Do Income Leakage Variables have A Positive or Negative Impact on the Performance of the Economy? Empirical Study on Egypt

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Abstract

This study applied the two-stage least squares model (TSNLS and ARMA) to examine the effect of income leakages, represented by spending on imports and domestic savings, on the aggregate domestic demand, represents the sum of domestic consumption and investment spending, in Egypt, through the velocity of the money supply channel during the period 2000-2019.

The empirical findings show a one-year lag negative impact flowing from the velocity of the money supply to the aggregate domestic demand, and the negative statistical response of the aggregate domestic demand to the velocity of money supply becomes more powerful and statistically meaningful when the income leakage variables have been considered in the model. Thus, it can be said that income leakage variables contribute to the negative impact of the velocity of money supply on the performance of the Egyptian economy.

Keywords: income leakage, velocity of money, domestic savings, imports, aggregate demand, Egypt.

JEL: D53, E31, E44, E51, O12.

1. Introduction

1.1 Overview

The flows of income and expenditure between households, businesses, and public agents determine, to a large extent, the efficiency of the performance of the economy, where the flows of incomes and expenditures reflect the ability of the economy to reach a stationary equilibrium point and to increase its potential size. (Quesnay, 2018). The circular flows of income and expenditure model illustrate that those activities that generate and consume incomes are linked in a mutual interdependence framework (Marks and Kotula, 2009). Accordingly, the economy will experience a balanced economic growth as long as the money resources generated by the economy are maintained inside the economy. Empirically, economies do not grow in a sustainable balance, where they are usually subject to disturbances from the supply and/or the demand side of different markets in the economy. In other words, the shocks of supply and demand imbalance the sources and uses of incomes in the economy (Woodford, 2020). These imbalances may cause several economic problems, including inflation, stagnation, and

stagflation. Effective demand stands behind the fluctuations in both the aggregate demand and supply shocks in the economy, where its components affect both sides of the market forces. Despite that, the stability of the components of aggregate demand differs from one market to another and from one economy to another based on the characteristics of each economy (Fiebiger and Lavoie, 2019); however, the velocity of money is a crucial factor that affects the aggregate demand, where it has a direct impact on consumption and investment activities in all economies (Wang et al., 2010).

1.2 Study Problem

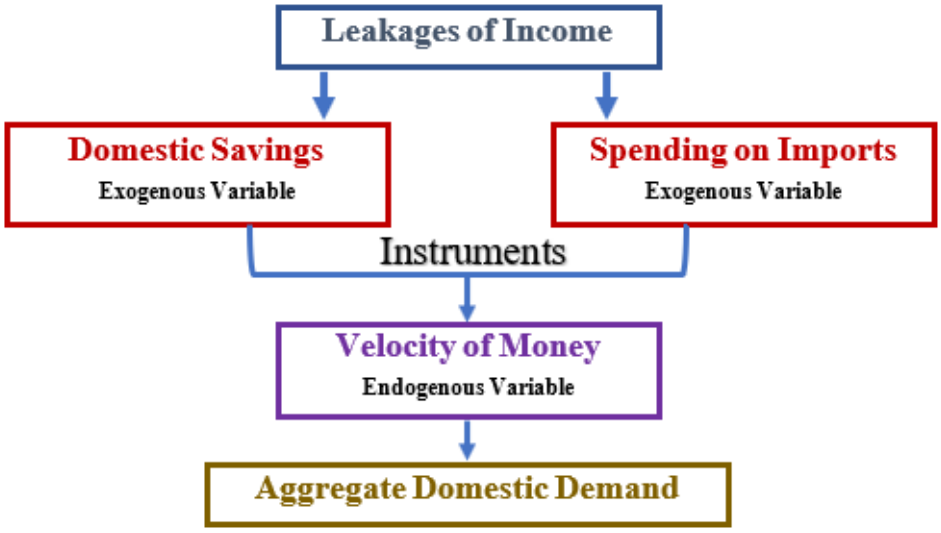
According to the circular flows of income and expenditure model, the flows of income are subject to two main income leakages that flow outside the economy, namely domestic savings and spending on imports. These income leakages are expected to have differentiated effects on the economy's performance, in general, and on aggregate demand, in particular, where domestic savings and spending on imports may have further effects on the velocity of money in the economy. On one side, based on the type of imports and the share of domestic content in the 'country's imports, spending on imports may positively or negatively impact aggregate demand (Hale et al., 2019). Besides, based on the efficiency of the financial systems, the flows of domestic savings may have a positive or negative impact on aggregate demand (Azimova and Mollaahmetoğlu,

2017). In this regard, it can be said that the flows of income outside the economy may stand behind the fluctuations in the performance of the economy through their direct and indirect effects on aggregate demand.

1.3 Study Objectives and Layout

This study tries to examine the effect of the velocity of money, as an endogenous variable, on aggregate domestic demand through two exogenous variables or instrumental variables to the velocity of the money supply, domestic savings, and spending on imports. In other words, the study examines the effect of the leakages of income on aggregate domestic demand through the velocity of the money supply channel, as illustrated by Figure (1).

Figure (1): The Study Layout



1.4 Study Hypothesis

Income leakage variables, represented by spending on imports and domestic savings, negatively affect the performance of the Egyptian economy through the velocity of the money supply channel.

1.5 Study Methodology

This study applied the two-stage least squares model (TSNLS and ARMA). This model adds instrumental variables to the independent variable and ultimately measures the combined effect of the exogenous and endogenous variables on the dependent variable.

1.6 The Scope of the Study

This study examines the effect of the leakages of income, represented by domestic savings and spending on imports, on the performance of the Egyptian economy through the period 2000-2019.

1.7 Sources of Data

Data are collected from the Egyptian Ministry of finance, Monthly Fiscal Reports, and the Central Bank of Egypt, Annual Reports.

1.8 Research Plan

Section (1): Introduction.

Section (2): Literature Review.

Section (3): The Development and Nature of Income Leakage Variables and the Velocity of Money in Egypt.

Section (4): Econometric Analysis and Empirical Estimates.

Section (5): Concluding Remarks and Recommendations.

2. Literature Review

The literature review section is divided into three parts. The first part covers the work of literature regarding the effect of domestic savings on the economy's performance, the second section covers the dynamics of the relationship between imports and economic growth, and finally, the third part covers the determinants and effects of the velocity of money on the economy.

2.1. The effect of domestic savings on the performance of the economy

Multiple pieces of literature found a positive effect of domestic savings on the performance of the economy. The study of Soylu (2019) shed light on the importance of domestic saving as an alternative to foreign direct investment, especially during periods of economic crisis. The study applied the Autoregressive Distributed Lag model to examine the relationship between economic growth, domestic savings, and foreign direct investment in Poland during the period 1992-2016 and argued that both savings and foreign direct investment are positively related to economic growth; however, the effect of foreign direct investment is relatively more powerful compared to the effect of

domestic savings. The study of Katircioğlu and Naraliyeva (2017) applied the 'Johansen's multivariate co-integration models to examine the existence of a long-run relationship between foreign direct investment, domestic savings, and economic growth in Kazakhstan during the period 1993-2002. The study argued that there were long-run positive unidirectional relationships between domestic savings and economic growth, and foreign direct investment and economic growth; however, there is no evidence for a long-run relationship between domestic savings and foreign direct investment. The study of Misztal (2011) applied co-integration models and the 'Granger's causality test to determine the effect of savings on economic growth in a sample of developed and developing and emerging countries through the period1980-2010. The study argued that domestic savings positively affects the economic growth rate in all the sample countries; however, the opposite is not true, where economic growth did not stimulate domestic savings in all sample countries. The study of Lean and Song (2009) applied cointegration and causality tests to determine the mutual relationship between domestic savings and economic growth in China during the period 1955-2004. The study argued that domestic savings stimulate economic growth in the short and long run while economic growth, on the other hand, encourages more domestic savings.

Other studies argued that the effect of domestic savings on economic growth differs from one economy to another according to the level of development. The study of Rasmidatta (2011) applied the Granger causality test to investigate the mutual relationship between domestic savings and economic growth in Thailand through the period 1960-2010. The study illustrated that there is one direction relationship that flows from economic growth to domestic savings while the effect of domestic savings on economic growth was insignificant. The study of Anoruo and Ahmad (2001) applied the Vector Error-Correction model to investigate the causal relationship between economic and domestic savings growth rates for a sample of 7 African countries through the period 1960-1997. The study found differentiated results among the sample countries where domestic savings encouraged the rate of economic growth in some countries and failed to stimulate economic growth in other countries; however, economic growth was the main engine in generating domestic savings in all the sample countries. The study of Rahman and Ferdaus (2021) employed the Dynamic Ordinary Least Squares model to determine the long-run response of economic growth to domestic savings and investment through the period 1973-2018 in Pakistan. The study found that economic growth responds negatively to domestic savings and positively to domestic investment.

2.2. The dynamics of the relationship between imports and economic growth

Some studies tried to examine the effect of different categories of imports on economic growth. The study of Khan et al. (2019) applied the Granger causality test to examine the effect of imports on economic growth in Pakistan through the period 1975-2014. The study argued that imports of capital and intermediate goods encourage the rate of economic growth while the increase in the rate of economic growth encourages imports of consumer goods. The study of Ashraf et al. (2011) tried to examine the effect of different import categories on real GDP growth in Pakistan through the period 1970-2008, applying Granger causality tests on annual data. The study found differentiated results based on the categories of imports, where imports of capital, raw materials, and intermediate goods positively affect real GDP growth. In contrast, consumerism imports are found with no effect on economic growth in Pakistan. The study of Ugur (2010) applied the multivariate VAR analysis and the Granger Causality test to determine the effect of different categories of imports on economic growth in Turkey through the period 1994-2005. The study argued that there is a mutually positive effect between the growth of imports of intermediate and raw material products and real GDP growth. At the same time, there is a unidirectional relationship between the growth of imports of consumer goods and the growth of real GDP.

Other studies found a two-direction relationship between imports and economic growth. The study of Miyan and Biplob (2019) applied the Johansen Co-integration test and the Granger-causality test to examine the effect of exports and imports on economic growth in Bangladesh through the period 1981-2017. The study concluded that exports encourage economic growth, and in turn, economic growth encourages imports in the short run; moreover, there is a long-run equilibrium relationship between exports, imports, and economic growth. The study of Mishra (2012) utilized the Vector error correction estimates and the Granger causality tests to examine the mutual relationship between imports and economic growth in India through the period 1970-2010. The study argued that there is a two-direction positive relationship between imports and economic growth.

Several studies found a differentiated effect of imports on the performance of the economy. The study of Uddin and Khanam (2017) applied the Ordinary Leas Squares model to examine the impact of imports on economic growth in Bangladesh during the period 1981-2011. The study argued that spending on imports has a negative impact on the growth of real GDP. The study of Bakari and Mabrouki (2017) applied the Johansen co-integration analysis to examine the impact of exports and imports on the economic growth in Panama through the period 1980-2015. The study concluded that both exports and imports are with great impact on stimulating economic growth in Panama. The study of

Ali and Li (2016) applied the ARDL model to examine the ability of imports to encourage the level of economic growth in Pakistan and argued that imports are able to encourage the level of economic growth in Pakistan. The study of Bouoiyour (2003) examined the effect of exports and imports on economic growth in both the short and long term in Morocco through the period 1960-2000 by applying the co-integration and error correction model and argued that exports and imports support the level of economic growth just in the short-run while in the long-run this effect turns to be statistically insignificant.

2.3. The *determinants and effects of the velocity of money*

The study of Khanom (2019) examined the determinants of the velocity of money in Bangladesh during the period 1972-2015. The study applied the Engle-Granger residual-based cointegration approach on annual data of the considered period and argued that financial development plays a crucial role in determining the velocity of money; however, the velocity of money negatively affects a number of variables that determine the growth of real GDP. The study of Prasetyo (2018) applied the ARDL model on quarterly data through the period 2000-2017 to examine the variables that affect the growth of money supply and the velocity of money in Indonesia and argued that both economic growth and the appreciation of the value of local currency increase the demand for money and encourage the velocity of money to follow an upward sloping trend while

neither interest rate nor households spending has a significant effect on the velocity of money and the demand for money. The study of Naser (2017) examined the effect of some monetary variables on the income velocity of money in Bangladesh through the period1979 2014, applying the co-integrated error correction model. The study argued that there is a mutual negative relationship between the growth of real income and the income velocity of money in the long run, while the income velocity of money may have other positive impacts on both financial development and inflation in the long run. The study of Anderson et al. (2015) applied dynamic regression models to examine the factors that stand behind changes in the velocity of money during the great depression and great recession, specifically during the two intervals 1926-1950 and 2003-2018. The study argued that the inflows and outflows of money supported by different degrees of risk are the primary determinates of the velocity of money during periods of depression and recession. The study of Adam (2013) employed the VAR analysis and the Johansen cointegration test to examine the effect of financial development on the velocity of money during the period 1992-2012 in Sudan. The study found a long-run relationship between measures of financial development and the velocity of money. The study of Kim and Subramanian (2009) applied the GMM methodology to determine the effect of the velocity of money on inflation in the United States of

America through the period 1951-2005. The study argued that the velocity of money could generate inflation and estimate the Phillips curve.

What is new with this study?

This study tries to shed light on the key players that may affect the performance of the economy through their effects on the aggregate domestic demand, where income leakage variables, represented by spending on imports and the flows of domestic savings, are introduced as exogenous variables to the velocity of money supply, the endogenous variable, and finally, the combined effect of the endogenous variable and the exogenous variables on aggregate domestic spending will be estimated to determine the contribution of income leakage variables in affecting the performance of the economy through the velocity of the money supply channel.

3. The Development and Nature of Income Leakage Variables and the Velocity of Money in Egypt.

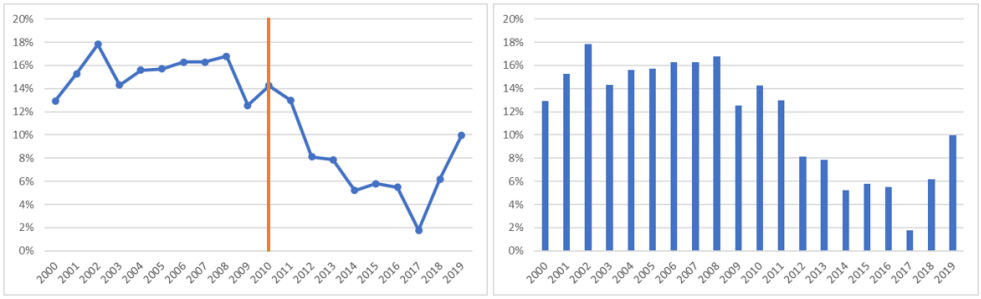
3.1. The behavior of domestic savings and spending on Imports

3.1.1. Domestic Savings

The domestic savings ratio to nominal GDP followed a downward-sloping trend and recorded 12%, on average, with a standard deviation of 5% through the study period. Dividing the study period into two sub-periods, 2000-2010 and 2011-2019, the deterioration of the state of domestic savings becomes more

apparent, where the ratio of domestic savings to nominal GDP recorded 15%, on average, with a standard deviation of 2% during the first sub-period. This ratio deteriorated to 7%, on average, with a standard deviation of 3% during the second sub-period of the study. See figure (2).

Figure (2): The Ratio of Domestic Savings to Nominal GDP



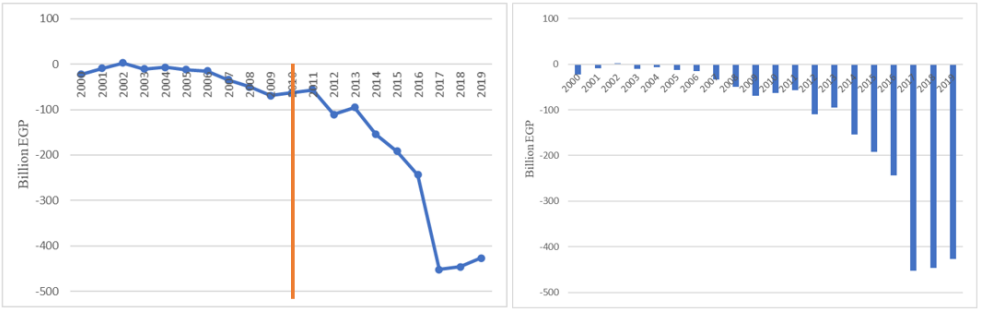
Source: Author's calculations based on data extracted from Ministry of Finance, Monthly Fiscal Reports.

Figure (2) shows that following the 25th of January revolution, the propensity to save has retreated. This retreatment intensified in 2017 with the devaluation of the Egyptian pound in the wake of the flotation process in late 2016. With the stability of the exchange rate and political status, the saving rate has started to improve since 2018.

The gap between domestic savings and investment spending has been widened in favor of domestic investment and fluctuated massively during the study period, where the domestic savings recorded an average deficit of 123.3 billion Egyptian pounds

with a standard deviation of 152.1 billion Egyptian pounds during the study period. See figure (3).

Figure (3): The Development of Domestic Saving-Investment Gap



Source: Author's calculations based on data extracted from Ministry of Finance, Monthly Fiscal Reports.

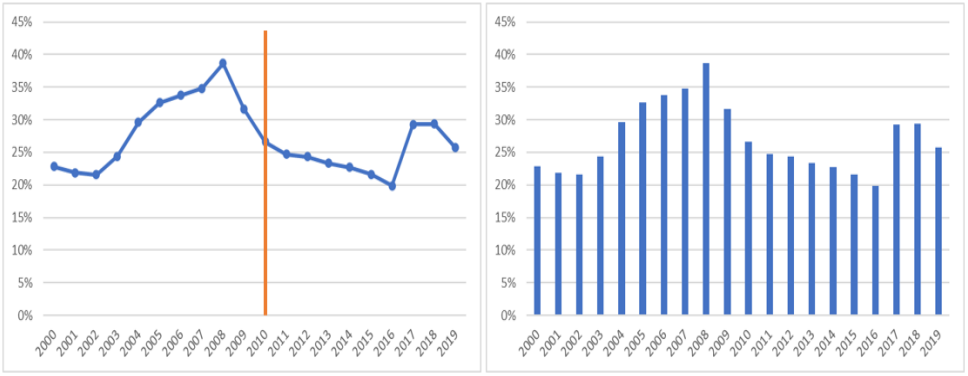
Figure (3) shows that the domestic saving deficit was relatively limited and stable during the period 2000-2010 and recorded 26.4 billion Egyptian pounds with a standard deviation of 24.3 billion Egyptian pounds. However, during the period 2011-2019, the deficit climbed heavily and recorded 241.8 billion Egyptian pounds with a standard deviation of 159.6 billion Egyptian pounds. The deficit reached its peak level in 2017 with 452.4 billion Egyptian pounds, starting from the year 2018, the deficit started to decline slightly.

3.1.2. Spending on Imports

The spending on imports as a ratio of nominal GDP fluctuated around an average rate of 27% with a standard deviation of 5%

during the study period. See figure (4).

Figure (4): The Development of Spending on Imports as a ratio of Nominal GDP



Source: Author's calculations based on data extracted from Ministry of Finance, Monthly Fiscal Reports.

During the period 2000-2010, the ratio of imports to nominal GDP recorded 29%, on average, with a standard deviation of 6% and declined to 25%, on average, with a standard deviation of 3% during the period 2011-2019.

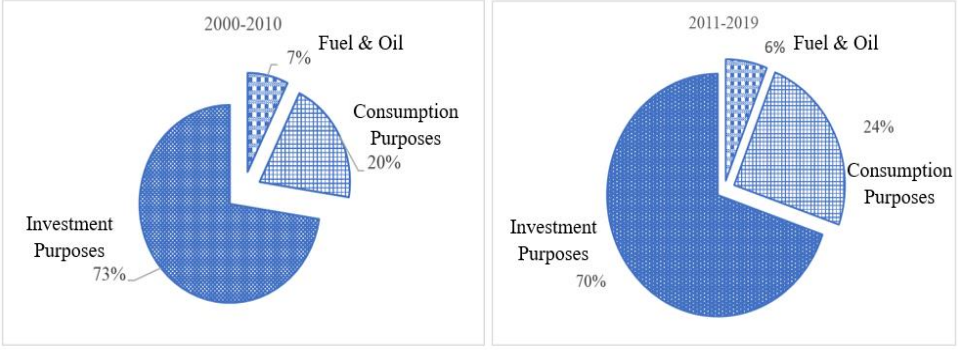
Imports of services represent 24%, on average, of total imports while imports of goods represent 76%, on average, of total imports through the study period. The share of imports of services in total imports has diminished in the second period of the study to represent just 17%, on average, of total imports during the period 2011-2019 while the share of imports of goods has increased to 83%, on average, of total imports during the same period. See figure (5).

Figure (5): The Development of the Shares of Imports of Goods and Services in Total Imports

Source: Author's calculations based on data extracted from Ministry of Finance, Monthly Fiscal Reports.

Imports of goods for investment purposes occupied the largest share of imports of goods with 70%, on average, of total imports of goods. In comparison, imports for consumption purposes occupied just 24%, on average, of total imports of goods as depicted by figure (6).

Figure (6): The Development of the Structure of Imports of Goods



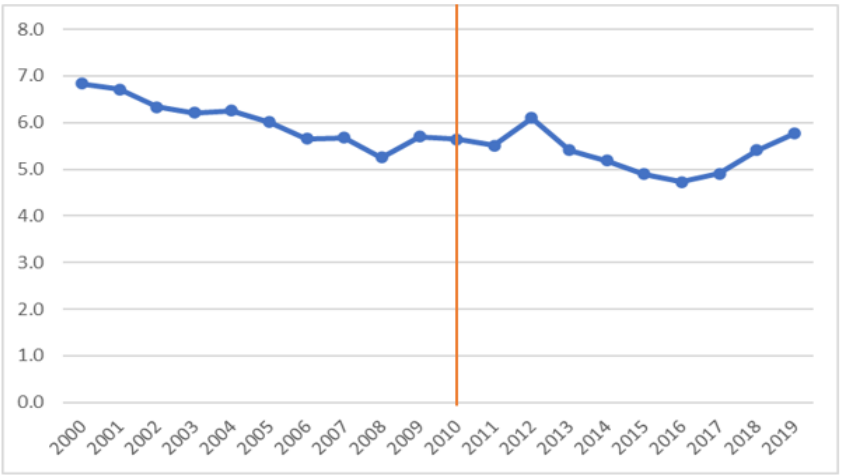
Source: Author's calculations based on data extracted from Ministry of Finance, Monthly Fiscal Reports.

Figure (6) illustrates that the structure of imports of goods was relatively stable during the study period where imports of goods for consumption purposes has slightly increased, at the expense of imports of fuel and oil and imports of goods for investment purposes, to represent 24%, on average, of imports of goods while imports of goods for investment purposes has retreated to represent 70%, on average, of total imports of goods during the period 2011-2019.

3.2. The Development of the Velocity of Money Supply

It can be said that the velocity of money supply followed a downward sloping trend and was relatively stable through the study period where the velocity of money supply recorded an average number of 5.7 with a standard deviation of 0.6 during the study period. During the first subperiod of the study, the velocity of money fluctuated around an average number of 6 with a standard deviation of 0.5; however, the velocity of money fluctuated at a lower number during the second subperiod, where the velocity of money supply recorded an average number of 5.3 with a standard deviation of 0.4 during the period 2011-2019, as illustrated by figure (7).

Figure (7): The Development of the Velocity of the Money Supply



Source: Author's calculations based on data extracted from the Central Bank of Egypt, Annual Reports.

4. Econometric Analysis and Empirical Estimates

This section examines the effect of income leakages, spending on imports, and domestic savings, on the aggregate domestic demand through their effects on the velocity of the money supply.

4.1 Specifying the Model

The two-stage least squares model has been built based on the following functions:

$$y_{n,t} = f(x_{n,t-m})$$

$$x_{n,t-m} = f(v_{n,t-k}; z_{n,t-j})$$

Where *y* represents aggregate domestic demand (consumption and investment spending), *x* represents the velocity of money supply (the endogenous variable), m represents the lags of the dependent endogenous variable *x*, v and z a are the two exogenous variables that represent the leakages of income (spending on imports and domestic savings, respectively), *k* and *j* represent the lags of the exogenous variables *v and z*, respectively.

The model is represented as follows:

$$\log(y_{nt}) = \beta_0 + \beta_1 \log(x_{nt-1}) + \varepsilon$$

$$\widehat{\beta_1} = \sum_{n=1}^{k-1} \frac{cov(log\ v, \log y)}{cov(\log v, \log x)} + \sum_{n=1}^{j-1} \frac{cov(\log z, \log y)}{cov(\log z, \log x)}$$

Where $\widehat{\beta_1}$ is the combined effect of the two exogenous variables spending on imports and domestic savings on the velocity of money supply and domestic demand. In other words, v and z are the instruments for *x*.

4.2 Stationarity Test

Two unit-root tests have been adopted to examine the stationarity of the model variables, Augmented Dickey-Fuller and Phillips–Perron tests, see appendix (1). The unit-root tests illustrated that all the model variables are stationary at the first difference.

4.3 The Validity of the Models

4.3.1 The Validity of the Ordinary Least Squares Model

Despite there are several shreds of evidence on the validity of the ordinary least squares model, where the F-statistic is statistically significant at a 1% significance level. R^2 is 0.73, and adjusted R^2 is 0.72, standard error of the regression is 0.46; however, the residuals are serially correlated where the statistic of the observed R^2 of the Breusch-Godfrey Serial Correlation LM Test is statistically significant at a 5% significance level. See appendices (2) and (3).

4.3.2 The Validity of the Two-Stage Least Squares Model

There are several pieces of evidence on the validity of the model in question. The F-test indicates that the F-statistic is statistically significant at a 1% significance level or 99% level of confidence, R^2 is 0.65 and adjusted R^2 is 0.63, standard error of the regression is 0.53, and finally, the residuals are not serially correlated where the statistic of the observed R^2 of the Breusch-Godfrey Serial Correlation LM Test is statistically insignificant at a 10% significance level. See appendices (4) and (5).

4.4 The Empirical Findings of the Models

The ordinary least squares model that measures the direct effect of the velocity of money on aggregate domestic demand illustrates that aggregate domestic demand responds negatively to the increase in the velocity of the money supply with one year

lag in the velocity of money, where this relationship is statistically significant at a 1% significant level, see appendix (2). When the two variables that represent the leakage of income, spending on imports and domestic savings, are considered through applying the two-stage least squares model, the negative impact of the velocity of money supply on the aggregate domestic demand has been strengthened, where the coefficient of the velocity of money supply increased from 7.2 to 9.7. Moreover, the problem of serial correlation of residuals has been mitigated when the two leakage variables have been introduced in the two-stage least squares model.

5. Concluding Remarks and Recommendations

The study's empirical findings illustrate that the velocity of money supply has a direct negative impact on spending on domestic consumption and investment and that the leakage of income outside the economy is a crucial factor that stands behind this negative impact. The two income-leakage variables, spending on imports and domestic savings, reinforced the negative impact of this trend when introduced in the relationship. Table (1) summarizes the outcomes of the regression models applied by the study.

Table (1): Summary of the Statistical outcomes of the Examined Relationships

Examined Relationship	Coefficient		Standard Error	Durbin-Watson Statistic	Breusch-Godfrey Test	
	Statistic	P-value			Observed R^2	Prob. Chi^2
The direct effect of the velocity of money supply on aggregate domestic demand.	-7.214	0.000	0.462	0.883	4.331	0.0374
The effect of the velocity of money supply on aggregate domestic demand considering spending on imports and domestic savings as exogenous variables (instrumental variables).	-9.684	0.000	0.533	1.774	1.989	0.1584

Source: Appendices 2, 3, 4, and 5.

The above findings confirm the validity of the study hypothesis, where income leakage variables, represented by spending on imports and domestic savings, have a negative impact on domestic consumption and investment spending or aggregate domestic demand through the velocity of the money supply

channel, which ultimately slows down the development of the level of economic activity in the economy.

The findings of the study conclude the following two points regarding the income leakage variables:

- The financial system in Egypt may suffer from a defect in supporting the process of economic growth, which is reflected in its ability to absorb, allocate, and use the domestic savings generated by the economy.
- Although the structure of imports of goods is predominantly productive, its negative impact on domestic consumption and investment spending may indicate an imbalance resulting from inequality in the distribution of income, as capital owners obtain the largest share of the fruits of the production process.

In this regard, the development of the financial system to be attractive to absorb domestic and foreign savings and efficient in allocating and using the available savings will serve the process of economic growth and effectively re-pumps domestic savings leakages into the economy. On the other hand, adopting policies that are able to achieve a satisfactory level of equitable distribution of income would transform the leakage resulting from spending on imports in the interest of serving the national economy.

Appendices

Appendix (1)

Unit Root Test (Stationarity Test)

Variable	Stationarity Status	Augmented Dickey-Fuller		Phillips–Perron	
		Statistic	Probability	Statistic	Probability
Aggregate Domestic Demand (*log y*)	Level	2.444	0.999	2.33	0.999
	First Level	-3.415	0.0242	-3.562	0.0181
The Velocity of Money Supply (*log x*)	Level	-2.068	0.2583	-2.067	0.2586
	First Level	-3.944	0.0084	-3.942	0.0084
Spending on Imports (*log v*)	Level	0.010	0.948	0.067	0.954
	First Level	-3.363	0.0156	-3.568	0.0169
Domestic Savings (*log z*)	Level	-1.687	0.4195	-8.377	0.7849
	First Level	-3.988	0.0082	-4.763	0.0016

Appendix (2)

Dependent Variable: LOG(Y)

Method: Least Squares

Sample (adjusted): 2001 2019

Included observations: 19 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(X(-1))	-7.214748	1.042815	-6.918533	0.0000
C	19.67859	1.813734	10.84977	0.0000
R-squared	0.737922	Mean dependent var		7.151730
Adjusted R-squared	0.722505	S.D. dependent var		0.878537
S.E. of regression	0.462794	Akaike info criterion		1.396231
Sum squared resid	3.641030	Schwarz criterion		1.495646
Log likelihood	-11.26419	Hannan-Quinn criter.		1.413056
F-statistic	47.86609	Durbin-Watson stat		0.883852
Prob(F-statistic)	0.000002			

Appendix (3)

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	4.724420	Prob. F(1,16)	0.0451
Obs*R-squared	4.331315	Prob. Chi-Square(1)	0.0374

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Sample: 2001 2019
Included observations: 19
Pre sample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(X(-1))	0.128271	0.946317	0.135548	0.8939
C	-0.185604	1.644913	-0.112835	0.9116
RESID(-1)	0.610407	0.280831	2.173573	0.0451

R-squared	0.227964	Mean dependent var	-2.27E-15
Adjusted R-squared	0.131459	S.D. dependent var	0.449755
S.E. of regression	0.419151	Akaike info criterion	1.242770
Sum squared resid	2.811006	Schwarz criterion	1.391892
Log likelihood	-8.806316	Hannan-Quinn criter.	1.268007
F-statistic	2.362210	Durbin-Watson stat	1.569071
Prob(F-statistic)	0.126212		

Appendix (4)

Dependent Variable: LOG(Y)
Method: Two-Stage Least Squares
Sample (adjusted): 2001 2019
Included observations: 19 after adjustments
Instrument specification: LOG(V(-1)) LOG(Z(-1))
Constant added to the instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(X(-1))	-9.684728	1.420791	-6.816435	0.0000
C	23.96718	2.469935	9.703567	0.0000

R-squared	0.651434	Mean dependent var	7.151730
Adjusted R-squared	0.630930	S.D. dependent var	0.878537
S.E. of regression	0.533722	Sum squared resid	4.842597
F-statistic	46.46378	Durbin-Watson stat	1.774271
Prob(F-statistic)	0.000003	Second-Stage SSR	0.657293
J-statistic	0.000858	Instrument rank	3
Prob(J-statistic)	0.976637		

Appendix (5)

Breusch-Godfrey Serial Correlation LM Test:

Obs*R-squared	1.989357	Prob. Chi-Square(1)	0.1584

Test Equation:
Dependent Variable: RESID
Method: Two-Stage Least Squares
Sample: 2001 2019
Included observations: 19
Pre sample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(X(-1))	-0.644941	1.463741	-0.440611	0.6654
C	1.141069	2.549321	0.447597	0.6604
RESID(-1)	0.390279	0.285311	1.367905	0.1902

R-squared	0.104703	Mean dependent var	1.29E-15
Adjusted R-squared	-0.007209	S.D. dependent var	0.518684
S.E. of regression	0.520550	Akaike info criterion	1.676079
Sum squared resid	4.335563	Schwarz criterion	1.825201
Log likelihood	-12.92275	Hannan-Quinn criter.	1.701316
F-statistic	0.935582	Durbin-Watson stat	1.608641
Prob(F-statistic)	0.412797		

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