REAL EXCHANGE RATE AND EXPORT IN NEPAL

A Thesis

Submitted to the

Central Department of Economics,

Faculty of Humanities and Social Sciences,

Tribhuvan University, Nepal,

in Partial Fulfillment of the Requirements for the Degree of

MASTER OF ARTS

in

ECONOMICS

By

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November 2021

DECLARATION

I, BIPIN KHADKA, declare that this thesis entitled REAL EXCHANGE RATE AND EXPORT IN NEPAL submitted to Central Department of Economics is my original paper, and it does not contain any or full part of anyone's intellectual property, except otherwise mentioned. All sources of information have been specified acknowledged by reference to the author(s) or institution(s). This paper is my firsthand own creation, and it has not been submitted, published, or broadcasted earlier, than this, with my consent.

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RECOMMENDATION LETTER

BIPIN KHADKA has authored this thesis paper entitled 'REAL EXCHANGE RATE AND EXPORT IN NEPAL with my direct supervision and supervision. Mr. Khadka has prepared this thesis article for the partial fulfillment of a MASTER DEGREE OF ARTS IN ECONOMICS (MA ECONOMICS). I hereby recommend this commendable work to the thesis committee for further process of scrutiny.

…….

Resham Thapa-Parajuli, Ph.D.
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APPROVAL LETTER

This is to certify that this thesis entitled 'REAL EXCHANGE RATE AND EXPORT IN NEPAL' submitted by MR. BIPIN KHADKA to the Central Department of Economics, Faculty of Humanities and Social Sciences, Tribhuvan University, Nepal in partial fulfillment of the requirements for the Degree of MASTER OF ARTS in ECONOMICS (MA ECONOMICS) has been found satisfactory in scope and quality. Therefore, here mentioned thesis committee accepts this thesis as a part of the stated degree.

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ACKNOWLEDGEMENTS

I, BIPIN KHADKA, have prepared this thesis paper entitled REAL EXCHANGE RATE AND EXPORT IN NEPAL for the requirement of partial fulfillment of MASTER OF ARTS IN ECONOMICS (MA ECONOMICS), Tribhuvan University, Nepal.

First and foremost, I would like to express my hearty gratitude to my thesis supervisor Resham Thapa-Parajuli, Ph.D., for being my torch-bearer during my thesis work and beyond. In this way, I am indebted to Prof. Shiva Raj Adhikari, Ph.D., for this kind and timely suggestion in the way while accomplishing my task. The credit also goes to faculty members and staff who persistently encouraged me to boost my inner strength while I was there in the Central Department of Economics, Kirtipur, Kathmandu.

It is my pleasure to have my friend, Jeevan Pokhrel, by my side during this thesis and in my learning process. In addition, my friends, Anil Sharma, Bhuban Chandra Joshi, Manab Prakash Poudel, Hari Krishna Poudel, Pampha Sharma, Naba Raj Bhatta, and Janak Raj Upadhyay helped me technically and emotionally to complete this paper so they also deserve to be hailed in every aspect.

Kind guidance from the teachers to build up my level of confidence and creativity is always in due. At last, I would like to thank all those known and unknown literary persons, scholars, institutions, and organizations from where I get my references to include in this paper.

Bipin Khadka

November 2021

ABSTRACT

This study tries to investigate the degree and directional relation of real exchange rate and its volatility on the real export of Nepal, using OLS estimation, taking 63 observations using quarterly data for the period 2004Q3 to 2020Q1. In addition, this literature empirically studies deploying IV-2SLS framework, the continuing deterioration of the external competitiveness of Nepalese products globally due to appreciation of Nepali currency vis-à-vis IC and USD that is blamed to have been fueled by remittance inflow. Upon empirical analysis, unlike the global weakening link between real exchange rate and volume of export, our finding suggests there is no significant effect of real exchange rate on export of Nepal, at least statistically. Exchange rate volatility has statistically significant and inverse effect on the real export. Expectation of appreciation in real exchange rate yields rise in real export in same direction. For IV-2SLS framework, we treat remittance inflow as endogenous variable and several others as instruments. This results remittance inflow has inverse relation with the real exchange rate. That means there is no traces of remittance induced appreciation of real exchange rate of Nepali rupees. Nepal has an appreciation of REER by a single digit since base year 2010. So, her choice should be export promotion of comparative advantage goods which have high-value low-weight products rather than wasting time and resources in currency devaluation for export. There is dire need of forward-looking and forex hedging market. Since there is no appreciation of Nepali currency induced by remittance inflow, there is no urgency to halt migrant worker rather the policy maker should implement the conducive environment that flourishes the saving and investment habit of remittance receivers.

Keywords: Export, REER, IV-2SLS, External competitiveness, Exchange rate volatility, Remittance

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ADF	–	Augmented Dickey Fuller
ASEAN	–	Association of South East Asian Nations
BoP	–	Balance of Payment
CBS	–	Central Bureau of Statistics
CH	–	Cumby-Huizinga
CPI	–	Consumer Price Index
DW	–	Darwin Watson
G20	–	Group of 20
GDP	–	Gross Domestic Products
GMM	–	Generalized Method of Moments
IMF	–	International Monetary Fund
IRs.	–	Indian Rupees
IV	–	Instrumental Variables
IV-2SLS	–	IV-2 Stage Least Square
MA	–	Master of Arts/Moving Average
MoF	–	Ministry of Finance
NC	–	Nepali Currency
NFAR	–	Net Foreign Assets Reserve
NRB	–	Nepal Rastra Bank
NRs.	–	Nepali Rupees
OLS	–	Ordinary Least Squares
PML	–	Pseudo Maximum Likelihood
PP	–	Phillips Perron
PTM	–	Price-to-Market
Q	–	Quarter
QEB	–	Quarterly Economic Bulletin
REER	–	Real Effective Exchange Rate
ROW	–	Rest of the World
SAP	–	Structural Adjustment Policy
SK	–	Skewness Kurtosis
ULC	–	Nominal Unit Labor Cost
US	–	United States
USD	–	United States Dollar
VIF	–	Variance Inflation Factor

CHAPTER 1: INTRODUCTION

1.1 Background of the study

The relationship between exchange rate and export is one of the long-debated topics in economics. After the implementation of the floating exchange rate in 1971 by the Nixon administration in the US, the pattern of trade and its association with exchange rate has been changed, so is the exports. Even if there is a change in the policy variables in the world of uncertainty, the study of exports has been the concern of the study in the research. There is no doubt Nepal too has transfigured the pattern of exports in the international arena. Depreciation of the real exchange rate, according to Marshall Learner condition of currency appreciation, enhances the international competitiveness of domestic goods, boosts net exports, and eventually enlarges domestic GDP (Thapa, 2002). Empirical works of the literature suggest that the real exchange rate is the prime component that affects the volume of exports (Freund & Pierola, 2012; Eichengreen, 2013). Real exchange rate depreciation promotes exports and appreciation of real exchange rate decreases it through the price elasticity of demand approach. Price elasticity of demand is measure of the change in consumption of goods and services to the change in price. However, in the aftermath of the global financial crisis, some episodes of significant depreciation appeared to have had only a minor impact on the export volume, which raised serious doubt about the effectiveness of policies to lower exchange rates (Khachatryan & Grigoryan, 2020).

Unlike many developed countries, Nepal does not have many products that have export competitiveness. According to the Ricardian theory of international trade, one country must focus on the production and export of those goods and services that have comparative advantage. Keeping all these things in mind this paper deals with the real exchange rate and remittance that affect exports of Nepal.

Literatures have found different results like no significant impact, negative significant impact and positive significant impact for the relationship between the exchange rate volatility and the pattern of export. Hall et al. (2010), Chit et al. (2010) and Vieira &

MacDonald (2016) observed the inverse relationship between the exchange rate volatility and volume of export from the empirical analysis over time. Hall et al. (2010) in their paper found that for Emerging Market Economies (EMEs) had not shown a negative and significant effect of exchange rate volatility and volume on exports. Similarly, Tenreyro (2007) and Mordecki & Miranda (2019) concluded that the export had no significant impact to the exchange rate variability. This is because the advantage of hedging firms exists in todays' market and firms can fulfill their speculative motive, for which they are rational and have symmetric information, due to the volatility of exchange (Tenreyro, 2007; Khachatryan & Grigoryan, 2020).

There exists conflicting arguments whether RER caters for export, contesting are the arguments in case of Nepal too. In this context, this research empirically examines the relationship between real exchange rate and exchange rate volatility with real export of Nepal. It seems there is no change in the exchange rate since nominal exchange rate does not account what real effective exchange rate incorporates. Due to this reason the export volume might have significant effect in international market. This work establishes the real change in the value of exchange rate and its association with export. This research work also investigates the possibility of the presence of remittance induced 'Dutch Disease' in Nepal. Recipients of remittances use the huge fund to the family consumption rather than investing in the productive sectors that boosts domestic production and domestic consumption (Thapa, 2020). Remittances might have channeled towards friendly avenues leading to trade deficit.

1.2 Statement of the problem

Literatures suggest that appreciation of real exchange rate diminishes exports and vice-versa (Paudel & Burke, 2015; Hunegnaw, 2017). It holds true in case of the exchange rate volatility and exports. That means some literature also argues that there exists positive relation of exports with the real exchange rate as well as with exchange rate volatility. This is because modern firms have symmetric information, and they take rational decisions based on that information. So, not all firms enjoy hedging, but several firms love speculation on the forex and they even benefit from using the modern days' airtime data and cutting-edge technology (Khachatryan & Grigoryan, 2020). On the other hand,

exchange rate depreciation is not a sufficient condition to improve and increase the export of the country since price competitiveness is only a single element of countries' ability, among other elements, to enhance their external competitiveness (Youssef & Zaki, 2019). Further, Hunegnaw (2017) pointed that depreciation of REER resulted the better off of export of labor intensive products whereas worsen the export of high skilled tech-intensive. As per this paper, countries waste much resource and time for devaluation of domestic currency to boost export. Chit et al. (2010) and Vieira & MacDonald (2016) showed that the exchange rate volatility has a statistically significant negative impact on the export. The bilateral exports flows get influenced by the relative volatility of exchange rate, which could be reduced by stabilizing the exchange rates with the main trading partners (Chit et al., 2010). Hall et al. (2010) concluded there exist positive relation between exchange rate volatility and export. This is because trading firm yields better profit due to availability of hedging instrument and operation of speculation over time.

For the period of our study from 2004 Q3 to 2020 Q1, the real effective exchange rate (REER) increased by 7.35% from 2004 Q3 to the dawn of the global financial crisis, 2008 Q1 whereas exports declined by 15.97% for the same period. The REER diminished by as low as 0.71% from 2008 Q1 to 2015 Q1 but the exports peaked by 19.07% for the same period. Furthermore, the REER increased slightly by 2.64% from 2015 Q1 to 2020 Q1, and the export decreased by 22.86% for the period considered (NRB Quarterly Economic Bulletin 2004 Q3 - 2020 Q1; Author's calculation). The above all three periods favor the theoretical relationship, that is deemed valid, between REER and exports.

Nepal has been on the verge of increasing remittances, from foreign employment, day per day. Thus, received remittances is one of the keys to reducing relative poverty to significantly low. On another dark side of remittance, Nepal has been trapped in the Dutch disease. Consumption expenditure increased on average by 12.48% between 2000/01 and 2010/11, while real GDP growth rate and labor productivity increased by just 3.43% and 1.1% respectively (Sapkota, 2013). This creates inflationary pressure on goods and services since there is a lack of productivity and a cheap labor force is voluntarily expat in search of employment. So, our Nepali products are less competitive

in the international market because of the appreciation of the domestic currency, which is simply termed as Dutch Disease.

With the aim of stabilization of government's program, World Bank granted a sum equivalent of $50 million back in the days of restoration of multiparty democracy in 1987. Among the five crucial clauses of the Structural Adjustment Policy (SAP) (Field & Interim, 2008), one of the very first principal elements of the program include macroeconomic policies to strengthen the country's budgetary and external finances and maintain a realistic exchange rate to promote exports (Field & Interim, 2008). This also depicts the multilateral assistance to Nepal for the proper regulation of the exchange rate. As a result of SAP in Nepal, there has been a revision of the exchange rate between Nepali rupees and Indian rupees more than half a dozen times and finally in the year February 12, 1993, the current peg of 1.6 NRs. = 1 IRs. came into force. In recent days there is debate about the reconsideration of the rate of the peg with Indian currency. It could depreciate Nepali rupees against Indian rupees to foster the exports, making external competitiveness of our products, and deteriorate the volume of imports.

In the case of developing countries, undervaluation of domestic currency not only reduces the trade deficit but also nourishes the environment for economic growth (Rodrik, 2009). The 1% depreciation of Nepali rupees against USD resulted in decline in trade deficit by 6.75% (Adhikari, 2018). Policy makers argue that Nepal should keep the pegged exchange rate with India because the revision of rate of peg or making the floating exchange rate could make the import-based semi-structured Nepali economy fragile. This would eventually make volatility in the capital flow resulting in the capital flight from the country. This might be the reason for not adapting the floating exchange rate regime or re-adjust the rate of the peg. Therefore, understanding the association of exports with real exchange add value in Nepalese policy makers.

The influence of real exchange rate on exports may or may not hold in the case of Nepal. Even if there is certain relationship between them, by which figure they get influenced is the concern of this study. In this context, this research work is an attempt to find a degree and direction of real exchange rate on export of Nepal. The exchange rate volatility might deter the export, is completely question this study seeks to answer. Remittance induced

loss of external competitiveness of Nepali products due to appreciation of real exchange rate of Nepal is also the concern of the study.

1.3 Objective of the study

The general objective of the study is to find out the possible degree and direction generated by the real exchange rate to the exports of goods and services of Nepal. There may be a large group of possible outcomes such as remittance induced Dutch Disease that directly or indirectly affects the flow of exports. The specific objectives are:

i. To study the relationship between real exchange rates and exports of Nepal
ii. To investigate the effect of exchange rate volatility on exports

1.4 Significance of the study

Nepal has long been in a fixed exchange rate regime with the Indian currency since early 1993. Our almost 2/3rd of the total trade is with India. There would not have been any hue and cry if there was a satisfactory position of exports and trade surplus. But the nightmare of imports has overweighted the volume of exports at an alarming rate. Policymakers are not clear whether continue the pegged exchange rate with Indian currency or let it float as per market forces. This gives rise to further study the literature of the relation of exports and exchange rates so that the lens of this study could act as a torchbearer for the future researcher in this topic.

This study would be significant to future researchers to extend the study to trace the degree and directional relationship between real exchange rate and exports. This research paper will inform the policy makers for understanding the association of REER on export of Nepal. In addition to this, this study will to helpful to study appreciation of Nepali currency geared by remittance inflow.

On the very initial stage, the impact of the exchange rates on exports would be calculated and it would further support the base for the investigating relationships between the effect of exchange rate volatility on exports. During the study, there would arise different relations to back the core of the study. Every forthcoming result signifies the crux of the study.

If the findings of the study get the fluctuation of exchange rates has any effect on the exports, then policy should be focused on the practicable firmness of the exchange rate. In contrast, if there is no or significantly low level effect of the exchange rates on exports then rather than wasting too much time and resources in the adjustment of exchange rates, policymakers should plan to make other favorable environments for export.

To remind, the earlier similar version of the literature has worked on the annual data, gravity model of trade, Marshall-Learner condition of currency depreciation, and so on. This study has focused on the OLS and IV-2SLS framework to analyze the variables taking the quarterly data from the period 2004 Q3 to 2020 Q1. This is the latest data as far as possible so it is assumed that the analysis would yield fresh and significant results.

1.5 Limitations of the study

Since numerous variables affect the exports of Nepal but here, we have considered the exchange rate, export weighted real GDP of trading partners' domestic GDP, exchange rate volatility and remittance inflow, assuming all other variables constant. They might be just few factors that affect exports. Due to the time and resource limitation the study just spotlights on them. Beyond this limitation of the study, there are some more listed below:

i. Not excelled to incorporate data before 2004 Q3 and beyond 2020 Q1 to incorporate the new political discourse after Maoist came to mainstream politics
ii. Nepal shares an open border with India, so the large unaccounted portion of smuggling export is always out of the study.
iii. In most of the terai region of Nepal it is hard to find the official exchange rate of Nepali rupees vis-à-vis Indian rupees. This has always been out of the national accounts and so does in this study.
iv. The figure of remittances could have been in a better position than the current one if and only if hundi transactions were accounted by researcher.

1.6 Organization of the study

This thesis has been five chapters. The checklist of the content of the paper is organized as follows: chapter two deals with the review of literature, followed by the research methodology in chapter three. Chapter four is the presentation and analysis of data and, chapter five concludes with the discussion on findings, conclusions, and policy recommendations.

CHAPTER 2: REVIEW OF LITERATURE

The degree and directional association of the exchange rate and exchange rate volatility on exports is a never-ending debate in the field of economics and policy making. This chapter is about the review of literature which reveal for positive as well as negative association among them. Methodology related literature is also reviewed.

2.1 Theoretical review

The relation of exchange rates on exports has been quite ambiguous in the sense that some literature suggests the devaluation of exchange rates favors exports, stabilizing exchange rate yields reward while other literature argues devaluation is not only determining factor affecting export, rather it is one of the factors only (Paudel & Burke, 2015; Chit et al., 2010; Youssef & Zaki, 2019). To go deep on the topic of the afore mentioned subject there needs to clarify a theoretical background of the exchange rates and exports. As we know, the export of a nation is accounted for in the BoP by debiting import and crediting export. In simple words, BoP is an accounting ledger that includes current account and capital (financial) account. This study is heavily focused on the current account since export as well as remittances both fall in this category of account. Since there is neither a game-changing article nor pioneer theory that manifests the relation of exchange rates on exports, so this paper borrows the BoP mechanism to deal with the exports and remittances variables. In this study, there has been taken three heavily/widely recognized theoretical literature on this topic.

2.1.1 Absorption approach to balance of payment

To improve the balance of trade, a country needs to increase the output of goods and services by more than it does absorption (Alexander, 1952, 1959). This can be elaborated using the Keynesian expenditure approach of national income/output.

$$Y = C+I+G+(X-M) \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(i)}$$

Where, Y = National output

C = Consumption

I = Investment

G = Government expenditures

X and M = Exports and Imports respectively

The absorption approach argues that devaluation will only be successful only if the value of *domestic output (Y)* and *domestic absorption (C+I+G)* widen sufficiently in the full employment level of output. So, briefly, this approach deals with the production and spending of the nation. Further, equation (i) can be written as,

$$X-M = Y-(C+I+G) \quad \text{..... (ii)}$$

This relation depicts that the trade balance (X-M) will strengthen if the national income increases more than absorption.

Vines (2008) further improved absorption approach of Alexander (1952, 1959). For this, let the price elasticity effects improve the balance of trade (X-M) by switching expenditure towards domestic goods. Now, let us take the well-known Keynesian trade multiplier,

$$k = \frac{1}{[1 - c(1 - t) + m]}$$

where, k = Keynesian trade multiplier

c = Marginal propensity of consumption i.e.$\frac{\Delta C}{\Delta Y}$

t = Government tax rate

m = Marginal propensity to import i.e.$\frac{\Delta M}{\Delta Y}$

Let x be the expenditure switching effects on the trade balance of a devaluation of the currency by one unit and let the overall effects of this devaluation on trade balance be y. Then,

Rise of output due to devaluation = kx and

Surge in absorption = c(1-t)kx

Then,

$$y = k[1-c(1-t)]x \quad \text{..... (iii)}$$

If c is less than unity and t is positive and less than unity, then absorption will increase by less than output and the above relation shows that trade balance will improve by devaluation. This result depicts the integration of the elasticity approach and Keynesian multiplier to affect output and absorption following a devaluation. Since the multiplier k times m is less than unity, the increase in imports induced by the multiplier, mkx, is less than the positive expenditure switching effect, x, and so the trade balance improves.

$$z = k - [1 + (1 - t)ck]$$
$$= k - [1 - c(1 - t) + m + c(1 - t)]k$$
$$= -mk \ldots\ldots\ldots\ldots\ldots\ldots (iv)$$

Let one unit increase in government spending will cause output to increase by k whereas absorption increases by the sum of the increase in government expenditure and the induced increase in consumption (1-t)ck, the trade thus worsen by an amount z.

Now, let the expected increase in trade balance be w, devaluation of currency be α units, and the required change in government expenditure be β. From equation (iii) and (iv),

$$w = [1 - c(1 - t)]kx\alpha - mk\beta \ldots\ldots\ldots\ldots\ldots\ldots (v)$$

For full employment level of output, trade balance can only be improved by reducing the absorption since the economy is already in full employment, no further output can be increased. So, the output does not change,

$$0 = kx\alpha\text{-}k\beta \ldots\ldots\ldots\ldots\ldots (vi)$$

Solving for β from equation (vi) and substituting into equation (v) and adding the value of the multiplier,

$$w = \left[\frac{1}{k} - m\right] kx\alpha + mkx\alpha$$
$$= x\alpha$$

So, $\alpha = w/x$ is the required devaluation.

Substituting this relation in equation (vi), the required change in government expenditure is simply $\beta = -w$. This state:

i. Government absorption must be reduced enough to release resources from domestic use.
ii. Devaluation must ensure these resources are used to improve trade balance rather than leading to a fall in domestic output.

2.1.2 Monetary approach

Balance of payment (BoP) deficit or surplus is a stock adjustment disequilibrium phenomenon and not a flow equilibrium phenomenon (Johnson, 1976). This

disequilibrium is, always and everywhere, a monetary phenomenon so that there is a significant role of both ΔM^s and ΔM^d in the position of BoP. This theory is based on following few assumptions:

i. No money illusion
ii. Full employment economy in all nations
iii. Perfect mobility of goods and services and financial assets in all nations
iv. Fixed exchange rate regime based open economy
v. Interest rates and prices are equal in all nations

Now,

If $M^s > M^d$ in an economy, then the excess money supply is used by people to buy foreign products and to fly capital abroad to invest in securities. All these require foreign currency from the accounts of central banks at a fixed exchange rate. So, this eliminates the excess money supply from the economy, and this subsequently deteriorates BoP's position and vice versa.

In this way, if $M^d > M^s$ in an economy, that leads to the flow of foreign currency from abroad as people have scarce money than their demand, so people sell their products, securities abroad and realize the money that is exchanged by the central bank at the fixed exchange rate. This boosts the position of BoP (Khatiwada, 1994).

In summary,

$$\emptyset[M^s - M^d] = 0, \text{ this gives balanced BoP}$$

$$\emptyset[M^s - M^d] < 0, \text{ this yield improved BoP}$$

$$\emptyset[M^s - M^d] > 0, \text{ this proves deteriorated BoP}$$

Having elaborated all this, the accounting position of BoP can only be realized based on the volume of NFAR (Net Foreign Assets Reserve held by the central bank). Now,

The money demand function is given by,

$$M^d = f\left(P, r, Y_p^{\propto}, e^{\beta\gamma}\right)$$

Similarly,

Money supply function is, $M^s = \text{mH}$

$$\text{or, } M^s = m(NFAR + NDC)$$

Where,

m = Money multiplier

M^s = Money supply

M^d = Money demand

H = High power money

P = Domestic price level

r = Domestic interest rate

Y_p= Permanent income

α = Income elasticity of money demand

e = Opportunity cost of holding money as an exponential variable

β = Opportunity cost elasticity of money demand

γ = Expected rate of inflation

NDC = Net domestic credit

In money market equilibrium,

$$Ms = Md$$

$$\text{or,} \quad m(NFAR + NDC) = f\left(P, Y_p^{\propto}, r, e^{\beta\gamma}\right)$$

Taking log on both sides,

$$logm + log(NFAR + NDC) = logP + \alpha logY_p + logr + +\beta\gamma loge$$

Now, differentiating both sides with respect to time, t

$$\Delta logm + \Delta log(NFAR + NDC) = \Delta logP + \alpha\Delta logY_p + \Delta logr + \beta\Delta\gamma$$

$$or, \Delta logm + \frac{\Delta NFAR}{(NFAR + NDC)} + \frac{\Delta NDC}{(NFAR + NDC)} = \Delta logP + \alpha\Delta logY_p + \Delta logr + \beta\Delta\gamma$$

$$or, \frac{\Delta NFAR}{(NFAR + NDC)} = \Delta logP + \alpha\Delta logY_p + \Delta logr + \beta\Delta\gamma - \Delta logm - \frac{\Delta NDC}{(NFAR + NDC)}$$

$$or, \quad \frac{\Delta NFAR}{H} = \Delta logP + \alpha\Delta logY_p + \Delta logr + \beta\Delta\gamma - \Delta logm - \frac{\Delta NDC}{H}$$

The growth rate of NFAR does not get affected by the change in domestic price, inflation, and interest rate as this model assumes all these are equal in all countries. Then,

$$\frac{\Delta NFAR}{H} = \alpha \Delta log Y_p - \Delta log m - \frac{\Delta NDC}{H}$$

From this relation, it can be concluded that the role of change of permanent income, money multiplier, and net domestic credit can affect NFAR of the central bank and whole position of BoP in positive, negative, and negative ways respectively.

2.1.3 Elasticity approach/Marshall Lerner condition

The elasticity approach is simply termed Marshall Lerner's condition of currency devaluation. This Marshall Lerner condition of currency devaluation states that a currency devaluation will only lead to improvements in the balance of payment if the sum of demand elasticity of imports and exports is greater than one (Derick et. al., 2013). Let us derive this proponent in mathematical terms.

BoP in domestic currency can be expressed as,

$$N_x = X - eM \ldots\ldots\ldots\ldots\ldots\ldots \text{(i)}$$

where,

X = Export

e = Exchange rate in exponential form

M = Import

Differentiating equation (i) on both sides with respect to 'e'

$$\frac{\partial N_x}{\partial e} = \frac{\partial X}{\partial e} - e\frac{\partial M}{\partial e} - M$$

Multiplying both sides by $\frac{e}{X}$

$$\frac{e}{X}\frac{\partial N_x}{\partial e} = \frac{e}{X}\frac{\partial X}{\partial e} - e\frac{e}{X}\frac{\partial M}{\partial e} - \frac{e}{X}M$$

If BoP is in equilibrium, then $N_X = 0$

That implies, $X = eM$

So,

$$\frac{e}{X}\frac{\partial N_x}{\partial e} = \frac{e}{X}\frac{\partial X}{\partial e} - e\frac{e}{eM}\frac{\partial M}{\partial e} - \frac{e}{eM}M$$

$$\frac{e}{X}\frac{\partial N_x}{\partial e} = \frac{e}{X}\frac{\partial X}{\partial e} - \frac{e}{M}\frac{\partial M}{\partial e} - 1$$

$$\frac{e}{X}\frac{\partial N_x}{\partial e} = \eta_X + \eta_M - 1 \ldots\ldots\ldots\ldots\ldots \text{(ii)}$$

This is termed as Marshall-Lerner condition.

Where,

$\eta_X = \frac{e}{X}\frac{\partial X}{\partial e} =$ Export elasticity

$\eta_M = \frac{e}{M}\frac{\partial M}{\partial e} =$ Import elasticity

From equation (ii), if

$\eta_X + \eta_M < 1$, BoP deficit (BoP improves by revaluation)

$\eta_X + \eta_M = 1$, balanced BoP (BoP has no effect of fluctuation of the exchange rate)

$\eta_X + \eta_M > 1$, BoP surplus (BoP improves by devaluation)

In conclusion, if a country devaluates its currency but exports low-value items then those goods would be cheap in the foreign market in foreign currency. This would have less effect of devaluation to improve BoP because, on the cost of devaluation, the export rises but not the volume of export rises significantly. If a country devaluates, then import reduces but if the η_M is very low compared to devaluation then goods would be demanded less (as prices increase) but the policy could not help significantly due to low η_M to improve BoP position.

Among these three approaches that deal with the balance of payment, there is no common ground that advocates, in one common voice, the effect of BoP. An absorption approach is purely a Keynesian approach which argues the decrease in domestic absorption volume than the volume of national output to improve the position of BoP. Whereas the Monetary approach favors the rise in permanent income, the fall of the money multiplier and plunge of net domestic credit helps to strengthen the position of the net foreign assets reserve (NFAR) of the central bank, which subsequently makes the position of BoP of a nation. Lastly, the elasticity approach proclaims the currency devaluation only helps the betterment of BoP position if the sum of demand elasticity of imports and exports is less than unity. These three approaches do not match with each other in theory but all of them unite for the better possible improvement of BoP using their diversified theoretical views.

2.2 Empirical review

The relation of an exchange rate with exports is a hot topic in the field of economics and international trade. There has been a lot of empirical research work performed on that topic in the national as well as international context. Some of the researchers ascertain the negative role of exchange rate and exports since the price of a product is a weighted determinant for the demand of that product. Another sphere of the literature suggests the role of the exchange rate is minimal in today's world having tons of exchange rate hedging instruments, so the role of currency fluctuation would be a white elephant. Concerning these wide spectrums of views and opinions, here, a few of the literature has been summarized below.

2.2.1 Nepali context

Thapa (2002) has tested the relationship between REER and GDP in the Nepalese economy using annual time series date from 1978/1979 to 1999/2000. The study assumed AD channel and AS channel for the real exchange rate to affect economic activities. AD channel is depreciation of real exchange rate eventually increases the international competitiveness of the domestic products and enlarges the export and real GDP of the domestic nation. In the contrast, AS channel advocates that the depreciation of the real exchange rate increases the cost of production and the income distribution favors the elite class of people and thereby decreasing the AD and real GDP. Empirical analysis found AD channel operated in Nepal. Marshall Lerner condition of currency depreciation showed elasticity of import and export higher than unity. That means the real appreciation of the exchange rate has a negative impact on AD as so does on real GDP. The paper furnished two policy recommendations. First, Nepal should keep its real exchange rate constant and it should be used as one of the prominent macroeconomic variables. Second, the M1 money supply continues to be the relevant monetary policy than the M2.

Sapkota (2013), in the study ‘Remittances in Nepal: Boon or Bane?’, taking annual data for the period 1974/75-2010/11, has highlighted the volume of remittances inflow and its effects in the sectors like exchange rate and external competitiveness using REER and remittances variables. Boon factors of remittance inflows are it has helped to uplift the

poverty inequality, increase foreign currency reserve, increase gross national saving, and increase the state of BoP surplus in the last decade, financed high imports for consumption and consumption tax accounts for 50% of total tax revenue generation. In contrast, the nightmare of negative effects of remittances is Nepal battered by Dutch Disease due to the huge flow of remittances. It has reduced in manufacturing and export sector. The paper further suggested that Nepal has no option but to let the inflow of remittance, issue diaspora bond to use in sustainable growth and safe landing from the alarming remittance flow.

Chaulagai (2015) has examined that, taking annual time series data for the period 1975-2013 if devaluation of Nepalese currency can be a policy instrument for the improvement of trade balance of Nepal with rest of the world. VAR and ARDL model suggested that there is no traces of J-curve in Nepalese trade rather it operated as L-curve. This implies that there is no space for improvement of Nepalese trade imbalance by the way of devaluation of nominal exchange rate.

Paudel & Burke (2015) has studied the exchange rate policy and export performance to 20 largest export destination in the Nepalese context for 1980-2010. They found the long-standing currency peg against Indian Rupees and the substantial appreciation of the real exchange rate from the late 1990s. They used Augmented Gravity Model (Hasson & Tinbergen, 1964) to find the impact of real exchange rate appreciation on the export of Nepal. Exports as the dependent variables and the GDP of trading partner, Population of two trading partners, bilateral real exchange rate index with a partner, FDI inflow in Nepal, Nepal's import tariffs, and a dummy for Indian Blockade, Regional trade agreement & Maoist insurgency as explanatory variables. Empirical results found that real exchange rate appreciation has a material adverse effect on the export of Nepal. So, Nepal may wish to reconsider its currency peg, either by an adjustment to the peg rate or by moving to a more flexible exchange rate system to avoid the export competitiveness trap. The study has suggested for export promotion of high-value low-weight products via airlift.

Devkota & Panta (2019) examined the existence of cointegration relationship between export, import and USD exchange rate using the annual time series data from 1965 to 2017. The finding suggested no existence of cointegrating relationship between export, import and the exchange rate of Nepal. This indicated unsustainable balance of payment crisis. Absence of cointegration relationship implied that the macroeconomic policies of Nepal had no efficient mechanism to make the export and import in long run equilibrium.

2.2.2 International context

Tenreyro (2007) has examined the trade impact of nominal exchange rate volatility using a broad sample of countries from 1970 to 1997. To deal with the endogeneity and the measurement error of exchange rate variability, an instrumental-variable (IV) version of the PML (Pseudo-Maximum Likelihood) estimator has been developed. Study has concluded that exchange rate variability has no significant impact on trade. This concluding remark has gone against the view of stabilizing the exchange rate to foster international trade. The paper has highlighted positive part of volatility on trade such as it creates a place for profitable opportunity by way of forwarding contracts, currency options, and hedging. In a nutshell, many countries has found it useful to peg their currency to that of a large and stable "anchor" country to reduce inflation. Hence, two countries that have chosen to peg officially or de facto to the same anchor tend to experience low bilateral exchange rate variability.

Personal & Archive (2008) investigated the relationship between quantitative analysis of exchange rate volatilities and misalignment in Uzbekistan for the period 1994Q3 to 2005Q2. During the study, Uzbekistan has changed its exchange rate policy at least three times to make its export more competitive in the international market. The study used two alternative proxies of RER volatility- the conditional variance of a GARCH-M(2,2) model and the conditional variance of a first-order ARCH model. In the empirical analysis of the paper, it has been found that government currency rationing policy was lessening the volatility. Furthermore, the gradual liberalization of the foreign exchange and trade regimes aimed at establishing a realistic and single market rate had led to a substantial increase in volatility.

Chit et al. (2010) has examined the effect of bilateral exchange rate volatility on the bilateral export flows of five emerging East Asian countries as well as on export flows to 13 other industrialized countries for the period from 1982Q1 to 2006Q4. The paper has employed generalized gravity model, augmented gravity model. Three different measures of exchange rate volatility were employed: the standard deviation of real exchange rate, the moving average standard deviation of the bilateral real exchange rate, and the conditional volatilities of the exchange rates estimated using a GARCH (General Autoregressive Conditional Heteroscedasticity) model. The results showed that the exchange rate volatility has a statically significant negative impact on the exports of emerging East Asian countries. The impact of exchange rate volatility of third countries confirms that not only absolute volatility but also relative volatility is important for bilateral export flows of emerging East Asian countries. Thus, the results haave suggested that sample countries should focus on stabilizing their exchange rates vis-a-vis the main trading partners rather than solely pursuing regional monetary and exchange rate policy cooperation, at least in the short run.

Hall et al. (2010) examined the exchange rate volatility and export performance taking the panel data sets covering 1980Q1-2006Q4 and 1980Q1-2005Q4 for Emerging Market Economies (EMEs) and other developing countries respectively. EMEs are Argentina, Brazil, Hungary, Israel, Korea, the Philippines, Singapore, South Africa, Thailand, and Turkey. Developing countries are Bolivia, Columbia, Costa Rica, Dominic Republic, Ecuador, Guyana, Malawi, Morocco, Pakistan, Paraguay, and Venezuela. Two different estimation methods – generalized method of moments (GMM) estimation and time-varying coefficient (TVC) estimation were used. The result showed that EMS suffered decline in export more than developing countries due to exchange rate volatility. This article dug out that exchange rate volatility in EMEs is much low compared to developing countries because EMEs have a greater choice of a financial instrument like currency hedging, firm holding a portfolio in foreign currency and better competition yields better profit due to speculation.

Hooy et al. (2015) studied “The impact of the Renminbi real exchange rate on ASEAN disaggregated exports to China” taking the annual data for the period 1994-2008. The

study mainly focused on the supply chain of ASEAN to China and the effect of Chinese Renminbi fluctuation over the period by deploying the Gravity Model and the panel cointegration approach. After joining IMF back in the year 2001, China has forwarded the internationalization of its currency. After the rigorous empirical analysis, the paper has concluded that income elasticity is positive and significant for the advanced manufacturing capabilities for long run tech development so that there is a positive and significant effect of change in RMB real exchange rate on ASEAN export to China.

Vieira & MacDonald (2016) examined the relationship between exchange rate (REER) volatility and volume of export of 106 developing, emerging and oil-exporting countries for the period 2000-2011. Findings of GMM estimator revealed no impact of exchange rate volatility on export when oil-exporting countries dropped from the sample, whereas if oil-exporting countries are included, the decrease in exchange rate volatility increases the export flow and vice-versa. Oil-exporting countries have high exchange rate volatility than their allies' countries. The policy suggestion of this article is the country should opt-out of the volatility of the exchange rate to have handsome export over time.

Hunegnaw (2017) investigated the effect of real exchange rate on manufacturing exports in 10 East African countries undertaking the series data for the period 1995-2013. ARDL method has been used to analyze disaggregated manufacturing exports. The short-run RER depreciation improved the export of labor-intensive, low-skill, and medium-skill tech-intensive manufacturing. In contrast, depreciation of REER worsens high skill technology-intensive exports. The result also found that an increase in real GDP boosts manufacturing exports and a rise in foreign real GDP also improves all manufacturing exports. The paper has one policy suggestion for amplifying exports of the countries. The countries should flourish conducive environment for economic growth without much resource wasting in the devaluation of the domestic currency.

Palazzo & Rapetti (2017) investigated the "Real exchange rate and export performance in Argentina, 2002-2008", published by the Journal of Post Keynesian Economics. For empirical analysis of RER and tradable profitability and exports of goods, the paper has derived and manipulated the simple equations as per demand. Throughout the analysis, primary and resource-based industries faced a relatively lower proportion of export

expansion whereas labor-intensive, low, and medium-tech manufacturing industries experienced a relatively higher share of export increment. This result favored exports and economic growth even in the case of higher RER since the mid-1980s in Argentina. Findings have suggested that export promotion can be backed by the RER for economic growth by using both macroeconomic as well as microeconomic channels.

Mordecki & Miranda (2019) studied the RER volatility dynamics in the export performance for Brazil, Chile, New Zealand, and Uruguay for the period 1990-2013. Generalized Autoregressive Conditional Heteroskedasticity (GARCH) and Integrated GARCH (IGARCH) methods have been used to study the relation. After analyzing facts, figures, and data in the study, it has found that only in Uruguay there has been long as well as short-run significance of RER volatility with a negative sign. New Zealand and Chile have dramatically low RER volatility, which meant the export has not been affected by the exchange rate uncertainty.

Youssef & Zaki (2019) studied the pattern on export performance and exchange rate of Egypt in the Policy Research Working Paper of World Bank Group. The gravity model has been used to predict bilateral trade flows based on economic size, geographic distance, and other dummy variables. The study further studied tariff and non-tariff barriers for export growth. The paper further elaborated that exchange rate depreciation is not a sufficient condition to improve and increase the export of the country since price competitiveness is only one element of countries' ability to enhance their external competitiveness. Finally, the authors have recommended improving external competitiveness by fostering and diversifying domestic production and remove non-tariff barriers to trade like admin, technical, and sanitary trade barriers.

Khachatryan & Grigoryan (2020) empirically studied the link between real exchange rate and exports of Armenia using quarterly data from January 2001 to June 2019. This is the baseline key paper of our study. They investigated the effect of real exchang rate and its volatility on export growth by performing rolling regression. The paper also estimated a two-stage model, of IV-GMM framework, for REER with endogenous remittances so as to trace the evidence of the Dutch Disease that caused the persistence deterioration in external competitiveness of Armenain exports. Upon empirical analysis, they found that

there was weakening link between exchange rates and exports for the developing country like Armenia. The exchange rate volatility had no statistically significant effect on exports. Finally, they traced the evidence of Dutch Diseases induced by the remittances inflow in Armenia.

2.3 Research gap

The relationship between exchange rates and contextual issue in exports is an economics literature. Majority of economics are interconnected in terms of trade and finance. Nepal is also an open economy, lately join the globalization process. Despite data limitation, some literatures are available, the earlier literature in the required field is that describes the association between REER and trade. Among the available literature, there exists conflicting arguments. There is a dearth of literature which explicitly stablishes the degree and distance between the variables.

Among those limited studies, Thapa (2002) has found empirically that traditional literature of real exchange rate holds for Nepal so, Nepal should firm its real exchange rate to gain from exports. This paper is in line with the Elasticity approach (also termed as Marshall-Lerner condition of currency depreciation). Paudel & Burke (2015) revealed that real exchange rate appreciation has a material adverse effect on exports of Nepal so, they have suggested reconsidering the peg rate with Indian currency and let the more flexible exchange rate to get rid of the export competitiveness trap. In this way, Sapkota (2013) came out with the result that there has existence of the boon and bane of remittances flow in Nepal. Boon factors are reduction of poverty, inequality, healthy position of BoP despite the absence of any signature exporting product, increase the foreign reserve in the central bank and the bane factors are the presence of Dutch disease, shrinking export competitiveness, and trade deficit. Adhikari (2018) in the NRB working paper has concluded that the depreciation of Nepali rupees vis-à-vis USD resulted in decline in trade deficit of Nepal. Khachatryan & Grigoryan (2020) has established a weakening link between real exchange rate and export of Armenia (a landlocked developing country like Nepal which is also heavely dependent on remittance inflow). They even found the deteroriation of external competitiveness of Armenia induced by the remittances inlfow.

Nepali and international context of the impact analysis of exchange rates on exports has found the mixed results that one stream of literature favors the currency depreciation as policy variable to boost exports (Hunegnaw, 2017) whereas other literature favors the other nurturing environment for exports favors exports than heavily focusing all arsenal and resources in currency depreciation (Palazzo & Rapetti, 2017; Youssef & Zaki, 2019). This study has ground to establish the relation of exchanger rate and exchange rate volatility on export of Nepal. Similar research in the case of Nepal has not been triggered by the author but in the case of the international context, there are few of them. So, this study is of Nepali flavor.

CHAPTER 3: RESEARCH METHODOLOGY

This chapter is about the research methodology. This chapter consists of research design, nature and sources of data, sample period covered, data organization and processing, and tools of data analysis and estimation methods.

3.1 Research design

The main objective of this study is to find the effect of exchange rates and exchange rate volatility on exports of Nepal. Further area of interest is to find out the possible appreciation of real exchange rate fueled by remittance inflow. For this purpose, the study uses both analytical as well as descriptive research design. Analytical research helps to analyze the significance of exchange rate and exchange rate volatility on exports of Nepal and whether endogenous remittances are creating Dutch disease in Nepal or not. In this way, descriptive research design deals with explaining the trend of variables employed.

Descriptive statistics include the number of observations, mean, standard deviation, minimum, and maximum of different variables used. In this way, several econometrics tools and techniques have been used to refine and get correct results. First and foremost, every univariate time series must undergo through stationarity test. For the stationarity test, this paper has considered the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1981) to find out the order of integration for each time series of the variables. Along with ADF, this study has also used the Phillips-Perron test (Phillips& Perron, 1988) for the same purpose as ADF has been used i.e. to find out the order of integration of each time series of the variables. The purpose of parallel check of whether presence or absence of unit root by ADF as well as PP test is to reconcile the results of both yields.

After the desired unit root is free of univariate variables given by unit root tests, the further process is to estimate the content of equations (5) and (6) by ordinary least square (OLS) to find out the degree and directional relation of exchange rates and their volatility with exports. Furthermore, a series of common diagnostic tests has been designated to depict the adequacy of the models. For this, normality has been measured using the

Skewness-Kurtosis test (SK test) and histogram test. Heteroskedasticity, variance test of the error term, has been tested using Breusch-Pagan test and serial correlation has been tested by the Breusch-Godfrey LM test (Rois et al., 2012). The main purpose of all these diagnostics checks is to get the reliability of the findings from the estimated models. The long-run and short-run impact of REER growth on exports are captured by long-run elasticity and short-run elasticity of REER respectively (Khachatryan & Grigoryan, 2020). Nepal might have suffered from the loss of external competitiveness due to inflow of remittances. Two-stage model for REER with treatment of remittances as endogenous variable has been used to test the possible weakening external competitiveness. For this IV-2SLS (Instrumental Variable-2 Stage Least Square) (Baum et al., 2007) has been widely used.

3.2 Nature and sources of data

Our research uses all the datasets in quarterly form from the period 2004 Q3 to 2020 Q1. The choice of the period is due to the limitation of the unavailability of readily quarterly data in the national as well as international context. All the study period is based on secondary data collected from several sources of national as well as international institutions. Some of the raw data has been equally purified by way of rebasing and converting nominal data into real one. In the case of REER, it has been calculated by the author by collecting raw data from sources mentioned below. CPI of Nepal has been converted into the base year 2010 collecting monthly CPI data from the Ministry of Finance, Government of Nepal. It has been used to convert nominal variables into real variables since the quarterly GDP deflator is not readily available. In this way, in the case of CPI of ROW, the top 10 export destinations of Nepal are all members of G20 (Group 20) countries except Bangladesh. So, it is wise to consider CPI of ROW anonymous to CPI of G20.

The trade share of Nepal with India and ROW has been calculated based on exports and imports of Nepal and its trading partners as a lump sum. The exchange rate of NC per USD is the nominal exchange rate which has been extracted from Quarterly Economic Bulletin of NRB. The volume of exports and remittances inflow has been extracted from the QEB of NRB. In the case of the GDP of Nepal, the base year is 2000/01 which has

been rebased by CPI of Nepal with the base year 2010. Similarly, the real annual GDP of Nepal's top 10 trading partners has been pumped from the World Bank data base and that has been scattered into quarterly real GDP using EViews 9 using a similar reason used by Chit et al. (2010). The table below shows the sources of the variables from where they are dug.

Table 3.1: Description of the variables

SN	Name of the variable (Code)	Source	Definition and description
1	CPI of Nepal	MoF, Nepal	Used to deflect nominal variables into real (base year 2010)
2	CPI of ROW (i.e., G20) and the US	OECD data	Used for REER calculation (base year 2010)
3	CPI of India	OECD data	Used for REER calculation (base year 2010)
4	Exchange rate of NC per USD	QEB, NRB	Nominal exchange rate used for REER calculation. 1 USD as per respective NRs.
5	Trade share	QEB, NRB	In % for cumulative export and import of ROW and India
6	Exports (Exp)	QEB, NRB	Export of goods and services in a fiscal year (amount in million rupees)
7	Remittance inflows (Remit)	QEB, NRB	Official remittance recorded from formal channel in NRB (amount in million rupees)
8	GDP of Nepal (dGDP)	CBS, Nepal	Available in 2001 basic price. Converted to base year 2010 by deflecting with CPI of Nepal (in million rupees)
9	GDP of Nepal's top 10* trading partners (pGDP)	World Bank	At basic price 2010 (in million rupees)
10	REER	Own calculation	At basic price 2010. REER is weighted average of NRs. with IRs. and USD
11	Exchange rate volatility (Vol)	Own calculation	Moving standard deviation of order 4. It is the uncertainty in forex market due to unexpected currency fluctuation

** India, US, Germany, UK, Turkey, China, Bangladesh, France, Italy, and Japan*

Real exports: Quarterly Economic Bulletin of Nepal Rastra Bank is the main source of the nominal exports over time. Thus, obtained nominal exports have been deflected by the Nepali consumer price index (CPI) to convert into real exports. Above mentioned idea of conversion can be found in a broad spectrum of literature (Ahmed et al., 2017; Khachatryan & Grigoryan, 2020; Phillips & Perron, 1988). Nepali CPI has been extracted from the MoF dashboard and has been rebased to a constant price of 2010.

Real effective exchange rate (REER): REER calculation has been done solely by the author, of this article, using the following formula as used by Nakorji et al., (2019):
REER = (Bilateral real exchange rate index of USD) ^ (Trade share with ROW) * (Bilateral real exchange rate index of India) ^ (Trade share with India)
Here, REER is the weighted geometric mean of bilateral nominal exchange rates and deflated using relative price measures. It can be shown as P_{MD}

$$\text{REER} = \ \text{i} = 1\text{n}\left(\frac{\text{Si}}{\text{Si}^*} * \frac{\text{Pi}}{\text{P}_\text{D}}\right)^{\text{w}_\text{i}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where,

n = number of trading partner countries (currencies) from the basket

S_i = National currency's exchange rate against the currency of the country i

S_i^* =National currency's exchange rate against the currency of the country i during the base period

P_i = Consumer price index in country i

P_D = Domestic CPI

W_i = Countries' trade weight (of the currency) in the basket

Real gross domestic product: The trading partner's real gross domestic product has something to do with the export of Nepal so, the export weighted real GDP of Nepal's top 10 trading partners viz. India, US, Germany, UK, Turkey, China, Bangladesh, France, Italy, and Japan have been analyzed in the summary period. The quarterly real GDP of a country like China is not readily available so the annual real GDP, from the World Bank, of all the top trading partners has been split into linear quarterly real GDP.

Exchange rate volatility: The volatility of the exchange rate influences the export flow of the country. As discussed in the several papers (Khachatryan & Grigoryan, 2020;

Lastrapes & Koray, 1990; Thursby & Thursby, 1987), the exchange rate volatility index has been listed with moving standard deviation of the changes of the real exchange rate, as discussed below:

$$\mathrm{Vol_t} = \left\{\frac{1}{m}\sum_{i=1}^{m}(\ln\mathrm{REER_{t+i-1}} - \ln\mathrm{REER_{t+i-2}})\right\}^{1/2} \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where, m=4, is the order of the moving average.

Remittance inflows: Huge inflows of remittance creates an increase in the domestic demand. The source of the remittance is the Quarterly Economic Bulletin of the NRB, and it has been converted in real term by deflating with CPI of the base year 2010.

3.3 Study period covered

For this study, the sample period covers the data set from 2004 Q3 to 2020 Q1 comprising 63 quarters. The prime reason for limiting the sample period is the unavailability of required quarterly data beyond the chosen period. Another logic behind the period selection is to get concise figures of export and exchange rate in the aftermath of the end of the Maoist insurgency followed by 12-point comprehensive peace accord. The disadvantage of using annual data rather than higher frequency data is that the tests may be less powerful (Mackinnon, 1996). Quarterly data has high frequency including more observation within a shorter period of time. This is an important advantage of using quarterly data over annual data (Han & Qiu, 2007).

3.4 Data organization and processing

Raw data collected from several sources, mentioned above, are well sorted out for the further processing of data. Hypothesis testing, methodology formation, and every required treatment for time series analysis are as per scholars' guidance such as Shrestha & Bhatta (2019). Every data that were in foreign currency and a different base other than our base year 2010 has been well converted into real term in the base year 2010 and millions of rupees. REER calculation is based on the borrowed knowledge of literature like Nakorji et al. (2019), Khachatryan & Grigoryan (2020); and Thapa (2002).

3.5 Tools of data analysis and estimation methods

Mean, standard deviation, minimum value, maximum value, Kurtosis analysis, Skewness test, histogram test are the simple diversified statistical tools used to analyze the descriptive analysis of variables used. Similarly, to find out heteroskedasticity, multicollinearity and serial correlation of variables, Breusch-Pagan test for heteroskedasticity (Youssef & Zaki, 2019), Variance Inflation Factor (VIF) test for multicollinearity (Craney & Surles, 2002), Breusch-Godfrey LM test for serial correlation (Rois et al., 2012) have been deployed respectively. Different tables and graphs have been used to get the desired results from respective analyses of variables.

The very first stage of regression analysis is to test the stationarity of each variable. For this, Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1981) and Phillips-Perron (PP) test (Phillips& Perron, 1988) are two of the generally accepted tests to find out the unit root in time series analysis. To get the empirical results from the data available, Instrumental Variable (IV) has been used in Two-Stage Least Square (2SLS) framework (Baum et al., 2003, 2007; Schaffer & Baum, 2013). They have suggested the conditionality followed by diagnostic treatment of IV 2SLS and the appropriate interpretation of the results using Stata. Before using IV 2SLS or IV-GMM in our study, the variables must define the validity of the model used. For the study of the effect of REER and exchange rate volatility on the export of Nepal, OLS has been used. In this way, to draw the effect of forward-looking exchange rate on exports, this paper has considered the 2SLS of IV framework, where next period REER growth as an endogenous variable: first lag of REER growth, exchange rate volatility growth, and remittances growth as instrumental variables at the first-stage model and the exogeneous variables are export weighted real GDP of trading partners, domestic real GDP, volatility and first lag of real export. The lag length of several variables that are yielded by Akaike Information Criteria (AIC) (Hu, 2017) has a limit of up to 8 lags, but the total range has not been used.

The study's treatment of endogeneity and IVs is not a sufficient condition, rather it is just a precondition of the first-stage model of IV-2SLS. Hence, the result of the first stage has to undergo some diagnostic tests. First, the Durbin Wu Hausman test of endogeneity has

to reject the null hypothesis that variables are exogenous at a 5% significant level. Once the regressor is deemed endogenous by the Durbin Wu Hausman test, the very next stage is the test of overidentification restrictions which is given by Sargan Baumann or Hansen J test. The null hypothesis for the overidentification restriction test is: Instrumental set is valid, and the model is correctly specified. If p value is larger than 0.05 then accept null, i.e. instruments set is/are valid and the model is correctly specified. Third diagnostic test is weak instruments tests-just identified model. According to the rule of thumb, if the value of F is larger than 10, then the instrument(s) is/are not weak. After passing all these diagnostic tests, IV-2SLS has to be used by fixing the endogenous regressor, instrumental variables and exogenous variables. Similarly, to draw the proximity of REER and remittances in Nepali case, here, remittances has been treated as endogenous variables at first stage model.

The theoretical framework of this paper is based on price-to-market (PTM) literature (Khachatryan & Grigoryan, 2020; Krugman, 1986; Penkova & Emilia, 2005). PTM is a state when the seller reduces mark-ups prices of products to stabilize prices in respect of buyer's currencies if the seller's currency has appreciated against the buyer's currency. The destination-specific adjustment of mark-ups in response to exchange rate changes is PTM (Krugman, 1986). PTM reveals an important feature of the competitive process in the traded goods market, more particularly, how the prices of trade goods prices to respond to exchange rate changes affects the international competitiveness of exporting firms (Penkova & Emilia, 2005). According to this literature, export price is an outcome of optimal pricing decisions by suppliers (Khachatryan & Grigoryan, 2020)

$$\frac{eP^x}{P*} = S\left[\frac{ULC}{P}, \frac{eP}{P*}\right] \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where,

e = NEER(Nominal Effective Exchange Rate)

P^x = Price of export in domestic currency

P^* = Foreign price level

P = Domestic price level

ULC = Nominal Unit labor cost

$$\frac{eP}{P*} = \text{REER}$$

Further, price elasticity of volume of export is calculated as:

$$\text{Exp} = D\left[\frac{eP^x}{P^*} = Y*\right] \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where,

Exp = Volume of export

Y* = Foreign demand measured by export weighted foreign GDP

From an empirical ground, following the empirical model specification suggested in the literature Khachatryan & Grigoryan (2020), the following baseline model has been estimated:

$$\Delta\ln\_Exp_t = \beta_0 + \beta_1 \Delta\ln\_REER_t + Z_t'\gamma + \epsilon_t \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where,

Z_t = Vector of controls, that includes domestic real GDP of Nepal, export weighted real GDP of Nepal's top trading partners, and exchange rate volatility measures

ϵ_t= Error term

The baseline model can be developed by including lagged exports, which allows accounting for export persistence over time. Persistence in export dynamics captured by the coefficient $\rho \in (0,1)$, and the remaining portion, $(1-\rho)$, is explained by other variables:

$$\Delta\ln\_Exp_t = \beta_0 + \rho\Delta\ln\_Exp_{t-1} + (1-\rho)[\alpha_1\Delta\ln\_REER_t + Z_t'\theta] + \epsilon_t \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

In the short run, the impact of growth on exports is gauged by short-run elasticity, $(1-\rho)\alpha_1$ and if export growth approached its steady stage value, the impact of REER growth on export is determined by long-run elasticity, α_1. Using similar reasoning like short and long-run elasticity for controls are captured by θ and $(1-\rho)\theta$ respectively.

The forward-looking nature of exporters' decision-making behavior is influenced by changes in expectations of the real exchange rate and so it affects the current export volume too. To visualize this forward-looking nature of exporters' decision-making behavior, equation (6) has been modified as follows in forward-looking nature. Modeling

the current exchange rate as a function of its expected values is a common way to study the forward-looking nature of exchange rates (Engel & West, 2005). The expectation of the real exchange rate has been accounted for by the below-mentioned relation,

$$\Delta \ln\_Exp_t = \beta_0 + \rho \Delta \ln\_Exp_{t-1} + (1-\rho)[\alpha_1 \mathbb{E}_t(\Delta \ln\_REER_{t+1}) + Z_t'\theta] + \epsilon_t \ldots\ldots\ldots (7)$$

$\mathbb{E}_t[.] =$ Expectation operator.

Equation (7) has been estimated with the technical help of two stages instrumental variable 2SLS (IV-2SLS). The primary motive of using IV is that REER can act as an endogenous variable, to influence exports as well as it can be a crucial variable that affects export competitiveness, with its instrumental variables. The plus point of IV-GMM over IV is, if heteroskedasticity is present, the GMM estimator is more efficient than the simple IV estimator, whereas if heteroskedasticity is not present, the GMM estimator is no worse asymptotically than the IV estimator (Baum et. al., 2007). Upon the several diagnostic tests of IV-GMM, the results found are not inconsistence with the IV-GMM estimator so, this paper has used the IV 2SLS instead of IV-GMM. Equation (7) would be estimated by IV-2SLS with the incorporation of lag of REER, volatility, remittances, export weighted real GDP of partners and domestic GDP.

To study the role of remittance inflow in real exchange rate, a two-stage IV-2SLS model would be estimated to examine the export competitiveness of Nepali export. Nepal has been blamed as too much dependent on remittances and that remittances have been supposed to have deteriorated export competitiveness by the channel of the exchange rate. The following version of the equation helps to trace the footprint of export competitiveness influenced by remittance inflow.

$$\Delta \ln\_REER_t = \delta_0 + \delta_1 \Delta \ln\_Exp_{t-1} + \delta_2 \Delta \ln\_Remit_t + \epsilon_t \ldots\ldots\ldots\ldots\ldots (8)$$

In equation (8), remittance is instrumented (treated as endogenous variable) by their lag up to second lag, first lag of REER and real export, export weighted real GDP of trading partners and exogeneous variable as first lag of real export.

3.5.1 Diagnostic test

It is well-known fact that time-series data has the inherent character of non-stationary. The very beginning part of the time series analysis is to detect whether the time series has stationarity or not. Stationarity data means those data which have mean, variance, and covariance close to constant or constant over time of consideration. The researcher has a prime job to know whether the data is stationary or not and if it is not stationary, treatment has to be done for them. The empirical analysis is fully backed by the assumption of stationarity of time series data, so the researcher is well alert of this proposition. There are several tools to detect stationarity of time series data, among them the most popular are ADF (Dickey & Fuller, 1981) and PP (Phillips Perron) test (Phillips& Perron, 1988). Dickey-Fuller test with certain lag is ADF so ADF test implements and uses additional lags of the first differenced variable. PP test uses Newey-West standard errors (Newey & West, 1987) to account for serial correlation. PP uses robust to serial correlation by using Newey-West heteroskedasticity and autocorrelation consistent covariance matrix estimator. One advantage of the PP test over ADF is that PP tests are robust to the general form of heteroskedasticity in the error term. Another is that users do not have to specify a lag length for the test regression.

The main purpose of using ADF and PP simultaneously is to cross-check the results suggested by the ADF test. This trend of cross-checking can be inspected in several papers. Now, here, the fundamental unit root test using ADF has been discussed in brief.

Augmented Dickey-Fuller Test (ADF): This test was developed by Dickey and Fuller in 1970 and named after them as the Dickey-Fuller test (Dickey & Fuller, 1981). The ADF test is expressed as:

The equation containing neither the trend nor the intercept is,

$$\Delta Y_t = \gamma_i Y_{t-1} + \sum_{i=1}^{k} c_i \ \Delta Y_{t-i} + e_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (*)$$

The equation for the only intercept and no trend is,

$$\Delta Y_t = \alpha_1 + \gamma_i Y_{t-1} + \sum_{i=1}^{k} c_i \ \Delta Y_{t-i} + e_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (**)$$

The equation for both intercept and trend is,

$$\Delta Y_t = \alpha_1 + \gamma_i Y_{t-1} + \alpha t + \sum_{i=1}^{k} c_i \ \Delta Y_{t-i} + e_t \text{.............................. (***)}$$

Where, ΔY_t = First difference of any variable Y.

The null hypothesis of ADF is $\gamma_i = 0$ against the alternative hypothesis of $\gamma_i < 0$. If we do not reject the null, the series is non-stationary whereas the rejection of the null hypothesis means the series is stationary. If the series is stationary without any differencing, it is said to be stationary at the level and is denoted by I(0) or integrated with order 0. Similarly, if the series is stationary after a first difference, it is said to be I(1) or integrated of order 1.

The OLS estimation has to incorporate the utmost factors which affect the dependent variables in the model. If the case of remaining data is not defined by the regressors, the residuals term incorporates their prediction the most. So, residuals are one of the crucial parts of regression analysis using OLS. There are well accepted three pillars of the OLS assumptions. They are auto-correlation/serial correlation, normal distribution and homoskedasticity.

In case of violation of any one assumption, the estimation of OLS does not yield robust estimated results in the study. This study has also tested the diagnostic tests of residuals to be able to draw healthy, reliable and unbiased conclusions.

Breusch-Godfrey LM test has been used for OLS estimation and Cumby-Huizinga chi-square test in the case of IV-2SLS estimation. For serial correlation test the null hypothesis is zero autocorrelation and alternative hypothesis is positive first-order autocorrelation. Breusch-Godfrey test for serial correlation is meant to be applied to a set of regression residuals under the assumption of weakly exogenous, or predetermined, regressors (Schaffer & Baum, 2013). Schaffer & Baum (2013) have suggested the use of the Cumby-Huizinga (CH) test for autocorrelation. CH test for autocorrelation has wide flexibility of lag order selection even in the case of endogenous regressors. Null hypothesis (H0) is disturbance is MA process up to order q whereas, the alternative hypothesis (H1) is serial correlation present at specified lags >q. If the p-value is larger than 0.05, we reject null and accept the alternative hypothesis.

Normality test has been done by using different tools like histogram, Kurtosis, Skewness, etc. of our variables. For empirical check of the normality condition, the test helps which compiles the result of Skewness as well Kurtosis of the data. Claim is normally distributed. If $p<0.05$, reject the claim that the variable is normally distributed at the conventional 5% level.

Homoskedasticity has been verified using Breusch-Pagan/Cook-Weisberg test for heteroskedasticity in OLS estimation and Pagan-Hall $\chi 2$test in case of IV-2SLS estimation. Null hypothesis is constant variance and alternative hypothesis is non-constant variance. If $p>0.05$, accept null.

Before as well as after OLS estimation, every variable needs to undergo several tests. In this way, the IV-2SLS model needs some diagnostic tests for the reliability of the estimation. Some of those diagnostic tests in IV-2SLS are: test of endogeneity, overidentification restriction test and weak instruments test.

We perform Durbin-Wu-Hausman test to check whether some of our explanatory variables are endogenous. It provides the avenue for further diagnostic tests like overidentification restriction and weak instruments tests. For forward looking model for REER and two stage model for REER, variables like REER growth and remittance might have endogeneity issues.

Sargan Baumann or Hansen J test are used to test the overall validity of the instruments. Null hypothesis is instruments set are valid, and the model is correctly specified. If $p>0.05$ at 5% level, then accept null. The rejection of the null hypothesis means that the instruments are either correlated with the errors or that they are omitted variables in the model. So, the test of overidentification restrictions is done to get vivid evidence of instruments' validity in the model.

Weak instruments can be traced with the help of correlations tests among the considered variables but for formal tests, Eigen value statistics should be tested. Null hypothesis instruments are weak. If minimum Eigen value statistics is less than the value, conventional rule of hand, 10, reject null hypothesis i.e. instruments considered are not weak.

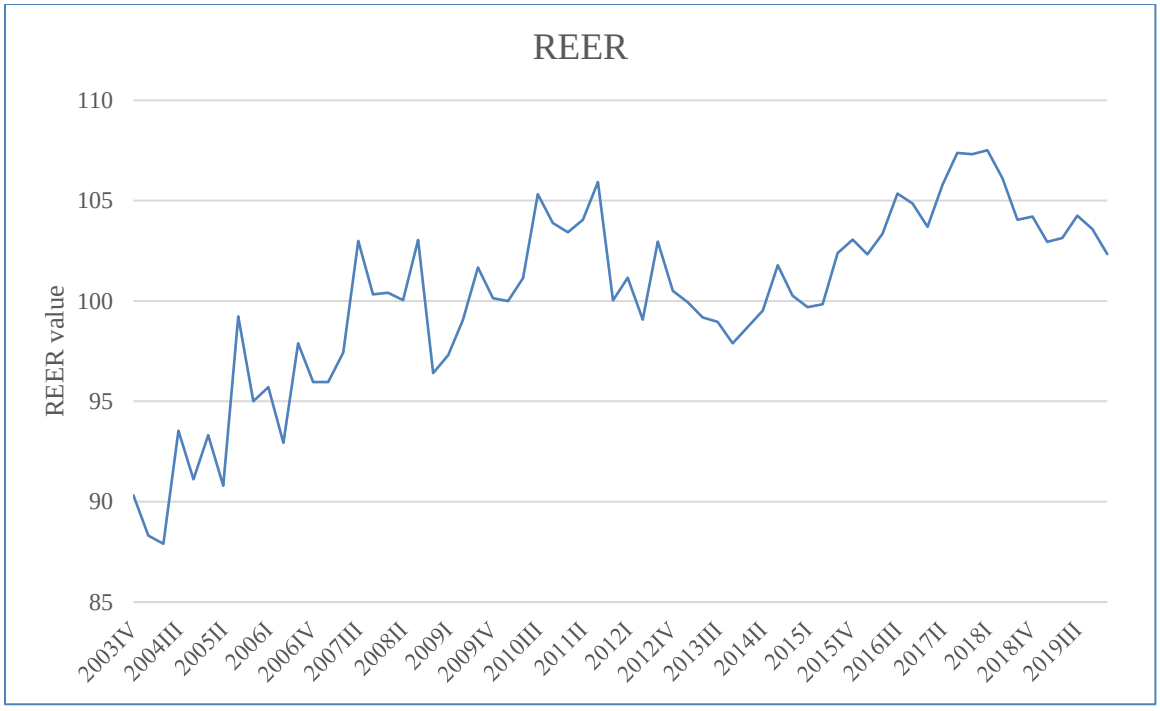
CHAPTER 4: PRESENTATION AND ANALYSIS OF DATA

This chapter presents the trend of variables, descriptive analysis of the variables, estimation of the regression equations and various diagnostic tests.

4.1 Some stylized facts

As REER is one of the key variables of this study. Its trend is in figure 4.1. We calculated REER including Exchange rate of NC vis-à-vis IC and USD, CPI of Nepal, CPI of ROW, CPI of India, and trade weights. The computation has furnished appreciation and depreciation trends of the REER value of Nepalese currency, which has been presented in the following graph.

Figure 4.1: REER value



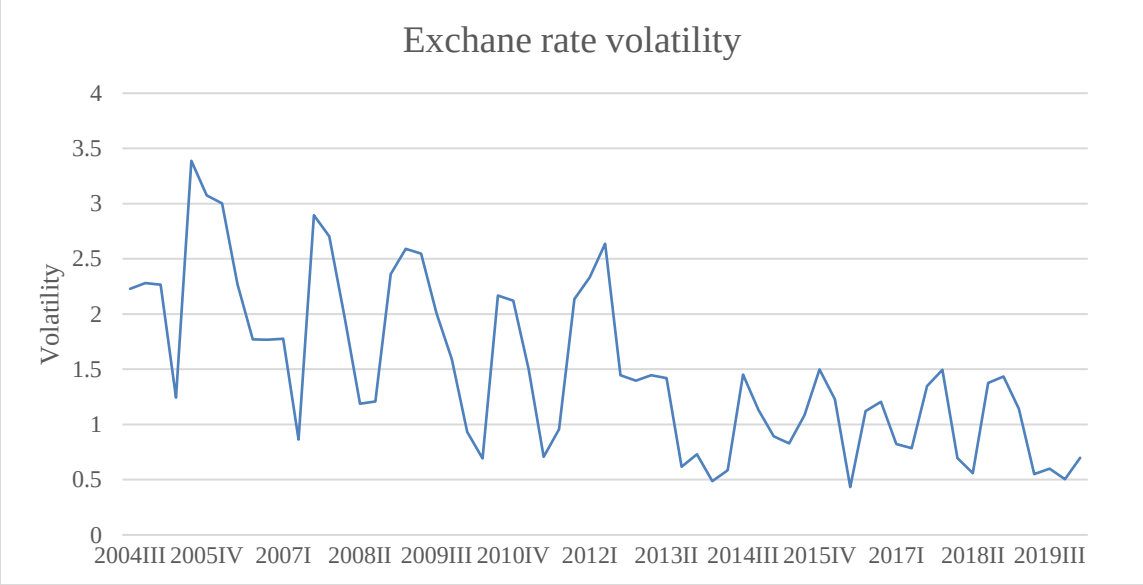
Source: Author's calculation based on collected raw data.

REER above and below 100 indicates appreciation and depreciation of REER respectively. The reference year is 2010 Q1.

Conventional trade theories suggest that depreciation of REER favors exports and appreciation deteriorates exports. In our REER calculation, the largest value, highest

appreciation, is 107.51 during 2018 and the respective lowest value, lowest depreciation, is 87.90 during 2004. The appreciation of REER during 2018 might be due to the sudden decline in CPI of Nepal after the Indian blockade and economic halt after Nepal earthquake 2015. Another reason might be rise in the then sluggish foreign trade after mentioned phenomena of 2015. The depreciation of REER during 2004 might have been due to increase in CPI level and fall of foreign trade simultaneously in the dawn of political change of 2006. Here, REER alone might be a necessary condition but might not be a sufficient condition to enhance exports. Their degree of integration has been discussed in the later section of this paper.

Figure 4.2: Exchange rate volatility



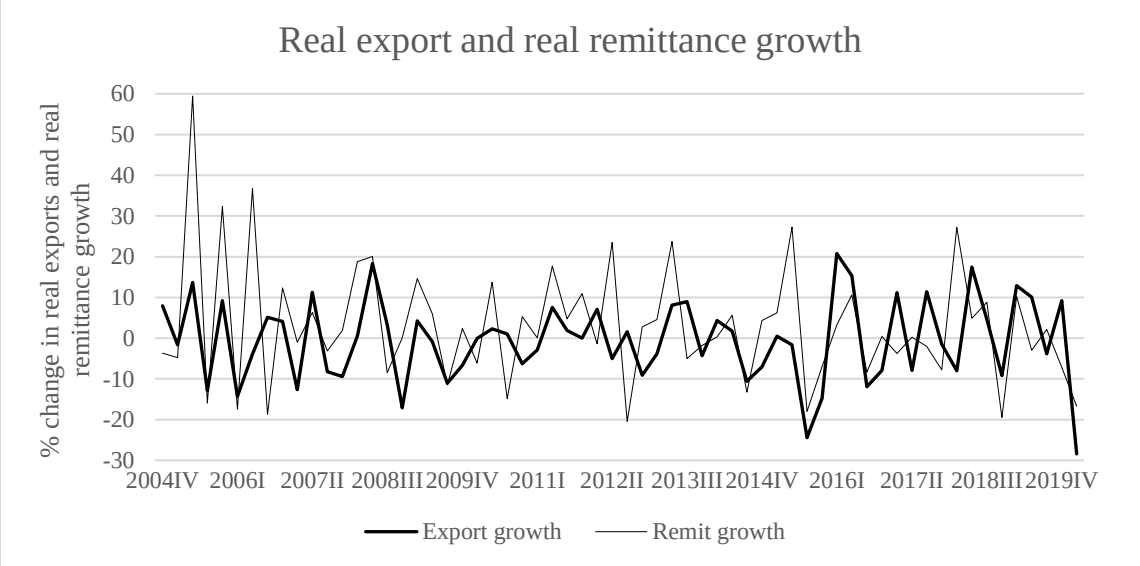
Source: Author's calculation

The exchange rate volatility has been calculated using the moving standard deviation of the growth rate of the real exchange rate. While calculating it, 4th order of moving average has been used. Technically, volatility measures the swing in either direction from the mean value. Higher exchange rate volatility variable represents a higher risk and vice versa. The REER volatility is maximum during 2005 Q3 and minimum during 2016 Q2.

The higher volatility in currency means exporting firm are more skeptic about the potential loss in near future, so the export chain loose mechanism of smooth export over time (Hall et al., 2010; Chit et al., 2010; Vieira & MacDonald, 2016). In contrast, other

literature suggests that exchange rate volatility may not affect exports since hedging opportunities exist these days and due to symmetric information, exporting firms love to play in the forex market as rational business operators (Khachatryan & Grigoryan, 2020). We analyze the REER volatility and its association with other variables in subsequent sections.

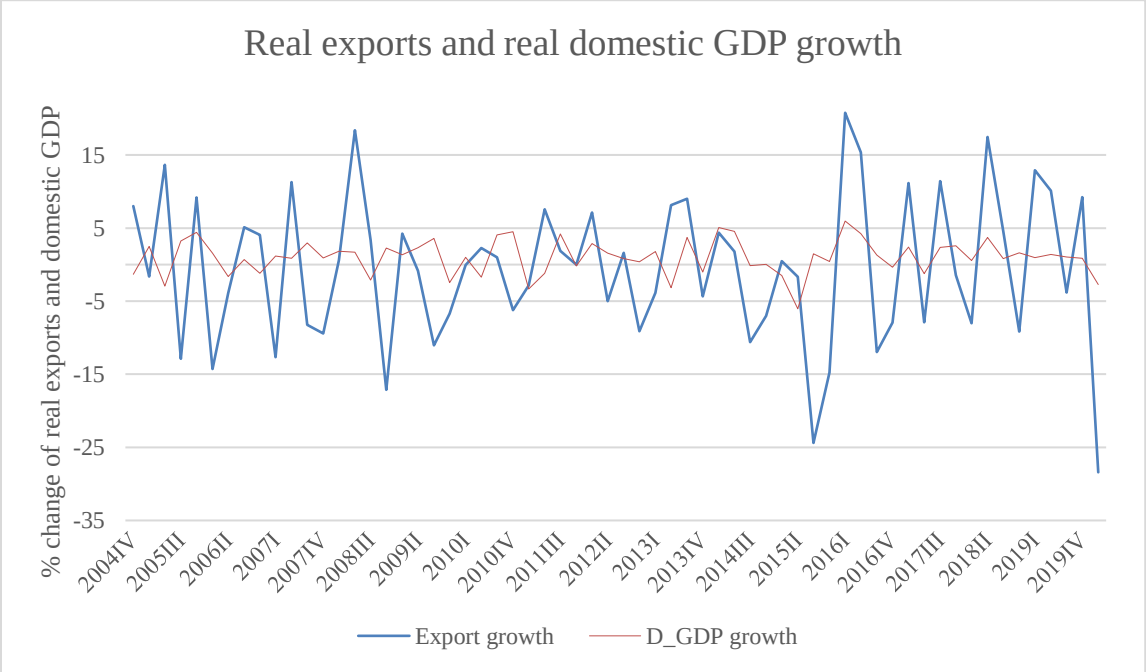
Figure 4.3: Real exports growth and real remittance growth



There is highest change in real remittance growth during 2004. This could be due to creation of safe foreign destination to war torn Nepalese workers in foreign employment. The lowest export growth during 2015 and 2019 might have association with Nepal Earthquake 2015 followed by Indian blockade and Covid lockdown of early 2020 respectively.

The calculated value of correlation between real export growth and real remittance growth is 0.4153. This result suggests the positive degree of association between them. Dutch Disease phenomena argues the decline in export competitiveness due to the remittance flow. But the positive correlation value suggests there could be some more hidden aspects other than change in export competitiveness created by remittance inflow.

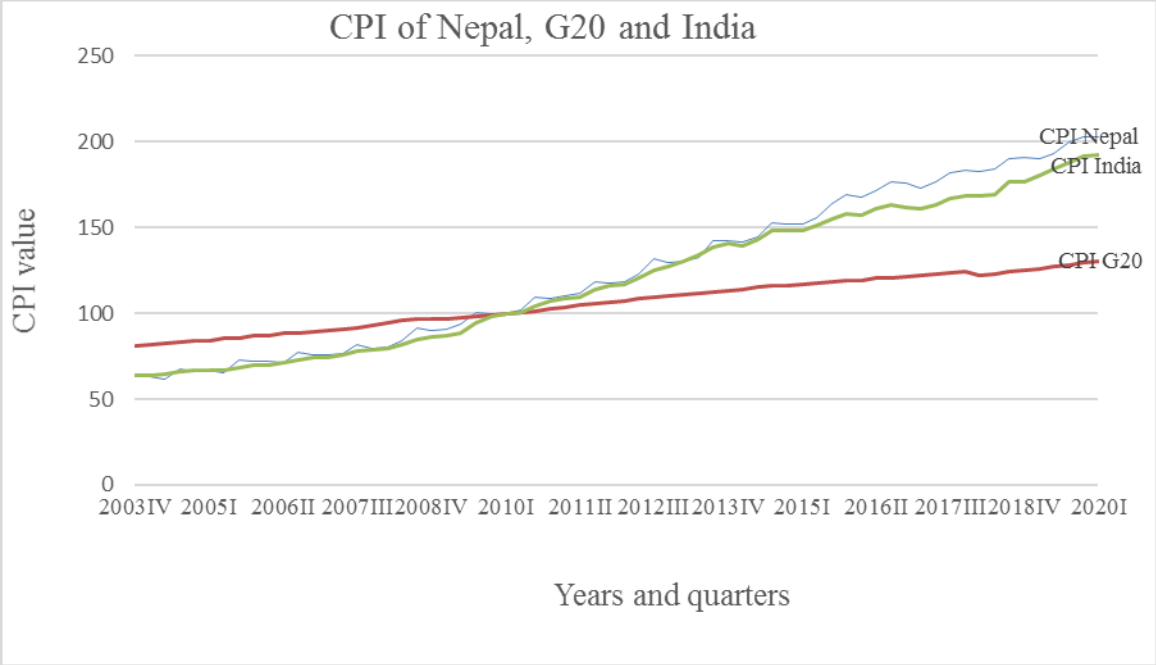
Figure 4.4: Real exports growth and real domestic GDP growth



Keynesian four sectors open economy gives space for net export while calculating national account and GDP. According to Keynes, there is positive and proportional relationship between GDP and exports.

The export growth and GDP growth are sketch in figure 4.4. It reveals that these two variables in growth term move together along the year 2004 Q3 to 2020 Q1. Export growth has reached its tipping point during 2016 where export growth has reached its maximum of 20.77 percentage soar from its immediate quarters. This may be due to the aftermath of the catastrophic earthquake and the immediate Indian undeclared blockade of 2015. Similarly, export growth has plunged up to -28.41 percentage during 2020 Q1. The rigid reason behind it may be due to the unexpected sudden lockdown, to keep the Covid-19 pandemic in control. The GDP growth rate of Nepal has toppled the most in 2015 Q2 up to -6.05 percentage, could be due to the Nepal Earthquake 2015 followed by the Indian undeclared blockade of 2015. In this way, the year 2016 Q1 has surged in the GDP growth rate of Nepal. This might also be due to the sudden rise of economic activities after the well-known 2015 events.

Figure 4.5: CPI of Nepal, G20 and India



Note: Base year for CPI of Nepal, G20 and India is 2010

Since the quarterly GDP deflator is not readily available, we used CPI of Nepal as a proxy to convert other nominal variables into real. Upward trend of Nepalese CPI and Indian CPI gives enough base to claim the association between them. Chaudhary & Xiumin (2018) and NRB (2017) claim inflation of Nepal is significantly influenced and largely determined by inflation in India. Nepalese price levels has Indian dominance due to weaker supply of domestic production and heavily dependent in Indian imported products (Chaudhary & Xiumin, 2018). The smooth growth of CPI of ROW (here G20) might be since G20 nations have more regulated and formal institutions to regulate economy. This could have strengthened to smooth the targeted inflation rate. Base year is 2010 so, all three CPIs overlapped in 2010 Q1.

4.2 Descriptive analysis of the variables

Descriptive statistics show the number of observations, standard deviations, minimum values, maximum values, kurtosis, skewness, mean, and medians as in the following table. Every variable is in percentage change (% Δ) of the natural logarithm (ln). Abbreviation of Exp, Remit, dGDP, pGDP, REER, and Vol represents Real exports,

remittances, domestic GDP, partner GDP, REER, and exchange rate volatility respectively, in the base year of 2010. Before the conversion of variables into natural logarithm, variables that have units of currency were in millions of rupees.

Table 4.1: Descriptive statistics

	N	Std. Dev.	Min	Max	Kurtosis	Skewness	Mean	Median
ΔExp	62	1.10	-3.48	2.08	3.53	-0.52	-0.10	0.00
ΔRemit	62	1.29	-2.02	4.72	4.30	0.73	0.20	0.11
ΔdGDP	62	0.19	-0.49	0.45	3.16	-0.44	0.08	0.09
ΔpGDP	62	0.22	-0.29	0.86	5.08	1.25	0.10	0.07
ΔREER	62	0.55	-1.44	1.97	5.15	0.46	0.03	0.01
ΔVol	62	297.77	-1821.31	458.18	20.97	-3.41	-77.12	-25.51

Note: Every variable is in % change

Although there are 63 observations from 2004 Q3 to 2020 Q1, calculation of percentage change (% Δ) has reduced the number of observations to 62. The maximum value of ΔExp (%), ΔRemit, ΔdGDP (%), ΔpGDP(%), ΔREER (%) and ΔVol (%) are 2.08, 4.72, 0.45, 0.86, 1.97 and 458.18 respectively. Similarly mean value of ΔExp (%), ΔRemit, ΔdGDP (%), ΔpGDP(%), ΔREER (%) and ΔVol (%) are -0.1, 0.2, 0.08, 0.1, 0.03, -77.12 respectively. Some variables are positively skewed while others are negatively skewed. In this way, desired variables' required value can be easily traced from the above table, 4.1.

4.3 Stationarity test of variables

Majority of the variables are not unit root free at their level. Every variable is unit root free at the first difference. The Table 4.2 is the summary of the Augmented Dickey Fuller test (Dickey & Fuller, 1981) for the detection of the presence of unit root. The PP test (Phillips & Perron, 1988) has also been used as a cross-check of ADF. Both the tests reveal the same result on the empirical ground but here the results of ADF have only been displayed. ADF test is the test of significance of the considered coefficients and error terms where the null hypothesis is, there is unit root in the coefficient(s). Rejection of null hypothesis at conventional 5 % level supports the conjecture of no unit is present.

Table 4.2: Stationary test of variables

Variables	t statistics	p-value	Remarks
ln_Exp	-1.65	0.4595	Level
Δln_Exp	-8.40	0.0000***	I(1)
ln_Remit	-2.38	0.1481	Level
Δln_Remit	-12.51	0.0000***	I(1)
ln_dGDP	-0.30	0.9251	Level
Δln_dGDP	-8.32	0.0000***	I(1)
ln_pGDP	0.38	0.9805	Level
Δln_pGDP	-6.15	0.0000***	I(1)
ln_REER	-3.00	0.0346**	Level
Δln_ REER	-12.44	0.0000***	I(1)
ln_Vol	-3.93	0.0018***	Level
Δln_Vol	-8.82	0.0000***	I(1)

*Note: ***, ** and * are 1%, 5% and 10% significance respectively.*

Table 4.2 displays the results of ADF test statistics of the variables under consideration in this study. The results of every variables depict that they are unit root free at the first difference, I(1). This indicates considered variables are stationary at I(1). t statistics is the ADF test statistic. If the absolute value is lower than critical value, the null hypothesis, variable has unit root, cannot be rejected.

4.4 Empirical estimation

The estimated equations 5, 6, 7 and 8 specified in section 3.5 of chapter 3 and summary of findings are in Table 4.3, 4.7 and 4.8, and in annex 1. Interpretation of the results has been done with possible comparison with existing literature with the fact-based arguments.

Table 4.3 and annex 1 are the summary of regression equations 5 and 6 which are set to study the effects of exchange rates and exchange rate volatility on real exports. The sign of the coefficients support the theory; in some cases, it is opposite. Existing literature (Paudel & Burke, 2015; Freund & Pierola, 2012; Eichengreen, 2013) suggest that there is a inverse relationship between exchange rate and export. But upon empirical estimation, real effective exchange rate has no significant effect (with negative as well as positive sing) on the real export of Nepal (Table 4.3 and Appendix 1). The change in the real exchange rate is a measure of short-run REER elasticities that measure the price

competitiveness of exports. In this way, the estimated coefficients of real domestic GDP growth are positive and vary from less than unity to unity. This means domestic GDP growth promotes the real exports of Nepal. In all possible outcomes of annex 1, the dependent variable is change in real export of Nepal. While estimating Panel A of annex 1, we do not include the change in exchange rate volatility. Panel B of Table 4.3 is with exchange rate volatility.

None of the estimated coefficients is significant except volatility coefficients and coefficients of real domestic GDP growth in Panel B of Table 4.3! These are unexpected results for the empirical analysis. One of the reasons for these insignificant coefficients maybe due to Nepal has negligibly low export compared to domestic GDP, export weighted partners' GDP and the explanatory variables here are tall figures of GDPs. Another plausible argument for most of real sector variables' coefficient being insignificant might be due to Nepalese trade, mostly export, might have been influenced by structural variables. Those variables are not considered in this paper due to our limitation. So, the inflated figures of partners' GDP and domestic GDP could have played a significant role to undermined and squeeze the dwarf figures of real exports of Nepal. The reason behind the insignificant of the parameters could be a hot debate in economics and a separate chapter of research beyond this paper, as this paper has limitations.

Table 4.3 Regression results

	Model 4		Model 5	Model 6
	Dependent	variable:	Δln_Exp	
VARIABLES		Panel B		
Δln_dGDP	1.01*			1.07**
	(0.52)			(0.53)
Δln_REER	-0.16		0.22	0.03
	(0.52)		(0.56)	(0.55)
Δln_pGDP	0.23		0.36	0.33
	(0.38)		(0.39)	(0.38)
Δln_Exp (-1)			-0.08	-0.07
			(0.14)	(0.13)
Δln_Vol	-0.10***		-0.10***	-0.1***
	(0.03)		(0.03)	(0.03)
Constant	-0.03*		-0.02	-0.03**
	(0.01)		(0.01)	(0.01)
Observations	62		61	61
R-squared	0.25		0.21	0.27

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.3 is the Panel B of Appendix 1. Extra variable in Table 4.3, other than of Panel A of Appendix 1, is exchange rate volatility. This is the only coefficient that is significant at a 1% level of significance. Domestic real GDP growth is another coefficient that is significant at 10% and 5% level in Model 4 and Model 6 respectively. In case of Model 4 and 6 of Panel B, if the domestic real GDP changes by 1%, the resultant real exports changes by 1.01% and 1.07% respectively in same direction. In the case of Model 4, 5, and 6 of Panel B, if the exchange rate volatility of Nepali currency fluctuates by 1%, real exports of Nepal fluctuate by 0.1% on every case but in the opposite direction, other things remaining constant. That means real export of Nepal declines/increases by 0.1% if Nepali currency appreciates/depreciates by 1%, other things remaining constant, in Panel B. That means, appreciation or depreciation of Nepali currency vis-à-vis USD by 0.1% results in the real exports of Nepal diminish or surges by 1% respectively, in the short run, other things remaining constant.

In a nutshell, none of the estimated coefficients, except volatility and domestic real DGP behaved as per expectations since almost all are not statistically significant on every case including 1%, 5% or at 10% level of significance. That means the insignificant variables considered here have no significant effect on the real export of Nepal, in the eye of econometrics analysis. The conjecture of insignificant cannot be drawn without the diagnostic test of the estimation model.

The reported R^2 is much low in Model 1, 2, and 3 of Panel A but it is satisfactory in Model 4, 5, and 6 of Panel B. It can be observed 25%, 21%, and 27% in Model 4, 5, and 6 respectively. Although low R^2 value warns about the imprecise predictions of the model since there could be more heavily weighted variables outside the model than the considered ones. But our interest is to understand the relationships between/among the variables. The good news is that a low R^2 does neither invalidate nor void the importance of any significant variables. Since we have low R^2 on one hand and insignificant estimated coefficients on other hand, the considered variables might have selection bias.

Heteroskedasticity test: The heteroskedasticity test has been tested using Breusch-Pagan/Cook-Weisberg test for heteroskedasticity. The null hypothesis of the Breusch-Pagan test for heteroskedasticity is error variance is constant. p-value less than 0.05 indicates the rejection of the null hypothesis and thus gives the absence of homoskedasticity and the presence of heteroskedasticity in the model. Claim is Error variance is constant. Among several remedies for the treatment of heteroskedasticity, Robust standard errors are one of the widely used tools. Robust standard errors can be used even if there is no idea of the absence or presence of heteroskedasticity in the model. If there is heteroskedasticity in the model, Robust standard errors do correct the model by adjusting standard errors (now Robust standard errors) and if there is no heteroskedasticity in the model, it has nothing to do with there. So, Robust standard errors have modified the choices of models in the above table. The results of test statistics show the calculated values of p greater than 0.05 in every model, which represent the absence of heteroskedasticity in every model in Table 4.3. So, there is no need to employ robust standard error in the models.

Table 4.4: Breusch-Pagan test for heteroskedasticity for model 6

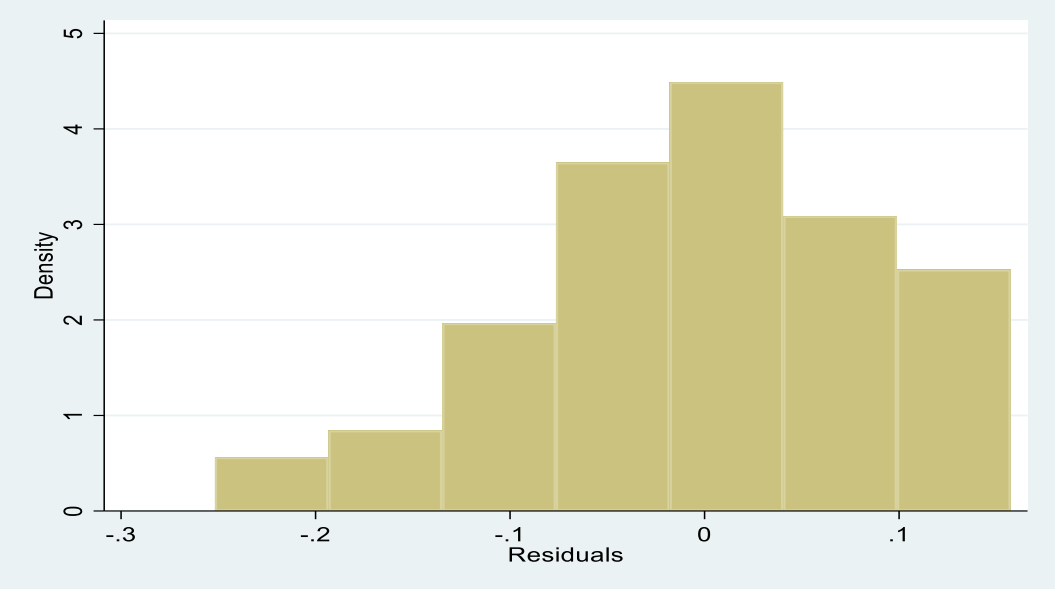
```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of dln_exp

         chi2(1)      =     1.66
         Prob > chi2  =   0.1980
```

Here, the value of p is 0.01 which is less than 0.05, so it rejects the null hypothesis that there is a constant variance of error term i.e. there is heteroskedasticity in the model. It has been corrected by deploying robust standard errors in the model.

The main purpose of considering heteroskedasticity results displayed here is due to the reason that Model 6 is the compact form of other intermediaries' models. So, to make less traffic of results, only one result of prominent models is displayed.

Normality test: Normality test measures the degree of scatteredness of the data in the model. Normality test of error term gives the results of omitted and scattered variables in the model. The Skewness-Kurtosis test has been used to measure the normality test. Kurtosis and Skewness measure the height and tail of the distribution respectively. Histogram gives the visualization of the normal distribution. Claim is normally distributed. If joint p-value is greater than 0.05, accept the claim. Upon empirical analysis, all the errors terms of Model 1 to 6 are found normally distributed. The result of Model 6 is displayed below.

Figure 4.6: Histogram of error term of model 6



The error term of Model 6 is also positively skewed.

Table 4.5: Skewness-Kurtosis tests for normality for model 6

Skewness/Kurtosis tests for Normality

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	joint adj chi2(2)	joint Prob>chi2
Model_6_er~r	61	0.0485	0.4157	4.59	0.1007

Joint p-value of Model 6 has calculated value of 0.1007, which is larger than 0.05, so the Model 6 is said to be normally distributed.

Serial Correlation: Serial correlation is a measure of the degree of influence that a variable has with its lag or lead value. So, for serial correlation, there is no need for at least two variables to measure the relation between the variables like in correlation. The Akaike Information Criterion (AIC) has given an optimal lag length as below:

Variables	AIC's optimal lag length
Real export	2
First lag of real export	2
Domestic real GDP	4
REER	4
Partners' export weighted real GDP	1

The measure of serial correlation is done based on Breusch -Godfrey LM test for autocorrelation. The purpose of using this test instead of the Durbin-Watson (DW) d-statistics test is, DW test has no adjustment factor for the customization lag length whereas the Breusch-Godfrey LM test has a broad choice of lag length selection. For a single lag, both tests have the same results. Breusch-Godfrey LM test for autocorrelation has null hypothesis 'no serial correlation. If $p<0.05$, reject null i.e., there is serial correlation in the residuals of the models. Every model from Model 1 to Model 6 rejects null at first lag except Model 2, Model 3, and Model 6, indicating no serial correlation at first lag. In the contrast, Model 2, 3 and 6 have serial correlation on first lag too.

i. Model 1 has no serial correlation after lag 5
ii. Model 2 has no serial correlation after lag 3
iii. Model 3 has no serial correlation after lag 5
iv. Model 4 has no serial correlation after lag 4
v. Model 5 has no serial correlation after lag 3
vi. Model 6 has no serial correlation after lag 6

Table 4.6: Breusch-Godfrey LM test for autocorrelation for model 6

Breusch-Godfrey LM test for autocorrelation

lags(*p*)	chi2	df	Prob > chi2
6	11.363	6	0.0778

H0: no serial correlation

Multicollinearity

Multicollinearity is a condition of perfect or exact linear dependence or relationships between two regressors or among regressors in a model. Multicollinearity can be

identified/traced using variance inflation factor (VIF) (Craney & Surles, 2002), which calculates the centered or uncentered variance inflation factors for the independent variables specified in a linear regression model. VIF tests the degree to which the standard errors are inflated due to the presence of multicollinearity.

Upon empirical test of every model, Model 1 to Model 6, there is no presence of multicollinearity. This is given by the fact that if Mean VIF is larger than 10, there exists multicollinearity and, in our case, Mean VIF is even less than 2 in each model.

As discussed earlier, changes in expectations of the real exchange rate potentially affect exporters' decisions and the current export volume also gets affected accordingly. A two-stage least square model (2SLS) has been deployed to get the estimated coefficients of equation 7, which considers the expectations of the real exchange rate. In the first-stage model, the next period REER growth (Δln_REER(+)) has been treated as an endogenous variable and it has been exposed as a dependent variable. Whereas first lag of REER, volatility growth, and remittance growth has been treated as instrumental variables.

After the completion, the calculations of the first-stage model followed by diagnostic tests as suggested by Baum et al., (2003, 2007 & 2013), the further part of the task is to run the second-stage model. The second-stage model is composed of the retrieved effect of exogenous variation of the expected REER growth on real export. Here, other control variables are export weighted real GDP growth of partners, export growth persistence (i.e., first lag of real export growth), domestic real GDP and exchange rate volatility.

The further step is a diagnostic test for the goodness of fit and appropriateness of the model. Baum et al., (2003, 2007 & 2013) have suggested primarily three diagnostic tests:

1. Durbin Wu Hausman test for endogeneity
2. Sargan Basmann chi-square test for overidentification test
3. F test for weak instruments tests

Durbin Wu Hausman test for endogeneity: This test is done to check whether the assumed and deployed endogenous variable is, in fact, endogenous for the instruments or not, in the model. Null hypothesis is variables are exogenous. If $p<0.05$, reject null i.e., variables are endogenous for the considered instruments. In our case, the endogenous

variable is expected REER growth. The result of Durbin Wu Hausman test gives REER (+1) is endogenous for the first lag of REER growth, volatility growth and remittances growth. This is because test statistics of Durbin Wu Hausman test for endogeneity has calculated value of less than 0.05, which reject the null hypothesis. The conformity of endogeneity of REER (+1) opens the way for the use of IV and 2SLS estimators.

Overidentification test: This test measures the crowd of instruments other than necessary for the model (Baum et al., 2007). It is measured by the Sargan (1958) and Basmann (1960) test. Null hypothesis is instrument(s) set is (are) valid, and the model is correctly specified. If $p>0.05$, accept null i.e., instruments are not overidentified and the model is correctly specified. In our analysis, both Sargan as well as Basmann test has calculated p-value of 0.2, which is larger than 0.05, so the instruments are not overidentified and the model is correctly specified.

Weak instruments test: This test is done to get whether deployed instruments are weak or not. F test gives the actual figure for the presence or absence of weak instruments. As per rule of thumb if F has a calculated value of 10 or larger than 10, then instruments used are not weak instruments (Baum et. al., 2007). In our calculation, F statistics is 11.74, which means the deployed instruments are not weak. The next step is to fit the effect of exogenous variation of the expected REER growth on export weighted real GDP growth of partners, export growth persistence (i.e., first lag of real export growth), domestic real GDP and exchange rate volatility, as control variables.

Table 4.7: Forward-looking model for REER

Variables	Stage 1 Dependent variable: Δln_REER(+1)	Stage 2 Dependent variable: Δln_Exp
Δln_REER(-1)	0.02	
	(0.11)	
Δln_Vol	-0.007	-0.06**
	(0.005)	(0.03)
Δln_Remit	0.10***	
	(0.02)	
Δln_REER(+1)		2.34**
		(0.94)
Δln_pGDP	-0.08	0.41
	(0.08)	(0.34)
Δln_dGDP	-0.07	1.27**
	(0.12)	(0.56)
Δln_Exp(-1)	-0.02	0.06
	(0.03)	(0.13)
Constant	0.0007	-0.03**
	(0.0031)	(0.01)
R^2	0.1024	
Observations	60	
Estimation	IV-2SLS	
ADF test (Z(t))	0.0000	
Skewness-Kurtosis test (χ^2-Prob)	0.2536	
Cumby-Huizinga (χ^2-Prob) for lag2	0.1831	
Pagan-Hall test (χ^2-Prob)	0.3756	
Durbin Wu Hausmann (χ^2,f-Prob)	0.01	
Minimum eigen value (f-statistics)	11.74	
Sargan Basmann (χ^2-Prob)	0.2	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Diagnostic tests have been done and their respective results are illustrated in Table 4.7. Durbin Wu Hausmann test of endogeneity has a calculated value of 0.01, which is less than 0.05, so null hypothesis, variables are exogenous, is rejected indicating instruments and endogenous variable treated satisfied the condition of endogeneity. Sargan Basmann overidentification restriction test accepts the null hypothesis that instruments set are valid, and the model is correctly specified. This is followed by an f test to check whether instruments are weak or strong. f-test has a calculated value of 11.74, which is larger than the rule of thumb value, 10. So, the f test gives the result that instruments are not weak.

These are diagnostic tests for IV which confirms the goodness of fit and the model's appropriateness.

In the first stage, only remittances growth is significant at 1% level, among the instruments used. The endogeneity of the instruments used, as shown in Table 4.7, opened the way for the further calculation even if only remittances has a significant result in first stage. In contrast to the first stage, the second stage of Table 4.7 has the exchange rate volatility, changes in expectation of real exchange rate i.e., next period REER growth (Δln_REER(+1)), domestic real GDP are significant at 5% level of significance. Whereas export weighted real GDP of the partner and first lag of real export are not significant even in 10% level of significance. R^2 is 10.24%, which tells that the given explanatory variables including endogenous variables and instruments have a 10.24% share in the fluctuation to the dependent variable, real export growth (Δln_Exp), other things remaining constant.

Significant coefficients deserve to be interpreted. First stage flash the result that if the remittances grows by 10%, the expected REER grows by 1%. In the second stage, exchange rate volatility and real export have negative relation. That means if exchange rate volatility rises by 10%, that results in the decline of real export by 0.6%, ceteris paribus. In this way, the result in the change in expected REER by 10% would results in 23.4% change in real export in the same direction. The last significant variable is domestic real GDP and if is changes by 10%, the resultant real export also changes by 12.7% positively, ceteris paribus.

The final task of this paper is to establish the relation between REER and endogenous remittances. For this, a two-stage model has been developed to dig out the fact of fluctuation of the real exchange rate due to remittance inflow.

Table 4.8: Two-stage model for REER

Variables	Stage 1 Dependent variable: Δln_Remit	Stage 2 Dependent variable: Δln_REER
Δln_Remit(-1)	-0.50***	
	(0.17)	
Δln_Remit(-2)	-0.01	
	(0.16)	
Δln_pGDP	0.74	
	(0.52)	
Δln_REER(-1)	-0.13	
	(0.88)	
Δln_Remit		-0.28***
		(0.07)
Δln_Exp(-1)	-0.09	-0.03
	(0.19)	(0.05)
Constant	0.02	0.008*
	(0.02)	(0.005)
R^2	0.55	
Observations	60	
Estimation	IV-2SLS	
ADF test (Z(t))	0.0000	
Skewness-Kurtosis test (χ^2-Prob)	0.6363	
Cumby-Huizinga (χ^2-Prob)	0.2879	
Pagan-Hall test (χ^2-Prob)	0.7613	
Durbin Wu Hausmann (χ^2,f-Prob)	0.0000	
Sargan Basmann (χ^2-Prob)	0.7	
Minimum eigen value (f-statistics)	3.5872	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Every variable and estimated coefficients have passed thoroughly diagnostic tests as suggested by Baum et al., (2003, 2007 & 2013). Table 4.8 also contains the estimated coefficients and results of test statistics of corresponding tests as illustrated in the table.

In the first stage of the model, remittances growth has been assumed as an endogenous variable; first and second lag of remittances, first lag of REER, first lag of export and export weighted real GDP of partners as instruments. Endogenous variable and its corresponding instruments have flashed the result of endogeneity given by Durbin Wu

Hausmann test statistics, overidentification restriction test given by Sargan Basmann test, and weak instrument test by f test statistics. First lag of real export has been treated as the exogenous variable. The calculated values are listed in Table 4.8 and the respective null hypothesis has been mentioned in the results of Table 4.7 and in section 3.5.2 of chapter 3. Furthermore, normality test, serial correlation, and stationary test, heteroskedasticity of residuals of stage 2 of Table 4.8 have been done using SK test, Cumby-Huizinga test for autocorrelation, ADF test and Pagan-Hall test respectively. All the results are consistence, and this support the validity of the model.

The second stage of Table 4.8 states that additional growth of remittances inflows of 1% results in depreciation in the value of real exchange rate by 0.28%, ceteris paribus. This finding is conflicting with the literature which states the presence of Dutch diseases in Nepal, fueled by remittances. In general, Dutch disease is the phenomena where there is loss in external competitiveness of the products due to sudden spike in the domestic real exchange rate. In our finding there is negative relation between the remittance inflow and real export. This suggests there is no footprint of loss of external competitiveness of Nepali export due to inflow of remittance indicating there is no existence of remittance induced Dutch Disease in Nepal. This result is opposite with the outcomes of Sapkota (2013).

CHAPTER 5: CONCLUSION AND RECOMMENDATION

This study investigates the relationship between exchange rate and its volatility on exports. We also intend to gauge the export competitiveness deterioration of Nepal via sizable remittance inflows. Export promotion is one of the much-debated topics in Nepal and this paper tries to mitigate, in some way, analyzing quarterly time-series data of 63 quarters starting from 2004 Q3 to 2020 Q1.

We estimated several regression equations, ADF test to trace stationary, Skewness-Kurtosis and histogram test for normality test, Breusch-Pagan/Cook-Weisberg for heteroskedasticity, Breusch-Godfrey LM test for serial correlation, and VIF test for multicollinearity have been used. In addition, in case of IV 2SLS estimation, Pagan-Hall test for heteroskedasticity, Cumby-Huizinga test for serial correlation is used for a diagnostic test of residuals and to check the goodness of fit of IV estimates, Durbin Wu Hausmann test for endogeneity, Sargan Basmann test for the test of overidentification restrictions and f test for weak instruments test have been deployed.

To substantialize the identified objectives, a baseline model [Equation (5)] has been estimated. The summaries of outcomes are in Table 4.3, 4.7, and 4.8. The degree and directional relation of exchange rate and exchange rate volatility on real export has been tested using OLS and to detect the export competitiveness of Nepal weighted by remittances, IV 2SLS estimation has been used, as specified in section 4.4 of chapter 4.

5.1 Findings

The relationship between change in REER (ΔREER) and change in real export of Nepal could not be established since there is no significant estimated coefficient. In this way, the first lag of export, and export weighted real GDP growth of trading partners have also failed to yield significant estimated coefficients. In contrast, domestic real GDP growth is significant in only two cases out of four incorporation in the model. That means our considered variables have nothing to do, at least statistically, with the real export of Nepal except the domestic real GDP. In Model 6 of Table 4.3, ignoring other coefficients, the rise of domestic real GDP by 10% pushes the simultaneous boost of real export by

10.7%. In another case, change in volatility is statistically significant at 1 % level yielding the estimated coefficient of -0.1, which means real export of Nepal increases by 0.1% if exchange rate volatility diminishes by 10% in the short-run, other things remaining constant.

In the case of forward-looking model of REER [REER(+1)] given by Table 4.7, the instruments used are first lag of REER change, change of exchange rate volatility, change of remittances inflow, domestic real GDP, export weighted real GDP of trading partners and first lag of real export worked well for the endogeneity, in first-stage. Several diagnostic tests, as suggested by Baum et al. (2007), have proved the validity of instruments and instrumented (endogenous variable) in the first stage. In the second stage, forward-looking model of REER growth, exchange rate volatility and domestic real GDP are found statistically significant at 5% level of significant. That gives the conjecture that Nepali export growth surges by 2.34 upon the expectation of rising in REER by 1%. The explanatory power of independent variables on the dependent variable in the second stage IV 2SLS estimation model is 10.24 % so the remaining variation on real export growth is due to other factors.

In addition, the study also attempt to map the state of export competitiveness of Nepal that is believed to have been plunging due to the tall figures of remittances inflow in recent time. This interesting relation is studied with the help of established relation between REER growth and remittances inflow growth over time. Here, remittances growth has been considered as endogenous variables which come to be correct upon the diagnostic test of IV 2SLS as suggested by Baum et al. (2007). Instruments used are up to the second lag of remittances inflow, first lag of REER, first lag of real export and export weighted real GDP of partners. The first stage model ratified the deployment of instruments and endogenous variable, growth of remittances. Every diagnostic test of residuals has the result that supports the model but in case of a test of weak instruments test of the diagnostic test of endogeneity, f test has less than half the value, 3.58, then the required rule of thumb value, 10, that suggest instruments are not weak. So, the instruments used in this case are considered weak instruments. In the second stage of IV 2SLS estimation, the endogenous variable, remittances growth, has flashed the result of

significance at a 1% level. This backs the result that upon plunges of remittances inflow growth by 10%, REER surges by 2.8%, other things remaining constant. So, this study suggests the inverse relation between REER and remittance inflow which is against the previous findings in national as well as international contexts. R square is quite fantastic standing at 55%, which indicates the variation of change in REER is accounted by independent variables (Δln_Exp(-1) and Δln_Remit) and the remaining is due to other factors.

5.2 Conclusion

Export weighted real GDP growth of partners; real exchange rate of Nepal have nothing to do with real exports of Nepal since their estimated coefficients are statistically insignificant. In contrast, there is significant positive role of domestic real GDP in the real export of Nepal. In addition, exchange rate volatility has an inverse relation with Nepali exports growth.

Both conjectures are against Khachatryan & Grigoryan, (2020). They found that there is weakening link between real exchange rate and export in Armenia, but our finding suggests that they have no statistically significant relation in Nepal. In addition, they argued that exchange rate volatility has no impact on export. This is also against our results. Lastly, they found the evidence of loss of external competitiveness of Armenian export induced by remittances inflows. This study has come into conclusion that there is no role of remittance inflow in the appreciation of real exchange rate rather they have inverse relation in Nepal. The countries should flourish conducive environment for economic growth without much resource wasting in the devaluation of domestic currency (Hunegnaw, 2017). Nepal has an appreciation of real exchange rate by mere single-digit considering the year 2010 as a base year so, her choice to depreciate would not account for the sudden surge in exports as suggested by literature but Nepal can still perform to make the volatility of exchange rate under control by establishing and developing forex hedging markets and other forward-looking markets. The immediate next step is the detection of positive and high coefficient of expectation of real exchange rate indicates that, in Nepal, real exchange rate appreciation does improve real export of Nepal. This result is in contrary with the result that shows the presence of Dutch disease in Nepal that

has huge cost of external competitiveness deterioration. To state in point, this paper has list of mentioned findings:

i. Unlike the global trend of weakening links between exchange rates and exports, Nepal has no significant impact of the real exchange rate on exports.
ii. Exchange rate volatility has a significant and inverse relationship with the real export of Nepal.
iii. The loss in external competitiveness of Nepal is not the result of remittances inflow growth so, there is no evidence of Dutch disease in Nepal.

5.3 Recommendations

Implementation of policy for exportable goods and services should be acted like there is a state emergency. Nepal's high dependency on India and third nations for even agro-products is an alarming sign of overall national security so, Nepal should not waste its precious resources on exporting minds and resources to formulate policy, but it should invest resources to act and get the result of the production of exportable goods and services of absolute and comparative advantages.

Hedging instruments and the market for exchange rate volatility have no space in Nepal so, to get the attraction of business and investment, Nepal should establish foreign exchange hedging market. Irrespective of dwarf figures of exports in front of towering import, Nepal at first just need to focus on substitution of import by domestic goods and services which would pay a handsome price for Nepal. Government and private sectors should utilize the productive age of Nepali people before their ageing to create decent jobs and employment opportunities inside country. Import substitution and export promotion policy must be properly implemented before the policy documents collect dust.

Nepal has the largest voluntary absentees' population in the world just in seek of employment in a foreign land. Nepal should not check its population to go abroad at once since this could impact negatively rather is should gradually reduce its working population in abroad. This will have socio-politico-economic pros in long run.

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APPENDICES

Appendix 1: Regression results

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		Dependent	variable:	Δln_Exp		
VARIABLES		Panel A			Panel B	
Δln_dGDP	0.90		0.95	1.01*		1.07**
	(0.58)		(0.58)	(0.52)		(0.53)
Δln_REER	-0.59	-0.13	-0.31	-0.16	0.22	0.03
	(0.57)	(0.60)	(0.60)	(0.52)	(0.56)	(0.55)
Δln_pGDP	-0.07	0.11	0.073	0.23	0.36	0.33
	(0.40)	(0.42)	(0.42)	(0.38)	(0.39)	(0.38)
Δln_Exp (-1)		-0.17	-0.17		-0.08	-0.07
		(0.15)	(0.15)		(0.14)	(0.13)
Δln_Vol				-0.10***	-0.10***	-0.1***
				(0.03)	(0.03)	(0.03)
Constant	-0.02	-0.01	-0.02	-0.03*	-0.02	-0.03**
	(0.06)	(0.06)	(0.07)	(0.01)	(0.01)	(0.01)
Observations	62	61	61	62	61	61
R-squared	0.05	0.03	0.07	0.25	0.21	0.27

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix 2: Data used for empirical analysis

(Amount in Rs. 000000)

Quarter	Exp	Remit	d_GDP	p_GDP	REER	Vol
2004 Q3	20241.5	21352.7	237958	5457458.8	93.54	2.23
2004 Q4	21857.7	20572	234762	5418178.7	91.11	2.28
2005 Q1	21498.7	19587.9	240622	5309885.1	93.32	2.27
2005 Q2	24435.1	31231.4	233506	5343851.2	90.79	1.24
2005 Q3	21286.7	26252.2	241024	5416000.3	99.24	3.39
2005Q4	23244.6	34731.2	251704	5654951.9	95.00	3.07
2006 Q1	19920.1	28684.1	255639	5590115.8	95.70	3.00
2006 Q2	19141.3	39211.9	251448	5770583.6	92.93	2.27
2006 Q3	20118	31884	253135	5957400.8	97.89	1.77
2006 Q4	20937.3	35817.7	250076	5872214.4	95.95	1.77
2007 Q1	18284.8	35453.7	253049	5823739.6	95.97	1.78
2007 Q2	20345.5	37684.2	255199	5565162.5	97.42	0.86
2007 Q3	18673.1	36505.4	262776	5454689.5	102.99	2.89
2007 Q4	16910.1	37193.6	265134	5388823	100.33	2.70
2008 Q1	17009.8	44176.1	270034	5455808.7	100.41	1.97
2008 Q2	20131.8	53016	274557	5770091.6	100.04	1.19
2008 Q3	20806.1	48510.9	268811	6131747.2	103.04	1.21
2008 Q4	17242.8	48568.2	274955	6769350	96.40	2.36
2009 Q1	17976.5	55665.4	278653	6900107.5	97.30	2.59
2009 Q2	17828.7	58977.6	285074	6685374.5	99.06	2.55
2009 Q3	15857.7	52220	295274	6601776.9	101.66	2.01
2009 Q4	14795.5	53464.9	287966	6363377.9	100.14	1.59
2010 Q1	14789.1	50211.1	290889	6335061.7	100.00	0.93
2010 Q2	15123.5	57130.4	285896	6437467.6	101.15	0.69
2010 Q3	15275.7	48670.4	297446	6536289.6	105.33	2.17
2010 Q4	14322.8	51240.7	310830	6453091.1	103.89	2.12
2011 Q1	13913.6	51299.5	300410	6548907.6	103.42	1.50
2011 Q2	14963.9	60385.2	296829	6550392	104.04	0.71
2011 Q3	15243.9	63220.4	309254	6890898.6	105.93	0.96
2011 Q4	15241.6	70109.8	308620	7686980.9	100.02	2.13
2012 Q1	16324.8	69143.8	317491	7531059.4	101.16	2.33
2012 Q2	15505.7	85387.8	322441	8272962	99.07	2.64
2012 Q3	15757.1	67917.9	325087	8466522.6	102.96	1.45
2012 Q4	14320	69793.2	326386	8332710.5	100.51	1.40
2013 Q1	13766.5	72967.4	332182	8277999.1	99.93	1.45

2013 Q2	14885	90259.3	321741	8560104.2	99.17	1.42
2013 Q3	16224.8	85706.1	333747	9816971.9	98.95	0.62
2013 Q4	15522.1	84139.6	330348	9854882	97.89	0.73
2014 Q1	16197.1	84388.6	347015	9846630.7	98.71	0.49
2014 Q2	16484.6	89134	362816	9656462.8	99.52	0.59
2014 Q3	14739.4	77278.3	362300	9907525.9	101.79	1.45
2014 Q4	13703.3	80600.8	362357	10211807	100.27	1.13
2015 Q1	13766.8	85598.9	356853	10303617	99.70	0.89
2015 Q2	13536.2	108953	335272	10634037	99.84	0.83
2015 Q3	10234.1	89338.1	340207	11015231	102.39	1.09
2015 Q4	8722.83	83136.9	341703	11272610	103.06	1.50
2016 Q1	10534.4	85851.2	362063	11593569	102.32	1.23
2016 Q2	12151.2	94949.4	377360	11611185	103.34	0.43
2016 Q3	10697.9	87026.9	382337	11682824	105.35	1.12
2016 Q4	9848.14	87391.8	381034	11910722	104.86	1.21
2017 Q1	10944.2	84072.5	390150	11852664	103.70	0.82
2017 Q2	10081.3	84278.3	385350	11589435	105.80	0.79
2017 Q3	11231.2	82569.4	394477	11692928	107.38	1.35
2017 Q4	11067	76164	404644	11825964	107.31	1.50
2018 Q1	10180.6	96874.9	406978	11941669	107.51	0.69
2018 Q2	11958.3	101570	422154	12583192	106.12	0.56
2018 Q3	12507	110556	425637	13332204	104.04	1.38
2018 Q4	11358.8	89034.9	432421	13525995	104.20	1.43
2019 Q1	12823.8	98166.4	436475	13407706	102.94	1.14
2019 Q2	14118.3	95252.8	442483	13322031	103.14	0.55
2019 Q3	13580.6	97278.7	447141	13660408	104.26	0.60
2019 Q4	14834.4	90346.6	450974	13844772	103.58	0.50
2020 Q1	10619.9	75273.2	438707	14334337	102.33	0.70

Appendix 3: Data used for REER calculation

Quarter	CPI, 2015=100			NC per FC		Trade Share		Quarter	CPI, 2015=100			NC per FC		Trade Share	
	Nepal	G20	India	USD	IC	ROW	India		Nepal	G20	India	USD	IC	ROW	India
2003Q4	41.92	68.70	41.70	73.57	1.60	0.43	0.57	2012Q1	77.35	91.06	76.25	79.74	1.60	0.34	0.66
2004Q1	41.47	69.30	41.80	73.40	1.60	0.46	0.54	2012Q2	80.14	91.94	78.93	87.00	1.60	0.35	0.65
2004Q2	40.30	70.10	42.10	72.39	1.60	0.35	0.65	2012Q3	85.97	92.48	81.73	88.45	1.60	0.37	0.63
2004Q3	44.30	70.46	43.17	74.34	1.60	0.37	0.63	2012Q4	84.47	93.17	83.39	86.49	1.60	0.34	0.66
2004Q4	43.37	71.04	43.45	72.99	1.60	0.39	0.61	2013Q1	85.02	94.06	85.18	85.20	1.60	0.31	0.69
2005Q1	43.85	71.53	43.56	70.72	1.60	0.37	0.63	2013Q2	86.73	94.74	87.34	87.38	1.60	0.34	0.66
2005Q2	42.89	72.25	43.81	70.37	1.60	0.37	0.63	2013Q3	92.90	95.48	90.53	99.40	1.60	0.35	0.65
2005Q3	47.74	72.81	44.77	70.53	1.60	0.37	0.63	2013Q4	92.91	96.01	92.19	98.99	1.60	0.33	0.67
2005Q4	46.88	73.51	45.63	72.85	1.60	0.36	0.64	2014Q1	92.69	96.60	91.04	98.06	1.60	0.32	0.68
2006Q1	46.98	73.99	45.52	71.13	1.60	0.37	0.63	2014Q2	94.61	97.65	93.34	95.36	1.60	0.34	0.66
2006Q2	46.69	74.90	46.41	72.55	1.60	0.37	0.63	2014Q3	99.89	98.18	96.65	97.03	1.60	0.36	0.64
2006Q3	50.36	75.33	47.56	74.02	1.60	0.36	0.64	2014Q4	99.44	98.37	96.78	99.19	1.60	0.38	0.62
2006Q4	49.51	75.53	48.58	72.11	1.60	0.35	0.65	2015Q1	99.13	98.83	97.04	99.15	1.60	0.37	0.63
2007Q1	49.50	76.20	48.71	70.69	1.60	0.36	0.64	2015Q2	101.56	99.92	98.82	101.39	1.60	0.35	0.65
2007Q2	50.00	77.21	49.35	66.79	1.60	0.39	0.61	2015Q3	107.31	100.46	101.12	104.08	1.60	0.40	0.60
2007Q3	53.23	77.77	50.75	64.74	1.60	0.37	0.63	2015Q4	110.73	100.80	103.03	105.56	1.60	0.47	0.53
2007Q4	51.93	78.69	51.26	63.26	1.60	0.35	0.65	2016Q1	109.44	101.20	102.52	107.65	1.60	0.36	0.64
2008Q1	52.68	79.82	51.77	63.75	1.60	0.33	0.67	2016Q2	112.27	102.14	104.94	106.91	1.60	0.36	0.64
2008Q2	54.84	81.31	53.17	67.13	1.60	0.37	0.63	2016Q3	115.62	102.59	106.47	106.69	1.60	0.36	0.64
2008Q3	59.91	82.30	55.34	71.02	1.60	0.44	0.56	2016Q4	115.06	103.03	105.83	107.88	1.60	0.34	0.66
2008Q4	59.01	81.83	56.49	78.07	1.60	0.45	0.55	2017Q1	113.08	103.70	104.94	106.25	1.60	0.36	0.64
2009Q1	59.28	81.88	56.61	79.76	1.60	0.37	0.63	2017Q2	115.58	104.38	106.47	102.83	1.60	0.40	0.60
2009Q2	61.33	82.63	57.89	77.47	1.60	0.43	0.57	2017Q3	119.00	104.89	109.02	102.71	1.60	0.36	0.64
2009Q3	65.48	83.36	61.84	76.70	1.60	0.45	0.55	2017Q4	119.67	105.54	109.79	102.85	1.60	0.34	0.66
2009Q4	64.95	83.97	64.01	74.14	1.60	0.46	0.54	2018Q1	119.21	103.42	109.91	103.03	1.60	0.34	0.66
2010Q1	65.34	84.77	65.29	72.91	1.60	0.38	0.62	2018Q2	120.52	104.28	110.68	107.71	1.60	0.36	0.64
2010Q2	66.68	85.37	65.80	73.19	1.60	0.35	0.65	2018Q3	124.04	105.47	115.14	113.23	1.60	0.37	0.63
2010Q3	71.34	85.85	68.22	73.44	1.60	0.33	0.67	2018Q4	124.63	106.16	115.40	113.99	1.60	0.34	0.66
2010Q4	71.24	86.77	69.88	71.66	1.60	0.32	0.68	2019Q1	124.37	106.82	117.69	112.26	1.60	0.35	0.65
2011Q1	72.15	87.99	71.15	71.96	1.60	0.33	0.67	2019Q2	126.28	108.11	120.11	110.84	1.60	0.35	0.65
2011Q2	72.82	89.08	71.66	71.24	1.60	0.37	0.63	2019Q3	130.70	108.88	122.54	112.94	1.60	0.38	0.62
2011Q3	77.31	89.68	74.47	74.19	1.60	0.36	0.64	2019Q4	132.63	110.00	125.34	113.75	1.60	0.39	0.61
2011Q4	76.64	90.28	75.74	81.95	1.60	0.35	0.65	2020Q1	132.51	110.74	125.47	116.49	1.60	0.37	0.63