
STATISTICAL LIMITATIONS IN TIMING AND RESTRICTIONS OF COMPARABILITY IN ADDRESSING FOREIGN DIRECT INVESTMENT (FDI), IN ROMANIA'S MARKET ECONOMY

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This paper analyzes some statistical limitations in timing and the most important methodological restrictions specific to the process of practical modelling of foreign direct investments (FDI). After a brief introduction about the need for comparability of statistical data and practical implementation, the following section describes the complex process of econometric FDI modeling, the main restrictions that had to be overcome were related to ensuring comparability, selecting only one fairly substantial database for macroeconomic indicators, and building a database for the country rating by statistically converting qualitative information into quantitative information, the option for two types of data sets or series (extended and small), due to the level of FDI, and the different order of magnitude of FDI values, relatively homogeneous since 1997, and not since 1990. The final section of conclusion ends the article with some final remarks about the specific solution used in modeling process.

Key words: foreign direct investments (FDI), statistical limitations, comparability, statistical restrictions.

Factorial statistical investigation involves ensuring the three specific issues, namely temporal, spatial and structural comparability of the phenomena modelled, which involves the exploitation of both econometric models constructed from indicators of value, and of models achieved solely from relative indicators (especially indices and rates), as well as structural modelling which render the implications of significant structural changes in the dynamics of such phenomena as investment, sensitive to the impact of a range of economic, social and political factors. The extensive spatiality of the factors approached, through their residential economies, as sources of investment flows, creates difficulties in selecting the unit of value for the quantifications; the option for lei, euro or U.S. dollars is just a small example of accuracy and

depth of thinking required by econometric statistical thinking. Modelling the evolution of foreign direct investment or FDI in Romania requires some initial option for long data series (according to criteria of availability, comparability and relevance), for appropriate time periods (here in the sense of cutting a quite recent time interval as impact in the present, derived from the forecast or projection requirements of modelling, to ensure a comparable level of volume, impact and intensity of flow analysis). Initially, it was considered that giving up the expression in lei for the euro was sufficiently justified in terms of the dominant volume of foreign direct investment of EU countries, but the need to compare the phenomenon globally inspired the solution of quantification through the U.S. dollar, and the appropriate data source has become the World Bank and its extensive system of indicators, at the expense of Eurostat and NSI, which provided partial coverage of the economic phenomenon.

Ensuring comparability of statistical data on FDI to be modelled

Econometric modelling is a process involving a series of significant steps:

(1) Repertorying the economic literature, an inventory of the main theories, defining and isolating in theoretical terms the economic system under investigation, formulating the pre-modelling questions, identifying the potential variables of interest, etc – represent the beginning phase of modelling.

(2) Presentation of the theory underlying the new econometric model, in fact a summary, a synthesis and a fresh contribution of the modeller to confirming an existing theory, or to the appearance of a new one, which is a natural consequence of the originality of any econometric model.

(3) Ensuring and capitalizing on the data (gathering, cleaning the data from intruders and measurement errors, increasing the relevance of data through aggregation, disaggregation or other procedures, selecting sub-populations and determining the significant data, selecting the essential features of the economic phenomenon, etc. – are all the result of the ability, skill and experience acquired in activities econometric modelling. A very important place is reserved to the comparability of statistical data, and their confrontation from a temporal, spatial and structural or organizational point of view.

(4) Estimation of the econometric models and first empirical results appear as relevant answers to key questions, among which we can mention: Is the model structured on the (co) rrelations between several, optimally selected, variables? Are the variables specified in the model independent? How accurate is the model's parameters estimation? Is the model validated for

the entire longitudinal time series? Is there stability in the parameters? What is the closeness of the solutions and model forecasts to the real values?, etc.

(5) The empirical results occur with the first parameterization implemented and confronted with the actual data in point of specified error level.

(6) The decisions based on statistical testing of hypotheses derive according to precise rules and sequences of development. The main general steps of the decision based on statistical testing can be formulated although each test is a specific decision-making universe. Any preliminary (gross) testing is, as a rule, followed by an additional testing (based on new data).

(7, 8) Model validation or invalidation is a process dependent on the modelling objectives, a model intended for the understanding of an economic phenomenon, which capitalizes on a validation process as rigorous, though not as extensive as, that of a model meant to confirm an economic theory, or one built to forecast on the short to medium term. Validation represents the process of assessing the accuracy of the prediction of a model, and refers to making predictions, simulations and analyses using the existing model, and then comparing the results with already known results.

(9) The conclusions and the impact on pre-existing theory modelling bring forward the pragmatism of modelling. One should not forget that the permanent purpose of econometric modelling is finding the appropriate model for solving a particular problem in the real economy. Basically, those models are sought out which can confirm or refute theories, predict with very small errors, simulate with a high decision impact.

**The evolution of net foreign investment flows of the FDI type, and of
FDI inflows in Romania after 1990**

- BoP, current U.S. dollars -

Table no. 1

	(FDI, net)	(FDI, net inflows)
1990	-18,000,000	10,000
1991	37,000,000	40,000,000
1992	73,000,000	77,000,000
1993	87,000,000	94,000,000
1994	341,000,000	341,000,000
1995	417,000,000	419,000,000
1996	263,000,000	263,000,000
1997	1,224,000,000	1,215,000,000
1998	2,040,000,000	2,031,000,000
1999	1,025,000,000	1,041,000,000
2000	1,048,000,000	1,037,000,000
2001	1,174,000,000	1,157,000,000
2002	1,128,000,000	1,144,000,000
2003	1,805,000,000	1,844,000,000
2004	6,373,000,000	6,443,000,000
2005	6,512,280,000	6,482,160,000
2006	10,971,010,000	11,393,430,000
2007	9,647,000,000	9,925,000,000
2008	13,606,000,000	13,883,000,000
2009	4,934,000,000	4,846,000,000
2010	3,263,000,000	3,453,000,000

Sursa: <http://data.worldbank.org/data-catalog#Tables>

The problem of comparable levels throughout the analysis period imposed both renouncing the year 1990 (as being a year of value corrections of aggregated data at national level), and ensuring a coherent transformation of all values expressed in current prices by means of assessment at comparable prices. The option for prices expressed as the prices of a central year in the period under review was natural (2000 prices expressed in U.S. dollars - constant 2000 U.S. dollars), and building a discount rate through inflationary procedures applied to the years before 2000, and deflationary procedures for the years after 2000, made recourse to the U.S. dollar inflation, and reconstituted the price index that generated it.

**The evolution of net foreign direct investment inflows coming into
Romania, after 1990
(The procedure of ensuring value compability of data on FDI)**

Table no. 2

	FDI, net (BoP, current U.S. dollars)	FDI net inflows (BoP, current U.S. dollars)	Inflation %	CPI %	Index ₂₀₀₀	FDI, net (constant 2000 U.S. dollars)	FDI net inflows (constant 2000 U.S. dollars)
1991	37,000,000	40,000,000	4.2	104.2	1.279424671	47,338,713	51,176,987
1992	73,000,000	77,000,000	3.0	103.0	1.227865477	89,634,180	94,545,642
1993	87,000,000	94,000,000	3.0	103.0	1.192092010	103,712,005	112,056,649
1994	341,000,000	341,000,000	2.6	102.6	1.157370884	394,663,471	394,663,471
1995	417,000,000	419,000,000	2.8	102.8	1.128041797	470,393,429	472,649,513
1996	263,000,000	263,000,000	2.9	102.9	1.097316923	288,594,351	288,594,351
1997	1,224,000,000	1,215,000,000	2.3	102.3	1.066391568	1,305,263,279	1,295,665,756
1998	2,040,000,000	2,031,000,000	1.6	101.6	1.038352	2,118,238,080	2,108,892,912
1999	1,025,000,000	1,041,000,000	2.2	102.2	1.022	1,047,550,000	1,063,902,000
2000	1,048,000,000	1,037,000,000	3.4	103.4	1	1,048,000,000	1,037,000,000
2001	1,174,000,000	1,157,000,000	2.8	102.8	0.9727626459	1,142,023,346	1,125,486,381
2002	1,128,000,000	1,144,000,000	1.6	101.6	0.9574435491	1,079,996,323	1,095,315,420
2003	1,805,000,000	1,844,000,000	2.3	102.3	0.9359174478	1,689,330,993	1,725,831,774
2004	6,373,000,000	6,443,000,000	2.7	102.7	0.9113120232	5,807,791,524	5,871,636,255
2005	6,512,280,000	6,482,160,000	3.4	103.4	0.8813462507	5,739,326,785	5,713,027,412
2006	10,971,010,000	11,393,430,000	3.2	103.2	0.8540176848	9,369,428,020	9,730,190,711
2007	9,647,000,000	9,925,000,000	2.9	102.9	0.8299491592	8,006,519,539	8,237,245,405
2008	13,606,000,000	13,883,000,000	3.8	103.8	0.7995656639	10,878,890,420	11,100,370,110
2009	4,934,000,000	4,846,000,000	-0.4	99.6	0.8027767710	3,960,900,588	3,890,256,232
2010	3,263,000,000	3,453,000,000	1.6	101.6	0.7901346171	2,578,209,256	2,728,334,833

Source: The data on <http://data.worldbank.org/data-catalog/#Tables> were brought to the stage of comparability.

This procedure was applied to several factors considered explanatory, thereby constituting a first database for modelling the phenomenon of FDI through value indicators including indicators on export, import of goods and services, but also on other indicators regarding FDI in the EU or the world, or other phenomena (e.g. the sample indicators from National Accounts from EU, and world economy)

**The evolution of foreign direct investment flows (net inflows)
in EU after 1990**

Table no. 3

Anul	Fluxuri nete ISD intrate în UE Foreign direct investment, net inflows (BoP, current US.dollars)	Indice de actualizare	Fluxuri nete ISD intrate în UE Foreign direct investment, net inflows (constant 2000 US. dollars)
1991	90,573,538,368.2	1.279424671	115,889,019,500
1992	91,374,826,876.1	1.227865477	112,195,995,400
1993	95,568,246,451.3	1.192092010	113,926,143,000
1994	92,775,134,150.5	1.157370884	107,375,239,000
1995	141,924,722,470.8	1.128041797	160,097,019,000
1996	141,913,790,609.3	1.097316923	155,724,404,000
1997	159,263,566,156.8	1.066391568	169,837,324,000
1998	304,388,682,618.8	1.038352	316,062,597,400
1999	647,471,121,679.4	1.022	661,715,486,400
2000	928,205,488,015.0	1	928,205,488,000
2001	454,795,242,895.6	0.9727626459	442,407,823,800
2002	427,523,252,281.6	0.9574435491	409,329,380,000
2003	353,188,835,085.6	0.9359174478	330,555,593,100
2004	292,521,856,016.7	0.9113120232	266,578,684,400
2005	684,856,629,777.7	0.8813462507	603,595,822,900
2006	678,381,183,195.1	0.8540176848	579,349,527,500
2007	1,192,050,562,317.5	0.8299491592	989,341,361,900
2008	649,738,579,845.6	0.7995656639	519,508,659,000
2009	532,433,064,520.4	0.8027767710	427,424,896,300
2010	361,834,451,532.5	0.7901346171	285,897,925,800

Sursa: datele de pe <http://data.worldbank.org/data-catalog#Tables> were brought to the stage of comparability.

In parallel, providing the modelling of an investment volume of similar magnitude and a comparable factorial intensity lead to the selection of a series of 14-consecutive terms, between 1997 and 2010, where the FDI values are approximately the same size, that is billions of US dollars, and where the quality of the econometric model and the coefficients of factorial determination are more substantial and consistent, and thus more feasible in the econometric modelling approach.

For the modelling based on relative indicators appearing as indexes of mobile base, the data were reconstructed both in the expanded form and the 20-term working version, and for the reduced form with only 14 terms, and for the econometric models based on relative indicators appearing as rates, analogously. For the parallel modelling related to the European Union, and global indicators, many factors have gathered the available value indicators, which were brought to a state of comparability (the option for U.S. dollars as currency emphasizes its special value even now), as well as the restricted variant, limited to 14 terms).

The ECR rating was processed and brought, in annual terms, to three

variants (A = weighted average of all months of the year for all infra-annual assessments; B = end of year rating, usually published in September, and C = beginning of the year rating, usually published in March), and subsequently expressed as an index for variant C. This brought them to comparing methodological indicators impossible to confront and compare with other relative and structural indicators. Confronting data coming from various sources (INS, World Bank, UNCTAD, etc.) led to selecting the data of the World Bank, which required less assurance of comparability, and held over 90% of the need for indicators that were to become the endogenous and even exogenous variables.

The major objectives of the rating or grading system of country risk are to distinguish the low-risk and the high-risk countries, or those of unacceptable risk. The rating / grading scales vary from one agency to another, and, although they are not explicitly detailed quantitatively, but only qualitatively, estimates can be obtained for the levels or stages of risk by determining the average value of the leap from one stage to another (specific to agencies):

**Rating scales used, and solutions to estimate
the percentage score per scale**

Table no.4

Moody's=20 scales*	Rating agency		Rating characteristics
	S&P =22scales*	Fitch = 22 scales*	
High or medium investment grade - the highest reliability - low risk			
Aaa = 100	AAA = 100	AAA = 100	Prime
Aa1 = 95	AA+ = 95.45	AA+ = 95.45	High grade
Aa2 = 90	AA = 90.90	AA = 90.90	High grade
Aa3 = 85	AA- = 86.35	AA- = 86.35	High grade
A1 = 80	A+ = 81.80	A+ = 81.80	Upper medium grade
A2 = 75	A = 77.25	A = 77.25	Upper medium grade
A3 = 70	A- = 72.70	A- = 72.70	Upper medium grade
Baa1 = 65	BBB+ = 68.15	BBB+ = 68.15	Lower medium grade
Baa2 = 60	BBB = 63.60	BBB = 63.60	Lower medium grade
Baa3 = 55	BBB- = 59.05	BBB- = 59.05	Lower medium grade
Speculative investment grade - low credibility - speculative risk			
Ba1 = 50	BB+ = 54.50	BB+ = 54.50	Non – investment grade - speculative
Ba2 = 45	BB = 49.95	BB = 49.95	Non – investment grade - speculative
Ba3 = 40	BB- = 45.40	BB- = 45.40	Non – investment grade - speculative
B1 = 35	B+ = 40.85	B+ = 40.85	Highly speculative
B2 = 30	B = 36.30	B = 36.30	Highly speculative
B3 = 25	B- = 31.75	B- = 31.75	Highly speculative
Extremely speculative investment grade - substantial risk (unacceptable)			
Caa1= 20	CCC+ = 27.20	CCC = 27.20	Substantial risk
Caa2= 15	CCC = 22.65		Extremely speculative
Caa3= 10	CCC- = 18.10		In default with little prospect for recovery
Ca = 5	CC = 13.55	CC = 22.65	In default with little prospect for recovery
	C = 9.00	C = 18.10	In default with little prospect for recovery
		DDD = 13.55	Non recovery
		DD = 9.00	Non recovery
	D = 4.50	D = 4.50	Non recovery

Sources: Lăzărescu(2000), Moody's(<http://www.moody.com/>), S&P(<http://www.standardpoor.com/>), and Fitch-IBCA (<http://www.fitchratings.com/>). *Note: The estimates belong to the authors, and ensure transfer of the scale from being qualitative to being quantitative. As can be seen, the steps / levels on the scales S&P and Fitch correspond up to substantial risk.

The data base for the external signal of the country risk rating started from the rating of the three major credit U.S. rating agencies, viz. Moody's, Standard & Poor's and Fitch, then adding Euromoney, which summarizes in its evaluation European thought (European investors are dominant in FDI entered in Romania).

The evolution of country risk rating and rating index in Romania, after 1996, according to the first three American agencies (reviewed in %), and Euromoney

Table no. 5

Year	Country risk rating in Romania* (reviewed according to the scale and hierarchy)			Country risk rating index in Romania (Previous year = 100%)			Country risk rating in Romania –Euromoney (ECR)			
	Moody's	S&P'S	Fitch	Moody's	S&P'S	Fitch	A variant - annual average	B.Variant	C.Variant	Index of C.Variant III Month
								Rating IX Month	Rating III Month	
1996	35	45.40	45.40	-	-	-	52.34	53.11	51.95	-
1997	35	45.40	45.40	100.0	100.0	100.0	52.00	52.96	51.65	99.4
1998	40	40.85	40.85	114.3	90.0	90.0	50.72	46.25	46.25	89.6
1999	25	40.85	31.75	62.5	100.0	77.7	38.13	36.85	36.28	78.4
2000	25	40.85	31.75	100.0	100.0	100.0	35.25	36.62	33.80	93.2
2001	25	36.30	36.30	100.0	88.9	114.3	40.17	40.50	41.14	121.7
2002	35	40.85	45.40	140.0	112.5	125.1	44.00	46.46	43.53	105.8
2003	40	49.95	45.40	122.3	122.3	100.0	47.46	49.76	46.25	106.2
2004	40	54.50	49.95	100.0	109.1	110.0	50.50	52.18	49.62	107.3
2005	50	59.05	59.05	108.3	108.3	118.2	51.54	50.61	51.95	104.7
2006	55	59.05	63.60	100.0	100.0	107.7	53.12	54.52	53.22	102.5
2007	55	59.05	63.60	100.0	100.0	100.0	56.40	57.12	56.55	106.3
2008	55	54.50	63.60	92.3	92.3	100.0	57.66	58.33	57.39	101.5
2009	55	54.50	54.50	100.0	100.0	85.7	56.00	55.00	55.88	97.4
2010	55	54.50	54.50	100.0	100.0	100.0	52.42	53.52	50.82	90.9
2011	55	54.50	59.05	100.0	100.0	108.3	50.72	51.51	49.09	96.6

Source: Moody's (<http://www.moody.com/>), S&P (<http://www.standardpoor.com/>), Fitch-IBCA (<http://www.fitchratings.com/>) and Euromoney (<http://www.euromoneycountryrisk.com/>). Note *: The rating of the agencies was recalculated on a percentage scale of 20 steps ranging from 0 to 100% for the agency Moody's, and 22 steps for the S&P, respectively Fitch, according to the number and hierarchy of the ratings declared methodology by each agency.

Conclusions

In the complex process of econometric modeling, the main restrictions that had to be overcome were related to ensuring comparability, selecting only one fairly substantial database for macroeconomic indicators, and building a database for the country rating by statistically converting qualitative information into quantitative information, the option for two types of data sets or series (of 13 and 14 terms), due to the construction of indices and the different order of magnitude of FDI values, relatively homogeneous since 1997.

As a paradox resulting from the variable analysis, prior to the modelling, it can be found that some trends in Romanian economy between 1996 and 2010 can no longer be found, on a medium-term, in the global ones, or are deeply offset in relation to global trends (FDI to global GDP, FDI to global gross capital formation, etc.), as highlighted, among other things, by the inverse relationship of some investment variable in Romania, analyzed in relation to world dynamics.

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