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Analysis of Equilibrium at the Euro Area Level from a New Model Perspective

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This paper aims to address issues related to equilibrium at the Euro Area. Research methodology implies a wide range of methods and techniques that are used to analyze macroeconomic phenomena and processes at the Euro Area. Following the empirical analyses, namely exploratory factor analysis and structural equation modeling procedure, we propose a model of equilibrium in the Euro zone, an area characterized by the existence of market with turbulence and search frictions. Using this econometric modeling technique, we test and estimate causal relationships that combines a series of empirical data and quantitative causal hypotheses.

Keywords: *equilibrium, gross domestic product, interest rate, Euro Area*

JEL Classification: *D58, R13*

1. Introduction

The economic reality is characterized by the existence of large and numerous interdependencies between markets. Equilibrium is a central concept of modern economic analysis describing situations which economists do not claim they could always occur, but which serve as reference for studying concrete situations.

The most important theories regarding economic equilibrium and disequilibrum were those enunciated by Alvin Marshall, Walras Leon and John Maynard Keynes, and based on their work followed other developed theories regarding an economy's phenomena. However those who addressed equilibrium from the perspective of an open economy were Mundell (1963) and Fleming (1962). The two of them have developed independently a model that studied the simultaneous equilibrium of the goods and services market, money market and balance of payments. As an overview of these developments and continuous evolution of macroeconomic theory, Mankiw (2010) proposed a synthesis of the economic models under a 7 equation model.

Since 2007, the global economy has been going through an experience that highlighted not only the flaws in the prevailing economic models, but also the negative aspects of human society, which led to the collapse of a sense of trust.

Based on these aspects, this paper intends to describe the results of research and equilibrium analysis in the context of new mutations at the level of the European Union and the Eurozone. The purpose of this paper is to empirically determine an equilibrium model for the European market. The aim of these analyzes is to conduct a research at the Euro Area level and to determine an equilibrium model for the markets with turbulence and search frictions.

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The starting point in this approach is that the unpredictability of econometric models regarding the appearance of a crisis requires the use of models that introduce new variables in equations systems designed to integrate the features of the new stage of normality. Since 2009, Kotler and Caslione have claimed that this new stage is characterized by the existence of economic turbulence caused by a set of critical factors.

2. Research Methodology

Research methodology is considering using a variety of strategies, methods and techniques that are used to analyze the aspects, phenomena and processes of aggregated macroeconomic at the level of the European Union and the Euro Area.

For the final empirical research, which will propose an equilibrium model for markets with turbulence and search frictions for which we will use the structural equation modeling procedure. Using this technique of econometric modeling, causal relationships are estimated and tested by combining a series of empirical data and quantitative causal hypotheses.

For the empirical analysis, we will use the Amos SPSS software for testing the suggested hypotheses. Thus, we will use macroeconomic time series for the variables that characterize the Euro Area (19 Member States). These time series were obtained from Eurostat, the European Central Bank and European Commission.

Table 1. *Variables and time series used in the empirical research*

Period	Variables
2001q1-2015q2	GDP (EA19_Y)
2001q1-2015q2	Consumption (EA19_C)
2001q1-2015q2	Government Consumption (EA19_G)
2001q1-2015q2	Investments (EA19_I)
2001q1-2015q2	Exports (EA19_EX)
2001q -2015q2	Imports (EA19_IM)
2001q1-2015q2	Balance of Trade (EA19_NX)
2001q1-2015q2	Taxes (EA19_T)
2001q1-2015q2	Interest Rate (EA19_R)
2001q1-2015q2	Monetary Base (EA19_M)
2001q1-2015q2	Prices (EA19_P)
2001q1-2015q2	Balance of Payments (EA19_BP)

For the empirical analysis of the equilibrium at the level of the Euro Area, a zone which is characterized by the existence of markets with turbulence and search friction, we will use exploratory factor analysis and structural equation modeling procedure. These econometric modeling techniques will be used to test and estimate the causal relationships, using a combination of series of empirical data and quantitative causal hypotheses.

3. Exploratory Factor Analysis for GDP Components

To analyze the structure of GDP and the relationships established between the GDP components, we will apply an exploratory factor analysis. The results obtained from this analysis help identify factors that will lead to a better comprehension of the structure of GDP and which will be introduced in the Euro Area's equilibrium model.

In this research, exploratory factor analysis (EFA) was used to provide a summary of the components of gross domestic product for the Eurozone. In this regard, the many components will be summarized by a smaller number of factors. The EFA was compiled in SPSS using the Principal Components extraction technique and the Varimax rotation method.

By implementing the EFA, we proceeded to explore the total variation for the exploratory factor analysis. Table 4.9 shows the number of selected factors (in this case, two factors), and the variation in each case, before and after the rotation.

Table 2. *Exploratory factor analysis results for 3 extracted factors*

	Initial Eigenvalues			**Extraction Sums of Squared Loadings**			**Rotation Sums of Squared Loadings**		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.749	68.719	68.719	2.749	68.719	68.719	2.328	58.189	58.189
2	1.072	26.788	95.507	1.072	26.788	95.507	1.493	37.319	95.507
3	.178	4.456	99.964						
4	.001	0.036	100.000						

The criteria used for determining the factors was that each element should have an eigenvalue greater than 1 (Field, 2013, p.642). Also, the eligibility of the factors can also be seen in terms of the variance explained by each resulted factor, exceeding 70%, namely for this first applied EFA the total variance explained is 95.507% (Table 2).

Table 3 helps to determine the representativeness of the components, which can be used to observe the most relevant variables each of two newly formed factors.

Table 3. *Rotated components' matrix*

	Component	
	F1_CGI	**F2_NX**
EA19_G	**0,816**	0,533
EA19_C	**0,876**	0,473
EA19_I	**0,944**	-0,197
EA19_NX	0,066	**0,973**

Note: EA19_G = government consumption, EA19_C = consumption, EA19_I = investments, EA19_NX = trade balance

Following the results of the exploratory factor analysis, we have obtained two factors, namely factor 1 (F1_CGI) which is influenced by the consumption (both personal and governmental) and investments, and factor 2 (F2_NX) which is mainly determined by the trade balance.

Table 4 presents the weights that can be used to obtain the factors' scores by multiplicating the coefficients presented in this table (Table 4) and the standardized variables. The factors' scores represent the composite and estimated scores for each record in the database from the derived factors (Malhotra, Birks, 2009 p.629).

Table 4. *Coefficients matrix for factors' scores*

	Component	
	F1_CGI	**F1_CGI**
EA19_G	0,282	0,220
EA19_C	0,327	0,157
EA19_I	0,527	-0,389
EA19_NX	-0,207	0,752

Note: EA19_G = government consumption, EA19_C = consumption, EA19_I = investments, EA19_NX = trade balance

Factors represent linear combinations of the original variables that can be calculated as follows:

$$F_i = W_{i1}X_0 + W_{i2}X_1 + W_{i3}X_2 + \ldots + W_{ik}X_k$$

$$F_{1\_CGI} = 0{,}282G + 0{,}327C + 0{,}527I - 0{,}207NX$$

$$F_{2\_NX} = 0{,}220G + 0{,}157C - 0{,}389I - 0{,}752NX$$

4. Structural Equation Model for a New Euro Area's Equilibrium

The two factors obtained in the preceding stage (F1_CGI and F2_NX) will join variables that characterize the money market (namely, money supply and interest rate) and the BP variable (namely, balance of payments which summarizes the relations of the Eurozone with rest of the world) in a model of structural equations which characterizes the market equilibrium of the Euro Area, which in turn is influenced by turbulence and search friction.

To determine and test the structural equation model that characterizes equilibrium in the Euro Area, we propose the following hypotheses:

H1: F2_NX has a positive influence on the money supply at the Euro Area
H2: F1_CGI has a positive influence on the money supply at the Euro Area
H3: Money supply has a negative influence on interest rate
H4: Balance of payments has a negative influence on interest rate
H5: F1_CGI and F2_NX influence each other in a positive relationship
H6: Balance of payments and F1_CGI are inter-correlated
H7: Balance of payments and F2_NX are inter-correlated
H8: F2_NX is inter-correlated with other unobservable factors of interest rate

These proposed relationships that will be examined by structural equation modeling are shown in Figure 1, consistent with the proposed hypotheses.

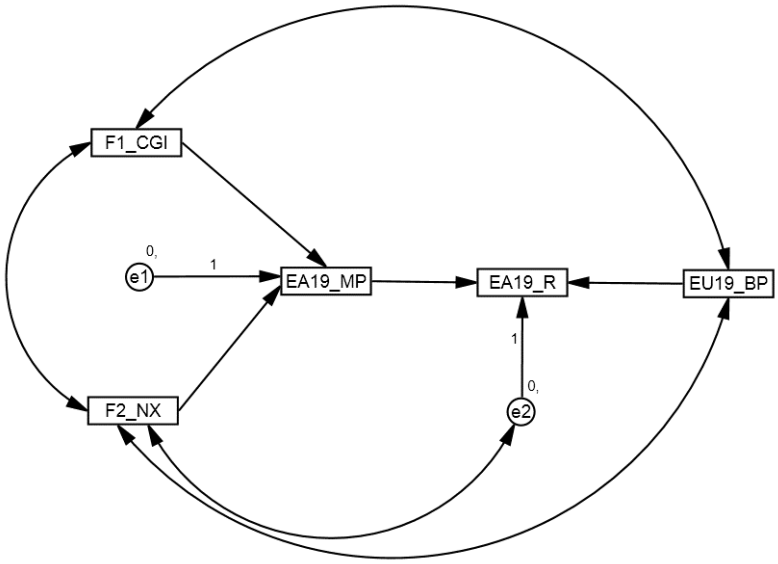

Figure 1. *Equilibrium model proposed for the Euro Area*
Note: F1_CGI= GDP's components of consumption and investments, F2_NX = GDP's component of trade balance, EA19_MP = monetary base/price, EA19_R = interest rate, EA19_BP = balance of payments, e1 = unobserved factors of monetary base/price, e2 = unobserved factors of interest rate

Using the theoretical basis and the results of the exploratory factor analysis, structural equation modeling was used to test the hypotheses of the proposed model in this section. The testing of the model will follow the criteria set by Hu and Bentler (1999, p.27) and developed in Table 5, denoting the eligibility of the newly proposed model.

Table 5. *Model accuracy*

Indicator	Model	Recommended values
χ^2	6.605 (p=0.037)	$p \leq 0.05$
χ^2 /df	3.303	≤5
NFI	0.982	≥0.90
RFI	0.909	≥0.90
CFI	0.987	≥0.90
RMSEA	0.201	≤0.10

Note: χ^2 =Chi-square, χ^2 /df = ratio of Chi-square and degrees of freedom, NFI = Normed fit index, RFI = Relative fit index, CFI = Comparative fit index, RMSEA = Root mean square error of approximation.

Overall, the proposed model has been established as relevant in terms of the accuracy indices, however, the calculated value of 0.201 for the root mean square error of approximation exceeds the stated

acceptable level. This is mainly due to the low number of observations and computing conditions set out in Amos.

The structural equation model implies a process entitled path analysis that uses bivariate correlations to estimate relationships in a system of structural equations. This process estimates the strength of each structural relationship in a path chart based on previously developed equations (Hair et al., 2010, p. 625). The structural relationship between two concepts is the empirically represented by an estimate of the structural parameter or path estimate (Hair et al., 2010, p. 702).

5. Results and Conclusions

The results of the longitudinal research show the validity of the proposed model for determining equilibrium at the Euro Area, which is characterized by the existence of turbulence and search friction.

Table 3 reflects information on the standardized estimates of regression weights, statistical significance, standard error, and the associated equations. Figure 2 offers a visual perspective of the standardized solution of the model. All hypotheses are confirmed in this newly proposed model.

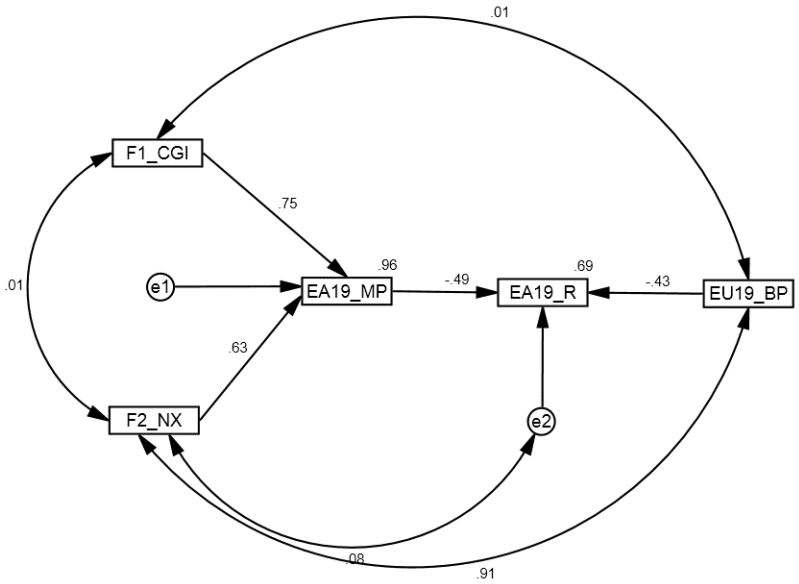

Figure 2. *Standardized solution of the structural equation model associated with Euro Area's equilibrium*
Note: F1_CGI= GDP's components of consumption and investments, F2_NX = GDP's component of trade balance, EA19_MP = monetary base/price, EA19_R = interest rate, EA19_BP = balance of payments, e1 = unobserved factors of monetary base/price, e2 = unobserved factors of interest rate

Table 6. *Structural equation model results for a new Euro Area's equilibrium*

Hypotheses			Standardized Regression Weights	Standard Error	Significance	Hypothesis Result
H1: F2_NX	→	EA19_MP	0,629	21458,980	***	Confirmed
H2: F1_CGI	→	EA19_MP	0,746	21458,414	***	Confirmed
H3: EA19_MP	→	EA19_R	-0,486	0,000	***	Confirmed
H4: EA19_BP	→	EA19_R	-0,429	0,000	***	Confirmed
H5: F1_CGI	↔	F2_NX	0,007			Confirmed
H6: EA19_BP	↔	F1_CGI	0,012			Confirmed
H7: EA19_BP	↔	F2_NX	0,914			Confirmed
H8: e2	↔	F2_NX	-0,085			Confirmed

Note: F1_CGI= GDP's components of consumption and investments, F2_NX = GDP's component of trade balance, EA19_MP = monetary base/price, EA19_R = interest rate, EA19_BP = balance of payments, e1 = unobserved factors of monetary base/price, e2 = unobserved factors of interest rate

The summarized results in Figure 2 and Table 3 show that the GDP, through its related components, directly influences the money supply, however consumption and investment have a stronger influence than the trade balance. Instead, the situation is reversed when considering the relationships of GDP's components with the balance of payments, aspects which are consistent with economic theory.

Another important observation is that trade balance negatively influences interest rate, and the same behavior is displayed by the money supply. Also, these aspects are consistent with theoretical knowledge.

However, following the validation of the model, at the Euro Area, we can observe a few major differences in comparison with existing econometric models. Examples in this regard are the GDP's structure, analyzed by the two factors (F1_CGI and F2_NX), and the investment model (a function dependent on taxes and interest rate).

These differences are mainly due to the difference of research approach. The determined model in this paper is a model characterized by the presence of turbulence and search frictions that characterizes the European Union, as an economic bloc, as well as the Euro Area.

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