Port logistics and Economic growth: An empirical investigation of Morocco, LAKHLOUFI, T.¹ & MOUSSAMIR, A.²

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Date of submission: 30/04/2020                  Date of acceptance: 25/07/2020

Summary:

Port logistics is an inevitable link in the chain of international logistics in a general way and in international trade in a particular way. According to UNCTAD (2013), the maritime link accounts for 80% of the world’s trade volume, although the physical continuity of freight transport requires the use of multimodal transport systems.

In this sense Morocco has been engaged over the last two decades, in a process of considerable port reforms, aimed at making its port logistics a locomotive of its economy. Indeed, the port logistics in Morocco has achieved important advances, in terms of maritime connectivity, and quality of port infrastructure, which has improved the Moroccan maritime presence on the international scene.

Therefore, it is time to assess the impact of these efforts on economic growth, since it plays an important role in political discourse and economic debates. Using the autoregressive model with staggered delays ARDL, we plan to answer the following question how port logistics can influence Moroccan economic growth?

The econometric estimates allowed us to confirm the positive effect of the port logistics on the economic growth of Morocco. Thus, these results approved the theoretical and empirical predictions

Key words: Port logistics – Economic growth – ARDL - Port traffic
Logistique portuaire et Croissance économique : une investigation empirique sur le Maroc

Résumé :

La logistique portuaire est un maillon inévitable dans la chaîne de la logistique internationale d’une manière générale et dans les échanges commerciaux internationaux d’une manière particulière. Selon la CNUCED (2013), le maillon du transport maritime occupe 80 % du volume du commerce mondial même si la continuité physique de l’acheminement de fret exige le recours à des systèmes de transport multimodal.

Dans ce sens le Maroc s’est engagé durent ces deux dernières décennies, dans un processus de réformes portuaires considérables, visant à rendre sa logistique portuaire une locomotive de son économie. En effet, la logistique portuaire au Maroc a réalisé des avancées importantes, en matière de connectivité maritime, et de qualité d’infrastructure portuaire, ce qui a amélioré la présence maritime marocaine sur la scène internationale.

Donc, c’est le temps d’évaluer les retombées de ces efforts sur la croissance économique puisqu’elle occupe une place importante dans les discours politiques et les débats économiques. En utilisant le modèle autorégressif à retards échelonnés ARDL, nous envisageons de répondre sur la question suivante comment la logistique portuaire peut influencer la croissance économique marocaine ?

Les estimations économétriques nous ont permis de confirmer l’effet positif de la logistique portuaire sur la croissance économique du Maroc. Ainsi, ces résultats ont approuvé les prédictions théoriques et empiriques.

Mots-clés : Logistique portuaire ; Croissance économique ; ARDL ; Trafic portuaire.
Introduction:

In the current economic context marked by the increase of international trade, by the spreading of free trade agreements and economic cooperation, and by the rapid development of the new information and communication technologies, the optimizations and facilitations issues of the trade to develop the economic activities occupy a vital place in the international economic scene.

In this wake, the port logistics is a capital vector to the development of the economic activities. And the reason coastal countries have implemented a train of strategies and reforms to develop the port sector in order to contribute positively to the economic development.

In the same sense, Morocco has implemented a series of actions aimed at the development of the port logistics, including the portal reform of 2006 which considered the abolition of the National Office of the ports (ODEP) and the creation of two entities : The National Ports Agency (NPA) and Marsa Maroc, the National Strategy for the development of the logistic competitiveness which aims at the development of the Moroccan logistic sector as a response to the various logistical needs of political sector, as the portal strategy to the Horizon 2030 which visualize the improvement of the port sector quality in order to align with the international standards and to make the said sector capable of Pushing the economic development toward the top.

Indeed, the Moroccan port sector displays up to this good performance, justified by the good Maritime connectivity, the increase in the volume of port traffic and the modernization of the port infrastructures. These elements allow it to be a facilitator of trade and a better component of economic development.

Therefore the purpose of this contribution is to analyze the effect of the port logistics on the Moroccan economic activities. To do this, we are discussing first, the base frame in the theoretical and empirical of our study and the development of the Moroccan port logistics. Secondly, we analyze the econometric link of the relationship between the harbor logistics and economic growth.

1. Literature and empirical review

1.1. The port logistics and economic activities

In a world economic marked by the growth of international trade, the increase in the number of free-trade agreements and economic cooperation, the improvement of infrastructures, the introduction of new technologies in the economic field, the port logistics arisen as an essential
link in the accomplishment of a large number in regard to the operations in the economic environment.

The improvement of the port logistics will reduce the costs and the expense of the international logistics, which will improves the comparative advantage of the exports of goods and it will promote the international trade. Therefore, the effectiveness of the maritime ports can generate more economic advantages, because it will increase the flow of goods, while the inefficient ports can ostracize a region from sources of inputs or markets less expensive.

As a result, the development of the port logistics will not only improve the efficiency of goods flow transport, but also to shrink the costs of transportation and transaction costs for businesses, an increase in the FDI, an increase the port traffic, expand the share of the market... The figure below shows the mechanism of port development effect on the economic growth.

![Figure 1: The mechanism of port development effect on the economic growth](image)

Source: Jouili and Allouche (2016)

In the light of the figure above, we can deduce the existence of a close relationships between the port developments and economic growth, through a set of positive economic impact generated by the ports including the effects of support, the effects of competitiveness and the effects of
diffusion, the increase of cargo-handling operations, an increased port connectivity, a port triptych efficient (cost-quality-delay).

These effects introduce a remarkable development of the hinterland in terms of businesses created and established on the national territory. This set of effects caused by the port logistics increase the value added within the country in various sectors (industrial, agricultural, service). In other words, improves the economic activity of the country.

At the empirical level our question has caused much ink to flow, researchers have used different econometric techniques to assess the effect of the port logistics on economic activities in various countries. In Italy, Acciaro (2008) has shown that ports constitute a catalyst of GDP in the Italian regions, more precisely in the region of Sardinia.

In Galles, Bryan and al. (2006) have found that the port industries are a major contributors to the local economies. In Cote d'Ivoire, Essoh (2013) studied the effect of the port logistics on the trade GDP, the GDP of transportsations and communication, the GDP of banking and insurance, and the GDP of the services. It was found that the harbor logistics has a positive effect on the GDP studied.

In Brazil, Gonçalves and Assumpção (2016), have confirmed the existence of a significant and positive relationship between the port activity and the regional GDP. Similarly, (Zheng and Lu, 2012) have found that the port logistics is the cornerstone of the Chinese economy. The mechanism of the effect is based on the volume of cargo to the port and the flow of containerized goods of major maritime ports which have a favorable impact on the GDP. This series of studies corroborates the positive impact of the port logistics on the economic activities, nation al., regional and local authorities of the countries in question.

1.2. The port logistics in Morocco

Morocco is aware of Maritime ports major roles in the encouragement and promotion of its economy. It has put in place a series of actions aimed to equip the kingdom of a port logistic performance. In fact, this actions stand out by three essential elements: The port reform, the port strategy to the horizon of 2030 and the National Strategy for the Logistics competitiveness.

The reform considered the creation of two entities: the National Ports Agency (NPA) which is responsible for regulating the area, control the market and ensure the transparency of the competition and the operating company of the ports (Marsa Maroc) which is charged with the commercial component (mainly the services rendered to ships and to the goods and other related activities), which has as main result to avoid to be the arbitrator and the player at the same time by the ODEP in the sector regarding the sovereign functions (develop and monitor the
implementation of the port policy, achieve strategic studies) remain under the auspices of the Directorate of Ports and of the public maritime domain (DPDPM).

For the port strategy, it enrolled in a framework of complexity to the problem and the adjustment of supply and demand in particular port of large possible variations in the volume of some flows (particularly for energy). It is supposed to respond to economic requirements, policies, to a port request expressed by the partners and national economic actors of international transport and contribute to national economic objectives.

This strategy is based on strategic axes to achieve the objectives related to the research of port performance through in particular the incentive to innovation, logistic performance, the optimization of existing port and connection infrastructure, the correct positioning in the national, regional and international context, the importance of the environmental and urban variable and the preparation and adaptation to long-term uncertainties. It also consists of dividing the Moroccan port landscape into six main areas (METL, 2011): the Eastern Pole, the North-West Pole, the center of Kenitra, Casablanca and Mohammedia pole, the Abda - Doukkala pole, The Souss – Tensift pole, the South Ports Pole.

As to the national strategy of the logistics development competitiveness, it aims to improve the contribution of the logistics sector in the economic growth of the Kingdom by creating a series of logistic areas multi flow, by encouraging the uniformization of flows, develop logistics training course. Moreover the said strategy envisages is to meet the various logistical needs of other sectors strategies of the nation.

All of this is in addition to the policy of major shipyards, which allows the creation of a series of port infrastructure including the Tangier-Med ports which has changed the Moroccan maritime profile and other Maritime ports which are in the construction phase such that the Nador west med port and kenitra Atlantic.

This series of actions has improved the situation of the port environment and it has introduced a new configuration in the area which represents the heart of the Moroccan trade with the rest of the world. The majority of the ports health indicators are in a favorable situation, the figure below shows the evolution of the Moroccan port production which is measured by the port traffic:

**Figure 2: The Evolution of the port traffic of Morocco**
The Moroccan port traffic customizes by a favorable growth with the exception of the decline during the years 2008 and 2009 due to the economic crisis, before resuming its upward trend in 2010. In effect, the evolution of the port traffic depends on a set of internal and external factors. The figure below clarifies the evolution of two port logistics main indicators.

The first index of the maritime connectivity developed by the United Nations Conference on Trade and Development (UNCTAD) is to measure the integration level of a country in the existing World Network of maritime transport. It is obtained from five components: the number of vessels, the load capacity of containers, the size of the largest vessels, the number of insured services and the number of companies who are deploying door-containers on the lines to the destination and from the ports of a country.

The second index is called the quality of port infrastructure. It is developed in 2007 by the World Bank, measuring the perception of the business leaders in respect of the port facilities of their country.

In the light of the chart above, we can deduce that the connectivity of Moroccan ports to the international ports has experienced a considerable evolution. This is mainly due to the creation of the Tangier Med port which has improved the maritime presence of Morocco in the international environment on one hand and to the proliferation of free trade agreements and cooperation agreements concluded by Morocco in the other hand.
For the quality of port infrastructure, it seems that the policy of the major shipyards launched by Morocco reached its results, also the Kingdom’s good quality port infrastructure.

2. Empirical methodology

The quantitative assessment is carried out on the basis of Morocco’s data during the period 1990-2018\(^1\). This model will be based on a dependent variable that is the real GDP per capita. With respect to the independent variable is the port logistics. It will be measured by the traffic of cereals. Finally we add two control variables to know the training gross fixed capital formation (GFCF) and human capital (the gross rate of enrolment in secondary education). The choice of the considered variables is based on Essoh (2013) ; Zheng and Lu (2012), and is also due to the availability of data.

In fact the answer on our problematic that the study of the effects of the port logistics on the economic growth in Morocco passes through the verification of this main following hypothesis: Port logistics positively influences economic growth.

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\(^1\) Depending of the availability of data.
To establish our econometric estimate we follow the following process:

1. Model specification,
2. Unit root tests
3. Cointegration tests
4. Robustness tests
5. Model stability tests.

Indeed, the general form of this relationship is as follows:

$$\text{GDP}_t = f(X_t, Y_t)$$

We will adopt a model of time lag (Bound testing) developed by Pesaran and al. (2001), because it can manage both the variables I (0) and I (1), and it has good properties in the case of small samples. The basic equation of the model ARDL is written as follows:

$$\Delta Y_t = c + B_1 Y_{t-1} + B_2 X_{1t-1} + B_3 X_{2t-1} + \ldots + B_{k+1} X_{kt-1} + \sum_{i=1}^{p-1} \lambda_{1i} \Delta Y_{t-i} + \sum_{i=0}^{q_1-1} \lambda_{2i} \Delta X_{1t-i}$$

$$+ \sum_{i=0}^{q_2-1} \lambda_{3i} \Delta X_{2t-i} + \ldots + \sum_{i=0}^{q_k-1} \lambda_{(k+1)i} \Delta X_{kt-i} + \mu_t \ldots$$

$$\Delta$$: The operator of first differences, \(P\): The number of optimal delays

$$\lambda_{1i} - \lambda_{(k+1)i}$$: Long-term relationships, \(\mu_t\) : the residual term

$$B_1 - B_{k+1}$$: The Representation error correction models (ECM), \(C\): the constant

Finally, we check the validity of the model, using the test of the normality of the errors, the test for Heteroscedasticity, the test of errors autocorrelation and the model coefficients stability test, so that the model remains globally significant, for a global relevance of the regression and to avoid spurious regressions. And we finalize our study by the CUSUM and CUSUM squared test showing the estimated parameters stability on the period of the study.

2.1. Unit root test

The results of the ADF test suggest that the variables GDP and the training Gross fixed capital (GFCF) are stationary in first difference. The traffic of cereals (TRA_CER) and human capital (kh) are stationary at the level. In effect these results show, the respect of the conditions of use of the ARDL approach that says that no variable is integrated in I(2).
Table 1: Result of the ADF test

<table>
<thead>
<tr>
<th>The variables</th>
<th>Test in level</th>
<th>Test in 1st difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intercept</td>
<td>Trend and intercept</td>
</tr>
<tr>
<td>Gdp</td>
<td>0.704310</td>
<td>0.1300</td>
</tr>
<tr>
<td></td>
<td>0.9900</td>
<td></td>
</tr>
<tr>
<td>TRA-CER</td>
<td>-1.564715</td>
<td>-6.364968</td>
</tr>
<tr>
<td></td>
<td>0.227</td>
<td></td>
</tr>
<tr>
<td>KH</td>
<td>0.217145</td>
<td>-5.387387</td>
</tr>
<tr>
<td></td>
<td>0.9688</td>
<td></td>
</tr>
<tr>
<td>GFCF</td>
<td>0.8412</td>
<td>0.6820</td>
</tr>
<tr>
<td></td>
<td>-0.659153</td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors, Eviews 10

2.2. Cointegration test

After the test of stationarity, we will check the existence or non-existence of a long-term relationship between the variables in question, and this through the test limits (bounds test), using the software Eviews 10.

Table 2: Result from Bounds test

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>12.98488</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: Authors, Eviews 10

The results of the procedure "bounds test" show that the statistics of Fisher (F= 12.98488), is greater than the upper terminal for the different thresholds of significance 1%, 2.5%, 5%, and 10%. So we reject the hypothesis H0 of the absence of a long-term relationship we can conclude from these results, the existence of a cointegration relationship in the long term for the estimated model.

2.3. Estimation of Long Run Coefficients

The table below shows the coefficients of the estimate in the long term the estimated model:

Table 3: The coefficients in the long term

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coef.</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRA_CER</td>
<td>0.044738</td>
<td>0.017640</td>
<td>2.536177</td>
<td>0.0248</td>
</tr>
<tr>
<td>KH</td>
<td>0.651913</td>
<td>0.068460</td>
<td>9.522588</td>
<td>0.0000</td>
</tr>
<tr>
<td>GFCF</td>
<td>0.068115</td>
<td>0.050079</td>
<td>1.360169</td>
<td>0.1969</td>
</tr>
<tr>
<td>C</td>
<td>-3.882450</td>
<td>0.131019</td>
<td>-29.63267</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Source: Authors, Eviews 10
The relationships of the long-term balance which derive from the ARDL model are presented in the table at the top. The results of this estimation confirm the theoretical and empirical predictions. The port logistics measured by the traffic of cereals has a positive effect and highly significant on the Moroccan economic activity which is measured by the GDP.

With respect to the variables of control that we have introduced in order to avoid bias in the estimate of the parameter of interest, shows a positive impact. The coefficient for the human capital is positive and highly significant. With regard to the gross fixed capital formation displays a favorable impact on the Moroccan GDP, corroborating a series of study especially that of de Zheng and Lu (2012), Deng et al. (2013), Igberi & Babatope (2013) and Acciaro (2008).

2.4. Short run impact and adjustment

The table below shows the coefficients of the estimate in the short term the estimated model:

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coef.</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(PIB(-1))</td>
<td>-0.441441</td>
<td>0.089488</td>
<td>-4.932962</td>
<td>0.0003</td>
</tr>
<tr>
<td>D(PIB(-2))</td>
<td>-0.109049</td>
<td>0.079713</td>
<td>-1.368015</td>
<td>0.1945</td>
</tr>
<tr>
<td>D(TRACER)</td>
<td>0.030170</td>
<td>0.006682</td>
<td>4.515380</td>
<td>0.0006</td>
</tr>
<tr>
<td>D(TRACER(-1))</td>
<td>-0.039116</td>
<td>0.009007</td>
<td>-4.342996</td>
<td>0.0008</td>
</tr>
<tr>
<td>D(TRACER(-2))</td>
<td>-0.017193</td>
<td>0.009254</td>
<td>-1.857849</td>
<td>0.0860</td>
</tr>
<tr>
<td>D(KH2)</td>
<td>0.104413</td>
<td>0.073265</td>
<td>1.425149</td>
<td>0.1777</td>
</tr>
<tr>
<td>D(GFCF)</td>
<td>0.154080</td>
<td>0.038386</td>
<td>4.013963</td>
<td>0.0015</td>
</tr>
<tr>
<td>D(GFCF(-1))</td>
<td>-0.076424</td>
<td>0.033438</td>
<td>-2.285517</td>
<td>0.0397</td>
</tr>
<tr>
<td>ECM(-1)*</td>
<td>-0.956499</td>
<td>0.103807</td>
<td>-9.214180</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Source: Authors, Eviews 10

After confirming the existence of a long-term relationship between economic growth and the port traffic Global. The coefficient of adjustment or force of reminder is statistically negative and significant widely, which ensures a mechanism for correction of an error. This coefficient, which expresses the degree with which the dependent variable will be recalled to the target of long-term, is estimated -0.956499 for our model ARDL, reflecting a fast adjustment to the target of the long term relatively. The estimate in the short term shows that our selected variables exert a negative effect on the GDP.
2.5. Robustness Tests

After the interpretation of the results of the estimates in the long term and short term, it is legitimate to check the validity of the model through the tests, heteroskedasticity, autocorrelation of errors and the stability of the coefficients of the model so that the model remains globally significant, and avoid the regressions misleading.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Breusch-Pagan-Godfrey</td>
<td>0.806074</td>
<td>0.6423</td>
</tr>
<tr>
<td>Breusch-Godfrey</td>
<td>0.086253</td>
<td>0.9180</td>
</tr>
<tr>
<td>Jarque-Bera</td>
<td>1.716323</td>
<td>0.42394</td>
</tr>
<tr>
<td>ARCH</td>
<td>1.574651</td>
<td>0.2221</td>
</tr>
</tbody>
</table>

Source: Authors, Eviews 10

2.6. The stability of the model

In addition to the tests of validity below, tests of stability of CUSUM and CUSUM Squares are used in order to assess the level of the parameters of the model. The first is based on the cumulative sum of recursive residues and the second is based on the squared sum of the recursive residues. The figure below shows that the parameters of the model are stable over time, because the recursive residues remain, on the entire period of the study, to the inside of the confidence interval at the threshold of 5%.

Figure 4: CUSUM Test

Source: Authors, Eviews 10
3. Results and discussion

The results gained from the implementation of the ARDL model show that the effect of the cereals traffic on Morocco’s GDP is significant. Moreover, this effect is found to be positive, as the increase in the cereals traffic lead to the rise of the GDP and similarly for cereals traffic’s decrease.

Therefore, we conclude that the port logistics’ potential affect significantly the evolution of the economic growth in Morocco. As a consequence, the economic growth movements during the last years could be partially explained by the improvement of port logistics capacity made Moroccan authority.

Our results seem to confirm the hypothesis the port logistics positively affect the economic growth. Thus, this hypothesis is shown to be verified in the context of the Moroccan economy, as it was verified in the framework of many countries for example, this conclusion is found also in China (Wang and BAI, 2012), Italy (Acciaro, 2008), South Africa (Chang et al., 2015), Belgium (Marzieh, 2012).
4. Conclusion and Policy Implications

The port logistics effects on economic activities fill a prominent place in the modern literature, particularly in this economic context marked by globalization.

The Moroccans trade using the seaway is in upward trend, which obliges the kingdom to develop its port logistics in order to respond to the various needs of its economy. In our present study, we have applied an autoregressive model to staggered delays ARDL (Auto Regressive distributive justice lags), in order to assess the effect of the port logistics on the economic activities of Morocco.

This combines the efforts made to improve the performance of the port logistics particularly in terms of infrastructure, quality of service and of triptych of the port logistics (cost-quality-delay) as well to make the port sector a better catalyst of the Moroccan economy.

Despite the good results shown by our study, a great effort must be made at the level of the modernization of the port equipment, the development of the quality multimodal transport connection (road and rail), and the optimization of the port cost.

In this wake, it is essential to ensure the good governance of the sectors related to the maritime ports since all of these strategies are considering the improvement and growth of the Moroccan economy. Therefore to achieve this we need a total synergy between those strategies. In the end, the maritime port is only one link in a chain where stakeholders are multiple.

One limitation of our study is that we examined the effect of logistics port on the global economic growth of Morocco. However, we didn’t identify the impact on the economic growth by region. Therefore one perspective of this paper is to lead an analysis of port logistics effect on regional GDP.

One other limitation of this essay is related to the data, in fact, we used data in annual frequency while the economic growth has a seasonal evolution. Therefore, one perspective is that instead of using annual data we can employ quarterly data.
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