



## **THE MEDIATOR ROLE OF LOGISTIC PERFORMANCE INDEX: A COMPARATIVE STUDY**

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### **Abstract:**

*Logistics sector is recognized as one of most important element of an advanced economies. Many studies tried to understand the relationship among the logistic sector and the prosperity of a country. We start to understand what is the meaning in the academic literature of logistic so as to better understand the Logistic Performance Index (LPI), published by the World Bank in 2007, 2010, 2012, 2014.*

*This research through the use of explanatory linear regression model was aimed to analyze the mediator role of Logistic Performance Index (LPI) on the relation between the Global Competitiveness Index (GCI) and Gross Domestic Product (GDP) from 2007 to 2014 in Europe (EU 28).*

### **Keywords:**

Logistic; LPI; GDP; Growth; Mediator Effect

### **1. Introduction:**

In 2015 a research of Istanbul Commerce University (Civelek et al. 2015) demonstrate through the use of regression linear model how the Logistics Performance Index (LPI) play a mediator role on the relation between Global Competitiveness Index (GCI) and Gross Domestic Product (GDP).

In that study (Civelek et al. 2015) tested the Mediator variable analysis method suggested by Baron and Kenny (1986) to a global model that covering 96 countries around World, they used World Bank data and took LPI, GCI and GDP data for the years 2007-2010-2012-2014.

Civelek, Uca and Cemberci demonstrated four point:

Logistic Performance Index (LPI) is positively influenced by Global Competitiveness Index; Gross Domestic Product (GDP) is positively influenced by Logistic Performance Index (LPI); Gross Domestic Product (GDP) is positively influenced by Global Competitiveness Index (GCI) and finally the Logistic Performance Index (LPI) has a mediator effect on the relation between Competitiveness Index (CPI) and Gross Domestic Product (GDP).

The mediator model tries to identify and explain the process that underlines a relation between an independent variable and a dependent variable via the inclusion of a third explanatory variable.

To establish the consistency of mediator model Baron and Kenny (1986) recommend three tests: First regressing the mediator on the independent variable; second, regressing the dependent variable on the independent variable and third regressing the dependent variable on both the independent variable and on the mediator.

Baron and Kenny (1986) asserted that the evidence for mediation is strongest when there is an indirect effect but no direct effect, which they call "full mediation." When there are both indirect and direct effects, they call it "partial mediation."

Zhao et al. (2010) starting from Baron and Kenny study identify three patterns consistent with mediation and two with non mediation: Complementary mediation: Mediated effect (a # b) and direct effect (c) both exist and point at the same direction.

Competitive mediation: Mediated effect ( $a \neq b$ ) and direct effect ( $c$ ) both exist and point in opposite directions.

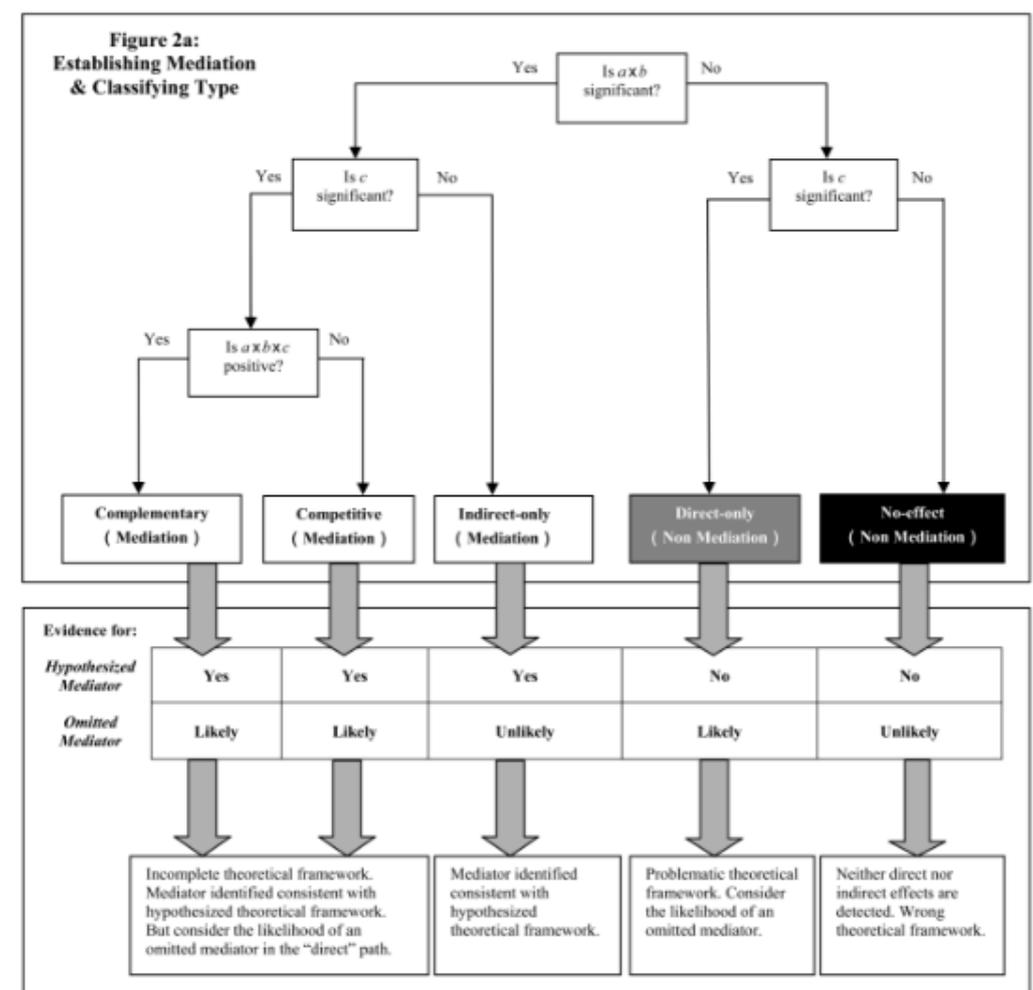
Indirect-only mediation: Mediated effect ( $a \neq b$ ) exists, but no direct effect.

Direct-only non mediation: Direct effect ( $c$ ) exists, but no indirect effect.

No-effect non mediation: Neither direct effect nor indirect effect exists.

## 2. Conceptual Framework

In 2007 the World Bank has developed a benchmarking tool, based on a index of six indicators, that measure and compare the logistics system performance in to 150 countries. The index allows a country to identify the strengths and weaknesses of its logistics system and partners too, and set actions to improve it. The Countries able to effectively connect to logistics global network have easier access to the markets and this is a key factor for economic development. The index and the indicators are estimated according to a worldwide survey aimed to forwarders and express carriers.



\*Model building by Zhao, Lynch and Chen (2010)

The six indicators used by the World bank are:

- Customs - transit efficiency from the border (speed, simplicity, predictability, formalities) by border control agencies, including customs.
- Infrastructure - quality of trade and transport infrastructure (ports, railways, roads, information and communication technologies).
- International shipments - ease of arranging competitively priced shipments.
- Logistics competence - logistics services competence and quality.
- Tracking & Tracing - Ability track shipments

The Logistics Performance Index and its indicators have been constructed from information gathered in a world-wide survey of the companies responsible for moving goods and facilitating trade around the world—the multinational freight forwarders and the main express carriers. It relies on the experience and knowledge of professionals (Avis et al. 2007).

The idea that the economic success of country depends on its international competitiveness took hold among business, political, and intellectual leaders in the late 1970s. The World Economic Forum which hosts the famous Davos conferences began issuing its annual World Competitiveness Index in 1980, and the ranking became a major criteria to judge a national performance.

The World Economic Forum's annual *Global Competitiveness Report* has studied and benchmarked the many factors underpinning national competitiveness. The Global Competitiveness Report is comprehensive tool that measures the microeconomic and macroeconomic foundations of national competitiveness. They define competitiveness as the set of institutions, policies, and factors that determine the level of productivity of a country. This concept of competitiveness thus involves static and dynamic components are grouped into 12 pillars of competitiveness:

- *Institutions, Infrastructure, Macroeconomic environment, Health and Primary education, Higher education and training, Labor market efficiency, Goods market efficiency, Financial market development, Technological readiness, Market size, Innovation*

it is important to keep in mind that they are not independent: they tend to reinforce each other, and a weakness in one area often has a negative impact in others (World economic forum).

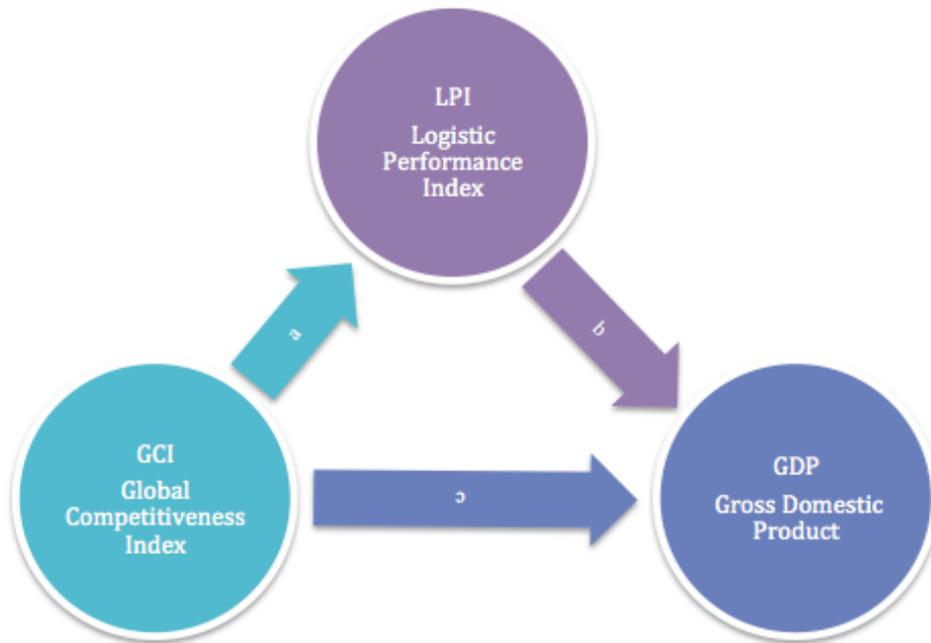
The GDP concept has historically been used to measure human wellbeing and progress. GDP - World Bank data at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. The Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2005 U.S. dollars.

### 3. Research Model

Main research question is to understand if the study “The Mediator Effect of Logistics Performance Index on the relation between Global Competitiveness Index And Gross Domestic Product” (Civelek, et al. 2015), taking into consideration 96 countries (we called it Global model) it is replicable taking into consideration the 28 European country (EU 28), if exist a mediator effect of LPI on the relation between GCI and GDP.

Figure1. Shows the conceptual model regarding the relation between the three variables, using the mediator effect model of Baron and Kenny (1986).

**Figure 1. Research Model**



Consequently to make a proper comparison we accept the four assumptions derived from the research model (Civelek et al. 2015) as show on table one.

**Table 1. Summary of Hypothesis**

H <sub>1</sub> : Logistics Performance Index is positively influenced by Global Competiveness Index.
H <sub>2</sub> : Gross Domestic Product is positively influenced by Logistics Performance Index.
H <sub>3</sub> : Gross Domestic Product is positively influenced by Global Competiveness Index.
H <sub>4</sub> : Logistics Performance Index has mediator effect on the relation between Global Competiveness Index and Gross Domestic Product.

Primarily relation among three variables was observed by means of the calculation of Pearson correlation coefficient. Table 2 showed that the correlation relation among variables are powerful and statistically significant.

#### **4. Hierarchical Regression Model**

To test the mediator model, we can prove the existence of Baron and Kenny conditions:

1. Change in the independent variable cause the mediator variable change.
2. Change in the mediator variable cause the dependent variable to change.

3. When the mediator and the independent variables are included together, the influence of independent variable on dependent variable to decrease or completely disappear.

The same hierarchical regression of Global model is used:

$$(a) \text{LPI} = \beta_0 + \beta_1 \text{GCI} + \epsilon$$

$$(b) \text{GDP} = \beta_0 + \beta_1 \text{LPI} + \epsilon$$

$$(c) \text{GDP} = \beta_0 + \beta_1 \text{GCI} + \epsilon$$

$$(c') \text{GDP} = \beta_0 + \beta_1 \text{GCI} + \beta_2 \text{LPI} + \epsilon$$

Table 2. Correlation coefficients

		LPI	GCI	GDP
LPI	Pearson Correlation	1	,916*	,576*
	Sig.		,000	,001
GCI	Pearson Correlation	,916*	1	,457*
	Sig.	,000		,015
GDP	Pearson Correlation	,576*	,457*	1
	Sig.	,001	,015	

The results of the regression analysis EU 28 are shown in the Tables 3, 4 and 5.

Table 3. Model summaries (EU 28)

Model	R	R <sup>2</sup>	Adjusted R <sup>2</sup>	Standard Error of the Estimate
(a)	,916	,838	,832	,16758
(b)	,576	,332	,306	781,18947
(c)	,457	,209	,178	850,11673
(c')	,602	,363	,312	778,00608

As shown in Table 3., difference between R<sup>2</sup> value of Model (c) and R<sup>2</sup> value of Model (c') was found as 0,154.

Table 4. Anova tables ( EU 28)

Model		Sum of Squares	df	Mean Square	F	Sig.
(a)	Regression	3,791	1	3,791	134,984	,000
	Residual	,730	26	,028		
	Total	4,521	27			
(b)	Regression	7876123,200	1	7876123,200	12,906	,001
	Residual	15866681,839	26	610256,994		
	Total	23742805,039	27			
(c)	Regression	4952645,435	1	4952645,435	6,853	,015
	Residual	18790159,604	26	722698,446		
	Total	23742805,039	27			
(c')	Regression	8610468,535	2	4305234,267	7,113	,004
	Residual	15132336,504	25	605293,460		
	Total	23742805,039	27			

All the models are generally meaningful as shown in the Table 4. Coefficients of the models are as shown in Table 5.

Table 5. Coefficients (EU 28)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		$\beta$	Std. Error	$\beta$		
(a)	Constant	-,084	,308		-,274	,787
	GCI	,754	,065	,916	11,618	,000
(b)	Constant	-3968,558	1283,542		-3,092	,005
	LPI	1319,909	367,404	,576	3,593	,001
(c)	Constant	-3450,905	1560,309		-2,212	,036
	GCI	862,089	329,315	,457	2,618	,015
(c')	Constant	-3262,550	1430,011		-2,281	,031
	GCI	-826,016	749,931	-,438	-1,101	,281
	LPI	2238,226	910,491	,977	2,458	,021

As shown in Table 5, the change in the independent variable cause the mediator variable to change. The change in the mediator variable cause the dependent variable to change. After the mediator and the independent variables are included to the analysis together, the influence of independent variable on dependent variable to decrease.

## 5. Conclusion:

According to these results, all the hypothesis are accepted. Therefore the mediator effect of Logistics Performance Index on the relation between Global Competiveness Index and Gross Domestic Product is statistically significant. The mediator model proposed in the examined study (Civelek et al.2015) operate with the observations used EU28 model. after the demonstration of the replicability of the work (Civelek et al.2015) we can state that LPI is a good predictor of the GDP performance. This confirms that the improvement of logistics systems of a nation has a positive effect on a wealth. To assess fully this study I invite the researcher to a careful reading of the previous search (Civelek et al.2015).

According to Baron and Kenny (1986) model when there are both indirect and direct effects, there is “partial mediation.” According to Zhao et al. (2010) exist a Complementary mediation: Mediated effect ( $a \neq b$ ) and direct effect ( $c$ ) both exist and point at the same direction. The most important contribution of this study is to test the research (Civelek et al 2015) replicability and the mediator model (Baron, Kenny). The main limitation of the research is only determining if the Baron and Kenny model working, without giving any explanation about the macroeconomic data results.

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