



## The Impact of Financial Development and Trade Openness on Economic Growth: Time Series Evidence from Luxembourg

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### Abstract

Financial deepening and trade openness are among one of the important drivers of economic growth. Liberalized financial sector promote investors and this boosts up production activities in any economy. On the other side, both exporters and importers together promote trading activities and this encourages quantity of output in any economy. Based on this intuition, this study is structured to inquire the effects of financial development and trade openness on economic growth for Luxembourg economy. This research uses ARDL bounds test for an annual data series from 1980 to 2020 and empirical results suggests that trade openness and financial development have significant and appreciating impact on economic growth. The results further confirm that capital stock has significant and increasing impact on economic growth. Among all these three drivers, trade is the strongest driver that boosts economic growth. Lastly, labor force is witnessed as irrelevant driver for the selected economy. These results are supported by all the diagnostic tests. In order to give boost to economic activities in Luxembourg, trade openness, financial development and capital accumulation should be regulated in such a way that they may remain production friendly in selected country.

**Keywords:** Quantity of Output; Financial Development; Trade Openness; ARDL Approach; Luxembourg

### 1. Introduction

Among various European economies, Luxembourg is a small but a prosperous economy. This economy is also enjoying incredible output growth in the recent past and therefore, it is considered as a leading economy in accordance with its per capita GDP. There are several reasons which have caused economic growth to change. Many scholars like Alharthi and Hanif (2020); Hanif (2018); Hanif and Gago-de Santos (2017); Hanif et al. (2020); Hanif et al. (2014); Huang et al. (2020) and Wang et al. (2022) explored different factors affecting economic growth in various sample economies. In the present research, we have tried to explore the role of financial development, trade openness, labor force and capital formation which can possibly influence economic growth in an emerging economy. We believe that development of financial sector channelizes money and credit markets that allow swift allocation of capital facilities to investors in the economy. Investors may target production activities through excessive provision of capital facilities and this lead to accelerate output growth in the country. In the researches of Manasseh et al. (2024); Oncel et al. (2024) and Paudel and Sun (2020) we witnessed significantly elevating trend in output growth due to extension in financial development.

Liberalization of trade demonstrates expansion of the exports, imports sum. This also means that receipts and payments of foreign exchange are increasing in the country. The stimulation in trade helps in improving domestic production through the increase in exports on the one side and it also increases greater variety of availability of goods to the domestic consumer through the increase in imports on the other side. The increased trade in a country improves the economic-efficiency by lowering the prices of locally produced goods. It further improves efficient allocation of resources which ultimately helps in improving domestic production and hence economic growth of the country. This transmission channel is supported by the empirical results which were reported by Sarker (2024); Abeka et al. (2021) and Malefanel (2020) in their studies. Nazli et al. (2018) suggested the role of trade reforms for factor productivity in Pakistan. On the basis of the advocates of trade led growth hypothesis and finance led growth hypothesis, we have taken these two factors into our research to explore how these would affect economic growth of Luxembourg. This research considers the production function framework which states that output is dependent on labor and capital. In labor abundant economies, labor influence economic growth significantly while in capital rich economies, capital accelerates economic activities significantly. The empirical studies conducted by Azam et al. (2021); Rehman et al. (2015) and Nazir and Qayyum (2014) also provided evidence of positive and significant influence of capital stock on economic growth. On the basis of the above discussion, we have designed a study which may consider labor and capital as primary inputs while financial development and trade openness as major inputs to target economic growth in Luxembourg. This research is going to address two hypothesis such as trade led growth hypothesis and financial development led growth hypothesis for Luxembourg.

The rest of the study will be arranged by presenting the findings of recent researches in the coming section. After this, model and proposed methods will be highlighted. Empirical results and their explanation will be shared afterwards. In the last section, we will present conclusion and possible recommendations on the basis of our findings.

### 2. Literature Review

In this part of the research, the studies executed by alternate scholars on the similar topic will be discussed. The detailed review is started from the contribution of Manasseh et al. (2024) in which they suggested that credit to private section as proxy for financial development significantly increase economic growth of emerging African economies. The study executed by Sarker (2024) in which significantly positive influence of capital stock, opening of trade and money supply as proxy for financial sector was disclosed for Bangladeshi economy. In another study, Oncel et al. (2024) inquired the determining factors of economic growth for 9-Commonwealth independent states. Their study concluded that domestic credit to private sector, capital accumulation and exports had significant but encouraging effects on economic growth. In a study conducted by Abeka et al. (2021) in which they

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suggested that the factors such as development of financial sector, openness of trade and capital accumulation were promoting economic growth in countries such as sub-Saharan Africa. After this, there was another study like Azam et al. (2021) in which they provided evidence of stimulating role of capital accumulation on domestic output growth. Besides this, we saw another research by Awan and Bibi (2021) who suggested that economic growth did not respond to the changes in export promotion for Pakistani sample. Malefanel (2020) conducted a research for Botswana in which the study reported that economic growth expanded due to expansion of trade. The study organized by Paudel and Sun (2020) for BRICS economies tested the role of financial development; economic growth and exports. They reported that exports and financial sector development had significantly boosting effects on economic growth. For Pakistan and India, we found the increasing effects of exports for domestic production in the study conducted by Khan and Eminullah (2019). The study by Bist (2018) inquired the role of multiple factors on economic growth and the empirical results suggested that economic growth was significantly increasing due to increase in financial sector liberalization, capital stock and openness of trade in case of 16-African and Non-African economies. The study conducted by Rani and Kumar (2018) in which they found short-term double-directional causation between development of financial activities and economic growth. The liberalized financial and trading activities and capital stock had stimulating effects on economic growth in case of BRICS countries. The study conducted by Rehman et al. (2015) for Australian economy to inquire the role of financial sector and trade liberalization for economic growth. They highlighted that capital stock; financial sector development and trade openness had significant and elevating impact on economic growth. They further suggested that trade and economic growth had two-directional causation whereas finance had one-way causation to economic growth. Labor force and capital accumulation are the primary inputs that may impact economic activities therefore, we found Nazir and Qayyum (2014) who reported escalating and significant impact on economic growth of capital whereas, an additional unit of labor inversely influence economic growth in case of Pakistan. However, the contribution of Apergis and Payne (2012) suggested that both inputs were helping in giving boost to economic growth in Central American countries.

Besides sharing findings of the previous researches upon the topic undertaken in this document, now we are going to highlight the arguments about data channels and techniques to estimate empirical results in the coming part which is given as below:

### 3. Data and Techniques

This part is structured to present the details about the data series taken in the present research. The variables such as output per capita, labor force, total, capital formation, trade openness and domestic credit to private sector as proxy for financial development have been picked up using World Bank (2024)'s data bank. The data is annual and dated on a regular frequency for all the variables. The time-span of the selected variables ranges from 1980 to 2020. All the variables are represented in natural log form. The below presented equation is representing our model for conducting this research:

$$\ln Q_t = f (\ln L_t, \ln K_t, \ln T_t, \ln F_t)$$

**Table 1: Variables: Name & Representation**

Name	Representation	Data Source
Per capita output as proxy for Economic Growth	$\ln Q_t$	World Bank (2023)
Labor Force, Total	$\ln L_t$	World Bank (2023)
Capital Formation	$\ln K_t$	World Bank (2023)
Trade Openness	$\ln T_t$	World Bank (2023)
Domestic Credit to Private Sector as proxy for Financial Development	$\ln F_t$	World Bank (2023)

The findings part will begin from summary stats table. This table will let us know whether the considered factors of this document are going to represent normal distribution or not. After this, the significance of regressors will be tested by the VIF-test. Next, we will use any suitable unit root test such as KPSS (1992) unit root test which will provide us stationarity status of the variables considered in this research. In case if the status of stationarity appear to be mixed then we will considered cointegration approach proposed by Pesaran et al. (2001). This method will suggest if the F-test appear to be greater than the upper critical value then cointegration between dependent and independent variables will be confirmed. Based on this, long and short term coefficients will be estimated. These results will be cross checked with the help of diagnostic tests such as serial correlation, functional form, normality, heteroskedasticity and stability tests. In the light of diagnostic stats we will be to confirm whether the calculated results for this research can be taken for policy actions or not. The stability test will suggest the stability of the coefficients.

### 4. Calculations and Arguments

The calculation part starts from summary stats. The results shared in Table 2 poses that labor force in total have a highest mean like 12.2252 percent during the selected time-span than the per capita output which reveals 11.2898 percent mean. Whereas the mean value of financial development appears to be the lowest among all which is -3.9744 percent. After this, when we see the probability values of JB-test of capital stock and trade openness then we may conclude that both variables are signifying normally distributed variables. However, the rest are not. The following Table-2 provides the calculations of summary stats:

**Table 2: Descriptive Stats**

Variables	Average	S.Deviation	J.B.-Test	P.Value	Size
$\ln Q_t$	11.2898	0.3232	5.0582	0.0797	41
$\ln L_t$	12.2252	0.2249	4.8861	0.0869	41
$\ln K_t$	29.9878	1.1706	1.7326	0.4205	41
$\ln T_t$	5.4973	0.2633	3.7438	0.1538	41
$\ln F_t$	-3.9744	1.4580	83.4083	0.0000	41

The significance of explanatory variables using VIF-test is shared in Table-3. VIF-test suggests if the calculated value is greater than or equal 10 between two explanatory variables then these are significantly correlated. Hence these tend to create multicollinearity in the proposed model. So, before proceeding next, this issue must be settled. From the calculations shared in Table-3, we may see that the VIF-test has values less than 10 for all explanatory variables. Therefore, there is no evidence of multicollinearity in our proposed model.

**Table 3: VIF Matrix**

Variables	$\ln Q_t$	$\ln L_t$	$\ln K_t$	$\ln T_t$	$\ln F_t$
$\ln Q_t$	-	2.5229	1.2350	4.0204	3.4220
$\ln L_t$		-	1.9377	9.4445	1.3864
$\ln K_t$			-	1.8739	1.1631
$\ln T_t$				-	1.7450
$\ln F_t$					-

After stating VIF calculations, we are going to proceed for testing stationarity status for our proposed factors. For this reason we use KPSS unit root test and results presented in Table 4 suggest that labor force, total (0.6480) and capital formation (0.6743) have LM-stats less than the 1-percent critical value (0.739). However, all the other variables such as per capita output, trade openness and financial development have their LM-stats greater than the 1-percent critical value (0.739). This confirms that labor force, total and capital formation are level-stationary variables while the other three variables are first differenced stationary variables. The results are shared in the following Table-4:

**Table 4: Stationarity-Test by KPSS**

At Level		At First Difference	
Variables	LM-Test	Variables	LM-Test
$\ln Q_t$	1.0236	$\Delta \ln Q_t$	0.5283
$\ln L_t$	0.6480	$\Delta \ln L_t$	0.5847
$\ln K_t$	0.6743	$\Delta \ln K_t$	0.0521
$\ln T_t$	1.0825	$\Delta \ln T_t$	0.0890
$\ln F_t$	0.7902	$\Delta \ln F_t$	0.5530

The above table concludes the stationary status of the variables of this study is mixed. This shows that some are level and some are first-differenced stationary variables. This exhibits us to apply ARDL-bounds testing technique for obtaining cointegrating linkage between economic growth and its factors. The results shared in Table-5 suggest that F-test and W-test have greater values such as 9.2264 and 46.1320 than the corresponding upper critical bounds at 5-percent significance level like 4.4915 and 22.4577. This confirms that per capita output and financial development, trade openness, labor force, total and capital stock have long run cointegrating linkage with each other. The insignificant probability values of serial correlation, functional form, normality and heteroskedasticity tests suggest that the proposed model of this research does not contain all these challenges. Therefore, we may proceed for estimating long and short term results for the selected ARDL model. The results are shared in the following Table-5:

**Table 5: ARDL Bounds Testing Approach**

Estimated Model	$\ln Q_t = f(\ln L_t, \ln K_t, \ln T_t, \ln F_t)$			
Lag Length of the Model	(1, 0, 2, 0, 0)			
F-test	9.2264**			
W-test	46.1320**			
Significance Level	Tabulated Values for F-Test		Tabulated Values for W-Test	
5 percent	3.2063	4.4915	16.0316	22.4577
10 percent	2.6541	3.7931	13.2705	18.9655
	Testing for Diagnostics			
Serial Correlation	1.6432 [0.200]		Normality	0.3881 [0.824]
Functional Form	2.2517 [0.133]		Heteroscedasticity	0.2250 [0.635]

Note: \*\* (\*) shows 5 (10) percent significance level. The information shared in square braces is the p. values.

After presenting discussing the above table, now we are going to explain the impact of financial development and trade openness impact on economic growth for long-run span and results are shared in Table-6. Financial deepening and trading activities have significant and increasing effects on economic growth in Luxembourg. If we increase trade openness by one percent then it will significantly increase economic growth by 0.8984 percent while one percent increase in financial development promotes economic growth significantly by 0.1564 percent. Expansion in financial activities actually allows investors to enhance investment and production activities. This will give boost to economic growth. On the other side, when both exporting and importing activities are promoting in the country, it allows to accelerate domestic production. Hence this leads us to conclude the evidence of finance-led-growth and trade-led-growth hypothesis in Luxembourg. Besides these results, we may see that capital formation also promote economic activities. This means that one percent increase in capital helps in significantly increasing quantity of output by 0.1048 percent. The results further show that labor force does not appear to be relevant for targeting quantity of output. On the basis of these results, we may summarize that the coefficient of trade openness among all is the highest one. This means that trade leaves strong impact upon quantity of output in Luxembourg in the longer-span. The calculations are provided in following Table-6:

**Table 6: Long Run Coefficients**

Dependent Variable = $\ln Q_t$				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\ln L_t$	-0.2571	0.2733	-0.9407	0.3541
$\ln K_t$	0.1048	0.0226	4.6380	0.0001
$\ln T_t$	0.8984	0.2380	3.7744	0.0007
$\ln F_t$	0.1564	0.0254	6.1594	0.0000
Intercept	7.0435	2.6228	2.6855	0.0115

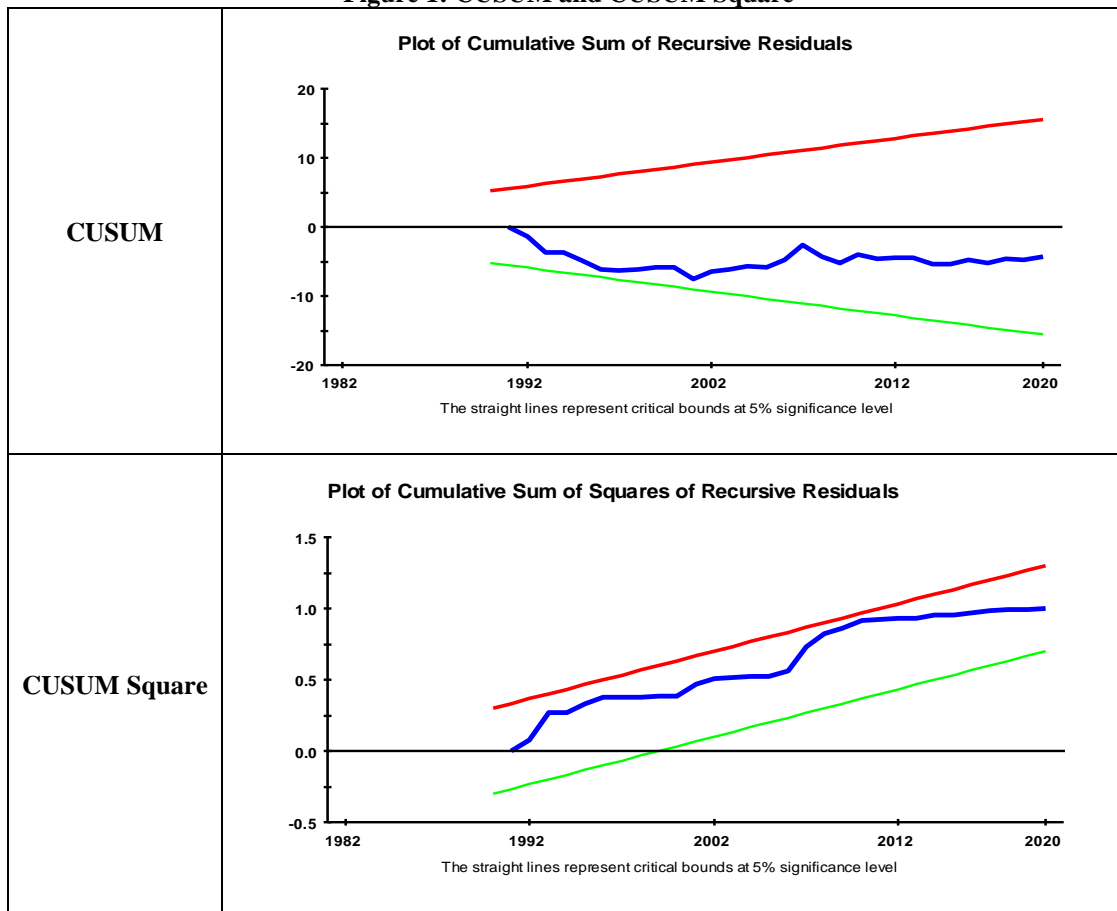
**Table 6: Short Run Coefficients**

Dependent Variable = $\Delta \ln Q_t$				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\Delta \ln L_t$	-0.0539	0.0516	-1.0439	0.3046
$\Delta \ln K_t$	0.0107	0.0044	2.4009	0.0225
$\Delta \ln K_{t-1}$	-0.0130	0.0048	-2.7054	0.0110
$\Delta \ln T_t$	0.1884	0.0467	4.0331	0.0003
$\Delta \ln F_t$	0.0328	0.0092	3.5774	0.0012
CointEq(-1)	-0.2097	0.0402	-5.2216	0.0000
Diagnostic Tests				
	R-Bar-Squared		0.6319	
	F-Test (Probability Value)		12.3379 (0.000)	
	DW-Test		2.2979	
	Akaike Information Criterion		97.0416	
	Schwarz Bayesian Criterion		90.3374	

Besides shedding light on the estimates of above Table-6, now the short term coefficients are going to be discussed which are presented in Table-7. The results suggest that labor force has insignificant but adverse impact while capital accumulation, financial deepening and expansion of trade have boosting and significant impact on economic growth. The coefficient of capital stock is the

weakest coefficient while the coefficient of trade liberalization is the strongest among all. One percent increase in trading activities is going to promote output by 0.1884 percent in short term while one percent increase in financial development is boosting economic growth by 0.0328 percent. This suggests that trade-led; finance-led and capital led growth hypotheses are evident in both longer and shorter time spans in this research. Besides this, the coefficient of speed of adjustment is also witnessed as negative and significant. This confirms convergence hypothesis. The CUSUM and CUSUM square graphs are also presented after the Table 7 that suggest the stability of the estimated coefficients during the selected period. The shorter term results and CUSUM and CUSUM Square graphs are presented as below:

**Figure 1: CUSUM and CUSUM Square**



## 5. Conclusion

This research takes into account the role of financial deepening and trade openness to inquire the empirical changes in economic growth. By taking an annual data for period from 1980 to 2020, the results of ARDL bounds test suggest long run cointegrating link between economic growth and its drivers in Luxembourg. This study confirms that liberalized financial sector and liberalized trading actions are significantly improving economic growth in both time spans taken in this research. This research also reports that capital accumulation has significant and appreciating impact on economic growth. On the basis of these results, trade liberalization is the strongest driver while the labor force is irrelevant driver of economic growth in Luxembourg. The estimated results are robust to all the diagnostic statistics. This research suggests that expansion of trade, liberalization of financial sector and stimulation of capital stock must be promoted so that boosting effects economic activities may be enjoyed in the selected economy.

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