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Impact of Commodity Concentration and Geographical Concentration upon Export instability in Pakistan

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Abstract: *This research study investigates the factors affecting export instability in Pakistan by using time-series data from 1981 to 2017. The determining factors of export instability in this study are commodity concentration index, geographical concentration index, food ratio, export earnings and total export quantity. The study employs Autoregressive Distributed Lag (ARDL) model to investigate the long-run (LR) relationship between export instability and its employed determinants. The empirical evidence reveals that commodity concentration, geographical concentration, food exports and export earnings are the key factors explaining export instability in Pakistan. The study finds the positive relationship between export instability and commodity concentration, while a negative association with geographical concentration. Furthermore, food exports and export earnings are also found to be negatively related to export instability. The study finds that concentration or dependence on a few exports causes export instability in Pakistan, but this problem would be overcome if Pakistan's commodity basket for exports become diversified.*

Keywords: Export Instability; Commodity Concentration; Geographical Concentration; Food Exports; ARDL

JEL Classification: F10, F20

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Introduction

International trade drives the process of development around the globe. The earnings of export sector uplift the marginalized investment, makes the imports of capital goods possible from developed economies and expands the output to achieve high growth rates in less developed countries whereas the contrary scenario is unfortunate (Douglas, 2016; Rashid, Ullah, & Bedi-uz-Zaman Ullah, 2012). Despite the merits of these channels Less Developed Countries (LDCs) suffer volatility in export earnings due to instability in exports, which is vastly discussed in the literature of economic. There might be several responsible push and pull candidates to debate the issue. However, commodity concentration and geographical concentration have major attributes towards export instability. The former refers to narrow export base whereby the later describes less number of market avenues for the products. More often, export instability differs from country to country due to the export structure or composition and demand and supply-side variations (Malhotra, 2015). There is a common consensus among the earlier studies (Coppock, 1962; Glezakos, 1973; MacBean, 1966; Massell, 1970; Savvides, 1984)that export instability mainly exists in the developing countries than developed countries. Narrow export base of LDCs is concentrated on primary and natural resource based products. The exports of developed countries are primarily based on capital or manufactured goods whereas; exports of developing countries consist of primary products like food and raw material. Therefore, exports of developing countries fluctuate more in the foreign markets as compared to developed countries due to inelastic and unbalanced demand and supply of their products.

Like other developing countries, Pakistan's exports are also reliant on primary products based on agriculture that directly or indirectly provides raw material to many industries. The agriculture sector is an important sector of Pakistan's economy, contributing about 19.5 percent of GDP (*Economic Survey of Pakistan, 2016-2017*). Therefore, owing to the reliability on primary based export commodities, Pakistan's export basket also suffer in the foreign markets due to demand and supply-side fluctuations by receiving volatile export receipts. Pakistan has been experiencing the problem of trade and Balance of Payment (BOP) deficits since its birth. Government of Pakistan has introduced many policies during different tenures to promote exports and economic growth like devaluation, concession in taxes and duties, import substitutions, export-led growth packages, export finance schemes, different trade agreements like, (PTAs), (FTAs) and (GSP) etc. Despite additional measures undertaken by the government to encourage exports, Pakistan's export performances remained gloomy (Douglas, 2016; Hanom, 2009; Khalil, Mehmood, & Hassan, 2017; Rashid *et al*., 2012).

Pakistan also witnessed the problem of export instability like other developing countries. Exports of Pakistan are also limited in few commodities and markets for many years, which caused instability in Pakistan's export receipts. In recent years,

exports of Pakistan has declined mainly due to higher concentration of few products (like leather, cotton, rice, cotton manufacturing and others) that contributes a more significant share of 71.8 percent to total exports. Similarly, the export of these products also concentrated to the fewer markets like(Afghanistan, Germany, USA, China, UK, France, Italy, UAE, Spain and Bangladesh etc.) having significant share in total export earnings *(Economic Survey of Pakistan, 2016-2017).*

The bleak picture of export sector provides a logical chain to export instability, compelling to identify the factors behind export receipts instability in Pakistan. Purposefully, commodity and geographical concentration indices stab to probe into exports instability in Pakistan. There are various studies conducted in the literature like (Asheghian & Saidi, 1999; Charette, 1985; Hanom, 2009; Khaduli, 1993; Love, 1986; Malhotra, 2015) that considered the commodity and geographical concentration of exports as essential factors causing the export instability in different economies. Most of the studies in literature focused on the effects of export instability on economic growth but responsible factors of exports instability are discussed by Aslam (1985) and Tariq and Najeeb (1995) before three decades. So, the present time series research is filling the niche by constructing relevant indices to know their effect on exports instability in Pakistan by covering the period from 1981 to 2017. The section 2 is followed by introduction in section1 providing relevant empirical studies. Section 3 portrays methodology of study, Section 4 describes results and discussion and Section 5 concludes the study.

Literature review

Export instability has been the main concern of LDCs, due to its damaging impact on growth and development. These countries suffer exports instability due to narrow production base by affecting organization of the economy (Aslam, 1985; Devkota, 2004; Douglas, 2016; Glezakos, 1973; Hamid, 1983; Hanom, 2009; Lim, 1976; Rashid *et al*., 2012; Tariq & Najeeb, 1995). Developing countries due to their reliability on the primary nature of export goods experienced greater instability in their export earnings because; the prices of these commodities fluctuate primarily in foreign markets. Whereas, developed countries receive stable export earnings due to the production of manufactured or capital nature goods and the prices of these products remains stable and experience fewer variations in foreign markets (Coppock, 1962; Glezakos, 1973; Lashkary, Ahmadi, Fard, & Mardani, 2013; MacBean, 1966; Massell, 1964, 1970; Meilak, 2008; Mitri, 1971; Murray, 1978; Naya, 1973).

Export instability is caused by various factors but primary product exports, commodity concentration and geographical concentration of exports have achieved considerable attention in the literature(Asheghian & Saidi, 1999; Charette, 1985; Hanom, 2009; Hock, 1977; Khaduli, 1993; Love, 1985; MacBean, 1966; Malhotra,

2015; Mulugeta, 2009; Naya, 1973; Tariq & Najeeb, 1995; Tegegne, 1991). Primary export products contributed more to the export earnings instability, due to the unstable prices in foreign markets and demand and supply related factors. Factors causing demand-side fluctuations are; cyclical changes, wars, crisis, government policies, purchasing power or consumer incomes, substitutes of export products, inflation, restriction on trade, outdated technology, rate of exchange and speculations regarding prices of these products. On the supply side, there are many factors that lead to export instability like, domestic consumption and production, plant diseases, floods, pests attack, climate changes, droughts, changes in tariff and tax system and cobweb-mechanism (Aslam, 1985; Hamid, 1983; Khaduli, 1993; MacBean, 1966; Massell, 1970; Mulugeta, 2009; Park, 1974; Tariq & Najeeb, 1995).

There are many studies like, Massell (1970), Murray (1978), Devkota (2004), Hanom (2009), Hamid (2010) and Malhotra (2015) depicting significant positive relationship between narrow export base and export instability in developing countries. Whereas, the study of Tariq and Najeeb (1995) reveals the fact that decreasing share of primary products in total exports is one of the responsible reason. The studies of Massell (1970), Aslam (1985), Love (1986) and Tariq and Najeeb (1995) further categorized the primary export products into two export groups i.e. food and raw material exports to explain the export earnings volatility. Food exports are considered an essential factor in determining export instability in LDCs but the otherwise or mixed relationship is also observed. Raw material exports are also the arena of primary products giving both way effect on export instability.

Undoubtedly, the former needs digging in supply side factors taking into account domestic instabilities, cobweb-mechanism, and weather conditions etc. Brodsky and Sampson (1979), Aslam (1985) and Charette (1985) also concluded that food exports have a positive and significant effect on the export volatility due to supply-side factors like domestic instabilities, cobweb-mechanism, and weather conditions etc. Raw-material exports which are also the part of primary goods export base caused export instability in many countries. Numerous studies (Hock, 1977; Khaduli, 1993; Love, 1986; Massell, 1970) reveal a positive relationship between raw-material exports and unstable export receipts, due to elastic demand of the export commodities while the contrary relationship is also noticed due to the increasing world demand or share of manufacturing exports in total export by developed countries. According to Massell (1970), no explicit models could define the statistical relationship among both variables so a shake conclusion is the fortune. Therefore, results and interpretation of many relevant studies remained complicated and unjustifiable.

Geographical concentration is another critical factor affecting the export instability in a developing country. The fewer are the export markets to send the produce, the larger is the export instability to be faced by LDCs due to demand-side instabilities importing country's government policies, trade restrictions and inflation etc. Perhaps, export instability varies from one country to another, due to the structure

and composition of export, relative dependence on foreign trade and economic conditions of the country. Therefore, factors that caused export instability also differ from country to country (Malhotra, 2015). The other way round is also noticed by a few researchers. (Brodsky & Sampson, 1979; Charette, 1985; Z. Hamid, 2010; Hanom, 2009; Hock, 1977; Kingston, 1973; Massell, 1970; Naya, 1973) noticed that market concentration has the negative effect on export instability or stabilizing impact, due to diversified export markets and trade agreements among trading partners.

Infect, the concrete arguments to affect export instability also lie with few other factors like Per capita income (PCI), size of export sector, value of export to GDP, domestic consumption, exchange rate fluctuations and inflation. According to Massell (1970), PCI does connect income elasticity of demand with price elasticity of demand in a country. An economy with high PCI transfers its resources toward that goods (manufactured or technology-intensive) whose demand remains stable which in turn helps in reducing the export instability.

Handful studies (Massell, 1970; Naya, 1973) reveal that market share of exports or size of the export sector is statistically insignificant variable in explaining the export instability, but a study of Hock (1977) shows that market share of exports has a positive and significant relationship with the unstable export receipts, due to inelastic prices and supply of export in short-run. Domestic consumption ratio is also a crucial factor to affect instability in export earnings in developing countries (Charette, 1985; Khaduli, 1993; Massell, 1970). When domestic consumption of a country increased, exports of the country decline due to variation in export quantities, which in turn leads to the unstable export earnings and vice versa. Similarly, Khaduli (1993) in Kenya finds that domestic consumption has a significantly positive effect on export volatility. Charette (1985) also finds the same results and suggested that, if there is domestic instability in exports commodities than stability in exports cannot be achieved through agreements accounting international trade of commodities. Massell (1970) concludes with positive but insignificant impact of domestic consumption on export instability.

The studies of Murray (1978), Hamid (1983), Tariq and Najeeb (1995), Kassa (1998) and Wasim (1998)used export quantity instability as an essential source of unstable exports receipts. Furthermore, a few studies (Hamid, 1983; Kassa, 1998; Murray, 1978) disclosed that in developing countries export instability mainly occur due to export quantity fluctuation rather than the prices of exports due to supply side factors like, domestic consumption, changing weather conditions, lower productivity etc. Whereas, results of the Tariq and Najeeb (1995) and Wasim (1998) studies indicate that export quantity is weakly related to export receipts instability in Pakistan, that also do not support the view that instability in export quantity leads to a greater degree of variability in export receipts. Exchange rate fluctuations and inflation are also vital sources of exports instability. The studies of Asheghian and Saidi (1999) and Lashkary *et al.,* (2013) empirically examined inflation and exchange rate instability as contributory factors in export instability of Venezuela and Iran, respectively.

Devkota (2004) pointed out that instability in agricultural and non-agricultural GDP are the sources of instability in exports. This study indicated that both these factors were positively related to unstable export, but, agricultural GDP found statistically insignificant and non-agricultural GDP was statistically significant variables. The study also highlighted some other factors like lack of product specialization, quality of exports, inappropriate tax system, and supply-side instability of agriculture produce, responsible for export volatility in Nepal. Hanom (2009) found a significant positive effect of fluctuation in agriculture GDP on unstable export earnings in Yeme. Malhotra (2015) investigated the factors of export instability in India by disaggregating export products. The disaggregation pointed out that petroleum product exports and textile & related product exports are negatively related to unstable exports in India, whereas, the study indicated that chemical &related product and engineering product exports are positively and significantly explaining the volatility of exports in India. Moving further, oil exports instability significantly led export earnings volatility. A studies (Hanom, 2009; Lashkary *et al*., 2013; Dougla, 2016) conducted in Yemen, Iran and Nigeria respectively, diverted the attention towards world oil prices and concluded that earnings from these exports remains unstable, which severely effect Balance of Payments position, investment, government earnings and expenditures, consumption and growth of these economies. The study of Douglas (2016) found that non-oil GDP had a significant contribution in determining unstable exports in Nigeria, and suggested that there is a need to make diversification and promotion of manufactured exports in Nigeria due to the comparative advantage in these exports.

Conclusively, least diversified export basket remained a major bottleneck to achieve export stability in various economies. Narrow export base usually adds in getting export instability. Quite considerably, narrow exports market or lower number of countries as buyers of product also remain a defined and definite way to exports instability.

Methodology & Model Specification

The present study employs annual time-series data for the period 1981 to 2017, to empirically investigate the factors affecting export instability in Pakistan. Empirical investigations show various causes of export instability in different countries. Based on the evidence two major regressors are decided i.e commodity concentration and geographical concentration. Furthermore, control variables are also employed to fulfil estimation requirements. The first step is to construct dependent variable followed by the construction of indices as regressors.

In time-series data analysis, first and foremost important step is to check the stationarity of the data because time-series data shows the trend over time. Therefore, to check the stationarity unit root test is conducted. A time-series variable is said to

be stationary when it has a time-invariant mean, variance and covariance. On the other hand, time series becomes non-stationary and has a unit root problem when its statistical properties like mean, variance and covariance of the series changed over time that also affects the (LR) relationship among variables. When the non-stationary series included in the estimation process, it gives statistically faulty or misleading results like a higher value of R-squared, significant fand t-statistics and low value of (DW). The problem of non-stationary time-series can be resolved by differencing the series (Gujarati, 2009).

Data & variables description

Dependent variable

Export instability (XI)

There are many ways to measure export instability explained in the literature (Cuddy & Valle, 1978; Douglas, 2016; Erb & SCHIAVO–CAMPO, 1969; Glezakos, 1973; Hock, 1977; Kingston, 1973; Love, 1986; MacBean, 1966; Massell, 1964, 1970; Mitri, 1971) like log variance index (LVI), Cuddy Della Valle instability index (CVI), log trend index (LTI), coefficient of variation (CV), mean absolute deviation (MAD) method, five–year moving average (MAV) and each of these measures have some relative strength and limitations. The present study considers the index of "absolute percentage deviation of the export value from the exponential trend". This measure is used by many researchers (Hanom, 2009; Lashkary *et al*., 2013; Love, 1986; Malhotra, 2015). According to Love (1986), this measure of percentage deviation is appropriate for time-series studies that measure the year to year variability in export values, but the previous studies like (Brodsky & Sampson, 1979; Glezakos, 1973; Hock, 1977; Massell, 1964, 1970) used the measures that were suitable for cross-sectional studies, because those measures could not be changed during a period and are defined by only one parameter. Therefore, the study selected evidence based measure to calculate export instability index (XI) because it is appropriate for the time-series study.

The export instability index is:

$$XI_t = \left| \frac{X_t - \hat{X}_t}{\hat{X}_t} \right| \times 100$$

Where,

XI_t = Export Instability Index

X_t =Actual value of exports

$\hat{X}_t$ = Estimated trend value of exports based on an exponential trend

The exponential trend is:

$$\log X_t = \alpha_0 + \beta_1 t + \epsilon_t$$

Where,
X_t = Actual value of exports in year t
t = Time trend
ϵ_t = Error term

The trend values of export are calculated by taking the antilog of the exponential trend

$$\hat{X}_t = \text{Antilog}(\alpha_0 + \beta_1 t)$$

Here, the study uses the exponential trend because it fits the data well for the selected time period, and the theoretical explanation of using exponential trend is that "countries tend to plan in term of their growth rates, not in terms of absolute increments" (Massell 1970, p. 619; Tariq & Najeeb 1995, p.1183). Therefore, it is quite relevant to take a deviation from the exponential trend. Data on this variable is collected from *Various Economic Surveys of Pakistan*.

Independent variables

Commodity Concentration (CC)

It is an explanatory variable in this study and defined, as the concentration of exports in one or few items, or heavy reliance on primary product exports. To construct this index various studies in the literature like (Asheghian & Saidi, 1999; Devkota, 2004; Hanom, 2009; Massell, 1964, 1970; Tariq & Najeeb, 1995; Tegegne, 1991) have used the "Gini-Hirschmen Coefficient Index" (GHI), which "defines the degree of concentration in a country's exports". The advantage of applying (GHI) is that it gives year to year concentration index of export commodities (Tegegne 1991, pp.3-4). Therefore, the present study also uses the (GHI) to calculate the commodity concentration index (CCI). To construct the index, this study considers the twenty-two major export commodities due to the greater share of these commodities in export earnings (*Various Economic Surveys of Pakistan*). The commodities are; fish& fish preparation, rice, fruits, raw wool, cotton thread, cotton cloth, raw cotton, leather, cotton yarn, cotton waste, paints& varnishes, petroleum products, animal casings, footwear, synthetic textile, guar & products, tobacco raw & manufactured, drugs & chemicals, carpets& rugs readymade garments, surgical instruments and sports goods. The index is calculated through the following formula:

$$CCI_t = 100\sqrt{\sum_{i=1}^{n}\left(\frac{X_{it}}{X_t}\right)^2}$$

Where,
CCI_t = Commodity Concentration Index
n = Number of commodities
X_{it} = Value of exports from commodity i in year t and
X_t = Total exports in year t

The maximum value of the index (CCI) is 100; it only occurs when a country depends only on one export product but when a country exports different goods the lowest value of the index is $100/\sqrt{n}$ (Massell 1970; Tariq & Najeeb 1995, p.1184). This variable is expected to have a positive sign. Data on selected commodities have been taken in millions of rupees from Various Economic Surveys of Pakistan.

Geographical Concentration (GC)

Geographical concentration of exports is also used as another explanatory variable in this study and defined as, concentration or dependence of a country exports in a few markets or regions that caused the fluctuation in total export earnings. This variable is also calculated through"Gini-Hirschmen Coefficient Index" (GHI) that also measures the export markets concentration and used by many researchers in their studies like (Asheghian & Saidi, 1999; Brodsky & Sampson, 1979; Devkota, 2004; Malhotra, 2015; Massell, 1970; Tegegne, 1991)as an important factor responsible for export instability. To construct the (GCI) study has considered nine markets. The markets are; OIC, OECD, SAARC, Other Europe, Other Africa, ASEAN, Other Asian, Central America and South America.

The Geographical Concentration Index is:

$$GCI_t = 100\sqrt{\sum_{i=1}^{n}\left(\frac{X_{it}}{X_t}\right)^2}$$

Where,
GCI_t = Geographical Concentration Index
n = Number of markets or regions
X_{it} = Value of export from market i in year t and
X_t = Total exports in year t

This variable is expected to have a positive or negative sign on the dependent variable. Data on the destined exports is extracted from *VariousEconomic Surveys of Pakistan* in millions of rupees.

Food Ratio (FR)

It is an explanatory variable in this study, which is obtained by the ratio of food exports to total exports. Food exports lead to stabilizing the earnings from exports due to inelastic demand and supply (Aslam, 1985; Brodsky & Sampson, 1979; Massell, 1970; Tariq & Najeeb, 1995). The expected sign of this variable is negative and data in millions of rupees is taken from *Various Economic Surveys of Pakistan*. The food export includes fish& fish preparation, rice, fruits, guar& products and tobacco raw & manufactured.

Exports (LNEXP)

Exports are the goods and services that are produced in one country and sales to another country to earn foreign exchange. Stable exports lead to decline the volatility in export earnings (Aslam, 1985; Massell, 1970; Naya, 1973) used this variable in their studies as a stable element to control the variations in export earnings. The expected sign of this variable is negative and data is in millions of rupees taken from *Various Economic Surveys of Pakistan*. Exports in natural log form included as a stability component of export earnings instability.

Export Quantity (EXQ)

Export quantity is the volume of total exports of the country purchased by other countries or regions. Murray (1978), Hamid (1983) and Tariq & Najeeb (1995) used this variable to determine export instability. The growth rate of export quantity is used in this study. The data on this variable is taken from *World Development Indicators(2017)*. This variable is expected to have a negative sign.

Measurement of Export Instability

There are many ways to measure the export instability index described in the literature. The UN Secretariat (1952) conducted a study on "Instability in export markets of underdeveloped countries" by using the following method to measure instability, which is obtained by the absolute difference in values from year to year, expressing this difference as a proportion of the larger of the two annual values and then averaging of these percentages. This method does not require any formula for trend adjustment (Coppock, 1962). The study of (Douglas, 2016; Massell, 1964; Mitri, 1971) used this measure to compute export instability. The formula of this method is as follows:

$$II = \frac{ABS\left(X_{t+1} - X_t\right)}{X_t} \times 100, \text{ if } X_t > X_{t+1}$$

and

$$II = \frac{ABS\left(X_{t+1} - X_t\right)}{X_{t+1}} \times 100, \text{ if } X_{t+1} > X_t$$

Where,
ABS=Absolute value
X_{t+1} = Exports of Next year
X_t = Exports of Current year

Log-variance index (LVI) method is another method to calculate export instability used by Coppock (1962). This index is greatly influenced by the two extreme years of the series, therefore; when this index is used for short-range time series, it gives almost a random estimate of instability (Glezakos 1973, p.671). The studies of (Erb & Schiavo-Campo, 1969; Hock, 1977) also used this measure to compute instability in exports.

The index is as following:

$$II = \left[\left(\text{Anti}\log\right)\sqrt{V\ \log} - 100\right] \times 100$$

$$V\log = \frac{1}{T-1}\sum\left(\log X_{t+1} - \log X_t - M\right)^2$$

$$M = \frac{1}{T-1}\sum\left(\log X_{t+1} - \log X_t\right)$$

Where,
T = Number of years
X_{t+1} = Next year exports
X_t = Current year exports

Massell (1964) used two measures to calculate the instability index that was based on trend corrected measure. Firstly, the study used "normalized standard error" that is the square root of the unexplained variance divided by the mean of the observations. This measure is a pure number and independent of the overall level and the growth rate of the country's export (Massell 1964, p.49). Botsas (1975) also used this measure to compute export instability. This index measures the fluctuation in exports as a whole around the trend line. The instability index is as following:

$$I = \frac{\sqrt{\frac{\sum\left(u_t\right)^2}{n}}}{\bar{Z}}$$

Where,
I = Export instability index
$u_t = Z_t - (\beta_0 + \beta_1 t)$
Z_t = Exports in year t
β, s = Estimated by least squares
t = Time
n = Number of Years
$\overline{Z}$ = Mean of the observations = $\frac{\sum Z_t}{n}$

Secondly, Massell used average annual percentage rate of change in the value of exports (Massell 1964, p.50). This index measures the year to year fluctuation in exports. The index is:

$$I^* = \frac{\sum w_t}{n}$$

Where,

$$w_t = \frac{|u_{t+1} - u_t|}{\max,[Z_t, Z_{t+1}]}$$

u_{t+1} = Next year exports
u_t = Current year exports
Z_t = Current year exports
Z_{t+1} = Next year exports
n = Number of observations

Macbean (1966) used the "average percentage deviation of actual export value from the estimated or trend value". Macbean used the five-year moving average (MA) measure in order to calculate the trend value. This measure detaches the trend factor from the short-term variations. The formula is as following:

$$II = \left[\sum_{t=3}^{N-2} \frac{(|X_t - MA_t|)}{MA_t}\right] \times \left(\frac{100}{N-4}\right)$$

Where,
X_t = Actual value
MA_t = Five year moving average of X_t centered on year t
N = Number of observations

This method of calculating instability index has demerit due to losing values from the beginning or end of the series. There is also difficulty in the selection of interval that determines the trend and hence the measure of instability. Murray (1978)also used this measure to calculate export volatility.

Glezakos (1973) used the index "The arithmetic mean of the absolute values of the yearly changes in the time series corrected for the trend and expressed as a percentage of the average of all observations" (Glezakos 1973, p.672). The study used a linear trend. Glezakos (1973) export instability index has some characteristics like; it can be changed with respect to time, not dependent on the trend size, symmetry with regard to common trend and it also considered the relative importance of the fluctuations. The measure is as follows:

$$I_x = \frac{100}{\bar{X}} \frac{\sum_{t=2}^{n} |X_t - X_{t-1} - b|}{n-1}$$

Where,
I_x = Export instability index
$\bar{X}$ = Mean of the observations
$X_t = a + bt$
X_{t-1} = Previous year value of exports
b = Slope of linear trend
n = Number of observations

Kingston (1973) and Aslam (1985) used an average "absolute percentage deviation of observed values from a secular trend that exhibits a constant percentage rate of growth" (Kingston 1973, p.383).

The index is:

$$I - I = \frac{\sum_{t=1}^{N} \left(\left| \frac{y_t - y'_t}{y'_t} \right| \times 100 \right)}{N}$$

Where,
y_t = Observed values in time period t
y'_t = Antilog of the logarithmic least squares estimate of the secular trend value for time period t
N = Number of years included in the study

Kingston (1973) used this measure after considering the relative strengths and limitations of other alternative measures. According to Kingston trend measure used in his study is useful due to consistency with an acceptable concept of stability of an economic time series over a period of year. Moreover, this measure is also easily understandable (Kingston 1973, p.382).

Log-trend Index (LTI) is another measure used by Murray (1978) in order to find out the export instability that measures the difference from a constant growth rate trend line (Mulugeta 2009, p.6). The Index has the following form:

$$LTI = \left(1/n\right)\left(X_t - ae^{bt}\right)^2 \times 100/\bar{X}$$

Where 'a' and 'b' are the estimates derived from the least squares fitting of

$$\log X_t = a + bt + u_t$$

n = Number of observations
X_t = Actual export values
$\bar{X}$ = Mean of the actual values

Cuddy and Valle (1978) introduced export instability measure that is also known as Cuddy and Valle Index of instability (CVI). The index is a s following:

$$I = CV\left(1 - \bar{R}^2\right)^{\frac{1}{2}} / 100$$

Where,
CV = Coefficient of variation = $\frac{\sigma}{\bar{X}}$

σ = Standard deviation = $\sqrt{\frac{\sum\left(X_t - \bar{X}_t\right)^2}{n}}$

n = Number of observations
X_t = Actual value of exports
$\bar{X}_t$ = Mean of the actual value
$\bar{R}^2$ = Adjusted $R^2 = 1 - \left(1 - R^2\right)\frac{n-1}{n-k}$
k = Number of parametes included in the study

This measure adjusts the coefficient of variation to the extent for which the series can be explained and detain unanticipated variation in the export markets. It allows comparison of fluctuation across series with linear and non-linear time trend, or any other specification (Charrette 1985, p.16).

Coefficient of variation (CV) is the simplest formula, which is also used in measuring export instability in the literature by (Massell, 1970; Tegegne, 1991; Tegene, 1990) which is obtained by dividing the standard deviation to mean of the observed values. These studies used the exponential trend to measure instability. One weakness of this measure is that it is based on a constant growth rate of exports for a given country (Naya 1973, p.631). The formula is:

$$CV = \frac{\sigma}{\bar{X}}$$

Where,

σ = Standard deviation = $\sqrt{\frac{\sum (u_t)^2}{n}}$

$u_t = Z_t - (\beta_0 + \beta_1 t)$

Z_t = Exports in year t

β, s = Estimated by least squares

t = Time

n = Number of Years

$\bar{X}$ = Mean of the observations = $\frac{\sum X_t}{n}$

Love (1986) used percentage deviation of actual exports from the trend value to measure export instability. Love (1986) used a five-year moving average to calculate trend values. The formula is:

$$u_t = \frac{(X_t - \bar{X}_t)}{\bar{X}_t}$$

Where,

u_t = Instability index

X_t = Actual values of export

$\bar{X}_t$ = Trend values obtained by five years moving average of X_t centred on year t

This measure computes instability index for each year in the series. Whereas, the previous index mentioned in the literature gives one parameter for the whole period (Love, 1986). This measure removes the problem of multicollinearity, which was most likely to occur in the cross-section studies between commodity and geographical concentration (Brodsky & Sampson, 1979; Murillo-Martinez, 1988). This measure also used by (Asheghian & Saidi, 1999).

Poudyal (1988) to compute export instability used the measure, which is based on the average percentage deviation of actual export values from an exponential trend (Devkota, 2004). The formula is as follows:

$$II = \left[\frac{X_t - \hat{X}_t}{\bar{X}} \right] \times 100$$

II = Export instability index

X_t = Actual value of exports

$\hat{X}_t$ = Estimated value by an exponential trend

$\bar{X}$ = Mean of the actual value

Tariq and Najeeb (1995) used the measure of "percentage deviation from each year actual value from the trend value" to calculate instability of exports. The measure is as follows:

$$I_t = \left(\frac{X_t - \hat{X}_t}{\hat{X}_t} \right)$$

I_t = Export earnings instability Index
X_t = Actual value of total exports in year t
$\hat{X}_t$ = Estimated trend value in year t
t = Time period consider the study

Average Absolute Deviation (AAD) measure is also used by Kassa (1998) in order to calculate the export instability which has the following form:

$$AAD = \left(\frac{100}{n} \right) \frac{\sum_{t=1}^{n} \left| X_t - \hat{X}_t \right|}{\hat{X}_t}$$

Where,
n = Number of observations
X_t = Actual value of exports
$\hat{X}_t$ = Estimated trend value
t = Time period

Absolute percentage difference (APD) of the actual value from observed value is another measure used by Hanom (2009), Lashkary *et al*. (2013) and Malhotra (2015) to calculate export instability. These studies have used the exponential trend to calculate estimated values. The advantage of using this measure is it removes the problem of multicollinearity. The measure is:

$$I = \left| \frac{X_t - \hat{X}_t}{\hat{X}_t} \right|$$

X_t = Actual value of total exports in year t
$\hat{X}_t$ = Estimated value of exports in year t

Table 1: Description of the variables

Variables	Definitions	Notations	Sources	Expected sign
Export Instability	Year to year fluctuations in the export earnings	XI	Various Economic Surveys of Pakistan	-
Commodity Concentration	Concentration or dependence on one or a few export items	CC	Various Economic Surveys of Pakistan	Positive (+)
Geographical Concentration	Concentration or dependence of export on a few markets or regions	GC	Various Economic Surveys of Pakistan	Positive (+), Negative (-)
Food Export Ratio	Share of food exports in total export earnings	FR	Various Economic Surveys of Pakistan	Negative (-)
Exports	Exports of goods and services to other countries or regions	LNEXP	Various Economic Surveys of Pakistan	Negative (-)
Export Quantity	Total quantity of exports of the country to other countries	EXQ	World Development Indicators (WDI)	Negative (-)

Model Specification

The following econometric model is undertaken in this study:

$$XI_t = \beta_0 + \beta_1 CC_t + \beta_2 GC_t + \beta_3 FR_t + \beta_4 LNEXP_t + \beta_5 EXQ_t + \mu_t \quad (1)$$

Where,
XI = Export instability
CC = Commodity concentration
GC = Geographical concentration
FR = Food exports ratio
LNEXP = Exports in natural log form
EXQ = Total exports quantity
t = Times in years
u_t = Error term

Following ARDL framework equation (1) is estimated to check the long-run (LR) relationship among the variables:

$$\begin{aligned}\Delta XI_t = {} & \alpha_0 + \sum_{i=1}^{k} \alpha_1 \Delta XI_{t-i} + \sum_{i=0}^{k} \alpha_2 \Delta CC_{t-i} + \sum_{i=0}^{k} \alpha_3 \Delta GC_{t-i} + \sum_{i=0}^{k} \alpha_4 \Delta FR_{t-i} \\ & + \sum_{i=0}^{k} \alpha_5 \Delta LNEXP_{t-i} + \sum_{i=0}^{k} \alpha_6 \Delta EXQ_{t-i} + \delta_1 XI_{t-1} + \delta_2 CC_{t-1} \\ & + \delta_3 GC_{t-1} + \delta_4 FR_{t-1} + \delta_5 LNEXP_{t-1} + \delta_6 EXQ_{t-1} + u_t \end{aligned} \quad (2)$$

Here, Δ represents the first difference operator, k shows the optimal lag length, u_t indicates the error term $(\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6)$ represent the short-run (SR) dynamics and $(\delta_1, \delta_2, \delta_3, \delta_4, \delta_5, \delta_6)$ represent long-run (LR) coefficients. In the second step of

this approach long-run coefficients are calculated. For this purpose, the following equation is constructed to estimate the (LR) model:

$$XI_t = \alpha_0 + \delta_1 XI_{t-1} + \delta_2 CC_{t-1} + \delta_3 GC_{t-1} + \delta_4 FR_{t-1} + \delta_5 LNEXP_{t-1} + \delta_6 EXQ_{t-1} + u_t \quad (3)$$

Furthermore, Error-Correction Model (ECM) is estimated to check the short-run (SR) relationship among the variables. The Error-Correction model (ECM) is as follows:

$$\Delta XI_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 \Delta XI_{t-i} + \sum_{i=0}^{k} \alpha_2 \Delta CC_{t-i} + \sum_{i=0}^{k} \alpha_3 \Delta GC_{t-i} + \sum_{i=0}^{k} \alpha_4 \Delta FR_{t-i} \quad (4)$$
$$+ \sum_{i=0}^{k} \alpha_5 \Delta LNEXP_{t-i} + \sum_{i=0}^{k} \alpha_6 \Delta EXQ_{t-i} + \pi ECM_{t-1} + u_t$$

The Error-Correction (ECM) term measures the speed of adjustment of the dependent variable towards the long-run equilibrium and "π" is the coefficient of adjustment or (ECM). The positive sign of the Error-Correction term (ECM) shows the divergence (move away from the equilibrium point) of the dependent variable and negative sign indicates the convergence (move towards the equilibrium point). The value of the coefficient lies between 0 to -1. If the coefficient of (ECM) is equal to one that represents that hundred percent adjustments take place towards the long-run equilibrium and if the value of the coefficient is equal to zero that means, no adjustments occur towards the (LR) equilibrium (Nkoro & Uko, 2016).

Results and Discussion

To get the reliable estimates of regression unit root test is conducted through Augmented Dicky-Fuller (ADF) hich are reported in table below.

Table 2: Unit Root Results

Variables	Level	1st Difference	Decision
XI	-2.127819 (0.2354)	-6.388783 (0.0000)	Non-stationary at level I(0) but stationary at 1st difference I(I)
CC	-2.829832 (0.1970)	-6.021077 (0.0001)	Non-stationary at level I(0) but stationary at 1st difference I(I)
GC	-3.224425 (0.0958)	-6.443468 (0.0000)	Non-stationary at level I(0) but stationary at 1st difference I(I)
FR	-3.289327 (0.0229)	-	Stationary at level I(0)
LNEXP	-1.960930 (0.3020)	-5.302252 (0.0001)	Non-stationary at level I(0) but stationary at 1st difference I(I)
EXQ	-7.623459 (0.0000)	-	Stationary at level I(0)

Here, values in parentheses () indicates the p-value and the values lie above the parentheses shows the t-statistics values

After checking the stationarity of the dataset, the next step is to estimate Vector Autoregressive (VAR) model to select the optimal lag length for the estimation of the model through (ARDL) approach. The present study uses the Eviews-9 for the estimation of the model, which provides the facility of automatic selection of the optimal lags for the model. Hence, for the empirical estimation process software automatically selects the four optimal lags for the model. Moreover, Bound test approach is used in this study to confirm the long-run (LR) relationship among the variables under consideration. The results of the bound test are reported in Table (3).

Table 3: Bound Test Results

F-statistics	29.55767	
Critical Bound Values	Lower Critical Bound	Upper Critical Bound
Significance Level		
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Table (3) reports the results of the bound test. Here, the F-statistics value is higher than the upper critical bound value suggesting that there exists the long-run relationship among the variables. Therefore, the null hypothesis of no co-integration ($H_0 : \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = 0$) is rejected against the alternative hypothesis of co-integration between the variables ($H_1 : \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq \delta_6 \neq 0$) at five-percent level of significance.

After getting confirmation of the existence of long-run (LR) relationship among exports instability (XI) and other variables of interest i.e commodity concentration (CC), geographical concentration (GC), food export ratio (FR), exports (LNEXP) and export quantity (EXQ). Long-run results of ARDLmodel are presented in Table (4).

Table 4: Long-Run Results of Autoregressive Distributed Lag (ARDL) Approach

Dependent variable: XI				
Variables	**Coefficients**	**Standard-Errors**	**t-statistics**	**p-values**
CC	6.156588**	1.993073	3.088993	0.0176
GC	-9.453663*	2.522685	-3.747461	0.0072
FR	-6.152123*	1.686532	-3.647796	0.0082
LNEXP	-6.837014***	3.235172	-2.113338	0.0724
EXQ	0.145416	0.347919	0.417959	0.6885
C	572.379404*	162.011357	3.532959	0.0096

*,**,*** shows level of significance at 1%, 5% and 10% level

Results of the Table (4) depict that coefficient of commodity concentration index (CC) is positive and significantly related to export instability (XI) at the five-percent

level of significance, meaning that one-percent increase in commodity concentration (CC) brings about (6.16) percent increase in export instability (XI). Positive and statistically significant effect of commodity concentration on export instability supports the findings of few other studies (Asheghian & Saidi, 1999; Devkota, 2004; Hock, 1977; Love, 1986; Massell, 1970; Naya, 1973; Tariq & Najeeb, 1995; Tegegne, 1991). The direct relationship between commodity concentration (CC) and export instability (XI) shows that Pakistan exports are concentrated in few or less diversified exports products that lead to unstable export earnings. The coefficient of (GC) shows that geographical concentration (GC) is statistically significant but negatively related to export instability (XI) meaning that, one-percent rise in geographical concentration (GC) will decrease the export instability (XI) by (9.454) percent. The negative relationship of the geographical concentration (GC) with export instability (XI) implies that dependence on a few export markets does not cause the export instability in Pakistan. It may be occurring due to the existence of different commodity or trade agreements between Pakistan and its trading partners. This inverse relationship of the geographical concentration (GC) with export instability (XI) is in line with few studies (Brodsky & Sampson, 1979; Charette, 1985; Hock, 1977; Kingston, 1973; Massell, 1970; Tariq & Najeeb, 1995). The coefficient of food export ratio (FR) is also statistically significant and has a negative effect on the export instability (XI). This implies that one-percent increase in food export (FR) leads to (6.152) percent decrease in the level of export instability (XI). This outcome is similar to the results of (Love, 1986; Massell, 1970; Murillo-Martinez, 1988; Tariq & Najeeb, 1995). Similarly, export earnings (LNEXP) are also statistically significant at the ten-percent level of significance and has the negative effect on the export instability (XI), meaning that one-percent rise in exports (EXP) will decrease the export instability (XI) by (6.84) percent. The negative sign or significant statistical effect of exports (LNEXP) on export instability (XI) is also confirmed with findings of (Massell, 1970) study. Lastly, the insignificant effect of exports quantity (EXQ) reveals that it is not related to export instability (XI) in Pakistan and this outcome is also similar to another study (Tariq & Najeeb, 1995; Wasim, 1998). After getting estimated coefficients for long run estimates, the estimates for short run are also reported in table (5).

Table 5: Short-Run Results of Selected Model (3, 3, 3, 4, 4, 3) for Autoregressive Distributed Lag (ARDL) Approach Based on Akaike Information Criterion (AIC)

Dependent Variable: Export Instability (XI)			
Variables	**Coefficient**	**t-statistics**	**Probability Value**
dXI_1	0.370589**	3.353604	0.0122
dXI_2	-0.206318	-1.357009	0.2169
dCC	-1.214386***	-2.281249	0.0565
dCC_1	-2.849400*	-5.899429	0.0006
dCC_2	-1.115521***	-2.231960	0.0608
dGC	-1.009683**	-2.483888	0.0420
dGC_1	1.489168*	4.882574	0.0018
dGC_2	2.412029*	5.907638	0.0006
dFR	-1.662786*	-3.807003	0.0067
dFR_1	0.969518***	1.967078	0.0899
dFR_2	-1.422396**	-2.687196	0.0312
dFR_3	1.085252	1.656809	0.1415
dLNEXP	41.978152*	4.403115	0.0031
$dLNEXP_1$	-86.868938*	-5.568157	0.0008
$dLNEXP_2$	51.120116*	4.081190	0.0047
$dLNEXP_3$	-35.328730*	-4.548634	0.0026
dEXQ	-0.017433	-0.170525	0.8694
$dEXQ_1$	0.024546	0.352275	0.7350
$dEXQ_2$	0.217555**	2.907933	0.0227
ECT(-1)	-0.651778*	-5.048873	0.0015

*,**,*** shows level of significance at 1%, 5% and 10% level

In Table (5) the Error-Correction Term (ECT (-1)) represent the speed of adjustment towards the equilibrium of the estimated dynamic model. The coefficient of the Error-Correction Term (ECT (-1)) tells about how quickly the variable converges towards the equilibrium point after the short-run shocks. The Error-Correction term (ECT (-1)) is statistically significant at one-percent level of significance and has the negative sign that also depicts a long-run relationship among the variables of interest. The coefficient of Error-Correction term (ECT (-1)) is (0.65), that shows about sixty-five percent disequilibrium or deviation from the long run (LR) in export instability (XI) in the previous year shock is corrected in the current year and it converges back to equilibrium. Commodity concentration (CC) at lag one and two is statistically significant but negatively related to export instability (XI) in short-run. It may be due to the increase in export earnings. The geographical concentration (GC) in short-run has a significantly positive relationship with the export instability (XI) at lag one and two due to increasing dependence on a few markets of export products. The variable food exports ratio (FR) has the negative and significant effect on export instability (XI) at lag period two in (SR) but, it has significantly positive effect on

export instability (XI) at one lagged period. In short-run exports at lag, one has statistically negative and significant impact on export instability (XI) but, at lag two, it has a significantly positive effect on export instability (XI). Export quantity at lag period two in (SR) has a positive and significant impact on export instability (XI) whereas; it is not related to export instability (XI) in the LR effect.

Diagnostic Tests

Lastly, diagnostic tests are conducted in order to check the reliability of the (ARDL) model. For the existence of the serial correlation "Breusch-Godfrey" (LM) test is used. To check the problem of Heteroskedaticity "Breusch-Pagan-Godfrey" test is used in this study. JB normality test is applied in order to check whether residuals are normally distributed or not. For the functional form of the model "Ramsey's Regressions Specification Error Test" (RESET) is used in this study. The results of these tests are presented in the Table (6).

Table 6: Diagnostic Tests Results

Tests	Statistics	Probability
Serial Correlation (Breusch-Godfrey)	0.336191	0.7295
Heteroskedasticity (Breusch-Pagan-Godfrey)	1.002165	0.5442
Normality (JB Test)	0.546821	0.760780
Misspecification(RESET)	1.785708	0.2299

Results of the above table (6) indicate that model is free from the problem of Serial Correlation and Heteroskedasticity. Moreover, there is no issue of normality in the model and model is correctly specified in this study. The p-values of all the diagnostic tests given in table (6) confirm these results. Moreover, the problem of endogeneity does not exist as the ARDL approach automatically resolves this issue.

Parameters Stability Test Results

The study has applied the two tests of (CUSUM) and (CUSUMSQ) to check the stability of (LR) and (SR) estimates of the selected ARDL model.

Figure 1: Plot of (CUSUM) of Recursive Residuals

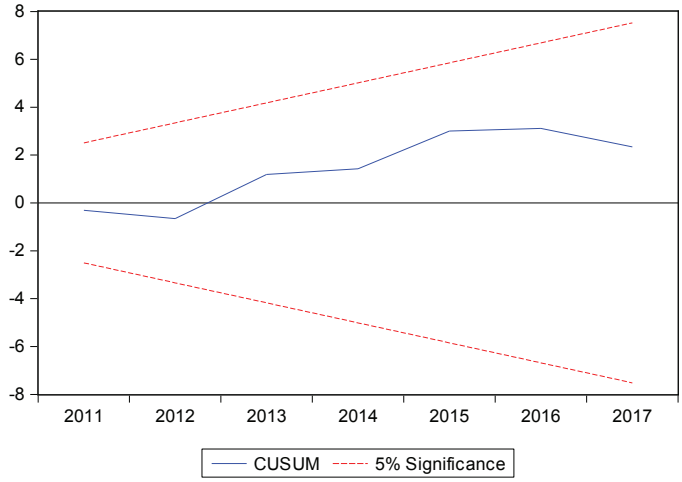
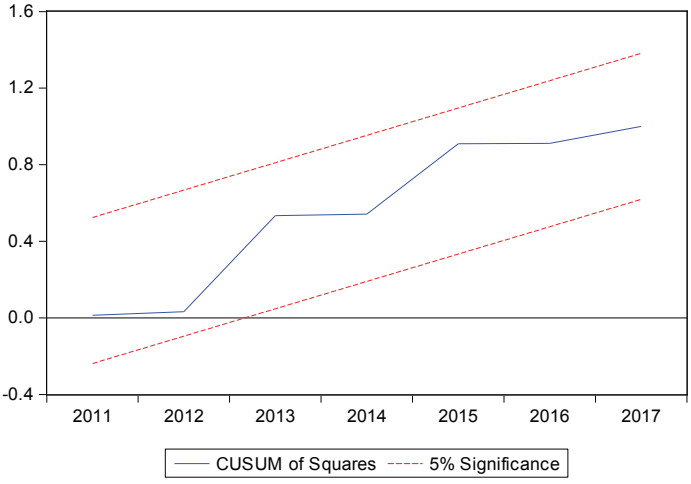


Figure 2: Plot of (CUSUMSQ) of Recursive Residuals



The figures (1) and (2) represent the plots of(CUSUM) and (CUSUMSQ) of recursive residuals, respectively. Both of the plots lie within the critical bounds at the five-percent level of significance. Hence, the tests concluded that (SR) and (LR) estimates of the model are stable and consistent.

Conclusion and Policy Implications

The primary aim of this study is to ascertain empirically the factors affecting export instability in Pakistan for the period from 1985- 2017. The selected factors are commodity concentration index, geographical concentration index, food ratio, total exports earnings and total exports quantity to other countries or regions. The empirical estimation is done through ARDL model approach. The main findings of the study reveal that all the candidates are statistically significant except export quantity. Commodity concentration is found to be statistically significant in explaining export instability in Pakistan and has a destabilizing effect on export instability. Whereas, geographical concentration, export earnings, food exports have a significant negative impact on the export earning instability. Export quantity is not related to export instability in Pakistan. The SR results represent that Error-Correction term (ECT (-1)) is statistically significant at the one-percent level of significance and has the negative sign revealing LR relationship among the variables of interest. The coefficient of Error-Correction term (ECT (-1)) is (0.65), that shows about sixty-five percent disequilibrium or deviation from the long run (LR) in export instability (XI) in the previous year shock is corrected in the current year and it converges back to equilibrium. The diagnostic test of the present study also witness for no problem of serial correlation, normality, misspecification and heteroscedasticity in the model. Moreover, the figures of (CUSUM) and (CUSUMQ) depicts that model is stable.

Based on the empirical estimation, the results of the present study suggest that Pakistan needs diversification in its export basket, to reduce export instability. Although, Pakistan export composition has significantly changed but still reliant on primary export commodities, which undergo larger variation in foreign markets and are contributing to the export instability. Food export plays a vital role in reducing export instability in Pakistan due to its stabilizing effect on export earnings. Therefore, more attention should be given to diversification in food export basket.

Pakistan made exports to a number of markets therefore, diversification in terms of markets will not be helpful in reducing export instability any further. Therefore, Pakistan should focus on the existing markets (Asian and ASEAN regions) to enhance exports to get the benefits of potential markets. Export earnings do help in stabilizing export instability. Therefore, more attention should be given to export promotion to reap the benefits of export earnings. Future research should be conducted to elaborate the disaggregated analysis at commodity level to explore the export basket composition and its contribution in export instability in the economy study also suggests that research should be further extended in terms of contribution of exports composition (Share of primary, semi-manufactured and manufactured export product groups) towards export instability to check the extent of export instability through exports composition.

Declarations

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Conflicts of interest/Competing interests

There is no conflict of interest/Competing interests.

Availability of data and material

The data that support the findings of this study are openly available in the website of World Bank (www.worldbank.org) and Economic Survey of Pakistan (https://www.finance.gov.pk).

Code Availability

Not applicable.

Authors' Contributions

Sadaf Nawaz: Methodology, Investigation, Writing – original draft.
Sajida Kamran: Conceptualization, Investigation, Writing, Project administration
Ramsha Saleem: Conceptualization, Investigation, Writing, Project administration
Muhammad Ali: Conceptualization, Project administration, Writing – review and editing.
Nadia Asad: Investigation, Review

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