# Macroeconomic Determinants of Air passenger Demand in Egypt

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**Abstract**

Air transport is strategic for economic development of Egypt's regional integration and economic growth supporting people mobilization, reinforcing Egypt's strategic geographic location. The current study examined the main economic determinants of air passenger demand in Egypt during the period 1982 till 2019 studying the interaction between short and long run variables using VECM "Vector error correction model" that found long run equilibrium relationship among studied variables. The positive significant demand factors found by short run analysis using VECM estimation and confirmed by Wald statistics and Granger Causality are consumer price index, and household consumption, while negative significant variables found to be foreign exchange rate, deposit interest rate. Further analysis carried using "Impulse response functions" IRFs and Variance decomposition found that the strongest variables are air carrier as proxy of air transport infrastructure showing the importance of infrastructure development over long run, followed by CPI as proxy of price level, household consumption as proxy of wealth effect and exchange rate as proxy of net export effect. The weakest impacts are deposit interest, and GDP per capita. GDP per capita found to be insignificant shows that demand on air travel is requested by travelers from abroad not only depend on local residents which also shown by negative significance of exchange rate.

**Keywords:** VECM, IRF, air passenger, CPI, Egypt, Variance decomposition.

## Introduction

Air and maritime transport are the main intercontinental transport modes, maritime transport main benefit is the low cost, and air transport main benefits are fast speed and reliability.

Since the end of Second World War air transport has been arranged by worldwide agreements between two or more countries which reinforced the international standards. Development of air transport industry considers one of the main improvements in the twenty first century and one of the main factors of fast and reliable transportation mean. In the modern era, air transportation is a necessary mode of transportation due to its efficiency (Kiboi *et al.*, 2017).

Liberalization of civil aviation started by end of 1970s, the concept of deregulation went into practice in 1978 "Airline Deregulation Act", and in 2002, airline liberalization applied to ease any unfavorable impacts of airlines competition due to deregulation. All of this increased the economic significance of air transport worldwide and increased number of air transport domestically and internationally.

Air passenger is the main source of civil aviation growth which shows the importance of determining the main factors affecting air passenger growth. The study objective is identifying the main determinants of air passenger demand in Egypt during the period 1982 till 2019.

Methodology of research will use VECM "Vector error correction model" studying long run equilibrium relationship among studied variables and short run analysis which also studied using Wald statistics and Granger Causality. Further analysis carried also using "Impulse response functions" IRFs and Variance decomposition. Two models will be estimated; the first model will try to identify the impacts of GDP per

capita as proxy of wealth effect, foreign exchange rate as proxy of net export effect, and consumer price index CPI as proxy of prices of on-air travel demand. Second model will try to identify impact of air carriers as proxy of air transport infrastructure, household consumption as proxy of households' income level, and deposit interest rate proxy of interest rate effect on air travel demand.

The remaining of paper is covering theoretical and literature background, then presenting a brief discussion of air passenger sector in Egypt, followed by data description and explanation of methodology, followed by results of empirical analysis, then ending with conclusion.

**Theoretical Background**

The neo-Keynesian assume that "Aggregate demand AD function is negative function of price level, describing the quantity demanded of all goods and services as a function of price level". Aggregate price levels can be measured by GDP deflator or CPI.

Keynes (1936) General Theory studied impact of price level reduction on AD; "Keynes effect" proposed that "lower price level increase real money supply, lowering real interest rate and increase AD". Keynes effect interpreted in Hicks' (1937) General Theory discussed as "lower price level increases the real money supply and shifts the LM schedule down. This lowers the real interest rate, spurring spending and a movement along the schedule". Pigou (1943) explained real balance effect as "lower price level would increase the real value of money balances, thereby making economic agents feel wealthier then increase spending". Lower price level raises real balances, that expands AD, shifting it up (Palley, 2007).

The negative relationship between AD and price level according to the following three reasons:

- Wealth effect. wealth decline in value according to increased price level due to falling of purchasing power of money, consumers become poorer, and reduce their consumption of goods and services.

- Interest rate effect. at higher price level, demand on loans by households and firms increase as they require more money to fulfill their requirement, which raise interest rate and decline spending.

- Net exports effect. at higher domestic price level, exports will be relatively expensive and imported goods become relatively cheaper which raise imports more than exports, then net exports (exports - imports) decrease which reduce AD as net exports is part of AD (Parkin, 2014).

There is number of empirical economic literature studies air transport determinants or factors driving air transport industry to growth. Graham (2000) defined demand determinants of air passenger as "the factors which make it possible for people to travel" (p.109). Demirsoy (2012) added to this definition "Determinants are factors which make it possible for people to travel and increase the number of travels taken by each individual" (p.12). The factors studied in literature can be categorized into five main categories: economic, socio-demographic, and market structure, geographic and market maturity variables. Economic determinants are the main influential factors driving demand of air transportation as "GDP, GDP per capita, expenditure, air fares and inflation" (Demirsoy, 2012).

There are number of empirical literatures found significant impact of economic factors on air transport demand as CPI "consumer price index", and interest rate as; "Adermo, 2010; Erratiab *et al.*, 2016" (Kiraci and Battal, 2018). Erratiab *et al.*, (2016) investigated demand determinants

of air passenger in Morocco the model included CPI, GNP, household consumption per capita. The analysis found that increasing household consumption increase demand on travelling. GNP has positive but weak impact as nearly 95% of air passengers are foreigner coming for tourism or the Moroccan living abroad, CPI found to be negatively significant which also found by Alperovich & Machnes (1994), stated that air passenger demand depends on total wealth of consumer. The rising inflation measured by CPI, raise artificially prices of goods and services bought by the average consumer, leads to reduction of consumer wealth, given no changes in current income.

Air transportation stimulates economic activity through its enabling effect. Ishutkina & Hansman (2008) defined enabling effect as "The total economic impact on employment and income generated by the economic activities which are dependent on the availability of air transportation services" (p.2). There is interrelation between air transportation and economy, as higher economic levels stimulate air transport and better air transport stimulates economic activity. Air transportation enable faster delivery time, as well as creation of direct and indirect economic effects including higher employment levels, better and faster access to markets, people and capital which in return stimulate higher demand levels that need to be supplied which creates higher production level which needs better and faster transportation to reach markets which stimulate demand on air transport. The success of this cycle needs also exogenous variables as infrastructure and regulations (Demirsoy, 2012). Bhadra & Wells (2005) stated that higher regional "economic activity" raises air transport demand. Studying USA found increase in "Gross State Product" GSP by 1% lead to increase of "Origin and Destination" O & D by 0.75% and 0.95% respectively.

Interest rate and exchange rate may affect air passenger demand in short-term. If the country's currency is stronger than other countries' currencies it will be attractive to this country's citizens to travel more as it will be more affordable to them to buy foreign currency more. It will be cheaper for them to travel abroad and buy products and make tourism at the other lower currency's countries (Department for Transport, 2010).

Income growth can be one of the factors explain rising air transport, GDP per capita, consumer expenditure and disposable or discretionary income are used in literature as proxy of income. Steiner (1967) found that discretionary income is the main factor for rising air traffic. Other studies as Graham (2000) used GDP as proxy of income with consumer expenditure and disposable income. CAA "UK Civil Aviation Authority" employs consumer expenditure as main factor of long-term demand of air transport (Demirsoy, 2012). Air transportation is more desirable mean of transportation for middle- and high-income people (Graham, 2000). Schafer & David (2000) stated that increasing personal income will increase people's mobility turning to much faster and expensive transport mode of transportation, as their transportation budget increases allowing them to shift from cheaper slower transportation mean to a faster more expensive means which raise demand on air transport.

Marazzo *et al.* (2010), studying air transport in Brazil found inter-relationship between air passenger and GDP, using vector autoregressive (VAR) model. Yao & Yang (2012), studying China 1995 till 2006 found positive correlation between "air transportation and economic growth". Suryani *et al.* (2012) studying Taiwan found that GDP has strong impact on air cargo. Chi & Baek (2013) studying USA air transportation found positive co-integration between air passengers and freight with economic growth. Profillidis & Botzoris (2015) investigated relationship between GDP and civil aviation; found that "economic growth" positively affects civil aviation. Brida *et al*. (2016) discussed long-term links between GDP

and air transportation in Mexico, and found two-sided causality between the variables.

Coppio *et al.* (2017) studying air transport in Brazil found that GDP is statistically significant (Egilmez, 2020). Hakim & Merkert (2016), studying air transport in South Asia from 1973 to 2014 found causality between air transportation and GDP. Dargay & Hanly (2001) studying demand determinants of air transport used income, foreign trade, airfares, domestic price level and exchange rate, using panel data found that air rates have a negative impact on air passengers, and income has positive effect. Study of Abed *et al*. (2001) deploying time series model for air travel in Saudi Arabia using number of air passengers as dependent variable and used independent variables include GDP, CPI, imports, population, consumption and total expenditure using four models. Found that the best model includes population and total expenditure with positive significant impact on air passenger demand. Also study of Ba-Fail *et al.* (2000) studied air travel determinants of "Kingdom of Saudi Arabia" and found positive correlation between "income growth and air travel". Studies as "Adermo, 2010; Fernandes & Pacheco, 2010" also found positive relationship between GDP per capita and demand of air transport (Kiraci and Battal, 2018).

Valdes (2015) studying middle- and high-income countries found that income growth is the main determinant of airline traffic. Baker *et al.* (2015) found long and short-run causality between GDP per capita and regional aviation. Mukkala & Tervo (2013) investigated the causality between air traffic and Europe regional growth found that economic development drives airport traffic (lakew, 2015). Dobruszkes *et al.* (2011) investigated the factors of air transport in Europe, GDP found to be significant with the strongest impact on air transport demand. Fridström & Thune-Larsen (1989) investigating Norwegian air transport found that population and income have positive elasticities. Karlaftis (2008)

investigated air passenger in Greece; found positive significant effect of income on air passenger traffic. Demirsoy (2012) found that the main variables affecting air transport demand are income and population. Airfares and prices of different transportation modes consider important determinant, because it's hard to get airfares data for some countries literature use alternative measures as CPI "Consumer price Index". Economic Theory states that there is negative relationship between price and demand, but in the last decade inflation rates have positive relationship with demand. Liberalization reduced impact of airfares due to rising competition between air companies which sign of inflation conversely (Demirsoy, 2012). Relationship between CPI and air transport is thought to be negative as the interest rate. The lower CPI leads to more savings by households and delay of noncompulsory spending. In addition, higher inflation rate leads to individuals' disposable income reduction which reduces purchasing power that causes negative impact of inflation on air travel by passengers. Kiboi *et al.* (2017) stated that interest rate and airfares related, as the increase in airfares negatively affects air passenger demand. When interest rate increases household savings theoretically supposed to increase and the non-necessary spending as travelling reduced, this states that demand on air transport by passengers is negatively affected by interest rate.

Despite the importance of air transport in stimulating economic growth and global integration, empirical literature studying air transport determinants of demand in Egypt is limited. Most studies concentrating on sector deregulation and its relationship with tourism as study of Omar and Sekkat (2012) that examined the relationship between liberalization and Egyptian airline performance. Ragab (2005) forecasting the impact of airline deregulation, and studies of "Marouani & Munro, 2009; Bottini & Marouani, 2009" estimated deregulation impact after implementation (Omar and Sekkat, 2012). Sakr *et al.* (2009) studied if airlines consider a barrier constraint to tourism in Egypt. The current study

aims to fill the gap in air transport empirical literature in Egypt due to the importance of identifying the main economic determinants of air transport in Egypt.

**Air Passenger Transport in Egypt**

Based on World Bank (2010) Ministry of civil aviation (MCA) has been created in 2002 separating civil aviation from other transportation sectors in Egypt. The ministry objective mainly is the development of international and domestically air transportation services. International air transport services faced gradual liberalization in the nineties making bilateral agreements with number of countries in Africa, Europe and Middle East. Since 2004, liberalization took more strong steps, awarding 13 licenses of domestic and international flights to private investors and 7 licenses of air taxis. Starting by early 2000s Airport services improved through more strengthen airport operations and capacity investments. Airport development investment plan launched by "Egyptian Holding company for air ports and navigation" EHCAAN spending above US$75 million in 2004 for doubling capacity of both airports of CAI "Cairo international airport" and Sharm el Sheikh (SSH), in 2005, agreements issued with international operators to manage major airports as CAI and main Egypt's airport, as well as, expanding main airports capacity to meet increasing traffic capacity, and development of airports infrastructure to facilitate growth of economic activities (World bank, 2010).

Based on IATA 2020, in total air transport support 602000 jobs; Egyptian Air transportation sector employ 97000 people, and supporting 102000 jobs, and support 20000 jobs as induced effects of consumption expenditure increased because of wages of the sector employees, in addition, to 383000 jobs raised due to spending by tourists arriving Egypt by air. Air transportation industry estimated to support GDP by US$ 7 billion, 2.1% of Egypt's GDP from air transport industry and tourists

arriving Egypt by air. The main important economic benefit of air transport coming from foreign tourists spending, and exports value, foreign direct investment and creative of productive assets which collectively enhance GDP. Egypt's air connectivity to Middle East grown very fast recently, Middle East air passenger to Egypt was 6.1 million "46.2% of total" consider as the largest air passenger market to Egypt, followed by 3.9 million from Europe "29.3 % of total", then 2.2 million from Africa "16.6 % of total". Egypt's Air Transportation market estimated to grow 108% during the next twenty years resulting of additional 13.5 bn. passenger by 2037.

**Data and Model Specification**

The data set covers the period from 1982 till 2019, the data obtained from World Bank. Economic variables assumed to affect air passenger demand which is examined through estimating two models. Model 1 will include “GDP per capita, exchange rate and consumer price index CPI”. CPI as proxy of price level include air fares and prices of goods and services, as assumed by economic theory of demand increase in price level reduce consumer's wealth which reduces purchasing power that supposed to reduce consumption, reducing air travel demand. GDP per capita shows household’s wealth and standard of living, wealth increase will raise their expenditure including transport budget, raising demand on air travel. Higher wealth will cause shifting from lower cost and less efficient transport mode to more luxurious expensive transport mode as air transport. Exchange rate expected to have negative impact on air passenger if it depends mainly on travelers coming from other countries as in case of lower local country's exchange rate relative to other countries' currencies local prices of goods and services will be relatively cheaper than other countries' prices which attract visitors raise demand of air passengers. If demand on air travel depends more on county's citizens it expected to have positive impact if the country's currency is stronger than other countries'

currencies it will be attractive to this country's citizens to travel more as it will be more affordable to them to buy foreign currency more. It will be cheaper for them to travel abroad and buy products and make tourism at the other lower currency's countries.

Model 2 analyzing air passenger demand using household consumption as proxy of income level, air carrier as proxy of air transport infrastructure as airports and, air traffic control system which supposed to have positive impact on air passenger as more developed air carrier and airports attract air passengers and third independent variable deposit interest rate as proxy of interest rate effect which supposed to have negative impact on air passenger as higher deposit interest rate increase savings which lower available budget to air travel reducing demand on air passenger.

All variables must be stationary of first level to use “Vector error correction model VECM” method; variables used in the models will be checked for stationarity using unit root tests of “Augmented Dickey Fuller (ADF)”, and “Philips-Peron (PP)”. VEC model is based on unrestricted VAR model so it’s essential to be specified correctly, by specifying the optimal lag length for both models by using “lag length criteria” and further diagnostics tests of VECM will be carried as “Breusch-Godfrey Serial Correlation Test”, residuals will be tested using “Breusch-Pagan-Godfrey Heteroskedasticity Test, and normality test”, and stability test using “inverse roots test” in which all inverse roots should be included inside the unit circle.

Then co-integration test will be carried to examine co-integrated movement among variables in long run using Johansen and Juselius (1992) methodology. In case if the maximum Eigen value test or trace test identifies more cointegrated relationships the interpretation is more difficult, for simplicity both models are specified with only one

cointegration equation, imposing restriction of one long run relationship. If variables found to be cointegrated using Johansen and Juselius (1992) methodology further examination of dynamics relate variables can be carried using VECM methodology which combines short and long run dynamics among studied variables. VECM can be written as follow.

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \ \Delta y_{\ t-i} \ + \ \varepsilon_t \quad \text{(Equ.1)}$$

$y_t$ is vector of included variables, $\Delta$ is difference operator, $\Gamma$ is short run coefficients matrix, p is lag length. Matrix $\Pi$ is the product of 2 matrices $\Pi = \alpha\beta$ , $\beta$ matrix includes stationary long run relationships and $\alpha$ matrix includes error correction terms as they contain coefficients of interest in VECM. Second term of the equation presents short run dynamics as $\Gamma$ is coefficient vector of lagged first difference of variables $\Delta\, y_{t-i}$ , i indicate VECM number of lags, $\varepsilon$ is white noise error term.

As mentioned by Stock and Watson (1988) "If variables are cointegrated there exists at least one linear combination among them which is stationary, determined by coefficients of $\beta$ matrix". Time series used usually expressed in logarithm to be able to interpret coefficients of $\beta$ matrix as long run elasticities. To identify causality direction ECT "error correction terms" is analyzed ($\alpha$), which reveals speed of adjustment in which variables adjust to any deviations from long run equilibrium (Batool and Goodman, 2021). Long run causality checked by usage of t-test for significance of adjustment speed in error correction term ECT.

Then short run causality is checked by deploying standard Wald statistic and granger causality test to determine direction of causality. Granger causality as mentioned by Batool and Goldman (2021), "measures weather the current and past values of variable $y_t$ help to improve the forecast of future values of variable $z_t$".

Assessing variables responsiveness intensity to shocks in short and long run using impulse response function IRF analysis, "shocks denoted as one standard deviation in innovations the effect also transmitted to other endogenous variables through VECM dynamic structure, as IRF track effect of shocks on each innovation overall endogenous variables in the VAR system. If innovation is simultaneously uncorrelated IRF can be directly interpreted so Cholesky decomposition is applied for making IRF innovations uncorrelated as they are usually correlated" (Mehmood *et al.,* 2013). IRF traces the impact of each variable in the model to one shock on current and future values; it identifies responsiveness of dependent variable in VECM to a shock on error term.

Further analysis of variables dynamics will be carried using variance decomposition VDC "which break down variance of unanticipated changes in dependent variable according to the contribution of each variable's innovation" (Enimola, 2010). Applying VDC approach based on VECM for comparing influence magnitude among included variables in each model through the studied period.

Based on the above the current research will try to estimate the following VECM models which specified as follows:

**First Model**

$$\Delta \text{LNAIRPASS}_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \text{LNAIRPASS}_{t-i} + \sum_{i=1}^{p} \alpha_2 \Delta\text{LNEXCH}_{t-i} + \sum_{i=1}^{p} \alpha_3 \Delta\text{LNCPI}_{t-i} + \sum_{i=1}^{p} \alpha_4 \Delta\text{LNGDPCAPITA}_{t-i} + \varphi ECT_{t-1} + \varepsilon_t \quad \text{(Equ.2)}$$

**Second Model**

$$\Delta \text{LNAIRPASS}_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta\text{LNAIRPASS}_{t-i} + \sum_{i=1}^{p} \alpha_2 \Delta\text{LNHHCONS}_{t-i} + \sum_{i=1}^{p} \alpha_3 \Delta\text{LNAIRCARR}_{t-i} + \sum_{i=1}^{p} \alpha_4 \Delta\text{LNDINTEREST}_{t-i} + \varphi ECT_{t-1} + \varepsilon_t \quad \text{(Equ.3)}$$

Variables defined as shown in table (1) in addition to descriptive data of each variable. ECT refers to error correction term relates to the fact that the deviation from long run equilibrium is corrected gradually through series of partial short run adjustments, its coefficient ($\varphi_i$) is the speed of adjustment it measures the speed at which dependent variables returns back to equilibrium after a change in independent variable. $\varepsilon_t$ is white noise error terms. Short run dynamics captured by coefficients ($\alpha_i$) of explanatory variables.

**Table 1: Descriptive statistic -Variables Abbreviation and indicators**

| Variable | Indicator | Mean | Median | Max. | Min. | Std. Dev. | Jarque-Bera P-value | Obs. |
|---|---|---|---|---|---|---|---|---|
| LNAIRPASS | "Air transport passengers carried" | 15.41 | 15.31 | 16.37 | 14.66 | 0.526 | 0.212 | 38 |
| LNHHCONS | "Households Final consumption expenditure" | 25.69 | 25.69 | 26.43 | 24.88 | 0.464 | 0.342 | 38 |
| LNDINTEREST | "Deposit interest rate" | 2.223 | 2.266 | 2.510 | 1.794 | 0.235 | 0.144 | 38 |
| LNAIRCARR | "Registered air carrier departures worldwide" | 10.79 | 10.64 | 11.66 | 9.893 | 0.497 | 0.218 | 38 |
| LNCPI | "Consumer price index" | 3.78 | 3.819 | 5.66 | 1.627 | 1.074 | 0.592 | 38 |
| LNEXCH | "Official exchange rate" | 1.24 | 1.312 | 2.87 | -0.356 | 0.955 | 0.378 | 38 |
| LNGDPCAPITA | "GDP per capita - constant 2015 US$" | 7.85 | 7.87 | 8.28 | 7.396 | 0.267 | 0.244 | 38 |

**Source**: Author's calculation. "Ln" at the beginning of abbreviations stands for logarithm

## Empirical results

To avoid "spurious correlation" time series has to be stationary of same order or integrated of same order, in case of integrated of same order it can be modelled by VECM. In literature, "Augmented Dickey-Fuller (ADF)" and "Philips-Peron (PP)" are the most-commonly stability tests used for time series which are employed and the results as shown in table (2), showing that all examined series are integrated of order one. To perform VECM analysis, the appropriate lag length should be determined; the analysis used "optimal lag length criteria which shows in table (3) that optimal lag length of first model is second lag and first lag of second model. Then diagnostics test carried based on VECM showing in table (3) that both models have no autocorrelation and free of Heteroscedasticity problem from first till third lag, regarding normality the three lags of first model are normally distributed and first lag of second. Both models found to be stable using inverse roots test found to be inside the circle as shown in figure (1). Cointegration test examined co-movement in long run of studied variables using Johansen and Juselius (1992) methodology as shown in table (4) evidence of long run relationship among both models' variables, in first model based on second lag as stated by optimal lag length criteria found 2 cointegrating equations indicated by trace test and 1 cointegrating equation indicated by Max-eigenvalue test and second model using first lag length found 1 cointegrating equation indicated by Trace test.

Model 1 estimated using VECM approach for further identification of the dynamics that relate variables. Estimated VECM with air passenger as target variable and explanatory variables as "exchange rate, CPI and GDP per capita" shown in equation (4) and long run shown in equation 5:

$$\Delta LNAIRPASS_t = -0.476 ECT_{t-1} - 0.678\ \Delta LNAIRPASS_{t-1} - 0.385\ \Delta LNAIRPASS_{t-2} - 0.251\ \Delta \mathrm{LNEXCH}_{t-1} - 0.099\ \Delta \mathrm{LNEXCH}_{t-2} + 0.815$$

$\Delta LNCPI_{t-1}$+0.043 $\Delta LNCPI_{t-2}$ -0.609 $\Delta LNGDPCAPITA_{t-1}$-0.597 $\Delta LNGDPCAPITA_{t-2}$ +0.059 (Equ. 4)

$ECT_{t-1} = LNAIRPASS_{t-1}$+ 0.478$LNEXCH_{t-1}$ - 0.916 $LNCPI_{t-1}$ - 0.215 $LNGDPCAPITA_{t-1}$ - 10.820 (Equ. 5)

P-value of F-statistics is significant at 1% which shows that data is fitted good, and Durbin-Watson statistic is 2.2 which shows that the model is free of serial correlation, which also confirmed by diagnostics tests in table (3).

ECT in Equation (5) indicates long run relationship between the variables as the expected sign for positive long run relationship among variables is negative sign, the coefficient is with correct sign (-0.476) and statistically significant at 1% confidence level which indicates that there is long run causality from independent variables to air passenger, that shows the ability of bouncing back to equilibrium, previous year errors will be corrected in the following year in adjustment rate of 47.6%.

Short run dynamics captured by coefficients of explanatory variables estimation results in table (5), shows that exchange rate is negative statistically significant at 10% confidence level to air passenger as expected from literature as reduction of exchange rate of local currency will make local prices of goods and services relatively cheaper than other countries which will attract visitors to Egypt, and if raised that will make prices relatively expensive which will reduce number of visitors showing that air passenger mainly depends on demand on air travel from abroad not only by local citizens. CPI as proxy of air fares and prices of goods and services found to be statistically significant at 10% confidence level to air passenger coefficient found to be positive which doesn't go with theoretical literature but that was explained by empirical literature, in the last decade inflation rates have positive relationship with demand as

liberalization reduced impact of airfares due to rising competition between air companies which inversed coefficient sign. GDP per capita found to be statically insignificant to air passenger which doesn't go with economic theory as increased wealth should increase demand, but that goes with the explanation of negative sign of exchange rate coefficient that demand on air travel derived mainly from abroad not by local citizens which shows that GDP per capita of citizens doesn't statistically affect demand on air passenger also that goes with findings of Erratiab *et al.*, (2016) studying Morocco which can state that lower-middle income countries air passenger demand depend on demand from abroad. As found by Valdes (2015) studying middle- and high-income countries found that income growth is the main determinant of airline traffic, also Ba-Fail *et al.* (2000) studying air travel determinants of "Kingdom of Saudi Arabia" which is high income country found positive correlation between "income growth and air travel. Also, insignificance of GDP per capita can be explained by income distribution as air transportation is more desirable mean of transportation for middle- and high-income people. According to ″World Inequality Database" WID in 2019, highest-income level in Egypt received 19% of total national income, while 50% of lowest-income level received only 17.2%, and Top-income which is 10% of citizens received 48.7% of the total national income that's shows that GDP per capita isn't good indicator for wealth effect which require further analysis of wealth effect in second model.

To examine short run causality Wald Statistics test and granger causality carried as shown in table (6) which found short run unidirectional causality from CPI and exchange rate to air passenger at 10% confidence level and no unidirectional causality from GDP per capita to air passenger which goes with the above results.

Model 2 is estimated using VECM with air passenger as target variable and explanatory variables as "household consumption, air carrier and deposit interest rate" shown in equation (6) and long run shown in equation (7):

$\Delta LNAIRPASS_t$ = -0.794$ECT_{t-1}$ -0.366 $\Delta LNAIRPASS_{t-1}$ + 5.307 $\Delta \mathrm{LNHHCONS}_{t-1}$ -+ 0.097$\Delta \mathrm{LNAIRCARR}_{t-1}$ -0.475 $\Delta \mathrm{LNDINTEREST}_{t-1}$- 0.168 (Equ. 6)

$ECT_{t-1} = LNAIRPASS_{t-1} -$ 0.918$\mathrm{LNHHCONS}_{t-1}$ - 0.429 $\mathrm{LNAIRCARR}_{t-1}$ - 0.561 $\mathrm{LNDINTEREST}_{t-1}$ + 14.063 (Equ. 7)

As shown from table (5) P-value of F -statistics is significant at 1% which shows that data is fitted good, and Durbin- Watson statistic is 2.04 which shows that the model is free of serial correlation, which also confirmed by diagnostics tests in table (3). VECM indicate long run relationship between variables as the coefficient is with correct sign (-0.794) and statistically significant at 1% confidence level which indicates that there is long run causality from independent variables to air passenger, previous year errors will be corrected in the following year in adjustment rate of 79.4%.

Coefficients of independent variables shows that household consumption as proxy of income level is positive and statistically significant at 1% confidence level to air passenger which goes with economic theory, this confirm that GDP per capita wasn't good indicator for wealth due to imbalance distribution of income. Infrastructure measures by air carriers found to be insignificant with air passenger at short run that might be because infrastructure development is long run activity. Deposit interest rate has negative statistical impact on air passenger at 10% confidence level which goes with literature as higher

interest rate increases household savings theoretically as savings become more valuable which reduce the non-necessary spending as air travelling, this states that demand on air transport by passengers is negatively affected by deposit interest rate which shows that wealth effect has impact on air passenger demand.

These findings confirmed also through using Wald Statistics and granger causality test as shown in table (6) which both found that in short run there is unidirectional causality from households' consumption to air passenger at 1% confidence level and from deposit interest rate to air passenger at 10% confidence level and no unidirectional causality from air carrier as proxy of air transport infrastructure to air passenger.

The results are checked further with IRF "Impulse-Response functions" based on VECM. IRFs identify responsiveness of dependent variables in the VECM due to a shock on error term. It traces effect of one-time shock to one of innovations on current and future values of dependent variables.

Model 1 results of IRFs "Impulse-Response functions" for 10 years on yearly basis shown in Figure 2(a) and 2 (b) shows the accumulated responses. A one standard deviation shock to exchange rate causes significant decreases in air passenger over the 10 years, it dropped strongly in the first 2 years then kept in rising till $6^{th}$ year then stabilized for the rest of the period, showing that a onetime 1% increase in exchange rate leads to a permanent decrease in air passenger by 0.037% from tenth year. Tracing impact of the response of air passenger to an impulse from CPI shows that impulse of CPI led to a positive reaction of air passenger all over the studied period with the maximum impact occurs at second year and dropped till sixth year then stabilized showing that a onetime 1% increase in CPI leads to permanent increase of air passenger by 0.016%. Tracing the impact of the response of air passenger to an impulse from

GDP per Capita show negative reaction of air passenger to impulse of GDP per Capita with the lowest point at second year to raise again till seventh year then stabilized for the rest of the studied period showing that one time 1% increase in GDP per capita leads to a permanent decrease in air passenger by 0.008%. The results of the three variables go with findings of VECM studied earlier and confirm that GDP per capita isn't good indicator of wealth.

Second model results of IRFs "Impulse-Response functions" for 10 years on yearly basis shown in Figure 3(a) and 3 (b) shows the accumulated responses. Tracing the impact of response of air passenger to an impulse from household consumption shows that one time shock of household consumption leads to permanent increase in air passenger, a onetime 1% increase in household consumption leads to a permanent increase in air passenger by 0.025% all over the studied period with strongest positive reaction at second year and minimum point at third year. Impulse of air carrier led to increase in air passenger all over the studied period the strongest positive reaction at second period and the minimum point at third year showing that a onetime 1% increase in air carrier leads to 0.032% increase in air passenger. This positive strong impact shows that air carrier as proxy of air transport infrastructure has positive impact to changes in air passenger demand on long run as infrastructure development needs time to show its impact. Tracing the impact of response of air passenger to an impulse from deposit interest rate shows negative reaction for three years then started to be positive after that with the maximum reaction at eighth year then stabilized the rest of the period, onetime 1% increase in deposit interest leads to a permanent increase of air passenger by 0.005%. This finding shows that the negative impact of deposit interest which explained as higher deposit interest rate attract people to save more and reduce their consumption including air travel, in long run this reaction turned into positive after three years of savings which

shows that people income started to increase and start to use this increasing interest rate as additional wealth to increase their travel budget.

To compare extent of contributions of time series FEVD "Forecasting error Variance decomposition" based on VECM gives the percentage of unexpected variation in each variable that is produced by shocks from other variables comparing magnitude influence among studied variables. FEVD estimation of first model as seen from table (7) in first year 100% of forecast error variance in air passenger is explained by itself further we move in future over long run influence of exchange rate and CPI become stronger in predicting air passenger, while GDP per capita influence is weaker. It shows that 72% of air passenger explained by its own innovative shocks and the contribution of exchange rate on predicting air passenger in future almost 8.4%, CPI contribution is 18.3%, while GDP per capita maximum influence was at second third year of 3% then decreased over years to reach only 1.35%. This indicates that share of GDP per capita is weakest in comparison with CPI and Exchange rate.

Considering second model as seen from table (8) in first year 100% of forecast error variance in air passenger is explained by itself further we move in future influence of household consumption and air carrier become stronger in predicting air passenger in long run. It shows that 72% of air passenger explained by its own innovative shocks and the contribution of household consumption 14%, air carrier 22% and deposit interest rate 0.7%. This indicates that share of deposit interest rate is minimum comparatively for household consumption and air carrier.

**Table (2) Unit Root Tests for Stationarity**

| Variable | PP | | ADF | | Integration order |
|---|---|---|---|---|---|
| | Level | Differenced | Level | Differenced | |
| LNEXCH | -0.6014 ( ***0.8583)*** | -2.999 ( ***0.0445)***** | -0.6014 (***0.8583)*** | -3.4524 (***0.0154)***** | I(1) |
| LNDINTEREST | -1.4239 (***0.5602)*** | -3.7666 (***0.0070)***** | -1.8342 ( ***0.3586)*** | -4.7102 ***(0.0006)***** | I(1) |
| LNAIRCARR | -0.8412 (***0.7980)*** | -10.0318 (0.0000)*** | -0.4811 (***0.8857)*** | -9.9013 (0.0000)*** | I(1) |
| LNAIRPASS | 0.1622 (***0.9663)*** | -10.6764 ( ***0.0000)*** | 0.5211 ( ***0.9852)*** | -10.6764 ( ***0.0000)***** | I(1) |
| LNGDPCAPITA | -0.7173 ( ***0.8300)*** | -3.7076 (***0.0081)*** | -0.4455 (***0.8895)*** | -3.7803 (***0.0070)***** | I(1) |
| LNHHCONS | -1.3681 ( ***0.5872)*** | -3.2425 (***0.0255)***** | -0.5623 (***0.8667)*** | -3.1444 ( ***0.0321)***** | I(1) |
| LNCPI | -1.2266 (***0.6526)*** | -2.7128 (***0.0817)**** | -0.9403 (***0.7635)*** | -2.8261 (***0.0646)**** | I(1) |

Source: Author estimation

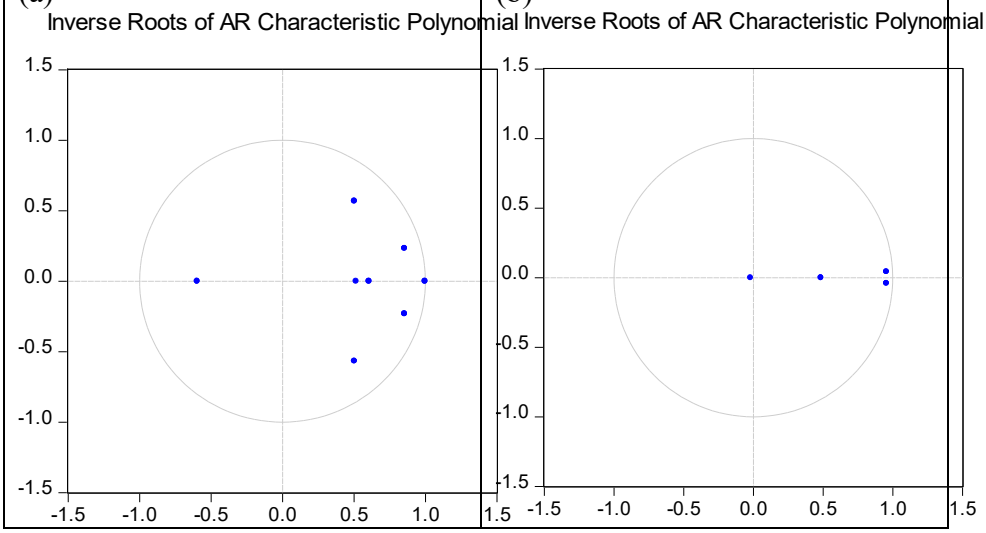
**Table (3) Diagnostics Tests and Lag Length specification**

| Lag length Criteria | | | | | | | Residual Serial Correlation LM Tests | | Jarque-Bera | Heteroskedasticity Chi Sq. |
|---|---|---|---|---|---|---|---|---|---|---|
| Lag | LogL | LR | FPE | AIC | SC | HQ | LRE | p- value | p-value | p value |
| Model 1 | | | | | | | | | | |
| 1 | 208.222 | 301.866 | 2.53E-10 | -10.756 | -9.866 | -10.448 | 36.828 | 0.002 | 0.574 | 0.336 |
| 2 | 244.258 | 53.539* | 8.36e-11* | -11.900* | -10.300* | -11.348* | 17.574 | 0.355 | 0.869 | 0.287 |
| 3 | 255.148 | 13.691 | 1.24E-10 | -11.608 | -9.297 | -10.810 | 10.826 | 0.822 | 0.923 | 0.550 |
| Model 2 | | | | | | | | | | |
| 1 | 216.34 | 298.58* | 1.59e-10* | -11.219* | -10.331* | -10.912* | 12.513 | 0.710 | 0.129 | 0.853 |
| 2 | 225.09 | 12.994 | 2.50E-10 | -10.805 | -9.205 | -10.253 | 12.764 | 0.692 | 0.047 | 0.930 |
| 3 | 237.75 | 15.919 | 3.35E-10 | -10.614 | -8.303 | -9.816 | 16.663 | 0.411 | 0.042 | 0.629 |

**Source**: Author estimation

Figure (1): Inverse Roots of AR Characteristic Polynomial

| Model 1 | Model 2 |
|---|---|
| (a) | (b) |




**Source**: Author estimation

**Table (4) Cointegration Test results**

| Model | Test for | Eigen value | Trace Test | | | Max-Eigen value test | | |
|---|---|---|---|---|---|---|---|---|
| | | | Stat. | Critical Value | P- value | Stat. | Critical Value | P-value |
| ١ | None * | 0.71 | 93.53 | 63.87 | 0.000 | 44.36 | 32.11 | 0.001 |
| | At most 1 * | 0.52 | 49.16 | 42.91 | 0.010 | 25.73 | 25.82 | 0.05 |
| | At most 2 | 0.37 | 23.42 | 25.87 | 0.098 | 16.44 | 19.38 | 0.12 |
| | At most 3 | 0.18 | 6.97 | 12.51 | 0.346 | 6.97 | 12.51 | 0.34 |
| ٢ | None * | 0.503313 | 56.10197 | 54.07904 | 0.0326 | 25.19261 | 28.58808 | 0.1279 |
| | At most 1 | 0.325022 | 30.90935 | 35.19275 | 0.1348 | 14.15073 | 22.29962 | 0.4483 |
| | At most 2 | 0.26468 | 16.75863 | 20.26184 | 0.1418 | 11.06817 | 15.8921 | 0.2468 |
| | At most 3 | 0.146209 | 5.690457 | 9.164546 | 0.216 | 5.690457 | 9.164546 | 0.216 |

**Source**: Author estimation

**Table (5) VEC Models Estimation**

| Dependent Variable: D(LNAIRPASS) | | | | |
|---|---|---|---|---|
| | Coef. | Std. Error | t-Statistic | Prob. |
| ECT (-1) | -0.476469 | 0.170926 | -2.787580 | 0.0100 |
| D(LNAIRPASS(-1)) | -0.678914 | 0.192091 | -3.534343 | 0.0016 |
| D(LNAIRPASS(-2)) | -0.385471 | 0.171574 | -2.246679 | 0.0337 |
| D(LNEXCH(-1)) | -0.251461 | 0.143726 | -1.749594 | 0.0925 |
| D(LNEXCH(-2)) | -0.099678 | 0.143215 | -0.696003 | 0.4928 |
| D(LNCPI(-1)) | 0.815667 | 0.471240 | 1.730895 | 0.0958 |
| D(LNCPI(-2)) | 0.043459 | 0.460878 | 0.094296 | 0.9256 |
| D(LNGDPCAPITA(-1)) | -0.609629 | 1.493768 | -0.408115 | 0.6867 |
| D(LNGDPCAPITA(-2)) | -0.597918 | 1.451482 | -0.411936 | 0.6839 |
| C | 0.059072 | 0.059120 | 0.999200 | 0.3273 |
| Durbin-Watson stat | 2.216455 | R-squared | | 0.589448 |
| F-statistic | 3.988184 | Prob(F- | 0.002924 | |
| Model 2 Dependent Variable: D(LNAIRPASS) | | | | |
| | Coef. | Std. Error | t-Statistic | Prob. |
| ECT (-1) | -0.794428 | 0.283445 | -2.802757 | 0.0088 |
| D(LNAIRPASS(-1)) | -0.366181 | 0.220204 | -1.662915 | 0.1067 |
| D(LNHHCONS(-1)) | 5.307405 | 1.795926 | 2.955247 | 0.0060 |
| D(LNAIRCARR(-1)) | 0.097321 | 0.152352 | 0.638792 | 0.5278 |
| D(LNDINTEREST(-1)) | -0.475631 | 0.243021 | -1.957157 | 0.0597 |
| c | -0.168468 | 0.081317 | -2.071750 | 0.0470 |
| Durbin-Watson stat | 2.048426 | R-squared | | 0.537903 |
| F-statistic | 6.984280 | Prob(F-statistic) | 0.000197 | |

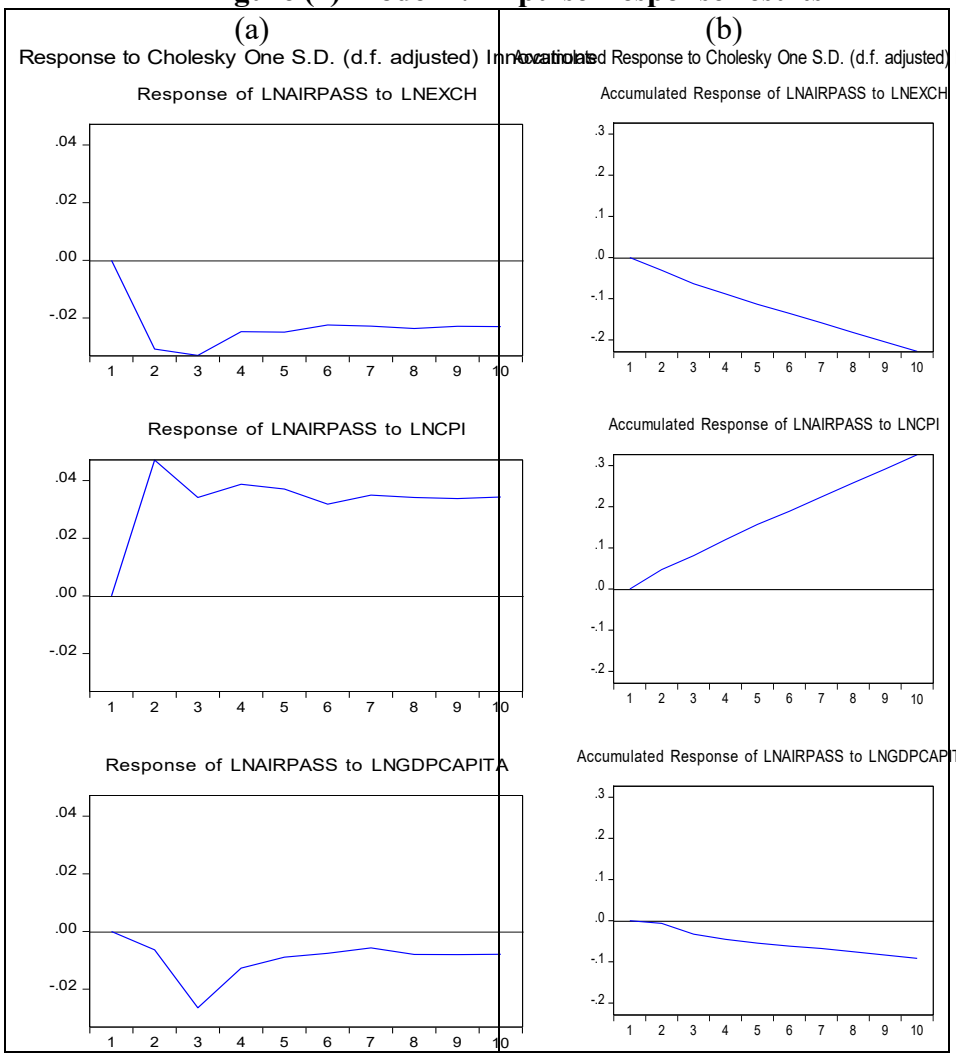
**Source**: Author estimation

**Table (6) Wald statistic and Granger Casualty results**

| Wald statistic results | | | | |
|---|---|---|---|---|
| Model 1: Dependent variable: D(LNAIRPASS) | | | | |
| Variable | F-stat. | | Chi-square | |
| | value | Prob. | value | Prob |
| LNEXCH | 2.620 | 0.0927 | 5.240 | 0.0728 |
| LNCPI | 2.607 | 0.0937 | 5.214 | 0.0737 |
| LNGDPCAPITA | 0.337 | 0.7170 | 0.674 | 0.7138 |
| Model 2: Dependent variable: D(LNAIRPASS) | | | | |
| LNHHCONS | 8.733 | 0.0060 | 8.733 | 0.0031 |
| LNAIRCARR | 0.4080 | 0.5278 | 0.408 | 0.5230 |
| LNDINTEREST | 3.830 | 0.0597 | 3.8304 | 0.0503 |
| VEC Granger Causality/Block Exogeneity Wald Tests | | | | |
| Model 1: Dependent variable: D(LNAIRPASS) | | | | |
| Excluded | Chi-sq | | df | Prob. |
| D(LNEXCH) | 5.240 | | 2 | 0.0728 |
| D(LNCPI) | 5.214 | | 2 | 0.0737 |
| D(LNGDPCAPITA) | 0.674 | | 2 | 0.7138 |
| All | 7.419 | | 6 | 0.2838 |
| Model 2: Dependent variable: D(LNAIRPASS) | | | | |
| Excluded | Chi-sq | | df | Prob. |
| D(LNHHCONS) | 8.733 | | 1 | 0.0031 |
| D(LNAIRCARR) | 0.408 | | 1 | 0.5230 |
| D(LNDINTEREST) | 3.830 | | 1 | 0.0503 |
| All | 13.620 | | 3 | 0.0035 |

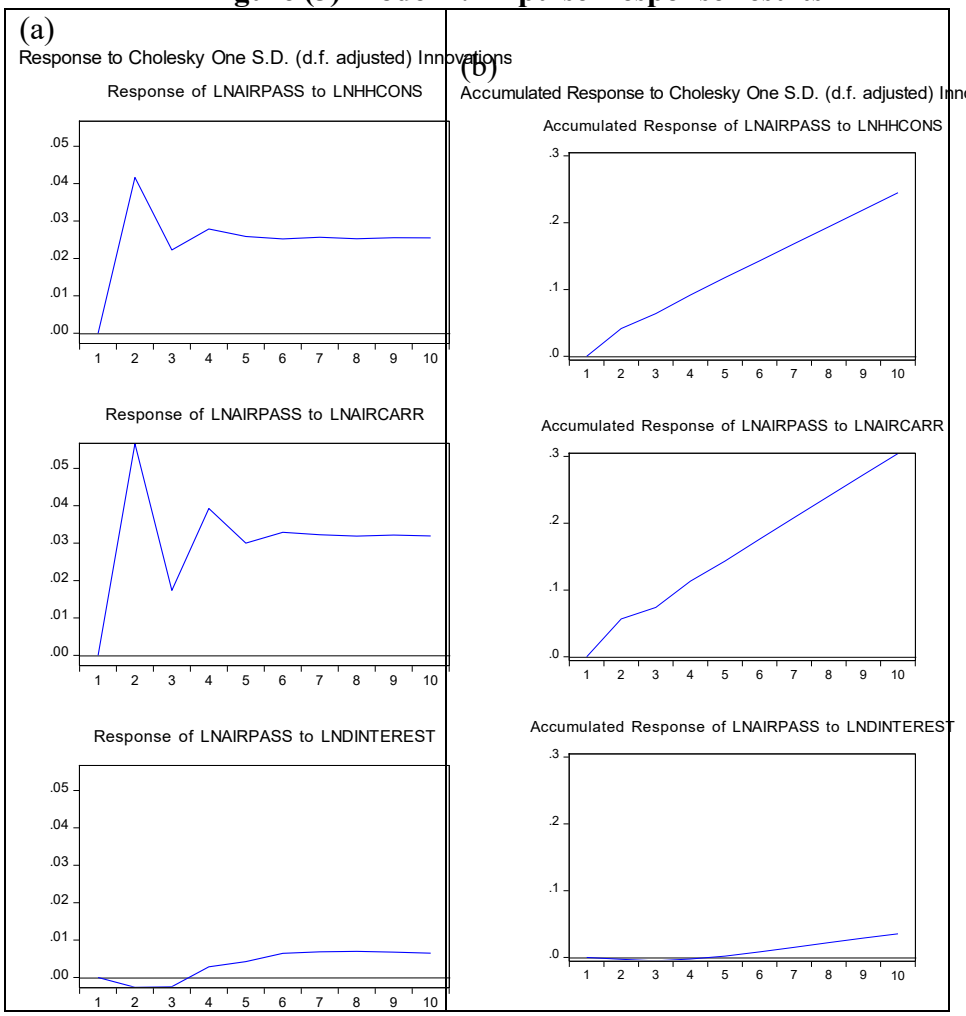
**Source**: Author estimation

**Figure (2) Model 1: Impulse Response results**




**Source**: Author estimation

**Figure (3) Model 2: Impulse Response results**




**Source**: Author estimation

**Table (7) Model 1 Cholesky Ordering Variance Decomposition**

| Period | S.E. | LNAIRPASS | LNEXCH | LNCPI | LNGDPCAPITA |
|---|---|---|---|---|---|
| 1 | 0.107225 | 100.0000 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 0.123490 | 78.97244 | 6.208456 | 14.55327 | 0.265827 |
| 3 | 0.155212 | 74.42224 | 8.451054 | 14.05231 | 3.074391 |
| 4 | 0.178537 | 73.53244 | 8.308637 | 15.33004 | 2.828892 |
| 5 | 0.192833 | 71.73418 | 8.791336 | 16.83768 | 2.636804 |
| 6 | 0.209810 | 72.55311 | 8.566965 | 16.52322 | 2.356705 |
| 7 | 0.223735 | 72.31383 | 8.575243 | 16.97445 | 2.136473 |
| 8 | 0.236898 | 72.12080 | 8.645038 | 17.21600 | 2.018154 |
| 9 | 0.250019 | 72.20725 | 8.599003 | 17.27880 | 1.914941 |
| 10 | 0.261875 | 72.08794 | 8.606390 | 17.46983 | 1.835845 |
| 20 | 0.360830 | 71.96572 | 8.483544 | 18.04663 | 1.504104 |
| 30 | 0.437896 | 71.92636 | 8.416481 | 18.25944 | 1.397721 |
| 31 | 0.444869 | 71.92391 | 8.411847 | 18.27342 | 1.390830 |
| 32 | 0.451734 | 71.92161 | 8.407479 | 18.28655 | 1.384361 |
| 33 | 0.458496 | 71.91945 | 8.403357 | 18.29891 | 1.378276 |
| 34 | 0.465160 | 71.91742 | 8.399461 | 18.31058 | 1.372541 |
| 35 | 0.471730 | 71.91551 | 8.395774 | 18.32159 | 1.367127 |
| 36 | 0.478209 | 71.91370 | 8.392281 | 18.33201 | 1.362006 |
| 37 | 0.484602 | 71.91199 | 8.388967 | 18.34189 | 1.357156 |

**Source**: estimated by researcher

**Table (8) Model 2 Cholesky Ordering Variance Decomposition**

| Period | S.E. | LNAIRPASS | LNHHCONS | LNAIRCARR | LNDINTEREST |
|---|---|---|---|---|---|
| 1 | 0.103870 | 100.0000 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 0.131161 | 71.21724 | 10.09190 | 18.64998 | 0.040884 |
| 3 | 0.146578 | 73.20891 | 10.39208 | 16.33785 | 0.061161 |
| 4 | 0.163012 | 69.57380 | 11.32806 | 19.01830 | 0.079841 |
| 5 | 0.175528 | 68.60453 | 11.94513 | 19.32330 | 0.127047 |
| 6 | 0.188136 | 67.69937 | 12.19435 | 19.87896 | 0.227323 |
| 7 | 0.199626 | 66.93181 | 12.48185 | 20.26642 | 0.319915 |
| 8 | 0.210621 | 66.45353 | 12.65117 | 20.49802 | 0.397278 |
| 9 | 0.221095 | 66.01409 | 12.81533 | 20.71610 | 0.454484 |
| 10 | 0.231096 | 65.68660 | 12.94949 | 20.86866 | 0.495256 |
| 20 | 0.314129 | 64.00067 | 13.65664 | 21.68495 | 0.657752 |
| 30 | 0.379389 | 63.37104 | 13.91870 | 21.99140 | 0.718861 |
| 31 | 0.385307 | 63.32918 | 13.93612 | 22.01177 | 0.722920 |
| 32 | 0.391136 | 63.28980 | 13.95251 | 22.03094 | 0.726739 |
| 33 | 0.396879 | 63.25269 | 13.96796 | 22.04901 | 0.730338 |
| 34 | 0.402541 | 63.21765 | 13.98255 | 22.06606 | 0.733736 |
| 35 | 0.408124 | 63.18451 | 13.99634 | 22.08219 | 0.736949 |
| 36 | 0.413631 | 63.15313 | 14.00941 | 22.09747 | 0.739993 |
| 37 | 0.419067 | 63.12336 | 14.02180 | 22.11196 | 0.742879 |

**Source**: estimated by researcher

## Conclusion

The paper studied macroeconomic determinants of air passenger demand through two models employing VECM methodology studying at first model aggregate price level using CPI, wealth effects using GDP per capita and net export effect using exchange rate. Second model studied household consumption as proxy of wealth, interest rate effect using deposit interest rate, in addition to air carrier as proxy of air transportation infrastructure. The main results shows that liberalization of air transport sector had important impact of competition which reduced the impact of increasing air fares on demand on air transport by passengers which shows the importance of raising competition and the importance of lower local prices in comparison with other countries which attract travelers from abroad and raise demand on air passenger. The importance of air transportation infrastructure development for increasing demand on air travel by passengers as better developed airports and air carriers facilitate more reliable and fast transportation process which will raise attractiveness of Egypt as travel destination to travelers from abroad. As well as the importance of raising wealth of residents for example through higher deposit interest rate to raise demand of local residents on air travel.

Based on the neo-Keynesian model Aggregate demand AD function is negative function of price level which is measured by either the GDP deflator or the CPI, "Keynes effect" proposed that a lower price level increase real money supply, lowering real interest rate and increase AD; this negative relationship between AD and price level take place through three effects; wealth effect as wealth decline in value according to increased price level due to falling of purchasing power of money, Interest rate effect at higher price level the demand on loans increase which raises the interest rate which reduce AD, and net exports effect as at higher domestic price level, exports become relatively expensive and imported goods become relatively cheaper which raise imports more than exports and decrease AD.

Estimation of first model found long run relationship between the variables, previous year errors will be corrected in following year in adjustment rate of 47.6%. The Short run dynamics captured by coefficients of explanatory variables indicated that exchange rate is negative statistically significant to air passenger as expected from literature as reduction of exchange rate of local currency will reduce local prices of goods and services relatively to other countries which will attract visitors to Egypt, that shows that air passenger mainly depends on demand on air travel from abroad not by local citizens. CPI found to be statistically positive significant which doesn't go with theoretical literature but that was explained by empirical literature, that liberalization reduced impact of airfares due to rising competition between air companies which inversed coefficient sign. GDP per capita found to be statistically insignificant to air passenger which doesn't go with economic theory, but that goes with the explanation of negative sign of exchange rate coefficient that demand on air travel derived mainly from abroad. Also, insignificance of GDP per capita can be explained by income distribution in Egypt as according to ″World Inequality Database" WID in 2019, highest-income level in Egypt received 19% of total national income, while 50% of lowest-income level received only 17.2%, and Top-income which is 10% of citizens received 48.7% that's shows that GDP per capita isn't good indicator for wealth effect. Short run significance also examined using Wald Statistics test and Granger causality which confirmed the results. Further study of the phenomena using "Impulse response functions" IRFs tracing effect of shocks to one of innovations on current and future values of dependent variables, showed negative response of air passenger to shocks of exchange rate and GDP per capita while shocks of CPI showed a positive response. Also, variance decomposition carried for further analysis found that 72% of air passenger explained by its own innovative shocks and the contribution of CPI is 18.3%, followed by contribution of exchange rate in predicting air passenger in future almost 8.4%, while GDP per capita maximum influence was at second third year of 3% then decreased over years to reach only 1.35%.

Second model VECM estimation indicates long run relationship between the variables previous year errors will be corrected in the following year in adjustment rate of 79.4%. Short run Coefficients of independent variables shows that households' consumption as proxy of wealth effect is positive statistically significant which goes with economic theory, infrastructure measured by air carriers found to be insignificant, and deposit interest rate has negative statistical impact on air passenger which goes with literature as higher interest rate increases household savings theoretically as savings become more valuable which reduce the non-necessary spending as air travelling, which shows that wealth effect has impact on air passenger demand. These findings confirmed also through using Wald Statistics and Granger causality.

IRFs found that an impulse from household consumption leads to permanent increase in air passenger and the response of air passenger to an impulse from air carrier shows that air carrier led to increase in air passenger all over the studied period while it was insignificant in short run analysis which shows that infrastructure development has higher impact in long run as infrastructure is a long run development process which requires time to affect. Response of air passenger to an impulse from deposit interest rate shows negative reaction of air passenger due to impulse of deposit interest rate for three years then started to be positive reaction after that leads to a permanent increase of air passenger for rest of the periods. This finding shows that the negative significance of deposit interest at short run turned into positive impact in long run which shows that people income started to increase and start to use this increasing interest rate as additional wealth to raise their travel budget, also this confirmed using Variance decomposition showing that air carrier has the strongest response of 22% followed by household consumption of 14% and weakest reaction of interest rate of 0.7%.

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# محددات الاقتصاد الكلي للطلب على النقل الجوي الركاب بمصر

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**المستخلص:**

للنقل الجوي في مصر اهمية استراتيجية في دعم النمو والتنمية الاقتصادية والتكامل الإقليمي، حيث يدعم الموقع الاستراتيجي المميز لمصر. تقوم الدراسة الحالية بتحليل المحددات الاقتصادية الرئيسية للطلب على النقل الجوي للركاب في مصر خلال الفترة من ١٩٨٢ حتى ٢٠١٩ ودراسة التفاعل بين المتغيرات في الاجلين الطويل والقصير من خلال تقدير نموذج متجه تصحيح الاخطاء VECM وكشفت الدراسة عن وجود علاقة في الاجل الطويل بين المتغيرات محل الدراسة. وتم تحليل العلاقة الديناميكية بين متغيرات الدراسة من خلال تقدير دالة الاستجابة IRF وتحليل التباين لعوامل الطلب، وجاءت النتائج مدعمة للعلاقة الطردية التي وجدت من تقدير VECM في الاجل القصير والمتوافقة مع إحصائيات وسببية جرانجير. وظهرت العلاقة الايجابية بين السفر جوا وكلا من: مؤشر أسعار المستهلك، واستهلاك القطاع العائلي، بينما اظهر معدل الصرف الأجنبي وسعر الفائدة علاقة عكسية. ووفقا لتحليل IRFs المتغيرات الاقوى تأثيرا على طلب الركاب السفر جوا هي البنية التحتية للنقل الجوي حيث انها الاكثر تأثيرا على الطلب مما يوضح أهمية تطوير البنية التحتية على المدى الطويل للنقل الجوي مثل المطارات لجذب الركاب للسفر جوا، يليها مؤشر أسعار المستهلك ثم استهلاك القطاع العائلي كمؤشر للثروة يليهما سعر الصرف. واظهرت ايضا النتائج ان أضعف المتغيرات تأثيرا على الطلب هو سعر الفائدة ونصيب الفرد من الناتج المحلي الإجمالي وايضا ظهر عدم معنويته على الطلب على السفر جوا في التحليل قصير الاجل مما يظهر ادلة ان طلب الركاب السفر جوا في مصر يعتمد بنسبة كبيرة على طلب المسافرين الاجانب وليس المواطنين فقط، كما تعد المعنوية العكسية لانخفاض سعر الصرف النسبي مقارنة بالدول الأخرى اثبات اخر على جذب المسافرين من الخارج.

**الكلمات المفتاحية**: النقل الجوي، النمو، الطلب، نقل الركاب، الصادرات، سعر الصرف، المدي الطويل والقصير