other species. From 2002 to 2003, 8000 individuals were diagnosed with severe acute respiratory coronavirus syndrome (SARS-CoV), resulting in a fatality rate of 10 percent [8]. Since 2012, more than 1700 individuals were diagnosed with the Middle East Respiratory Coronavirus Syndrome (MERS-CoV) with a fatality rate of 36 percent [9-10]. Porcine outbreak coronavirus diarrhea (PEDV) had spread throughout the US wherein the mortality rate in piglets was almost 100 percent and killing out more than 10 percent of the total pig community of America in less than a year [11-13]. Also, coronavirus in humans and animals can cause tremendous harm to the gastrointestinal, respiratory, and central nervous system, risking human health and causing widespread socio-economic fall [14-15].

As of December 2013, 170 verified cases of human infection were recorded by the world health organization, including 72 death. Saudi Arabia has registered the largest number of cases of MERS-CoV. Patients treated in the UK, Germany, Spain, Tunisia, France, and Italy were also associated with the Middle East [16]. Pandemic zoonosis represents a dynamic interplay of environmental, biological, and socio-economic factors [17]. Over recent years, the research on emerging infectious diseases and the public's concern has expanded significantly [18-19]. The disease's effect on people, families, and nations continues to be highly significant, decreasing the GDP of affected countries by even more than half and decreasing the UN estimate of the world population by 480 million by 2050 [20-21].

As coronavirus disease 2019 (COVID-19) spread across the world, people faced a new and unfamiliar health threat about which only a limited set of information was available. In contrast, it was also readily changing at the initial stage. Although the outlook remains uncertain, COVID-19 has already caused high mortality, and the number is also increasing over time. To limit disease transmission, the World health organization has recommended precautionary measures such as social distancing. However, social distancing and isolation are the decisions to be taken by individuals. It primarily depends on the individual's socioeconomic characteristics, risk perception, and access to information. The implications of COVID-19 can be worsening for developing countries which are already lagging behind in socio-economic conditions, have low-risk perception and little information access. Given the importance of socio-economic conditions, risk perception, and information availability in developing countries, the present study examines people's behavioral responses to COVID-19 in Pakistan.

The study has designed a survey instrument to collect data on individuals' socio-economic characteristics and their views on specific areas of potential concern. The survey collected responses from 404 individuals of different age groups. The data is analyzed through descriptive statistics and a logistic regression model to study human behavior to deal with the COVID-19. The results revealed that the dependence of families on the earners is the main obstacle for isolation. Besides, people who perceived the pandemic and social pressure severity are more likely to go to isolation. The results are indicating that people with high socio-economic conditions are more likely to go to isolation. Notwithstanding, people with lower socioeconomic conditions are facing economic hardship due to shrinking work opportunities.

Followed by Introduction, section 2 discusses material and method, section 3 presents results and discussion, section 4 concludes the study and gives policy recommendations.

RESEARCH METHODOLOGY

The strategies to control COVID-19 are based on behavioral dispositions. Here, the social attitude toward perceived impacts depends on behavioral traits and predicting human behavior [22-23]. In principle, the Theory of Planned Behavior (TPB) constitutes an explanation of human behavior, attitudes, the individual norm as social pressure, and an ability to regulate human performance or behavior. The trait of TPB determines human intentions for the behavior because intentions directly transform

the behavior [24]. Further, the human beliefs that transform the attitude and then the behavior are based on information for any particular object. In contrast, the beliefs themselves are affected by societal attributes, cultural norms, and situational factors [25].

TPB caters to social psychology that deals with determinants of individual and societal intended behaviors linked to conscious reasoning and human intentions. These intentions are then linked to the individuals' behaviors in society to engage with certain events happening around them [26]. Furthermore, this theory is practical to describe broad-based human intentions and behaviors in all different study fields, including environment or climatic studies [26-28].

The humanely perceived ethical and moral obligations that construct an individual's emotional state are further linked to an individual's sense of responsibility and the action that changes and transforms time-to-time [29]. Thus, individual or societal attitudes, norms, and behavior predict human intentions to act and react [26]. So, the TPB is deployed in this research to predict human (individual and societal) attitudes and behavior towards COVID-19.

This study designed a survey instrument to gather individuals from Pakistan about the COVID-19 and their socio-economic characteristics. The survey collected responses from 404 individuals of different age groups in line with the demographics of Pakistan. The questionnaire is divided into six different modules: demographic characteristics, perception about COVID-19 and motivation to avoid it, the socio-economic impact of COVID-19, and their views about the government's policy quarantine. The data is analyzed using descriptive statistics and a logistic regression model.

The data is analyzed in two stages. First, all the responses are described in percentages to understand perception and motivation in all aspects. Due to the dependent variable's dichotomous nature, the binomial logistic model is used to investigate the likelihood of different variables' impact. As such, there is no other alternative to the binomial logistic regression model. It studies the association between a categorical dependent variable and a set of independent (explanatory) variables.

Let

$$p_i = pr(y = \frac{1}{x=x_i}) \ldots (1)$$

p_i represents the probability of social distancing, which is dependent on explanatory variable (x_i), the model can be written as

$$\log\left(\frac{p}{1-pi}\right) = logit(p_i) = \beta_0 + \beta_i x_i \ldots (2)$$

If we consider x_i is *Severity of the disease,* and when $x_i = 1$, β1 shows the log of odds of social distancing in the case of non-believer on the effect of social distancing on lifestyle. We can write the model in terms of odds as:

$$\frac{p_i}{(1-p_i)} = \exp(\beta_0 + \beta_i x_i) \ldots (3)$$

Transforming equation (3) in terms of the probability of the outcome, after including the residual terms yields:

$$P_i = p_i + f_i = \exp(\beta_0 + \beta_i x_i) / (1 + \exp(\beta_0 + \beta_i x_i)) + f_i \ldots (4)$$

RESULTS AND DISSCUSSION

Table 1 depicts the gender, age, qualification, employment status, and monthly household income. More than 51 percent of the respondents were females. Fifty-seven percent of the total respondents were of age less than 25 years, whereas around 36 percent were of age from 25 to 45 years of age bracket. The respondents' qualification varies from high school to university level with different employment status and monthly income.

Table 1: Respondents demographic characteristics

Demographic		**Percentage**
Gender	Male	48.33
	Female	51.67
Age		
	< 25	57.42
	25-45	35.89
	> 45	6.70
Qualification		
	≤ High School	33.49
	Graduate	41.15
	Postgraduate	25.36
Employment status		
	Full-time employed	27.75
	Part-time employed	11.00
	Unemployed	6.70
	Others (Students & Housewife)	54.55
Monthly Household Income		
	<25000	16.81
	25000-50000	30.83
	50000-100000	27.27
	100000 above	25.09

Only less than 1 percent of the respondents were not aware of the COVID-19 that can be seen as a positive indicator to deal with the pandemic, but unfortunately, only 57 percent of them were of the view that it can be transmitted with human interaction. It provides insight to run a massive awareness campaign to communicate about the misery COVID-19 can cause. About precautionary measures to avoid transmission of Covid-19 sourced from human interaction, 94 percent of the respondents agree with the preventive measures. More than 61 percent of the respondents believe that there are obstacles and barriers to protect from COVID-19 whereas 85 percent of the respondents believe COVID-19 can cause damage to health or life. The results are presented in Table 2.

Table 2: People perception of COVID-19 (percent)

Sr. No	**Items**	**Yes**	**No**
1	Are you aware of the current global pandemic, COVID-19?	99.04	0.06
2	Do you think coronavirus is transmitted from human interaction?	57.42	42.58
3	Are you taking precautionary measures against coronavirus?	93.78	6.22
4	Are there serious obstacles and barriers to protect yourself from COVID-19?	61.72	38.28
5	Do you believe that COVID-19 can affect your health or life?	95.22	4.78

Table 3 shares the motivation of respondents to avoid COVID-19. 88 percent of the respondents are motivated to avoid COVID-19 because everyone is talking about it, whereas 95 percent of the respondents are aware of the steps to avoid interaction with this pandemic. 86 percent of the respondents highlighted social media as the primary motivator to prevent the COVID-19. 94 percent view prevention as a better option than cure. Interestingly, around 60 percent of the respondents were concerned about their families because of their dependence. Almost 59 percent of the respondents were trying to be isolated, and more than 87 percent of the respondents have started using masks, sanitizer, and practicing frequent hand wash.

Table 3: People motivation to avoid COVID-19

Sr. No	Items	Yes	No
1	Are you aware of the steps that can be taken to avoid pandemic?	95.22	4.78
2	As everyone is talking about COVID-19, so it has motivated you to avoid it.	88.04	11.96
3	Is it better to take preventive measures rather than cure for coronavirus disease?	94.26	5.74
4	Is there an increased pressure from social media and news to take preventive measures?	86.12	13.88
5	You are more concerned about your family because they are dependent on you.	59.81	40.19
6	Are you trying to keep yourself isolated or social distancing from others to avoid COVID-19?	58.85	41.15
7	Have you increased the use of mask, sanitizers and practice frequent hand wash?	87.56	12.44

This study runs a logistic regression model by taking isolation and social distancing as a dependent variable and finding the relationship of Severity, social pressure, motivation to avoid, human interaction, age, gender, income, and education with isolation and social distancing. Whereas this study has defined isolation, Severity, social pressure, motivation to avoid, and human interaction as follow: -

Isolation and Social distancing:	*People who are trying to keep themself isolated or social distancing from others to avoid COVID-19.*
Severity:	*People who believe that COVID-19 can affect their health or life.*
Social pressure:	*People who take pressure from social and news media to take preventive measures.*
Motivation:	*People who are more concerned about their family because they are dependent on them.*

Table 4 provides estimates about predictors of social distancing and isolation. The odds ratio from the logistic regression model confirmed that people who believed that COVID-19 could affect their health or life are 2.67 times more likely to go into isolation and keep social distancing. Furthermore, people who feel more pressure from social media and news are 1.32 times more likely to adopt social distancing or go into isolation. Furthermore, people who are more concerned about their family members are 1.43 times more likely to protect themselves from COVID19 through isolation or social distancing. Likewise, people who believe coronavirus transmits from human interaction are more likely by 2.90 to isolate themselves or keep themselves socially distant. It is also evident from the study that it is less likely to keep social distancing or go into isolation for an additional year of age. It is an essential concern because aged people are more vulnerable to COVID-19 because of less immunity. However, because of economic dependence on their family livelihood, they are forced to go out of home for jobs and cannot follow the isolation or social distancing hence vulnerable to COVID-19. In this perspective, the government needs to understand the constraint behind not following the social distancing guidelines for the significant proportion of the population, especially in earners. It demands vigorous policy to take responsibility for those who have no food at home. This way, isolation and social distancing can be made possible. Insufficient funds availability with the government cannot be accepted as an argument, especially in a country where taxes and policy rates are already very high.

In such an emergency, it is the government's responsibility to arrange for financial resources. In this regard, it is critical to understand that the government has to take one of the two options, i.e., either be ready for the heavy life losses and get a permanent dent in the society and economy or go for a short-lived economic downturn. Naturally, there should be no option except to go into lockdown for a certain period to avoid an unforgettable misery. The gender-segregated results shown that males were 30 percent less likely to go into isolation or social distancing than females. Furthermore, higher-income groups are 1.5 more likely to live isolation strategy/social distancing because of having enough financial resources. People with more education or higher qualification are also 1.69 more likely to keep themselves isolated or distant socially.

Table 4: Logistic regression Model

	Isolation/social distancing
Severity	2.67***
Social Pressure	1.32**
Motivation to Avoid	1.43***
Human interaction	2.90***
Age	0.50**
Gender	0.70***
Income	1.50**
Education	1.69*

***is significant at 99 percent, ** 95 percent * 90 percent

CONCLUSION

This study examines the behavioral responses of individuals to COVID-19 in Pakistan. A survey instrument is designed to collect data from individuals regarding socio-economic characteristics along with others. The data is analyzed through descriptive statistics and a logistic regression model. The primary data results reveal that there is a need to increase awareness among the population about the transmission of COVID-19 through human interaction. People are facing obstacles in social distancing and going into isolation. These obstacles are primarily the dependence of their families to earn a livelihood. Even in the absence of complete lockdown and at the initial stage of vulnerability, people face a decline in their earnings due to the shrinkage of economic activities. The logistic model results further confirm that people understand the Severity, feel pressure from social media and news, are motivated because of their families, and understand the transmission of COVID-19 from human interaction. Therefore, they are more likely to practice social distancing and isolation.

The economic sustainability bound them to compromise on social distancing and isolation. It is strongly recommended that the Governments of low-income countries like Pakistan should put all of their resources and efforts to make social distancing and isolation possible in the pandemic situation so that loss of human lives can be avoided. Otherwise, it will be too late because a pandemic is a natural coping mechanism, but it spreads widely due to human negligence. In contrast, the primary responsibility rests with the governance system.

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Exchange rate volatility: A forecasting approach of using the ARCH family along with ARIMA SARIMA and Semi-Structural-SVAR in Turkey

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ABSTRACT The ability to predict the volatility of exchange rate is an enormous challenge when it comes to economic and financial considerations. In this context, it is important to be able to predict the exchange rate volatility in financial markets and the world economy. This paper proposes a heightened approach to modelling and forecasting of exchange rate volatility in Turkey. For past recent years, Turkey experienced political turbulence that the possibility of effecting exchange rate, thus create uncertainty volatility of exchange rate. The daily exchange rate data have been taken from 2005-2017 and applied autoregressive conditional heteroscedasticity ARCH and GARCH families (EGARCH, IGARCH, and PARCH) to forecast exchange rate volatility. The proposed methodology able to calculate the breakpoint by including dummy variables. The result is more confined after including dummy that EGARCH (1,1) is best performing to forecast exchange rate volatility and successfully overcome the leverage effect on the exchange rate. Moreover, this paper also investigates the monthly data forecasting by applying ARIMA SARIMA along with SVAR technique for next few months. The Exchange rate pass-through also encounter it, which indicates the pass-through is more pronounced in PPI than CPI. The forecast result of SARIMA and SVAR distribute the same direction of fluctuation in exchange rate that is declining of current exchange rate in the future. However, ARIMA's forecast tends to increase and different with two models.

KEYWORDS: Exchange rate; Forecast; SVAR; Volatility; Turkey

INTRODUCTION

The Forecasting of the volatility in the exchange rate are key factors that influence the global financial market. As the global financial market is most liquid markets in the world. Fluctuation in the exchange rate affects the profitability of financial institution. Forecasting the exchange rate is crucial as it has significant impact on the macroeconomic fundamental such as oil price, interest rate, wage, unemployment and the level of economic growth.(Ramzan, S 2011); (Broll and Hansen-Averlant, 2010). In practice, most countries are administered by a floating exchange rate system. The interventions taken from the central bank need to be prevent unwanted or disparaging movements in the stock market. (Akincilar, 2011).

The Exchange rate has taken a long part of history of Turkish economy since 19's. At the beginning of 2000, the central bank of the Republic Turkey (CBRT) implemented the inflation targeting regime towards exchange rate. Arat (2003) argued that the inflation targeting regime itself has a purpose to determine increases of exchange rate. However, since the crisis hits Turkish financial and banking sector in 2001, the Turkish exchange rate regime has changed to be free and floating in the market. Therefore, the CBRT only have to intervene and prevent reserve accumulation and excessive volatility. In other word, there might be risk of high volatility in Turkish lira in recent decades (Tuncay, 2010).

The election result chooses Erdogan party to mandate the government office in 2002 and has impacted the Turkish lira to lifting up. However, the Erdogan regime's achievements are still worse and far from over. In 2006, before the subprime mortgage crisis contracted world economies, several speculations on emerging economies came up, include Turkey. The Turkish lira and other emerging economy's currencies depreciate deeply together with other developing economies due to the outflowing amount of capital (WEF, 2015).

Despite the subprime mortgage crisis began in developed countries, it quickly spreads to the world and drags some developing countries include Turkey. Thus, the pressure on the Turkish lira has responded by CBRT to proceed actions on the economy with some policies in monetary. This includes stabilizing inflation and exchange rate. CBRT targets its self are met

Forex market demand of the private sector and lessen the volatility in exchange rate (Cömert and Çolak, 2014).
In World Bank Economic (2012) view, raise concerns about capacity of Turkey to maintain the progress had begun after the 2008 crisis influencing hardly the economy. Several major events in its region has been impacting the economy and challenged Turkey's macroeconomic achievements in the future. Slowed growth in the European Union and deteriorating geopolitical in Turkey's neighborhood impacting negatively on export, investment, and growth of the economy.
The election in June and November also created challenges for Turkish economy in the future. Some speculation about Erdogan's party or AKP unfairly win the election has provided Turkish lira to boost it's depreciate in three month high against US Dollar. Turkish lira as most vulnerable emerging market currency dragging deeply until the lowest level on record (WEF, 2015). Moreover, the global oil prices are falling until 48 US Dollar, the lowest since the price in 2009. The falling of oil price possibly effecting world's economy due to shortening revenue of oil exporter countries.
Turbulence of politics in Turkey and its neighborhoods also could make consequents to the deteriorating Turkish economy. Cabinet reshuffle, an attempted coup in July, have affected market trust on Turkish economy and momentum to reform the government. This also fostered by Turkish referendum in April, 2017 that allowed the current government to be authoritative. Tourism sector also declining and hitting the Turkish economy in recent years.
To the same degree IMF comment about turkey, economy in February 2017 that after failed coup attempt increased the political uncertainty, Along with rising global interest rate, political uncertainty cause of loss in investor confidence and to be exposed Turkey to liquidity shocks. IMF future remark on the turkey, economy that Turkey's net international investment position (NIIP) will continue to depreciate by 10% until the current account deficit reduced. REER was slightly above average in October 2016, and an average of 5-15 percent REER continue to lose over-year in 2016. In response, the IMF gives some policy suggestion to come out this volatility by decreasing the Current account deficit net international reserves should continue to increase by CBRT. Limits currency sales for extreme volatility time period. [1]
One of the highlighted comment on IMF regarding forecasting of turkey economy growth Turkish economy will grow only 2.5% in the end of 2017, well below the average 4.5%.In the report IMF predicts that consumer inflation will remain in double digits and close at 10.1% a year before it declines to 9.1% in 2018.[2]
Deputy Prime Minister of Turkey Mehmet Simsek responses to the IMF forecasting by saying Turkey economy will again disapprove the IMF projected forecast.(Mehmet Simsek tweeted April 18) He is optimistic on the turkey economic growth. In line with CBRT monetary policy committee meeting.

LITERATURE REVIEW

Financial analysts have begun to model and explain the model of exchange rate returns and volatility using time series econometric models because of unexpected events, unstable fluctuations in financial markets, and uncertainties in prices and returns. Güloğlu, B et al (2007) examined the volatility in the nominal exchange rate (TL / $) in Turkey between in March 2001 and March 2007 week was estimated by using ARCH, GARCH and SWARCH models. The period covered corresponds to the period when the exchange rate is floating. First, exchange rate volatility is estimated by using ARCH and GARCH models and the deficiencies of these models are revealed. The estimation results show that various economic and political events in Turkey and in the world affect exchange rate volatility and that these periods of volatility are permanent. As Bala, A, D et al(2013) studied the monthly exchange rate return series volatility with GARCH models and the results show the presence of volatility in three currencies, and most of the asymmetric models deny the existence of volatility. Volatility persistence and log likelihood statistics showed that volatility model with breakdowns were improved the results by predicting volatility models with breaks compared to GARCH models without volatility breaks and reduced majority persistence of the model.

Exchange rate interventions are used to control the volatility of irregular movements in the exchange market. Ramzan, S et al (2012) studied the Forecasting exchange rate by using an ARCH family of model in Pakistan. The monthly exchange rate data of Pakistan for the period of July 1981-May 2010 obtained. The GARCH model performed the best model to remove volatility and EGARCH performed better by an encounter leverage effect on exchange rate return and provide a legitimately forecasting. We can also see that Barunik, J et al(2016) analysis the An improved approach to modelling and predicting volatility using high frequency data. By realizing GARCH framework, explore how the decomposed integrated volatility and jumps influence the upcoming volatility. The results show that jump variation from the integrated variation is essential to predict performance. We have found that most of the information on future fluctuations comes from the high frequency portion of the spectrum that represents the very short investment horizon. Correspondingly Pilbeam, K et al (2014) examined the exchange rate forecasting by using GARCH MODEL and versus implied volatility forecast. In paper used to daily closing prices for four currency pairs the euro, pound, Swiss franc and yen against the dollar. The data covers the period from 1/1-

[1] 03-02-2017 IMF Executive Board Concludes 2017 Article IV Consultation with Turkey
[2] The International Monetary Fund's (IMF) April 2017 World Economic Outlook report

2002 to 30/12-201. The result indicates that GARCH models are not useful to predict foreign exchange rate volatility in period of both low and high volatility.

For Turkey economy exchange rate volatility encounter by Güvenek, Betal (2009). The real exchange rate index has been testified by using ARCH, GARCH. After volatility expending the equation and taking TGARCH. They concluded that suitable model is the Two-Sided TARCH (1,1) model as a result of the analysis for the purpose of smoothing the self-centeredness. In terms of Turkey's economy. It is necessary to create an investment climate where policies can easily shape the investments of middle and long term foreign investors. Moreover Öztürkö, K (2010) worked on the exchange rate volatility in Turkey. In this study, the explanatory power of the Student-t distribution is compared with the normal distribution by adapting the standard GARCH and GARCH models to the dollar / lira exchange rate (USD / TRY). The results obtained, unlike the previous findings, show that the leptokurtic property of the t distribution is not better than the normal distribution in the description. However, when the Akaike and Schwartz information criteria are taken into consideration, it is observed that t-distribution is better than normal distribution and TGARCH models are better than GARCH models.

ARIMA estimation had been used in the econometric and financial purpose to forecast exchange rate volatility. Gadwala and Mathur (2014) used ARIMA model as one of their analysis to forecast the fluctuation of exchange rates in India. ARIMA model together with OLS can explain exchange rate volatility way better than VAR model. The analytical framework of comparing performance of time series models to forecast exchange rate by news (2008) resulted that the ARIMA model provides better than another time series models such as exponential smoothing and Naive models. The forecasting of the exchange rate in the case of Turkey also conducted by Akincilar, themes, and Sahin (2011) which used ARIMA model to forecast the volatility of exchange rate, along with Holt's method and Winer's method.

Since there is possibility of seasonal peak of exchange rate volatility in some periods of observation, some scholars also using Seasonal ARIMA model to forecast exchange rate volatility. Etuk (2013) suggests that SARIMA model might be better to use as the model to forecast Naira-Euro daily exchange rate. In addition, Kadilar, Simsek, and Aladag (2009) also build time series forecasting models like SARIMA to result the forecasting of the exchange rate in Turkey, together with ARCH model and alternative model of neural network.

The semi-structural method allows their use by restricting the set of structural models (Stock, H, Watson, W 2001) (Beraj et al 2015). For this Bouakez, H et al (2010) examined the U.S. monetary policy and uncovered interest rate parity shocks on the bilateral exchange rate between the U.S. and each of the G7 countries by using structural vector auto regression (SVAR). Their end result is that the nominal exchange rate has been delayed in the monetary expansion response and declined about ten months after it began to be appreciated. The shock is caused by large and persistent decoupling from the uncovered interest rate parity. The variance decomposition results show that monetary policy shocks constitute a negligible proportion to exchange rate fluctuations. Of particular significance of volatility Brunet, A et al (2015) working on the impact of monetary policy shocks on the price level, output, and exchange Applied SVAR with the recursive model, variance decomposition analysis in SVAR and flip flop analysis. The result indicates that in maturing financial markets, financial signals may gradually be transmitted to the real sector. In this sense, the mechanism of monetary transmission perhaps may be fragile and delayed. Variance decomposition shows When we started using money, we found that it added valuable information, explaining significantly more exchange rate fluctuations compared to the non-monetary model. Flip flop explained that during 2001-2008 monetary policy is most influenced factor to explain exchange rate fluctuations monitored by inflation fluctuations. Furthermore Mwase, N (2006) studied the effect of exchange rate on consumer price in Tanzania. The data have been collected from the year 1990-2005 and used vector autoregression (VAR) and structural vector autoregression (SVAR), VEC, Granger Causality test. The findings showed that 10% depreciation leads to 0.05 percent increase in inflation after a two-quarter lag. It is also stated that there is a negative relationship between exchange rate depreciation and inflation in the long run.

Masha, I et al (2012) examined the Exchange Rate Pass Through to Prices in Maldives during 1994–2010.ERPT using nonparametric: recursive vector autoregression approach on CPI and PPI. The assessment shows that ERPT is quite high to ICP and about 79 percent of the exchange rate pass through to the consumer price. On the basis of variance decomposition, international commodity price shocks are a major source of change in the two price index in addition to exchange rate changes. The findings also deliver valuable information that most of the shocks of prices Most of the shocks in prices continue for the first year, and show that any response to changes in the price level due to external shocks or intentional policies must take account of a long horizon. Same analysis Leigh,D et al (2002) studied the exchange rate pass-through in Turkey. This paper used data from 1994-2002 and using the recursive VAR model to measure the ERPT effect of nominal exchange rate of CPI and WPI. The exchange rate pass-through to prices in turkey approximately one year, but mostly in the first quarter of the

year. ERPT more visible in WPI than CPI. McCarthy, J. (2007) scrutinizes the effects of exchange rates and import prices on local PPI and CPI in selected industrialized economies using post-1982. The empirical model VAR that contains the price distribution chain used. Impulse responses show that import prices have a strong influence, while foreign exchange rates have a slight influence on the local price. The transition is bigger in countries with a larger share of imports and more permanent exchange rates and import prices. During 1996-98, most of these external factors had a great deal of disinflation in the country, but not in the US.

METHODOLOGY

3.1. ARCH- (Autoregressive conditional hetroskedasticity) Family Model

In economics and financial econometric we also required the model who not only deal with expected return, but also encounter the uncertainty, risk. Such models are ARCH-Family models that are capable of dealing with the volatility (variance) of the series.

In any econometric analysis always assumed that there is no problem of Hetroskedastic means the variance of the disturbance term as constant over the time. However, many financial as well as econometric time series reveals periods of volatility so in such a case the assumption of homoskedasticity (constant variance) is very limited. In order to corporate the behaviour of conditional variance or more appropriately of conditional hetroskedastic we used ARCH-family model.

$$Y_t = x_t \Upsilon + \mu_t \quad (1)$$

$$\sigma_t^2 = \omega + \alpha \mu_{t-1}^2 + \beta \sigma_{t-1}^2 \quad (2)$$

The first one equation is mean equation is written as a function of exogenous variables with an error term. σ_t^2 is the conditional variance equation as it is a pre-period estimation variance based on previous period information. The second equation has three terms: the mean (ω), the ARCH term(μ_{t-1}^2)it indicates that when a big shock happen in the period t-1 , it is more likely that the value of μ_t(in absolute term because of mean square) will be bigger as well. That is, when μ_{t-1}^2large/small, the variance of the next innovation μ_t is also large/small. The estimated coefficient α must be positive for the positive variance. The GARCH termσ_{t-1}^2. As one of the drawbacks of ARCH specification, according to ENGLE (1995) was it is looking more like a moving average than an interrogation. So by Tim Bollerslev, published an article and start a new GARCH family. So in GARCH family included lagged conditional variance terms as autoregressive term.

So this terms is interpreted in a perspective that if a currency trader want to predicts the current period's variance by giving a weighted average of a long term average, i.e. the constant, the forecasted variance from the last period (the GARCH term), and information about the volatility observed in the past period (the ARCH term)

The variance equation can be expanded to allow the inclusion of exogenous repressors or dummy variables with breaks.

$$\sigma_t^2 = \omega + \alpha \mu_{t-1}^2 + \beta \sigma_{t-1}^2 + \xi dum_{it} \quad (3)$$

Where dum= $dummy_{1t}$….$dummy_{nt}$ variables Corresponds to the periods of important policy changes in the foreign exchange market. A high order GARCH model with dummy is written as

$$\sigma_t^2 = \omega + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2 + \sum_{i=1}^{p} \alpha_i \mu_{t-i}^2 + \sum_{k=1}^{k} \xi_k dum_{t-k} \quad (4)$$

As above mentioned, p is the order of the ARCH term, q is the order of the GARCH term, and k is corresponds to the dummy variable.

In 1991 the exponential GARCH (EGARCH) model suggested by Nelson, that deals with the asymmetric effect between positive and negative effect. The specification of the conditional variance written as

$$log \sigma_t^2 = \omega + \sum_{j=1}^{q} \beta_j \log(\sigma_{t-j}^2) + \sum_{i=1}^{p} \alpha_i \left|\frac{\mu_{t-i}}{\sigma_{t-i}}\right| + \sum_{k=1}^{r} \gamma_k \frac{\mu_{t-i}}{\sigma_{t-k}} \quad (5)$$

In the above equation, note that when μ_{t-i} is positive ('good new') the total effect of μ_{t-i} is $(1+\gamma_i)|\mu_{t-i}|$: while when μ_{t-i} is negative ('bad news') the total effect of μ_{t-i} is $(1-\gamma_i)|\mu_{t-i}|$.The EGARCH is covariance stationary provided$\sum_{j=1}^{q} \beta_j$.(Zivot, 2009).

If the parameters of the GARCH models are restricted to the one from the total and the constant term is left we will get *integrated* GARCH (IGARCH) model, which is given by

$$\sigma_t^2 = \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2 + \sum_{i=1}^{p} \alpha_i \mu_{t-i}^2 \quad (6)$$

3.1.2. Types of forecasting

Since the collapse of the 1970 Bretton Woods fixed exchange rate system, countries have been very important in predicting exchange rate or currency value. For this reason, he developed various methods and techniques to estimate exchange rates. For example, the following are types of forecasting;

Non-Structural System

In the non-structural system that does not require the existence of predefined associations between variables. The non-structural model is explained as a vector autoregressive model and allows variables to interact freely without constraints. The non-structural system as a whole produces superior estimates in the series and lead to poorest forecast. (Kimberly, 2014) The below forecasting approach came under the non-structural forecast

- ARMA, ARIMA, ARFIMA, SARIMA
- VAR, BVAR, VEC, BVECM

Semı-Structural System

The semi-structural method allows their use by restricting the set of structural models (Stock, H, Watson, W 2001) (Beraj et al 2015). Semi-structural equations formulate, articulate macroeconomic forecasts, accomplish scenario analysis, and inform the monetary policy formulation process

- SVAR
- SBVECM

Structural System

The structural equations show that error correction terms add value to the predictions (Kimberly, 2014). Structural models are established as regression models where the explanatory variables are the functions of the time and the coefficient factors are allowed to change over time. (Proietti, T1991)

- DSGE(Dynamic Stochastic General Equilibrium)
- SEM(Simultaneous Equation Model)

3.2. ARMA- Autoregressive Moving Average

The general form of the ARMA is an ARMA (p,q) models of the form :

$$Y_t = \sum_{i=1}^{p} \phi_i Y_{t-i} + \mu_t + \sum_{j=1}^{q} \theta_j \mu_{t-j} \qquad (7)$$

The implication behind the time series behaviour of Y_t is largely determined by its own value in the previous year. So, what will happen in t time (present time will depend on the t-1 (previous time period) It is called an AR (p^{th}) process. And the other term μt is an MA (q^{th}) process means moving average. The insinuation behind of MA method is that Y_t depend on the value of the immediate past error, which is known at t time period.[3] The stationary property of the model is dealt with AR (p^{th}) part of the specification. Similarly, the property of inevitability for the ARMA (p,q) model will have to do with an MA(qth) part of the model.

3.2.1. ARIMA- Autoregressive Integrated Moving Average

ARMA process can deal only that model who satisfied the stationary properties, that is mean, variance and the covariance is constant over the time. However, most of economic and financial series has time trend, so mean of Y_t one period is different from mean of another time. So this reject the property of stationary that mean is not constant over the time. So in order to avoid the problem, The ARIMA process induced stationarity by detrend the data through taking the difference. It can be writing as

$$\Delta Y_t = Y_t - Y_{t-1} \qquad (8)$$

In general, if we take difference of a series d time in order to induce stationarity, and invertible ARMA process, so undiffernced series is following an ARIMA (p,d,q) notation.

3.2.2. SARIMA- Seasonal Autoregressive Integrated Moving Average

The above model is deal with the non-seasonal time series analysis. Thus with the intention of adjusting seasonality in the time series, we applied SARIMA model. Therefore, if there is a seasonally autoregressive parameter P (SAR) or if there is at

least a seasonal moving average parameter Q (SMA) or both parameters (P, Q). A seasonally SARIMA model is embodied as SARIMA(P,D,Q), where P is the number of autoregressive lag, D is the differencing lag , and Q is the moving average lag and can be written as

$$Y_t = \sum_{i=1}^{P} \phi_{iS}\, Y_{t-i} + \mu_t + \sum_{j=1}^{Q} \theta_{jS}\, \mu_{t-j} \qquad (9)$$

3.3. SVAR (Structural Variance Auto Regressive)

SVAR dynamic structural model is interpreted by vector form. The system of equation can be written as follow:

$$B_0\, y_t = \mathrm{k} + B_1\, y_{t-1} + B_2\, y_{t-2} + \ldots B_p\, y_{t-p} + u_t \qquad (10)$$

Where y_t is an n x 1 vector, k is an n x 1 vector of constants, u_t is n x 1 structural error vector, and p is the number of lags. B_0 matrix is defined as

$$B_0 = \begin{bmatrix} 1 & -B_{12}^{(0)} & \cdots & -B_{1n}^{(0)} \\ \vdots & \vdots & \cdots & \vdots \\ \vdots & \vdots & \cdots & \vdots \\ -B_{n1}^{(0)} & -B_{n2}^{(0)} & \cdots & 1 \end{bmatrix} \qquad (11)$$

B_t is an nxn matrix which has *i* row and *j* column. Thus

$B_{ij}^{(s)}$ = 1,2,...,p we assumed each side of (3,1) is pre multiplied by B_0^{-1}, thus the result is

$$y_t = \mathrm{c} + \varphi_t y_{t-1} + \varphi_t y_{t-2} + \ldots + \varphi_t y_{t-p} + \varepsilon_t\,, \qquad (12)$$

$$\text{Where} \quad \mathrm{c} = B_0^{-1} \qquad (13)$$

$$\varphi_s = B_0^{-1} B_s \qquad (14)$$

$$\varepsilon_t = B_0^{-1} u_t \qquad (15)$$

The VAR equation (3,3) is a reduced form of the dynamic structural model of VAR equation (3,1). However, the structural error u_t has a relation with reduced form of residuals as

$$u_t = B_0^{-1} \varepsilon_t \qquad (16)$$

ESTIMATION

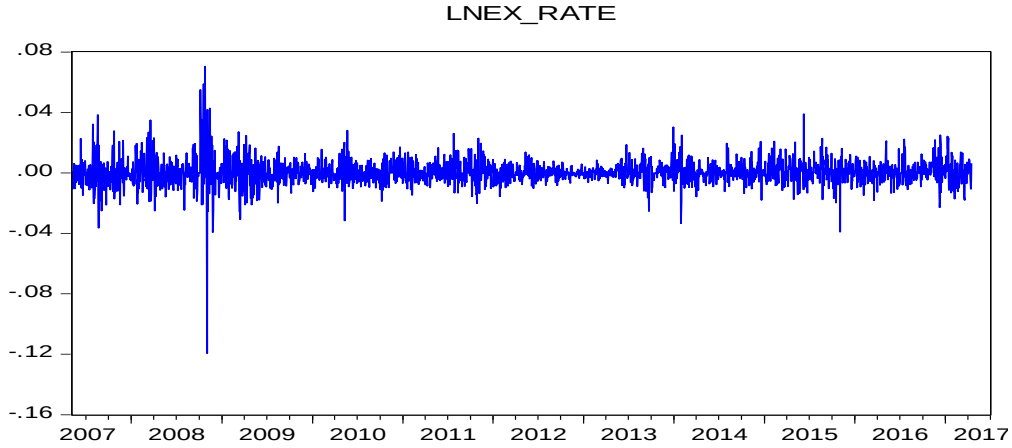
4.1. ARCH and GARCH Families Model

This study uses daily data to estimate the ARCH models. We also have estimated the ARCH model with monthly data on Real Exchange Rate. However, there is no present of ARCH effect in the model. Thus, we decide to use daily data in our model to control the autocorrelation pattern and Leverage effect on the models to predict the presence of asymmetric response in the volatility of exchange rate. Estimation of sample period is started from January 1st, 2005 through April 21st, 2017 (See figure 1, 2).

Figure 1. Time Series Plot of Exchange Rate Volatility (TL/USD)

Source: The Central Bank of the Republic of Turkey

Figure 2. Time Series Plot of Exchange Rate Return (TL/USD)



Source: The Central Bank of the Republic of Turkey

The first step, we need to estimate ARMA model with the AIC test approach. The AIC test result suggests ARMA (2, 2) model is our best model among the other ARMA models (see Table-1).

Table 1. The Akaike Info Criterion result of ARMA model

AR / MA	0	1	2	3	4	5
0	-6.753566	-6.753943	-6.753334	-6.752709	-6.753587	-6.753350
1	-6.753639	-6.753226	-6.752691	-6.752076	-6.752815	-6.753391
2	-6.753567	-6.753022	-6.760606	-6.760506	-6.760116	-6.759512
3	-6.752695	-6.752152	-6.755162	-6.759903	-6.759309	-6.759562
4	-6.753087	-6.752650	-6.759572	-6.759012	-6.758423	-6.759668
5	-6.752816	-6.752962	-6.758653	-6.758158	-6.758877	-6.759347

Author estimation

Thus, the second step is evaluating heteroscedasticity effect by ARCH LM test. According to ARCH LM test results in table 2, there is a presence of ARCH effect in ARMA (2,2) model since the probability is less than 5% (p-value=0.00).

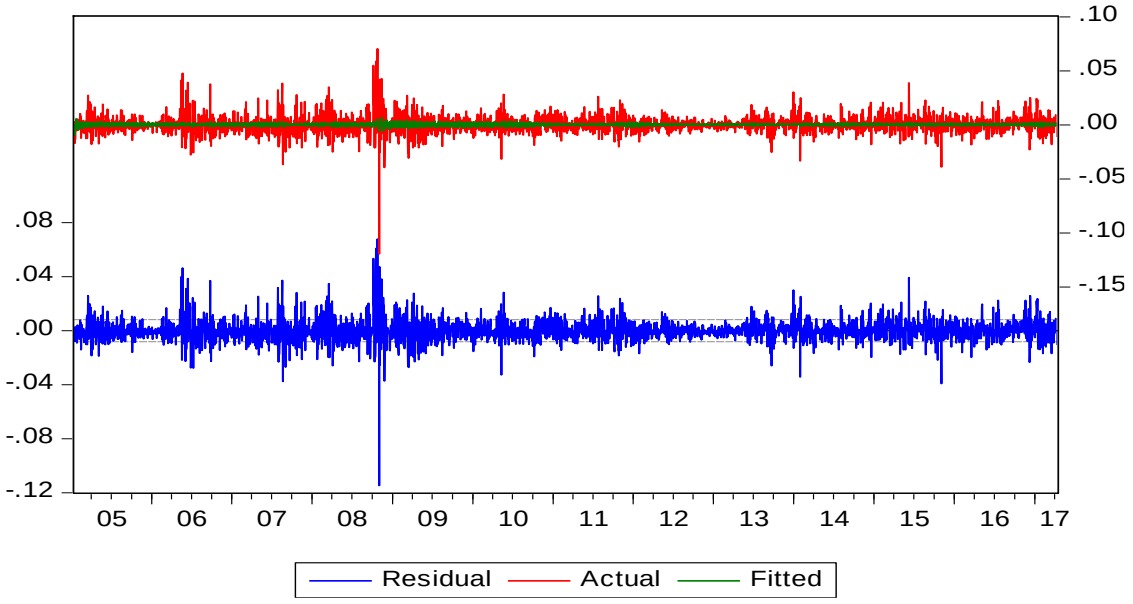
Table 2. ARCH LM test on ARMA (2,2) model

Heteroskedasticity Test: ARCH			
F-statistic	90.01529	Prob. F(1,3200)	0.0000
R-squared	87.60718	Prob. Chi-Square(1)	0.0000

Author estimation

In addition, ARMA (2, 2) also has persistence of residual (see Figure 3), therefore we can decide to focus on ARCH families to be further analysed.

Figure 3. Persistence of Residual, Actual, and Fitted.



Author estimation

Since the conditional heteroscedsticity of ARMA (2, 2) came out as our best model, thus we need to focus to the other specification of ARCH families modes such as ARCH, GARCH, IGARCH, and EGARCH (see table 3).

Table 3. Parameter for ARCH and GARCH models (TL/US) without volatility breaks

Parameter	***ARCH***	***GARCH***	***EGARCH***	***IGARCH***
C	8.58E-05	0.0001	0.000324	0.000170
	0.000139	0.00011	0.000106	8.58E-05
$AR(1)$	-1.106401	-0.5911	-1.901292	0.930267
	0.075977	0.18421	0.012527	0.293919
$AR(2)$	-0.687104	-0.6694	-0.960703	-0.424835
	0.061956	0.15772	0.012246	0.273715
$MA(1)$	1.165001	0.6317	1.916336	-0.891929
	0.066958	0.17939	0.009668	0.297271
$MA(2)$	0.739991	0.6916	0.975990	0.399356
	0.054827	0.15174	0.009481	0.276230
ω	5.07E-05	7.51E-07	-0.348111	-
	4.27E-07	1.16E-07	0.024089	-
α	0.268048	0.1081	0.073508	0.072745
	0.017120	0.0067	0.007268	0.002857
β	-	0.8873	0.977086	0.927255
	-	0.0056	0.002245	0.002857
Leverage effect- γ	-	-	0.162686	-
	-	-	0.009640	-
$\alpha + \beta$				
AIC	-6.836997	-7.083153	**-7.086881**	-7.062677
SW	-6.823727	-7.067987	-7.069820	-7.051303
obs	3203	3203	3203	3203

Author estimation

The variance equation parameters of ARCH, GARCH, IGARCH, and EGARCH models results, alpha and beta, have positive effects and significant with probability less than 1%. In case of GARCH, if the variance of exchange rate returns increase 1 unit, it might be affect the expected variance exchange rate return about 0.887. However, EGARCH and IGARCH models have more effect to the variance of exchange rate returns. The variance of exchange rate returns shock before or its residual also might be influencing the exchange rate returns variance increases. However, the result of AIC and SW test criteria suggest that ARMA (2,2)-EGARCH (1,1,1) model is suitable to be cited.

4.1.1. Leverage Effect

EGARCH model generally is used to define the asymmetric of variance exchange rate return of forecast models. Therefore, it can capture the possibility of leverage effect in our model. Since our GARCH model also has significant parameter, thus there might be a persistence of GARCH effect in our EGARCH model. The parameter of EGARCH has a positive significant effect, means that in the Turkish case, it has more positive information than negative information influencing the exchange rate return. Therefore, we can conclude that the exchange rate value appreciate for some periods. This finding is consistent with Ağcaer (2003), Ünal (2008) and Central Bank of The Republic of Turkey (2010) research findings result.

There might be also a possibility of exchange rate persistence in our sample of observation. Thus, we decided to analyze the effect of ARCH families models by dummy variable. The dummy variables are important to remove the effect of the conditional mean and variance equation. According to Quandt-Andrews Breakpoint test, there are some major extreme effect in the year of 2008, 2010 and 2015.

After the dummy variable implied in our model, the result of ARCH family's models is better than the result of ARCH family's models without dummy variable. The explanation of EGARCH model has also become better than our EGARCH model without dummy variable (see table 4).

Table 4. Parameter for ARCH and GARCH models (TL/US) with volatility breaks

Parameter	$ARCH$	$GARCH$	$EGARCH$	$IGARCH$
C	7.69E-05 0.000135	0.00012 0.00011	0.00111 0.00159	0.000171 8.51E-05
$AR(1)$	-0.529206 0.035310	0.88772 0.28293	0.20433 0.23029	0.91602 0.28871
$AR(2)$	-0.898904 0.033683	-0.38271 0.26484	0.79484 0.23041	-0.40408 0.26065
$MA(1)$	0.558197 0.036505	-0.83841 0.28648	-0.19034 0.22186	-0.87337 0.29181
$MA(2)$	0.893146 0.034383	0.35335 0.26833	-0.80907 0.22259	0.37726 0.26326
ω	5.07E-05 4.59E-07	1.02E-06 1.29E-07	-0.43012 0.02306	- -
α	0.232420 0.016206	0.11637 0.00713	0.07783 0.00779	0.07853 0.00299
β	- -	0.87249 0.00545	0.96959 0.00239	0.92147 0.00299
Leverage effect- γ	- -	- -	0.17186 0.00963	- -
$\xi - dummy$	0.001543 0.002203	0.00014 3.49E-05	1.36715 0.15988	8.28E-05 1.75E-05
$\alpha + \beta$				
AIC	-6.836997	-7.090736	**-7.094039**	-7.068484
SW	-6.823727	-7.073675	-7.075083	-7.055214
obs	3203	3203	3203	3203

Author estimation

4.2. ARIMA and SARIMA

To estimate ARIMA model, we used monthly data with sample of observation started from January 2010 through March 2017 to avoid the financial crisis effect on our estimation. We also calculated the exchange rate return to be used as our estimation.

Table 5. Akaike Info Criterion result of ARMA model

AR / MA	*0*	*1*	*2*	*3*	*4*	*5*
0	*-4.391280*	*-4.434739*	*-4.411707*	*-4.398007*	*-4.399670*	*-4.377147*
1	*-4.436085*	*-4.411739*	*-4.452364*	*-4.444490*	*-4.415550*	*-4.404784*
2	*-4.414273*	*-4.450604*	*-4.415644*	*-4.402680*	*-4.405677*	*-4.374042*
3	*-4.404955*	*-4.430461*	*-4.408421*	*-4.372111*	*-4.488663*	*NA*
4	*-4.386050*	*-4.409660*	*-4.383116*	*-4.395075*	*-4.453468*	*-4.497673*
5	*-4.363957*	*-4.354195*	*-4.364610*	*-4.353784*	*-4.444576*	*-4.338059*

Author estimation

The correlogram analysis resulted that autocorrelation and partial correlation are gradually decline. Therefore, it can be concluded that the ARIMA model is fit enough to be intrepeted. Thus, we continued to check the best ARIMA models for further analysis. Formerly, according to AIC, it suggested that ARIMA (4,1,5) came out as the best ARIMA model among the others (see table 5).

AR (4) can be explained as follows. AR (1), Exchange rate in previous month have a positive effect. It means 1 percent increasing in exchange rate return giving an increase in exchange rate return for the next month with value 0.56. After that, the exchange rate affecting its own value for 4 months. MA (5) means that the exchange rate gives a shock by its own within 5 lag (see table 6).

After finding the best model of ARIMA, thus we need to recheck the residual correlogram. Finally, the residual correlogram resulted that there is no autocorrelation in our ARIMA model. It is important also to check normality assumption in our ARIMA model. The Jarque-Bera test resulted that the probability is bigger than p-value 5% (with value 0.676). It means that the distribution of data in our ARIMA model suitable with normality assumption. By LM test, we can evaluate if there is serial correlation or not. With value of probability 0.9469 (which bigger than 5%), it can be concluded that there is no serial correlation in our ARIMA model. Heterocedasticity test also resulted that there is no ARCH effect with probability 0.44. Therefore, our model is good enough to be intrepeted.

Table 6. Time Series Result of ARMA model

Dependent Variable: EX_R
Method: Least Squares
Sample: 2010M09 2017M03
Included observations: 79

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.011185	0.003719	3.007146	0.0037
AR(1)	0.568905	0.117000	4.862451	0.0000
AR(2)	-0.500742	0.119260	-4.198753	0.0001
AR(3)	0.383623	0.104273	3.679014	0.0005
AR(4)	-0.674057	0.080373	-8.386562	0.0000
MA(1)	-0.363491	0.158974	-2.286485	0.0253
MA(2)	0.465044	0.121603	3.824283	0.0003
MA(3)	-0.430294	0.119578	-3.598442	0.0006
MA(4)	0.638932	0.109384	5.841186	0.0000
MA(5)	0.360845	0.140077	2.576045	0.0121
R-squared	0.284119			

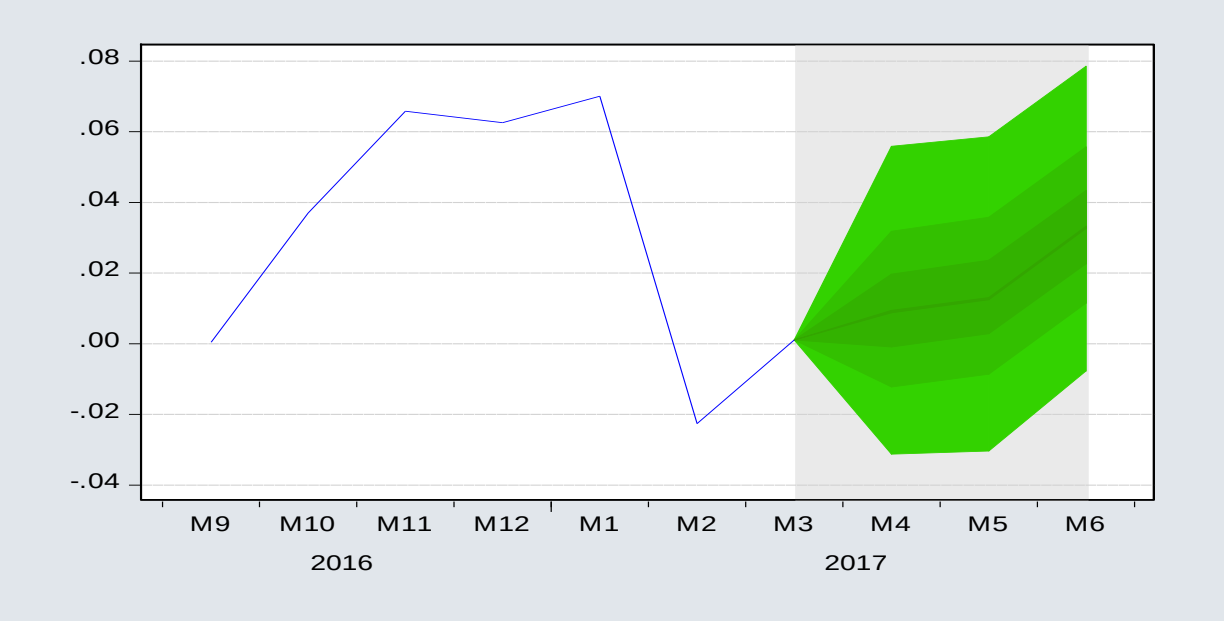
4.2.1. Forecast of ARIMA

To forecast the exchange rate, we applied 3 month forecast of ARIMA (4,1,5) model. The last value of the exchange rate in March, 2017 is 3.67 in Turkish Lira. Our ARIMA model expecting that the exchange rate will increase in the next three months until 3.88 TL (see figure 4-5).

The green colour of chart showed how the exchange rate volatility forecasted. Upper bound and lower bound mean highest volatility and lowest volatility. If the exchange rate volatility goes from the darkest green area to the light green area, it means forecast less of probability. In the next three months (until June) with 60% probability level, the exchange rate will be increase with confidence of interval 3.6-4.1. Therefore, it can be concluded that Turkish Lira will depreciate in next three months.

However, the forecast of next 6 months predicted that the exchange rate still continues to increase until 3.98 TL. For six months forecasting (until September) with 60% probability level, Turkish lira will be rising with confidence of interval 3.5-4.5. In addition, we also estimated Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) to evaluate the accuration of forecasting. RMSE and MAE give value 0.030807 and 0.026144 in respectively (we put the value in table 4.11).

Figure 4 Months Ahead ARIMA (4,1,5) model Forecast of Turkish Lira Using Fan Chart.



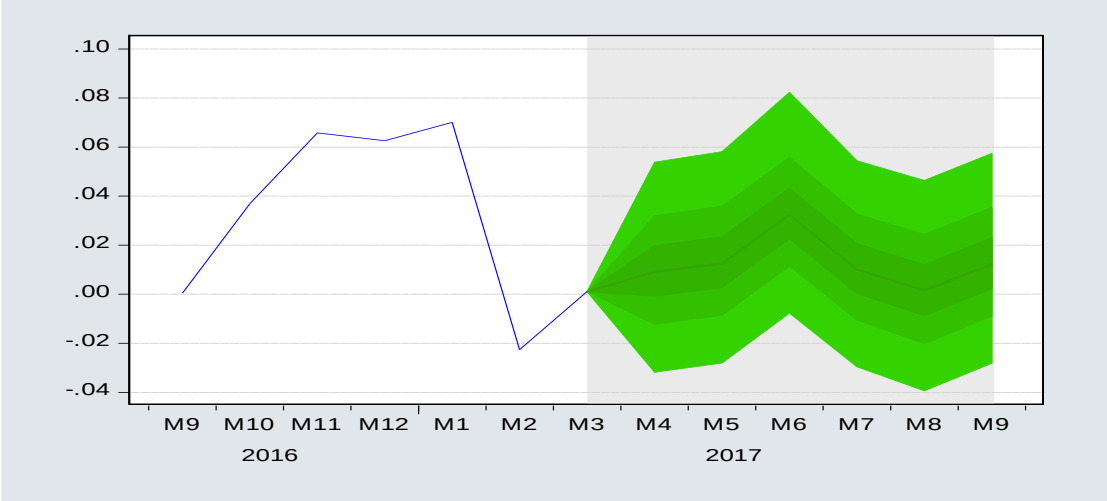
Author estimation

4.2.1. SARIMA

SARIMA model used monthly data started from January, 2005 through March, 2017. Since the volatility of our monthly data is high, it is important to evaluate in which periods our data have high volatility (some crisis or other events might create high peak of volatilities in the period of the sample). According to Quandt-Andrews Breakpoint Test, it can determine in which periods our data has high peak of volatilities. The Quandt-Andrews Breakpoint test resulted that in the period of April, 2010 through March, 2017, it has no higher peak of volatilities than other periods.

Thus, we also need to check the possibilty of seasonality in our data. However, by Census X-13 analysis, we found that our data has seasonality effect since the level value is 0.07. Therefore, we can continue to analyzed with SARIMA model. By 577 times estimations of SARIMA analysis, SARIMA (4,1,4) came out as the best model of our SARIMA analysis.

Figure 5. Months Ahead ARIMA (4,1,5) model Forecast of Turkish Lira Using Fan Chart.



It is also important to check residual diagnostic of our SARIMA model. As we estimated above; ccorrelogram of residuals squared resulted that there is no correlation. LM test has probability 0.4373 bigger than 10% means that there is no serial correlation in our data. By ARCH test, probability of heteroscedasticity gives value 0.5032 and bigger than 10%. It can be concluded that there is no ARCH effect in SARIMA model. According to Jarque-Bera test, the probability of normality is 0.223, thus our data is normally distributed. Therefore, oour SARIMA model has meet the assumptions criterias, thus we can continue to forecast the exchange rate by SARIMA model (see table 7).

Table 7. Time Series Result of SARIMA model

Dependent Variable: EX_R
Method: Least Squares
Date: 04/19/17 Time: 14:18
Sample: 2010M04 2017M03
Included observations: 84

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.021531	0.004127	5.217058	0.0000
AR(1)	1.290727	0.087617	14.73141	0.0000
AR(2)	-0.556737	0.123780	-4.497799	0.0000
AR(3)	0.640247	0.161594	3.962074	0.0002
AR(4)	-0.492293	0.088397	-5.569116	0.0000
SAR(6)	0.890419	0.037715	23.60937	0.0000
MA(1)	-1.192052	0.009412	-126.6568	0.0000
MA(2)	0.407824	0.015854	25.72356	0.0000
MA(3)	-1.153639	0.011998	-96.15446	0.0000
MA(4)	0.942843	0.008076	116.7421	0.0000
SMA(6)	-0.911305	0.012540	-72.67424	0.0000

R-squared	0.499443	Mean dependent var	0.010437
Adjusted R-squared	0.430873	S.D. dependent var	0.026932
S.E. of regression	0.020318	Akaike info criterion	-4.833090
Sum squared resid	0.030135	Schwarz criterion	-4.514769
Log likelihood	213.9898	Hannan-Quinn criter.	-4.705127
F-statistic	7.283752	Durbin-Watson stat	2.015396
Prob(F-statistic)	0.000000		

Author estimation

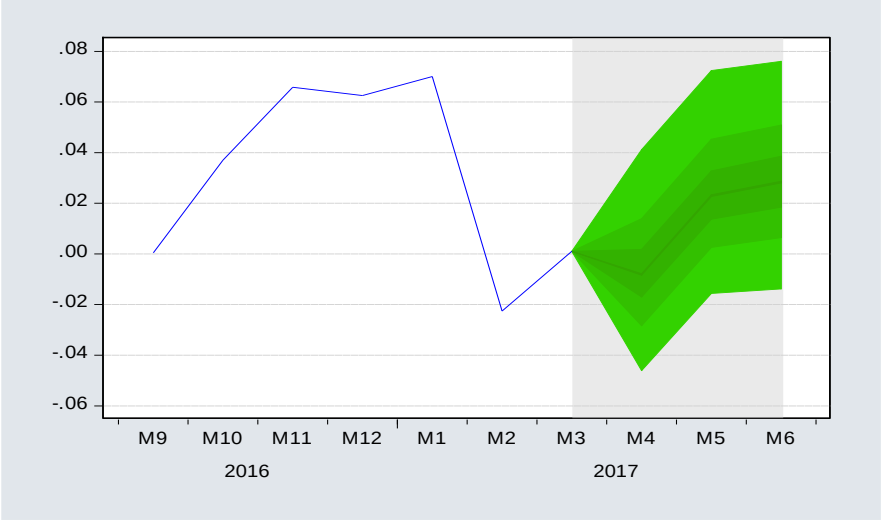
4.2.2. Forecast of SARIMA

The last value of the exchange rate in March, 2017 is 3.67 TL. Our forecast of 3 month exchange rate resulted that the exchange rate tends to increase until June, 2017. However, the value of exchange rate in April is decline, and then the exchange rate remains to increase until 3.85 TL.

The green colour of chart show how the exchange rate volatility forecasting. Upper bound and lower bound mean highest volatility and lowest volatility. If the exchange rate volatility goes from the darkest green area to the light green area means forecast less of probability. In the next three months (until June) with 60% probability level, Turkish lira will be increase with

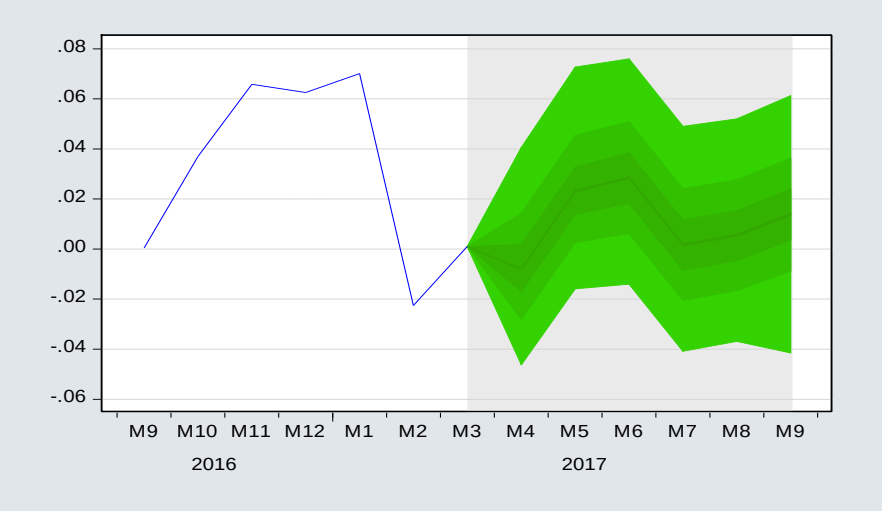
confidence interval 3.6-4.0 (see figure 6-7)).

Figure 6. Months Ahead SARIMA (4,1,4) model Forecast Of Turkish Lira Using Fan Chart.



Author estimation

Figure 7. Months Ahead SARIMA (4,1,4) model Forecast of Turkish Lira Using Fan Chart.



Author estimation

For six months forecasting (until September) with 60% probability level, Turkish lira will be increase with confidence interval 3.4-4.5. The next 6 month forecast also shows that the exchange rate slowly increases until 3.93 TL. Moreover, to checked the accuration of this forecast we need to estimated Root Mean Square Error (RMSE) and Mean Square Error (MSE). Root Mean Square Error (RMSE) and Mean Square Error (MSE) giving value 0.026 and 0.0229 respectively (see table 4.11).

4.3. SVAR

4.3.1. Identification

SVAR model is identified by five models of the structural shock, using Cholesky variance decomposition and the variance-covariance matrix. The first model is supply shock which identified by oil price. The demand shock will be identified by output gap with proxy industrial production index and it has oil price shock and its own shock respectively. The exchange rate itself is identified in the third variable. The fourth and fifth variable will be identified by different series of prices,

production price index and consumer price index.

$$\pi^{oil} = E_{t-1}\left[\pi^{oil}\right] + \varepsilon_t^{oil} \quad (17)$$

$$\Delta y_t = E_{t-1}\left[\Delta y_t\right] + \alpha_1 \varepsilon_t^{oil} + \varepsilon_t^{\Delta y} \quad (18)$$

$$\Delta e_t = E_{t-1}\left[\Delta e_t\right] + \beta_1 \varepsilon_t^{oil} + \beta_2 \varepsilon_t^{\Delta y} + \varepsilon_t^{\Delta e} \quad (19)$$

$$\pi_t^{PPI} = E_{t-1}\left[\pi_t^{PPI}\right] + \gamma_1 \varepsilon_t^{oil} + \gamma_2 \varepsilon_t^{\Delta y} + \gamma_3 \varepsilon_t^{\Delta e} + \varepsilon_t^{PPI} \quad (20)$$

$$\pi_t^{CPI} = E_{t-1}\left[\pi_t^{CPI}\right] + \gamma_1 \varepsilon_t^{oil} + \gamma_2 \varepsilon_t^{\Delta y} + \gamma_3 \varepsilon_t^{\Delta e} + \gamma_3 \varepsilon_t^{\Delta PPI} + \varepsilon_t^{CPI} \quad (21)$$

We applied monthly data with sample of observation started from March, 2007 through February, 2017 as our analysis. In spirit of Mc Carthy (1999) VAR analytical framework which explained pass through of exchange rate and import prices to domestic inflation, some variables will be implied in our Structural VAR framework. We describe variables like oil price, output gap, exchange rate, consumer price index, and producer price index in table 8.

The result of SVAR analysis will be divided in 3 parts. The first part is interpretation of responses of two variables of prices on exchange rate with impulse response graphics. After resulted the value of cumulative impulse responses, we applied the analytical framework of Exchange Rate Pass Through (ERPT) to identify the effect of change in exchange rate towards two of our index prices (Masha and Park, 2012). The coefficient changes of pass through:

$$PT_{t,t+s} = \frac{CP_{t,t+s}}{EP_{t,t+s}} \quad (22)$$

Where $PT_{t,t+s}$ the pass through coefficient at horizon s and period t is, $CP_{t,t+s}$ are the cumulative impulse responses of consumer price index at horizon *s* and period *t,* and $EP_{t,t+s}$ is the cumulative impulse responses of exchange rate at horizon *s* and period *t.* The last parts in our SVAR model is calculating the amount of the variable shock by variance decomposition tables. In the end of SVAR analysis, we compile our forecast of exchange rate.

Table 8. Descriptions of variables

Data	Descriptions	Source
Oil price	Crude oil price in USD (petroleum), simple average of three spot prices; Dated Brent; West Texas intermediate; and the Dubai Fateh	IMF Primary Comodity Index
Output gap	Industrial Production Index-Total	Turkish Statistical Institute
Exchange rate	Nominal exchange rate	Central Bank of the Republic of Turkey
Producer Price Index	PPI is a measure of the change in the prices of goods and services sold as output by domestic producers in a given reference period (2003=100).	Turkish Statistical Institute
Consumer Price Index	CPI is a measure the changes of the current retail prices of goods and services purchased by consumers over a given time period (2003=100).	Turkish Statistical Institute

The above measurement of variable is explained as annual growth since it is important to normalized data series and transferred all variable in the same unit of measurement. Hence we took annual growth rate of all variables to avoid the problem of level of integration (see table 9).

Table 9. Unit Root Test Reult by ADF test

		The equation type		Level	
Variables	Lag order	none (b=a=0)	intercept(a≠0, b=0)	ADF Test H0: p=0 there has unit root (P-value)	level of integration
Oil price-Π^{oil}	0		+	0.01***	I(1)
Output gap-y	0	+		0.01***	I(1)
exchange rate-e	0	+		0.05**	I(1)
Producer price index- PPI	0		+	0.01***	I(1)
Consumer price index- CPI	0		+	0.02***	I(1)

Level of significance 1%***, 5%**, 10%*, *Author estimation*

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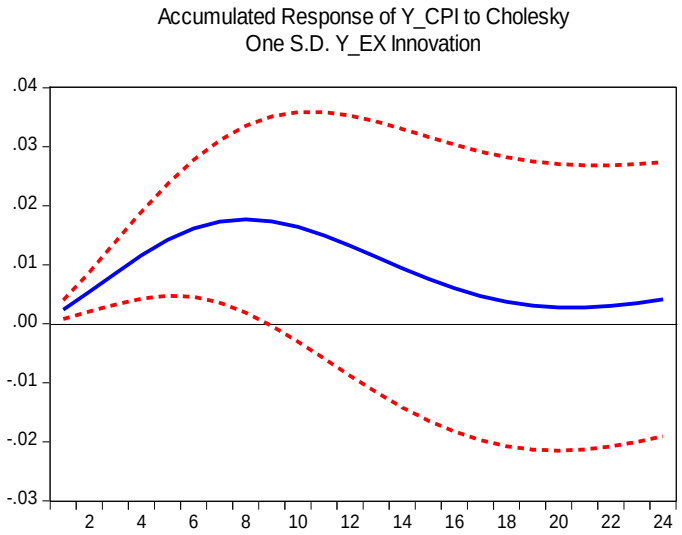
4.3.2. Impulse Response

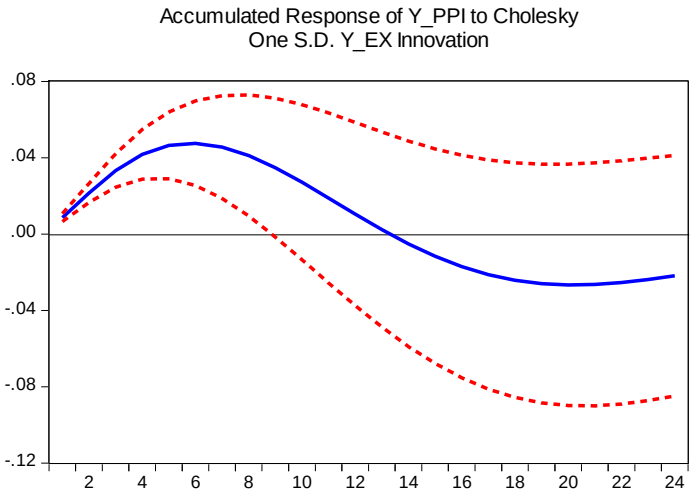
The exchange rate annual growth affecting inflation strongly 0 Lag order from 1-9 month significantly with 5% probability. In early five months the exchange rate shock is increasing inflation rates until 5 months. However, after seventh month, the influences are gradually slowed. Then after ninth months later the exchange rate shocks are not significantly affecting the inflations. According to Leigh and Rossi (2002), exchange rate pass through to consumer price and wholesale price index are only has effets on first fourth months, then the effect is fall down. However, since the exchange rate recently has strong influence to prices in Turkey, thus the exchange rate shock effecting CPI and PPI more than Leigh and Rossi (2002) findings (see figure 8).

Figure 8. Impulse Repsonse of CPI annual growth.



Author estimation

Figure 4.8. Impulse Response of PPI annual growth.

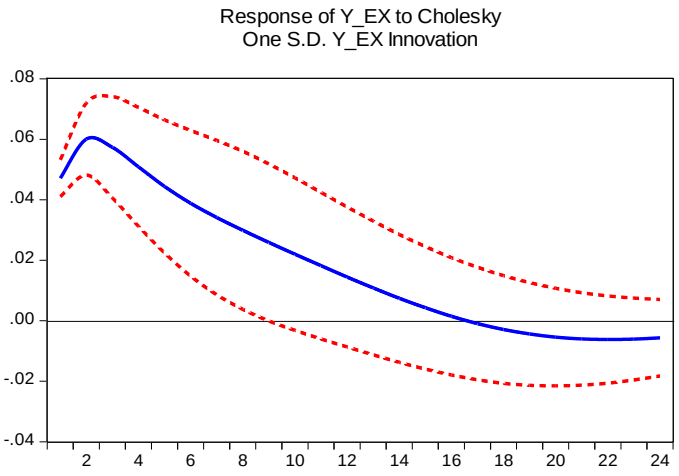


Author estimation

Several changes in Turkish economy recently might be possible to create this strong inffluences. First, the exchange rate volatility in Turkey is high for decades due to major market events that affecting Turkish economy. Second, After 2002, Turkish trade policy has chaged rapidly and more open to create trade with other partner countries. Exchange rate shock to CPI is more pronounced compared to PPI.

First two months, exchange rate responses by its own shock, give a strong effect to increase. Then, after two months the exchange rate response gradually slowly, and after six month its own response back to return (see figure 9).

Figure 9. Impulse Response of Exchange Rate Annual Growth.

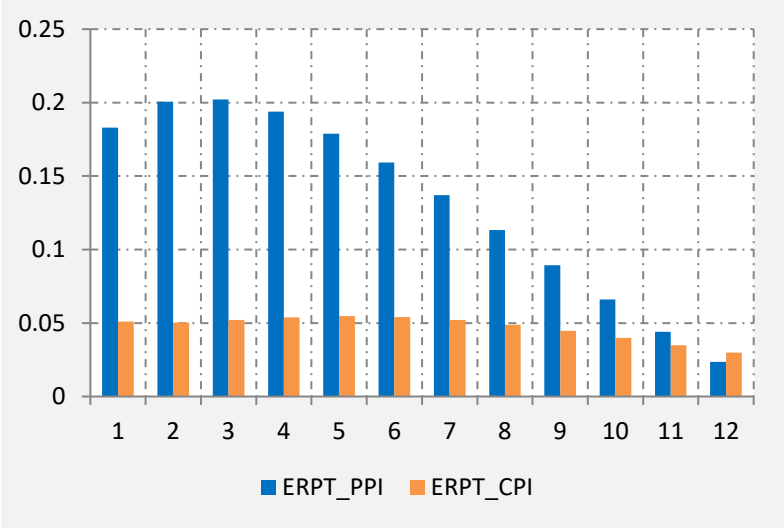


Author estimation

4.3.3. Exchange rate pass through -ERPT

We also used ERPT coefficient to measure how responsive inflation rate to changes in exchange rate. In the early 5 month, exchange rate pass through on PPI is 20 percent and 5% on CPI. One percent increases/decrease in the exchange rate will remain increase/decrease in annual inflation 0.05. After effect of Exchange rate shocks on inflation decrease, inflation changed about 55% (see figure 10).

Figure 10. Impulse Response of Exchange Rate Annual Growth.



Author estimation

4.3.4. Variance Decomposition

Impulse response fictions are useful to tell the direction and magnitude of shocks. Meanwhile variance decomposition tells us the amount of the shock. The exchange rate shocks appear to be important in explaining the composition of PPI inflation than CPI inflation. PPI is explained predominantly by its own innovative shock accounting 33% in the first two months and then it declines. As we saw in the impulse response fiction, it is significant until the 9 months, thus the exchange rate shocks explain

about 50% in the first two month and until 9 months the inffluence is decrease about 36% (see table 10).

Table 10. Variance decomposition of PPI annual growth

	Variance Decomposition of Y_PPI:				
Period	Y_OIL	Y_OUTGAP	Y_EX	Y_PPI	Y_CPI
2	14.01	0.72	51.41	33.85	0.00
8	31.72	4.13	36.38	17.88	9.89
12	26.76	4.23	41.05	13.75	14.20
24	25.40	3.69	45.04	11.96	13.92

Author estimation

CPI is explained its own innovative shock accounting 76.63% in first two months and after that it declines. Exchange rate shock explains CPI variance about 17% in first 8 months. CPI in general explains its own inertia and mostly explains exchange rate fluctuation (see table 11).

Table 11. Variance decomposition of CPI annual growth

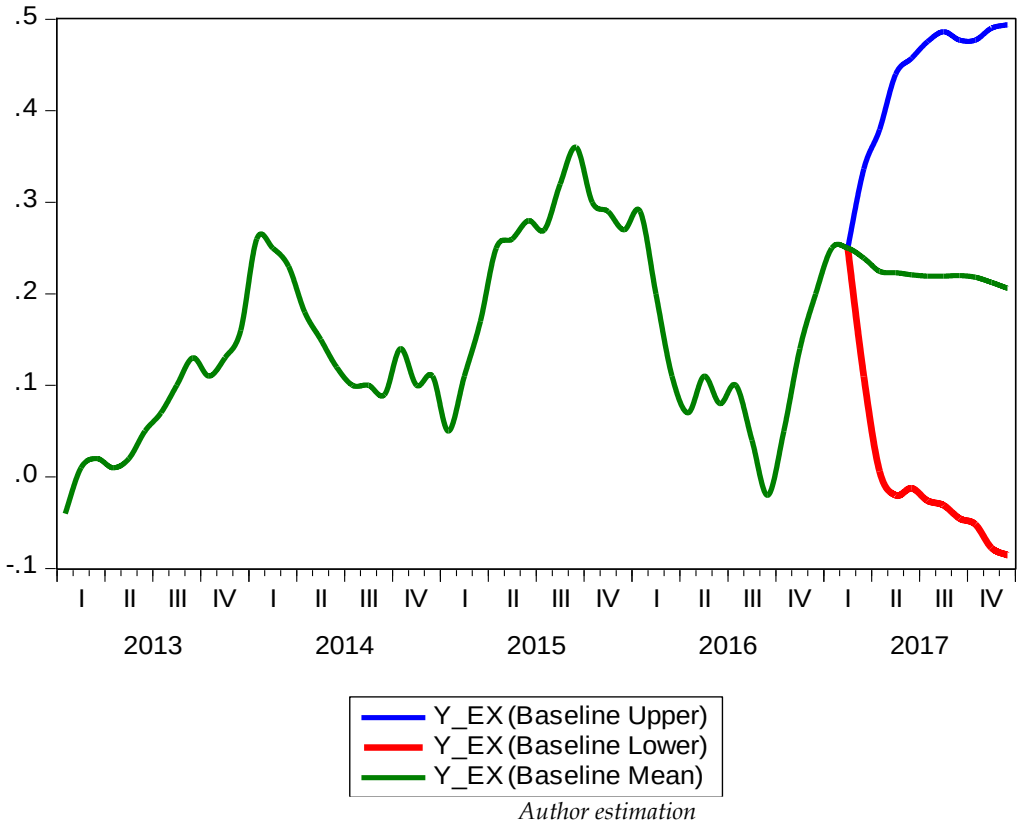
	Variance Decomposition of Y_CPI:				
Period	Y_OIL	Y_OUTGAP	Y_EX	Y_PPI	Y_CPI
2	4.05	3.65	10.17	5.50	76.63
8	17.93	2.14	16.46	5.17	58.30
12	25.16	2.02	16.34	4.57	51.91
24	24.50	2.08	19.71	4.56	49.16

Author estimation

4.3.4. Forecast of SVAR

After explaining SVAR analysis results, the forecast of exchange rate can be described on the figure 4.11. The last calculating of exchange rate is on March 17, 2017 with value 3.67 TL. Then the exchange rate from April to June is expected to decline until 3.56 TL. However, until in the end of the year, the exchange rate slowly increases to 4.22 TL (see figure 11).

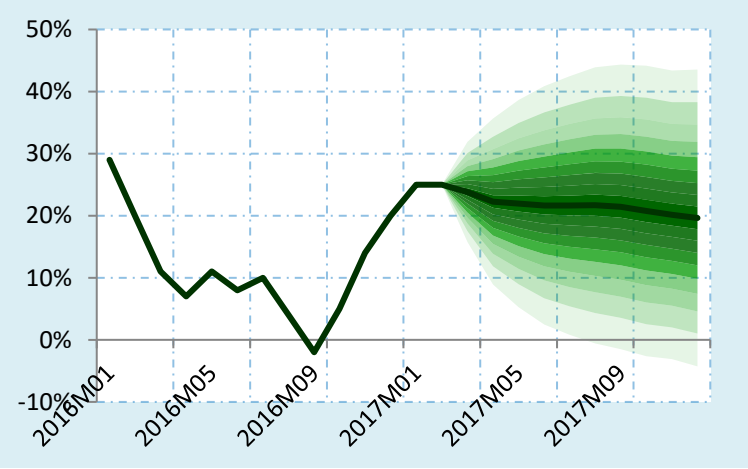
Figure 11. Forecast of Exchange Rate Annual Growth.



Author estimation

By the estimation result of Root Mean Square (RMSE) and Mean Absolute Error (MAE), it is posible to choose which model of the exchange rate would be the best in explaining of the exchange rate forecast. SVAR analysis of CPI variable's RMSE and MAE give result with value 0.1306 and 0.1061 respectively (see figure 12).

Figure 12. Months Ahead SVAR model Forecast of Turkish Lira Using Fan Chart.



Author estimation

4.4. Comparison of Forecasts

After analysing several techniques to forecasts the exchange rate , we compare which models would give the most accurate on forecasting the exchange rate. The figure 4.13. Shown the comparison of exchange rate forecast results. We had analyzed forecasting of exchange rate in 5 months, start from April, and 2017 through September, 2017.

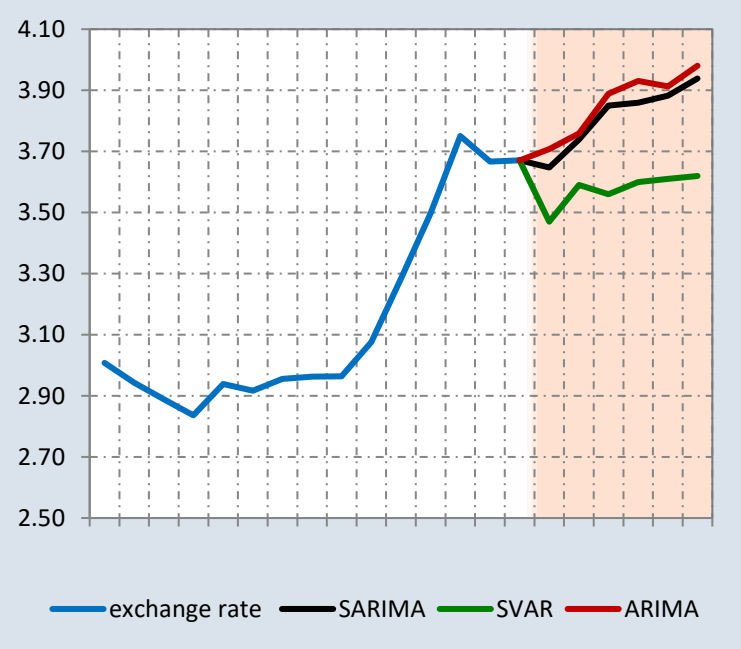
In the first month of forecasting or in April, all the models are expecting that exchange rate will continue to decrease as like the months before. SVAR give value the exchange rate forecasting about 3.47. However, SARIMA and ARIMA give values 3.65 and 3.71 in respectively. Moreover, the forecast of SARIMA has a value exchange rate nearly same with the actual value of the exchange rate (3.65) in April, 2017.

In April, 2017, SARIMA and SVAR also give the same trend of fluctuation in exchange rate due to the declining of current exchange rate. However ARIMA's forecast tends to increase and different with two models.

All the models expected to the rise in the exchange rate after April, 2017 and until September, 2017. ARIMA and SARIMA give a value of exchange rate 3.98 and 3.93 respectively. However, SVAR give more less value about 3.62 (see figure 13).

The forecast result by our 3 models expecting that Turkish Lira is continuing to rise untill the end of 2017. Since the developing countries includes Turkey has experienced slow on its economic growth, it might lead to increase more capital ouflow from developing countries in future. Problem of refugees also create such political instability in Turkey and it will effect Turkish economy reform in the future. Political insatbility was one of the reaason to decline tourism in the country as tourism sector is the sources of the huge foreign reserve in the Turkey. Because of week tourism season, failed coup attempt, and the contraction of Russian trade caused more deficit in the Current Account. Moreoever, net international investment possition will continue to deteriorate until there will be reduction in the current account deficit .

Figure 13. Comparison of Forecast Models



Author estimation

With the aim of checking which model are more appropriate for checking the volatility because applying one technique is not appropriate as advised by Bollerslev et al. (1994), Diebold and Lopez (1996) and Lopez (2001) we applied Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) analysis, we can conclude that SARIMA become more accurate to forecast the exchange rate since it has RMSE and MAE value low and close to zero. However, in case of SVAR model, the CPI variable's RMSE and MAE has a lower value than SARIMA's RMSE and MAE.

$$MAE_1 = n^{-1} \sum_{t=1}^{n} |actual - Forecast|$$

So generalized form is

$$MAE_1 = n^{-1} \sum_{t=1}^{n} |\sigma_t - h_t|$$

$$RMSE = \sqrt{n^{-1} \sum_{t=1}^{n} (\sigma_t - h_t) \text{ ^2}}$$

Table 12. Error Statistic for ARIMA, SARIMA, and SVAR

	ARIMA	SARIMA	SVAR
Root Mean Square Error	0.030807	0.026	0.1306
Mean Absolute Error	0.026144	0.0229	0.1061

Author estimation

CONCLUSION

This study has evaluated a large number of volatility model in terms of their ability to forecast the daily and monthly volatility of Turkish Lira against US Dollar. The forecasting of the volatility of the TL/USD has been measured by using ARMA, ARIMA, SARIMA, and SVAR model. We also applied ARCH, GARCH, EGARCH model to check the autocorrelation pattern and volatility shocks is positive or negative. Forecasting exchange rate for next 3 months by using ARIMA (4,1,5) model expecting that the exchange rate will increase in the next three month until TL 3.88. With SARIMA forecasting, exchange rate will rise with interval confidence 3.5-4.5 in the next 3 months and with interval confidence 3.4-4.5 in the next 6 months. The result of SVAR model divided into 3 parts. CPI and PPI responses on exchange rate shocks increase until 5 months but the responses are lost its effect in ninth month. However, exchange rate shock is more pronounced to PPI as compare to CPI. Exchange rate pass through (ERPT) on PPI is 20% and on 5% on CPI. Variance decomposition ensued that PPI and CPI explained predominantly by its own shocks accounting 33% and 76.6% respectively. Forecasting the exchange rate through SVAR, exchange rate expected to decrease until 3.56 in the months of April-June and in the end of the year exchange rate slowly rise until 4.22.

Thus in the end of our analysed, we evaluated 3 models of forecasting, ARIMA, SARIMA, and SVAR. The result from SVAR and SARIMA suggested that From March 2017 to April 2017 the exchange rate will depreciate but after that on May, 2017 to September, 2017 appreciation in exchange rate and more devaluation in the Turkish lira. The forecast comparison by RMSE and MAE also predict that SARIMA model forecast more accurate than other models.

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CEPSS

Economic Valuation of Goods and Services Provided by Pine Forest Ecosystems in Pakistan

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ABSTRACT: Pine Forest represents the most significant natural asset values. Natural forest goods and services can be consumed as foods, timber, and non-timber forest products directly or indirectly-by getting benefits from clean air, water, soil protection, and environmental sustainability. Similarly, forest ecosystems also contribute in the form of intangible values such as sociocultural, scientific, religious, and natural inheritance to the forthcoming generations. Both the market and non-market values of natural forests are of prodigious standing for human life. In this paper, the attempt is made to evaluate the economic values of forest environmental assets, goods, and services provided by the Pine forest in Pakistan using the latest tools and techniques (GIS, Remote Sensing, and Socioeconomic survey). The Pine forest in the study region is rich in values, it contributes $ US 11.66 million (Pakistani Rupees 1883.03 million) in the form of forest goods. Forests services contributes a total of $ US 1621.59 million (261885 million PKR). The services further divided into two sub-groups; environmental services and socio-cultural services. The contribution of environmental services is $ US 1341.25 million while the socio-cultural values are $ US 280.32 million. In total, the pine forests contribution to local, regional, and the global community are of $ US 9156.79 million (PKR 1480275 million).

KEYWORDS: Environmental sustainability; forest products; Forest Service**;** Economic value of Forest; Pakistan

INTRODUCTION

Pine forest ecosystem goods and services, and the natural capital stocks are produced to make them significant due to their direct and indirect contributions to national economies and human welfare. There have been many attempts to value these contributions both globally and regionally. In the past two decades, a good deal of progress has been achieved in developing valuation methods for forest ecosystem services and promoting their inclusion in national economic accounts.

In Pakistan, the valuation of forest ecosystem goods and services is one of the most untouched topics. Most of the research has been done on the distribution and management of forest with a rising number of studies at national, provincial, and local management unit levels (Tufail et al, 2020: Ahmad and Abbasi 2011; Ahmad et al, 2012; Nazir and Olabisi 2012, Tariq et al, 2014). Many of those have been carried out with different scales, perspectives, purposes and using different valuation concepts and methods. However, they have come up with widely varying results.

Pine forest in Pakistan is mostly found in the North-West of the countryside and generally governed by governments and communities. Out of four Pine forest districts, district Chitral is under the management of Khyber Pakhtunkhwa Provincial government and District South Waziristan is managed by the local community while district Shirani belongs to the local community and District Diamer by the Gilgit Baltistan Provincial Governments. The total area of these four forest districts is 28069 Km^2. The districts have been facing rapid population growth. At the end of 2017, the total number of residents was 1.42 million (Pakistan Population Census 2017). Due to the remoteness of the districts, the region is facing high illiteracy and highly dependence on agricultural and forest-based income generation activities.

Pine natural Forests have a critical role in the ecology, aesthetics, and socio-economic development of the localities and regions. Pine forest in Pakistan mixed with other tree species are spread over a total of 365564-hectare area, where 177324 hectares of Pine forest mixed with other tree occur in Diamer Gilgit, 95647 hectares of mixed Pine forest in South Waziristan, 63241 hectares mixed forest of Pine in Chitral, and 29172 hectares of pure Pine stand in Shirani District (from the District Forest Office of the each District). These forests are very rich in biodiversity, hosting a variety of fauna and flora.

This report is an attempt to estimate the full market and non-market values of these forests, using the latest field survey data on Pakistan Pine forest resources and secondary data from government departments. Unlike most other valuation studies, it includes an analysis of the distribution of the benefits from forest goods and services among economic sectors and local, regional, and global beneficiaries.

There are naturally many limitations to both the current and previous studies, many of which are pointed out in this report, and it is recognized that experts are unlikely to reach a consensus on nonmarket values. Such efforts are nevertheless important to help raise awareness of the multifunctional roles of forest ecosystems and can ultimately contribute to the conservation and sustainability of forest resources.

RESEARCH METHODOLOGY

2.1. Study Framework

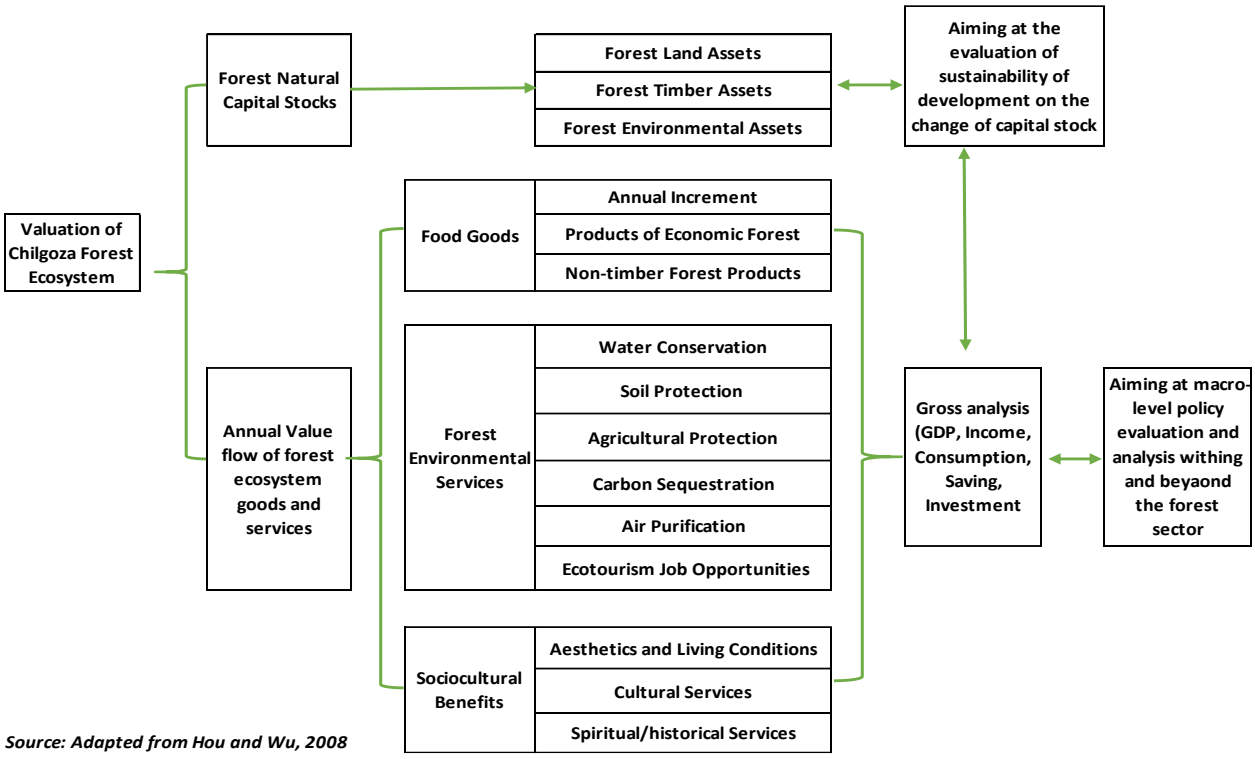
This study applies an updated framework for the valuation of forest ecosystems proposed by Hou and Wu (2008) concerning authoritative international documents in the field (Tufail et al, 2020: Eurostat, 2002a, 2002b; United Nations et al., 2003; Millennium Ecosystem Assessment, 2003; FAO, 2004).

The framework distinguishes between assets (natural capital stocks) and production (the flow value of forest goods and services), which have generally been mixed in other valuation studies globally. Change in the former indicates whether forest management is sustainable or not. Later is what should be counted in GDP (Gross Domestic Product) or green GDP.

In this framework, the benefits people obtain from forests are classified into three categories: forest goods, environmental services, and sociocultural benefits. Forest environmental services have been included in most studies in the world, but the new framework includes an additional and innovative category, forest environmental assets. This concept differentiates, for example, forest carbon storage (as an asset) from forest carbon sequestration flow (as a service).

The valuation method in this study involved the quantification of all forest ecosystem services and goods. The main methods used to value these amounts were the market value or (replacement costs, productivity loss, cost of illness, etc.) benefit transfer methods.

Figure 1: Study Framework



Source: Adapted from Hou and Wu, 2008

2.2. Valuation Categories

Forest natural capital

Forest land Assets: Forest land, one of the most important economic assets, is generally valued based on market transactions, either directly (e.g. using market prices for bare forest land) or as a ratio of the value of exchanged forest property. In this study, forest land was categorized into five types (forested land, open forest land, shrubland, nursery land, and bare forest land) and valued according to the prices of each type. A stratified sampling method has been applied to investigate the transaction Prices for different types of forest land in the Study area.

Standing Timber Assets: A simple stumpage value method was used for the valuation of standing timber. Stumpage prices by species and diameter were taken from existing transactions in the study area. In the latter case, the prices were adjusted using the ratio of the consumer price index for the area of origin (and other conversion factors as needed). These prices were applied to the stock according to its species and diameter composition.

Forest environmental Assets: The environmental assets considered in the study were forest carbon stock and forest wildlife. Estimates of forest carbon stock and stock changes were calculated based on growing stock and net increment using the biomass expansion factor (BEF) of the Intergovernmental Panel on Climate Change (IPCC, 2004). The value of forest carbon stock assets was calculated by multiplying forest carbon stock by the carbon price derived from the carbon project in Beijing forest (178 Yuan or US$23 per ton CO_2, 2007). The value was converted into rupees and dollars using the current exchange rate (April 2020).

Forest goods

Annual increment of standing timber. The value of the annual increment of the forest stand was estimated by the stumpage value method using the annual increment by species and age classes and the corresponding stumpage prices per cubic meter by species.

Products of economic forests. The market value method was used to estimate the value of fresh fruits, nuts, and flour products from economic forests, i.e. forests of economic value including those that have been specifically planted for these products. The production data were taken from the local farmers and the prices came from market surveys and direct observations.

Non-timber forest products (NTFPs). The value of the main non-wood forest products (wild medicinal materials, mushrooms, wild vegetables, bee products, and hunting, as well as tree breeding and planting, which are listed as NTFPs in Pakistan forestry statistics) was calculated using the market value method. Production data for these products were from a survey conducted in the study regions.

Forest Ecosystem Services

Water Conservation. "Green reservoir" services of forested watersheds include the capture and storage of water (contributing to the quantity of water available during the dry season) and the purification of water through the filtering of contaminants and the stabilization of soils. The total value of water conservation services was estimated based on the water regulating capacity and the cost of supplying water for the city (which includes the sewage treatment fee).

Water quantity was estimated by the water balance method, using the forest area and rainfall data to get the total water input into the catchments and subtracting evapotranspiration and surface runoff for each forest type. The maximum water quantity regulating capacity was equal to the total storage capacity of the catchment forests, and its value was estimated using the replacement cost method (using the cost of establishing a conventional water reservoir in Pakistan).

Soil protection. Forest vegetation helps stabilize soils, reduce surface erosion and sedimentation, and maintain soil fertility. The estimated value of soil stabilization primarily reflects the costs associated with sediment clearance, calculated with the replacement cost or avoided cost method, using the average cost for sediment dredging in the study area. The value of soil fertility protection was estimated by applying the market value method, assumed that the forested soil around the study area contains on average around (two) 2 percent compound fertilizer (Yu and Wang, 1999) and using the observed market price of compound fertilizer in 2020.

Agricultural protection. The study focused on the increased crop production benefits provided by forest shelterbelts. The market value method was adopted to estimate this value based on the increase in crop production, the area of cropland with forest shelter, and the price of the crop.

Carbon sequestration. Annual carbon sequestration was estimated using the net primary production of forest stands and the soil carbon sequestration by type of forest stand. Again, the carbon price was taken from the forest carbon project in the Beijing forest.

Forest ecotourism. The travel cost method has often been used to estimate the value of forest ecotourism. Because of limited time and funding, the present study applied the results from other research such as; the ecotourism value estimated by (TEEB Climate Issues Update 2009). This value was multiplied by the total forest area used for ecotourism to estimate the total value of forest ecotourism.

Biodiversity conservation. The study adopted the average per-hectare value of forest biodiversity conservation for the Beijing area estimated by Zhang (2002) using the opportunity cost method, multiplied by the forest area of Beijing.

Employment Opportunities. Employment creation was considered as a social rather than an economic benefit because the capacity of forests to provide traditional employment in remote communities was more important than the strictly economic benefits of employment creation since employment opportunities are very low in the study area. The analysis covered direct and indirect employment, using data on personnel and wages from the local markets.

Table 1. Data and Variables Measurements

Assessments of Environmental Goods and Services (Variables used)					
Topic	**Statistics and Related Information**		**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Forests	a.	Forest area		▪ By forest type ▪ National ▪ Sub-national ▪ By dominant tree species ▪ By ownership	FAO Global Forest Resources Assessment (FRA) ▪ UN Forum on Forests (UNFF) Monitoring, Assessment and Reporting (MAR) ▪ Montreal Process (Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests)
		1. **Total**	Area		
		2. Natural	Area		
		3. Planted	Area		
		4. Protected forest area	Area		
Use of forest land	b.	Use of forest land			
		1. **Area deforested**	Area		
		2. Area reforested	Area		
		3. Area afforested	Area		
		4. *Natural growth*	Area		
Timber resources	a.	Timber resources		▪ By type of product (timber, industrial Roundwood, fuelwood, etc.)	▪ SEEA Central Framework (2012) ▪ FAO ▪ Central Product Classification (CPC)
		1. **Stocks of timber resources**	Volume		
	b.	Forest production	Volume		
	c.	Fuelwood production	Volume		
Water resources	a.	The inflow of water to inland water resources		▪ Regional	▪ UNECE Standard Statistical Classification of Water Use (1989) ▪ UNSD: Environment Statistics Section-Water Questionnaire
		1. **Precipitation**	Volume		
		2. **Inflow from neighbouring territories**	Volume		
	b.	1. **Evapotranspiration**	Volume		
		2. Outflow to neighbouring territories	Volume		
		3. Outflow subject to treaties	Volume		
	c.	Inland water stocks		▪ Regional	
		1. Surface water stocks in artificial reservoirs	Volume		
		2. Surface water stocks in lakes	Volume		
		3. *Surface water stocks in rivers and streams*	Volume		
		4. *Surface water stocks in wetlands*	Volume		
		5. *Surface water stocks in snow, ice and glaciers*	Volume		
		6. Groundwater stocks	Volume		
Biodiversity	a.	Forest biomass		▪ Regional	▪ FAO Global Forest Resources Assessment (FRA)
		1. Total	Volume		
		2. *Carbon storage in living forest biomass*	Mass		

RESULTS AND DISSCUSSION

The Pine forest mixed with other tree species is distributed on over 359,392 Ha, in the four project sites which are shown in graph 2. District Diamer Gilgit Baltistan has the highest (177324 ha) forest area in the region followed by District South Waziristan and District Chitral while District Shirani in the West has the lowest but pure Pine forest area. Besides the distribution of these Pine forests, District Shirani found the leading producer of pine nuts having the annual value of 4553 million Pakistani rupees (28.19 million US dollar) followed by District Diamer Gilgit Baltistan having a net worth of 599 million PKR (3.71 million US$) of producing pine nuts annually. Pine forest in South Waziristan producing pine nuts having a total annual value of 150 million PKR (0.93 million US $) while District Chitral Pine production net worth is 85 million PKR (0.53 million US $). Graph 3 shows district wise the total production of pine nuts.

Figure 2: Forest Area of Four Project sites

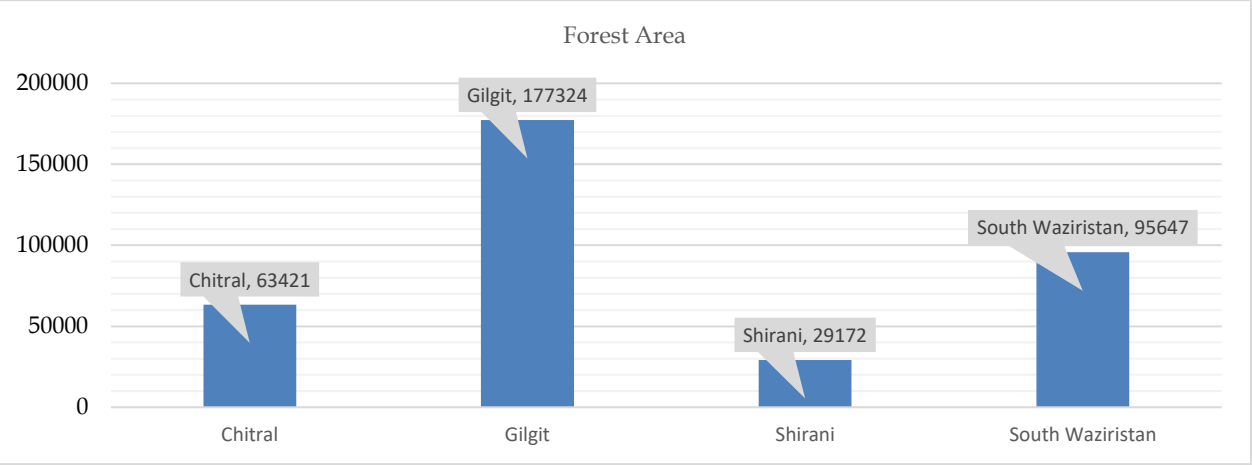
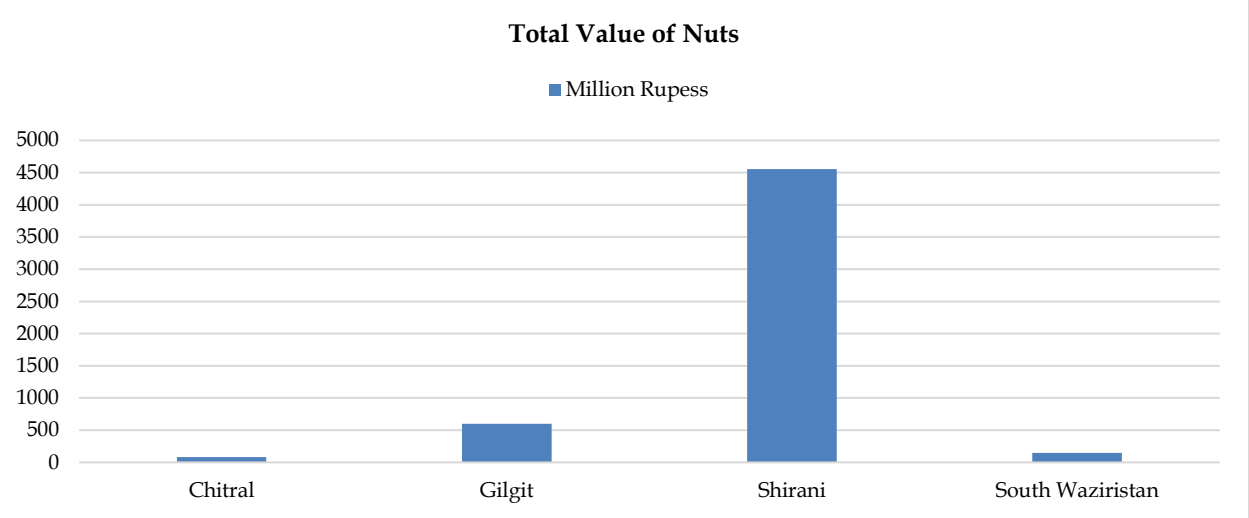


Figure 3: Total Value Nuts in Four Project Sites



Forest Biomass, Carbon Stock, and Value of Carbon Stock

The total biomass and carbon stock were calculated using the biomass expansion factor (BEF) of the Intergovernmental Panel on Climate Change (IPCC, 2004). The total calculated forest biomass stock in the study region was 93.07 Tg (46537670.08Mg), in

which the Diamer Gilgit Baltistan accounts 45.94Tg South Waziristan 24.77 Tg, Chitral 16.42 Tg, and Shirani 5.95 Tg. Similarly, the total carbon stock was calculated for the study region was 46.53 Tg in which the highest carbon stock found in Diamer followed by South Waziristan, Chitral, and Shirani.

Figure 4: Total Biomass and Carbon Stock

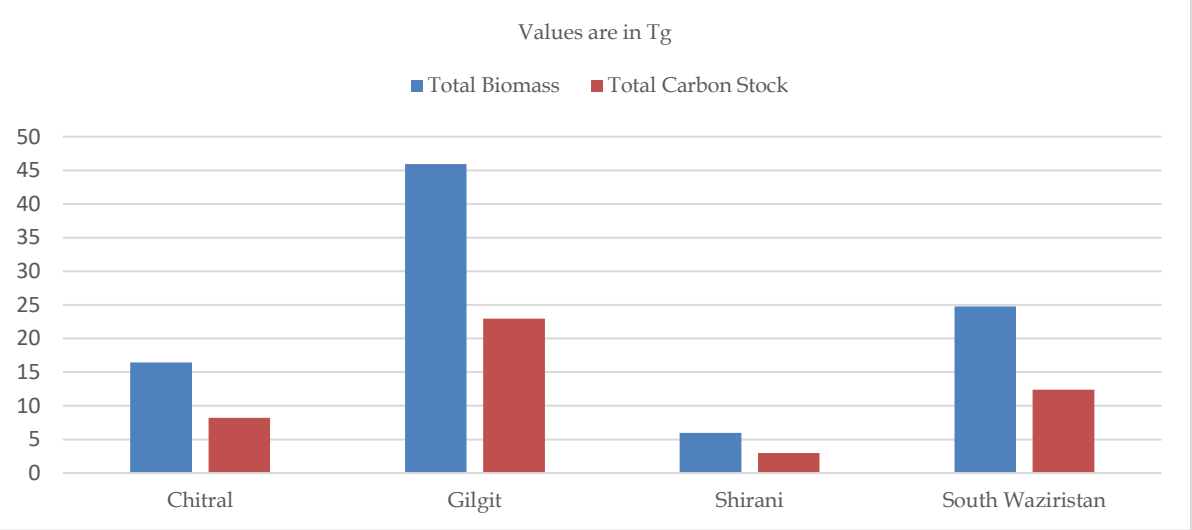
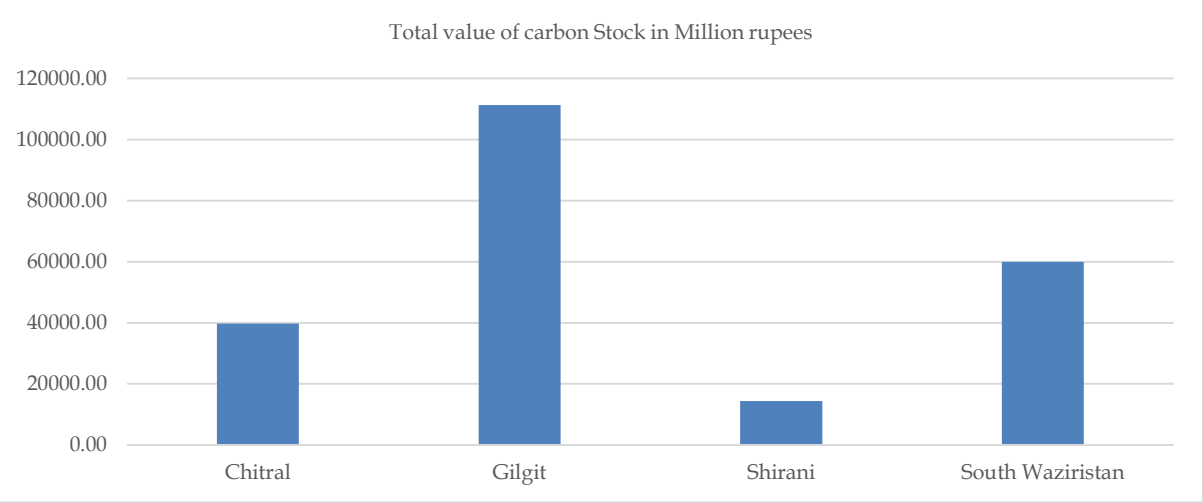


Table 4 shows value of total forest carbon stock assets in each district was calculated by multiplying the forest carbon by the price of carbon derived from the project in Beijing, 2007 (3715 rupees or US$ 23 per ton CO_2). Graph 5 represents the value of forest carbon stock in each district. Diamer Gilgit Baltistan has the highest value of forest carbon stock approximately 111249.36 million rupees (688.85 million US$) followed by South Waziristan which has 60006.92 million PKR (371.56 million US$). The value of total forest carbon stock for Chitral and Shirani was 39789.01 million PKR (246.37 million US$) and 14429.72 million PKR (89.35 million US$) respectively.

Figure 5: Total value of Carbon Stock

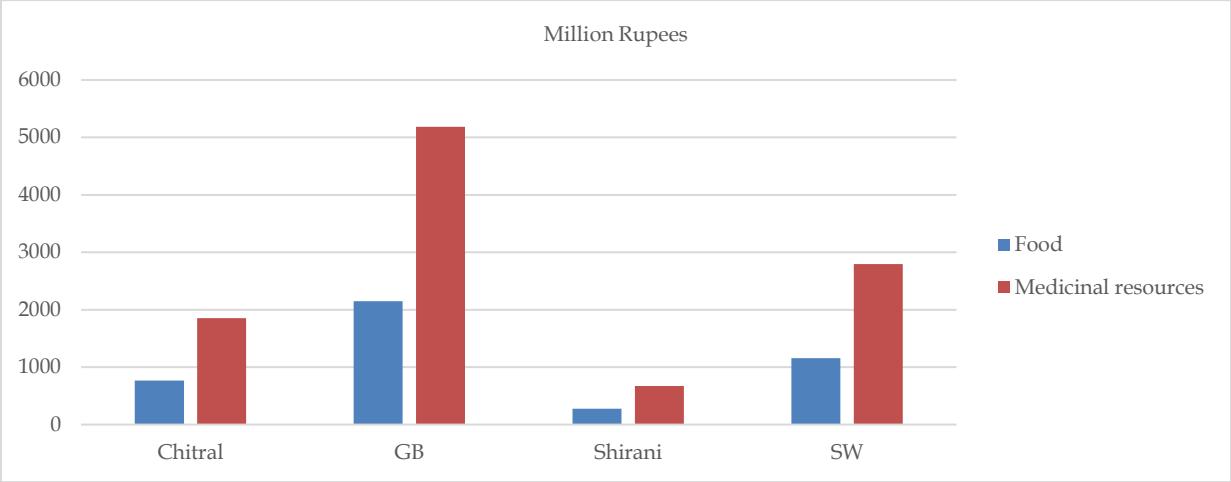


Food, Medicinal Resources, Water, and Climate Regulation

Pine forest annual contribution to food and medicinal resources are given in graph 6. Pine forest contributes a total of 4353.14 million PKR (US$ 27.42 million) in food and 10505.57 million PKR (US$ 66.17 million) in medicinal resources. District-wise

distribution of Pine forest shows that its contribution to Diamer is the highest which is 2147.84 million PKR (US$ 13.29 million) in food and 346875.5 million PKR (US$ 32.10) million in medicinal resources followed by South Waziristan, Chitral, and Shirani.

Figure 6: Valuation of Food and medicinal Resources



Pine forested watersheds include the capacity of capturing and storage of water which contributes to water availability during the dry season and the purification of water through the filtering of contamination and stabilization of soils. These forests contribute a total of 8299.98 million PKR (US$ 52.28 million) in water availability, 10253.40 million PKR (US$ 64.70 million) in water purification, and 78936.85 million PKR (US$ 497.17 million) in water flow regulation to the study region. District wise contribution of Pine forest to water resources is given below.

Figure 7: Contribution of Pine Forest to Water Resources

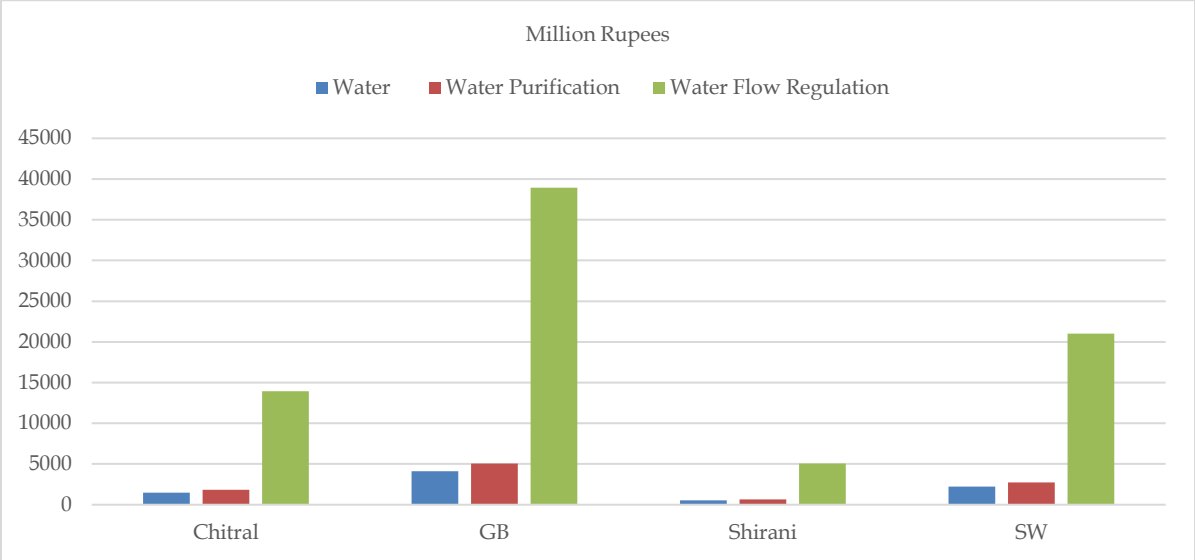
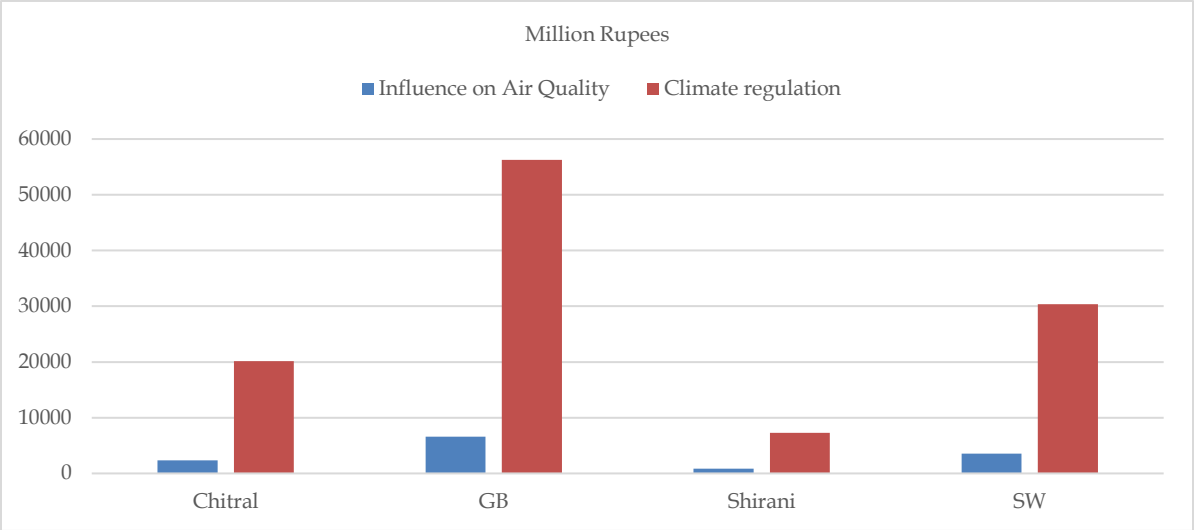


Figure 8: Contribution of Pine Forest to Air Quality and Climate Regulation



Pine forest influence on air quality and climate regulation is given in graph 8, which indicates that the Pine forest has high environmental values. Contributing a total of 13349.62 million rupees (US$ 84.08 million) under the influence on air quality while 114052.15 million rupees (US$ 718.33 million) when climate regulation takes place. The value for air quality and climate regulation is derived using the values from (TEEB Climate Issues Update 2009). District wise contribution of Pine forest for air quality and climate regulation is given in Figure 8.

District wise valuation of Pine Forest

District Chitral

Table 2: Annual Value of Pine Ecosystem District Chitral

Districts Chitral	Marketable		Non-Marketable		Total	
Output	Million Rupees	Million US Dollar	Million Rupees	Million US Dollar	Million Rupees	Million US Dollar
Pine Forest Goods	85.00	0.53			85.00	0.53
Forest Ecosystem Services (a & b)	5899.68	36.53	40314.45	249.63	46214.12	286.16
a Environmental Services	1813.65	11.23	36411.79	225.46	38225.44	236.69
b Sociocultural Benefits	4086.75	25.30	3902.39	24.16	7989.14	49.47
Forest Capital Stock	126842.00	785.40	39789.01	246.37	166631.01	1031.77
Total	***138727.07***	***858.99***	***120417.63***	***745.62***	***259144.71***	***1604.61***

Note: the conversion to the dollar was done using April 2020 exchange rate

The flow value of the annual output of Pine forest ecosystem goods and services of district Chitral is nearly 46299.12 million Pakistani rupees (286.69 million US$). In which Pine goods contribute 85.00 million rupees (US$ 0.53 million) while Pine services contribute 46214.12 million rupees (US$ 286.16 million). The contribution of services further divided into environmental services and sociocultural benefits. Pine forest environmental services output both marketable and non-marketable reach 38225.44

million rupees (US$ 236.69 million). Among the forest environmental services, water conservation and air purification had the most important role. The value of Pine forest capital stock of district Chitral reached 166631.01 million rupees (US$ 1604.61 million). In which marketable resources account for 126842.00 million rupees (US$ 785.40 million) and non-marketable capital stock 39789.01 million rupees (US$ 246.37 million).

District Diamer Gilgit Baltistan

Table 3: Annual Value of Pine Ecosystem District Diamer Gilgit Baltistan

Districts Diamer	**Marketable**		**Non-Marketable**		**Total**	
Output	**Million Rupees**	**Million US Dollar**	**Million Rupees**	**Million US Dollar**	**Million Rupees**	**Million US Dollar**
Pine Forest Goods	599.36	3.71			599.36	3.71
Forest Ecosystem Services (a & b)	16495.39	102.14	112718.48	697.95	129213.87	800.09
a Environmental Services	5068.90	31.39	101807.47	630.39	106876.37	661.77
b Sociocultural Benefits	11426.49	70.75	10911.01	67.56	22337.50	138.31
Forest Capital Stock	354648	2195.96	111249.36	688.85	465897.36	2884.81
Total	***388238.14***	***2403.95***	***336686.33***	***2084.75***	***724924.46***	***4488.70***

Note: the conversion to the dollar was done using April 2020 exchange rate

The annual flow value of the output of Pine forest ecosystem goods accounts for 599.36 million rupees (US$ 3.71 million) and services 129213.87 (US$ 800.09 million) of district Diamer. The contribution of services is further divided into environmental services and sociocultural benefits. Pine forest environmental services marketable values 5068.90 million rupees (US$ 31.39 million) and non-marketable values 101807.47million rupees (US$ 630.39 million). The value of the Pine forest capital stock of district Diamer is 465897.36 million rupees (US$ 2884.81 million). In which marketable resources account for 354648 million rupees (US$ 2195.96 million) and non-marketable capital stock 111249.36 million rupees (US$ 688.85 million).

District Shirani

Table 4: Annual Value of Pine Ecosystem District Sherani Baluchistan

Districts Shirani Output	Marketable		Non-Marketable		Total	
	Million Rupees	Million US Dollar	Million Rupees	Million US Dollar	Million Rupees	Million US Dollar
Pine Forest Goods	4552.50	28.19			599.36	3.71
Forest Ecosystem Services (a & b)	2139.88	13.25	14620.27	90.53	16760.15	103.78
a Environmental Services	657.47	4.07	13205.05	81.77	13862.51	85.84
b Sociocultural Benefits	1482.09	9.18	1415.22	8.76	2897.31	17.94
Forest Capital Stock	46000.00	284.83	111249.36	688.85	157249.36	973.68
Total	***52692.38***	***326.27***	***125869.63***	***779.38***	***174608.87***	***1081.17***

Note: the conversion to the dollar was done using April 2020 exchange rate

The total flow value of the annual output of Pine forest ecosystem goods, services, and standing capital stock of district Shirani is almost 174608.87 million Pakistani rupees (1081.17 million US$). In which Pine goods contribute 4552.50 million rupees (US$ 28.19 million) while Pine services contribute 16760.15 million rupees (US$ 103.78 million). Pine forest environmental services output contributes both marketable and non-marketable value of 13862.51 million rupees (US$ 85.84 million) while sociocultural benefits account for 2897.31 million rupees (US$ 17.94 million) both marketable and non-marketable. The value of the Pine forest capital stock of district Shirani reached 157249.36 million rupees (US$ 973.68 million). In which marketable resources account for 46000.00 million rupees (US$ 284.83 million) and non-marketable capital stock 111249.39 million rupees (US$ 688.85 million).

District South Waziristan

Table 5: Annual Value of Pine Ecosystem District South Waziristan

Districts South Waziristan Output	Marketable		Non-Marketable		Total	
	Million Rupees	Million US Dollar	Million Rupees	Million US Dollar	Million Rupees	Million US Dollar
Pine Forest Goods	150.00	0.93			599.36	3.71
Forest Ecosystem Services (a & b)	8897.47	55.09	60799.35	376.47	69696.82	431.56
a Environmental Services	2734.12	16.93	54914.05	340.03	57648.17	356.95
b Sociocultural Benefits	6163.35	38.16	5885.30	36.44	12048.65	74.60
Forest Capital Stock	191294	1184.48	60006.92	371.56	251300.92	1556.04
Total	***200341.47***	***1240.50***	***120806.28***	***748.03***	***321597.11***	***1991.31***

Note: the conversion to the dollar was done using July 2020 exchange rate

The annual contribution of Pine forest ecosystem goods to the local community of district South Waziristan is nearly 150.00 million rupees (US$ 0.93 million). The contribution of services to local, regional, and global community yearly accounts for 69696.82 million Pakistani rupees (US$ 431.56 million). The contribution of services is further divided into environmental

services and sociocultural benefits. District South Waziristan Pine forest environmental services output both marketable and non-marketable accounts to 57648.17 million rupees (US$ 356.95 million). In which marketable environmental services output reach 2734.12 million rupees and non-marketable environmental services 54914.05 million rupees. The Pine forest's sociocultural contribution to the local community both marketable and non-marketable accounts for 12048.65 million rupees (US$ 74.60 million). The value of Pine forest capital stock of district South Waziristan is almost 251300.92 million rupees (US$ 1556.04 million). In which marketable resources account for 191294.00 million rupees (US$ 1184.48 million) and non-marketable capital stock 60006.92 million rupees (US$ 371.56 million).

CONCLUSION

Unless most forest values are recognized through institutionalized valuation methods, forests as a land use will not get the societal attention needed to make them an integral part of a sustainable global economy. Many attempts in this direction have been made across the globe, but because of the wide differences in concepts and methods, the many estimates of forest ecosystem goods and services made in the past have been inconsistent and not amenable to meaningful comparison across services and periods.

As natural capital and ecosystem services become more stressed in the future, on account of both greater demand and reduced supplies (in part due to changing climate), their value can be expected to increase. Given the huge uncertainties involved, it may never be possible to have a precise estimate of the value of ecosystem services. Nevertheless, even crude estimates provide a useful starting point with implications for decision and policymaking.

To a full evaluation of the Pine forest contribution to local, regional, and global communities the study further recommends a joint approach of a high technological survey (GIS and Remote Sensing) and field survey of the households living in the peripheries of Pine forest. The study has certain limitations ranging from a field visits to funds availability. As the four project sites are very remote and traveling to each site is very time consuming and high costly, therefore based on this report a detailed study by a multi-disciplinary team is proposed

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