

**FINANCIAL INTEGRATION: A SENSITIVITY ANALYSIS TO MULTI-AGENT
PREFERENCES DECISION**

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Abstract

The aim of this research is to analyze the effects of the behavior of economic and financial actors on the measurement of international financial integration. The analysis is based on the application of the approach of decision support multiple criteria on a sample of 47 developed and developing countries. The results showed that the measure of international financial integration is dependent on the preferences and behavior of actors included in the analysis.

This dependence is confirmed by the sensitivity analysis applied in this article based on the ELECTRE method.

Key words: financial integration, behaviour, actors, sensitivity

I. INTRODUCTION

The last decades had a variety of crisis that began in Mexico in 1994, then, since 1997, it spread to all international financial markets. In this fact, it makes open the discussion about the architecture of the international system. The objective is to control the international financial instability by increasing the average of transparency and market surveillance. Under the pressure of financial and technological changes, countries are forced to liberalize their financial markets by a series of reforms of their financial systems. Some economists agree that the financial integration is necessary for the country because it allows them to earn benefits of the global economy. But for others, this integration is reinforced by international institutions to allow developed countries to take advantage of opportunities and benefits.

This phenomenon has quickly contaminated all developed countries, including European countries, where the most radical changes took place in the 1990s. La Porta et al. (1997, 1998) and Boughanmi et al. (2006)), in their studies on financial reforms, show that a country following a program of financial governance must satisfy stakeholders and any market participant (FDI speculators, households, banks, international institutions,). This encourages the Government to meet the demands of stakeholders: it is therefore here to endogenize the decisions taken by the different governments without denying the external constraints that governments are faced. This article identifies the relationship between the decisions of the governors and the behaviour of economic and financial agents. The approach used is multicriteria decision aid which this

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choice will be well explained. In what follows, we clear up firstly, the various actors in relation to the degree of international financial integration. Secondly, we build criteria for decision aid that reflects the value systems of these actors.

II. FINANCIAL INTEGRATION: MULTI-AGENT PHENOMENON

➤ Systems values multi-stakeholder:

The financial liberalization policies resulted in different actions of deregulation. But starting that there is not an optimal financial system, each governor have constraints of current and future situations of the economy. Indeed, his reaction is specific for its financial system. Political conflicts will therefore focus around which these actions because financial stakeholders will differ in their strategies and in particular in their choice of policies. We can distinguish four types of actors involved in the decision of the integration of financial sector: workers, investors, all international actors (such as a trade partners or international institutions) and government who arbiter between these different attitude.

- **The investor preferences**

On this directive, financial integration contributes to satisfy the interests of capital owners. In this fact, multiple markets, highly integrated with each other markets, allow capital owners to diversify risk while providing a better allocation of resources. A better financial integration by increasing the liquidity of stock markets, maximize easily shareholder value. According to Checchi (1996), financial integration has major consequence of lowering the cost of capital, which helps to increase the rate of profit. In this sense, the interests of investors go around this goal. It is possible for shareholders to reduce agency costs related to managerial control (Berle and Means (1932)) by the introduction of incentive mechanisms or by the establishment of a market for corporate control or either compensation arrangements such as stock options (Pagano and Volpin (2005)).

- **The workers preferences**

For the value systems of households, financial integration contributes to further weaken workers (Rodrik (1997)) by strengthening international competition, and more specifically for low-skilled workers. In addition, increased capital mobility may result many job losses in sectors highly exposed to international competition. Which is opposed to the values and ordinary workers reforms.

Investors, with their different types, want to maximize their profits. However, an increase in wages of workers results a decrease in the rate of profit. All these changes intended to increase shareholder value but also result high volatility for workers. It is therefore in the interest of workers, to maintain their power within the firm to avoid such a situation.

- **The value systems of international institutions**

Several studies have analyzed the different interactions that may exist between national and international

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policies. Putnam (1988) presents an analysis at two levels: the negotiations be taken in the international context are conditioned by the domestic political situation of each country and governments engaged in international negotiations are primarily occupied to meet the preferences of their constituents.

Thus, the coordination requires the application of convergent policies because the same objectives are similar, such as for example the construction of a regional zone (European Union). Quinn and Toyoda (2007) in their studies, suggest that the different international organizations can contribute and influence to set financial policies applied by the countries.

- **The preferences of governments: satisfaction conflicting behaviours**

Governments are constrained to satisfy any entity and actor by their local or international decisions. More specifically, the State is obliged to arbitrate between different heterogeneous preferences: Investors, households, international institutions and even the preferences of other governments to a single decision between countries. Indeed, the State shall arbitrate between conflicting objectives between economic entities. In addition to the attractive appearance of opportunistic local and international investors, financial liberalization policies also aim to increase economic efficiency and thus stimulate economic growth for the satisfaction of social welfare.

- **Governance and satisfaction conflicting preferences**

It is important to take into account the multidimensional nature of financial integration that depends on several micro and macro economic factors. The fact that economic, financial, social and political goals may conflict, financial integration can go together with a rise of conflicts that increase the risk for investors and reduces the attractiveness of capital.

Thus, governance strategies imposing actions deregulation or regulatory is taken through a balancing game between national objectives: employment, political stability ... and attracting foreign capital (FDI, speculators ...).

By the above paragraph, we have shown the existence of relations between actors' behaviour and the phenomenon of financial integration. In addition, these behaviours are characterized by conflicting preferences: for investors, their goals are the competitiveness and profit maximization which is almost conflict with the preferences of workers and households aim to maximize wages and employment. Also, governors generally tend to share with compromised actors (international institutions, investors, households and objectives of the State).

From this result, we present the second part of this article, a methodology to measure financial integration taking into account these constraints. Indeed, the objective is the construction of a model for aid to interpret and decide and implement governance strategies. Therefore, the methodological aspect is crucial for the method to be used must be specified. In what follows, our choice is based on multi-criteria approach to decision aid because it can incorporate conflicting values systems.

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III. FINANCIAL INTEGRATION: PREFERENTIAL SENSITIVITY

Decision-making situations began in the multidimensional and consisting of various aspects which is difficult to be reduced to a single dimension. This situation has led to the birth of a new approach, known as the multicriteria paradigm, multicriteria analysis or multicriteria decision aid. Multicriteria decision aid allows us to consider different points of view of the decision maker that no longer seeks the optimum of a single goal, but a satisfactory compromise in achieving several objectives can be conflicting.

Just after a period characterized by a pattern of thinking based on a concept of pure rationality, appears one based on the concept of limited rationality. This new pattern of thinking is based on a philosophy of satisfaction ("satisficing") where the notion of adequate solution or satisfactory compromise, replaces the optimal solution who Brans (2002) has described as unstable and fragile. In this context, our research is based to study the link between financial actor's preferences and measurement of financial integration. Indeed, by the application of multicriteria approach and methodology of Roy B. (1983), we obtained that the measurement of financial integration is based on 15 criteria, which form a coherent family:

TABLE I. COHERENT FAMILY OF CRITERIA

Code	Criterion
g₁	Trade openness
g₂	Financial development
g₃	Internal integration
g₄	The flow of foreign capital
g₅	Tax policy
g₆	economic growth
g₇	Deregulation
g₈	The volatility of exchange rates
g₉	Monetary Freedom
g₁₀	Vulnerability to shocks
g₁₁	The convergence of inflation
g₁₂	The political situation
g₁₃	The external debt
g₁₄	Transparency of information
g₁₅	Freedom Business

Taking into account the preferences of actors will be modeled within multi-criteria approach by the inter-criteria information (weight) and intra-criteria (discrimination thresholds). Furthermore, these thresholds form the pseudo-criteria include the indeterminacy and vagueness in the assessment of performance of countries sampled. The evaluation of financial integration based on multiple criteria and based on conflicting preferences will be submitted by the ELECTRE method based on outranking relation. Our problem is to rank countries according to their degree of financial dependence firstly. Second, we vary inter-and intra-criteria information In order to fully validate test if there are any connections between the behaviour of decision makers and measuring financial integration.

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➤ **International classification according to the degree of financial integration: Application of ELECTRE III method**

The multicriteria process has certain prerequisites: First, the fixing of actions (sample of 47 countries). Second, the analysis of the problem must be based on various criteria (criteria 15 built). Finally the intra and inter information criteria: These criteria haven't absolute discriminated power. Indeed, the corresponding values at 1% and 3% of the range of observations will help us to define the criteria that are the indifference threshold (q) and the preference threshold (p) information.

As for the weighting, we used the resistance matrix of Bruen and Rogers (1998) to express the dominance of criterion to another. This group of pair wise comparison produces a symmetric matrix which assigns a score to each criterion. The conversion of scores normed in weight is then a simple calculation of proportionality. Finally, we obtain the following information:

TABLE II. DISCRIMINATION THRESHOLDS

code	g ₁	g ₂	g ₃	g ₄	g ₅	g ₆	g ₇	g ₈	g ₉	g ₁₀	g ₁₁	g ₁₂	g ₁₃	g ₁₄	g ₁₅
q	7,04	1,71	0,73	0,29	0,21	0,14	0,04	0,04	0,28	0,41	0,25	0,05	2,25	0,04	0,62
p	3,52	5,13	2,2	0,86	0,63	0,43	0,12	0,13	0,85	1,23	0,76	0,14	6,74	0,12	1,85
weight	5	5	1	4,1	2,1	5	2,1	4,1	2,1	1	2,4	5	5	2,1	5

This method is used when the decision maker is able to present his preferences weighting pseudo criteria. In order to classify these actions, the first objective of this method is to calculate an indicator called degree of credibility. It express, for any pair of countries (a, b), what is the degree of credibility that can be given to the proposition « a is at least as good as b ». The affirmation of the outranking relation is based on two indices: concordance and discordance.

The exported data in the ELECTRE III software allow give upgrade relations with countries in varying degrees. We will be interested in what follows the ranks of countries.

TABLE III. RANKS OF COUNTRIES

Category	Country	Ranking
C1	Chile	1
	Singapore	
	Qatar	2
	A. Saudi	3
	Emirate	
	Sweden	
	Morocco	4
	Bahrain	5
	Thailand	
	Switzerland	

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	Norway	
	Canada	6
	South Africa	
	Mauritania	
	Oman	
	China	7
	Colombia	
	Germany	8
	South Korea	
	Israel	
	Jordan	9
	Mexico	
	Nigeria	10
	United. K	
	Tunisia	
	Czech	11
	Belgium	12
	Spain	
	Kuwait	
	Turkey	
	France	13
	Portugal	
	United. S	
	Poland	
	Russian	
	India	14
	Japan	
	Romania	
	Algeria	15
	Brazil	
	Lebanon	
	Argentina	16
	Venezuela	17
	Egypt	
	Italy	18
	Syria	
	Greece	19

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Of these results and rankings, we get the following interpretations:

- For Africa, we took a number nearly equal to 10% of the sample to determine the situation of countries in terms of financial integration. Indeed, these are usually found between the last two categories (low and moderately integrated countries). This is due to the fact that the financial systems of African countries are in recent generation and their majorities represent deficiencies of product offerings.

- As Asian countries (China, India, Japan, Thailand, Singapore,...), their affiliation to the first category (moderately integrated and highly integrated) is the result of the regional development and especially by their high trade openness.

- A third part studies the financial integration of the countries of Latin America: The application of the model shows levels of integration for the countries of America. Those who are weakly integrated or quasi-weakly integrated (countries that occupy the last positions of the category of moderately integrated countries) such as Venezuela, Argentina, Brazil. These countries have generally learned from recent crises such as the crisis in Argentina in 2001 and the devaluation of the Brazilian real in 1999. These events have led governments to restructuring to their savings decisions at macro and micro levels.

- The fourth part is studying those countries of Europe. Indeed, by studying the position of countries by degree of financial integration, we find that those countries are spread in three predefined categories. We find in a better classification, Sweden who has taken the lesson of the crisis in the 90s, and can be taken as an example. A variety of positions were caused by many reasons including structural heterogeneity.

Each country of the classification made above, can be a source of debate and governance decisions or remediation of economies shares by financial agents. In this sense, we applied previously the preferences referring mainly the weights of criteria that reinforce the behaviour of decision makers who wish to intervene for regulations on the levels of monetary policy, debt, commercial...

In what follows, we opt sensitivity analyzes aimed to study the fragility of country rankings when we change preferences. This change is simply other behaviours makers other than controllers (governors...) such as investors, speculators ... who have an interest in making decisions of international portfolio diversification...

➤ **Analysis of the sensitivity**

According to Insua (1999), the sensitivity analysis aims to determine how the results of a quantitative analysis based on the input parameters. In the following, we adopt two sensitivity analyzes: change of the importance of criteria and sensitivity thresholds preferences. Both analyzes allow us to validate if there is a link between behaviour change-maker with the measurement of financial integration.

- **Sensitivity to the importance of the criteria:**

According to this set of weights, which represents the preferences of actors to make decisions based on their objectives and based on their attitudes towards risk, we get the results below. We will choose 3 sets of weights characterizing different behaviours:

- P0: behaviour whose important criteria measure financial and economic soundness of a country
- P1: Behaviour whose important criteria give their names to the attractiveness of a country's physical investment.

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- P2: Behaviour whose important criteria give importance to the attractiveness of arbitrage traders.

TABLE IV. VARIATION OF WEIGHTING

Code	Criterion	P0	P1	P2
g ₁	Trade openness	5	1,9	1,4
g ₂	Financial development	5	2,5	4,6
g ₃	Internal integration	1	1,2	1,6
g ₄	The flow of foreign capital	4,1	4,3	4,6
g ₅	Tax policy	2,1	3,4	3,1
g ₆	economic growth	5	1,9	2,1
g ₇	Deregulation	2,1	4,3	4,6
g ₈	The volatility of exchange rates	4,1	4,1	4,2
g ₉	Monetary Freedom	2,1	3,5	3,1
g ₁₀	Vulnerability to shocks	1	4,5	5
g ₁₁	The convergence of inflation	2,4	1,9	2
g ₁₂	The political situation	5	5	4,4
g ₁₃	The external debt	5	1	1
g ₁₄	Transparency of information	2,1	4,1	4
g ₁₅	Freedom Business	5	4,1	3,5

According to this set of weights, we accomplished the following results:

TABLE V. RESULTS ACCORDING TO VARIATION OF WEIGHTING

Country	Rank 0	Rank 1	Rank 2
Chilli	1	2	2
Singapore	1	1	1
Qatar	2	3	3
A. Saudi	3	4	2
Emirate	3	2	2
Sweden	3	5	4
Morocco	4	7	8
Bahrain	4	6	5
Thailand	5	11	9
Swiss	5	7	5
Norway	5	5	5
Canada	6	6	6
South .A	6	10	9
Mauritania	6	10	11
Oman	6	8	7
China	7	14	11
Colombia	7	11	13
Germany	8	8	8
South Korea	8	10	11
Israel	8	12	12

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Jordan	9	15	10
Mexico	9	7	13
Nigeria	10	12	12
R. Unie	10	9	7
Tunisia	10	17	12
R .Czech	11	13	13
Belgium	12	13	7
Spain	12	15	12
Kuwait	12	11	15
Turkey	12	16	14
French	13	9	7
Portugal	13	9	10
U. kingdom	13	16	14
Poland	13	17	16
Russia	13	18	16
India	14	20	16
Japan	14	9	8
Romania	14	19	17
Algeria	15	19	17
Brazil	15	18	14
Lebanon	15	17	15
Argentina	16	21	18
Venezuela	17	22	19
Egypt	17	24	19
Italy	18	20	18
Syrian	18	23	20
Greece	19	22	20

The sensitivity study of the importance of criteria in the model assessing the financial integration of countries shows different classifications according to the difference of the value system of actors intervening in the decision. Indeed these results dictate that the behaviour and objectives of a system for values of a state governor is conflicting with a system of values of an international investor.

- **Sensitivity of thresholds preferences**

In this section, it is to vary the discrimination thresholds (indifference and preference). Changes will be in two levels:

- ✓ The first change will be an increase of 0.5% of calculating the thresholds of indifference and preference (q1 is equal to 1.5% of extend and p1 is equal to 3.5% of extend)
- ✓ The second change is another increase of 0.5% of p1 and q1 thresholds. (q2 is 2% of the extent and p2 is equal to 4% of the extent)

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TABLE VI. VARIATION OF DISCRIMINATION THRESHOLDS

	g1	g2	g3	g4	g5	g6	g7	g8	g9	g10	g11	g12	g13	g14	g15
q ₀	3,52	1,71	0,73	0,29	0,21	0,14	0,04	0,04	0,28	0,41	0,25	0,05	2,25	0,04	0,62
p ₀	7,04	5,13	2,2	0,86	0,63	0,43	0,12	0,13	0,85	1,23	0,76	0,14	6,74	0,12	1,85
q ₁	5,28	2,57	1,1	0,43	0,31	0,21	0,06	0,07	0,42	0,62	0,38	0,07	3,37	0,06	0,93
p ₁	12,3	5,99	2,57	1,01	0,73	0,5	0,14	0,15	0,99	1,44	0,88	0,16	7,87	0,14	2,16
q ₂	7,04	3,42	1,47	0,57	0,42	0,28	0,08	0,09	0,56	0,82	0,5	0,09	4,49	0,08	1,23
p ₂	14,1	6,84	2,94	1,15	0,84	0,57	0,16	0,18	1,13	1,64	1,01	0,18	8,99	0,16	2,47

The change in discrimination thresholds in both steps mentioned above, allows observing changes at the country rankings:

TABLE VII. RESULTS ACCORDING TO THE VARIATION OF DISCRIMINATION THRESHOLDS

Country	Rank 0	Rank 1		Rank 2	
Singapore	1	1	▶	1	▶
Emirate	3	4	▼	4	▶
Chile	1	1	▶	1	▶
A. Arabia	3	2	▲	2	▶
Qatar	2	3	▼	3	▶
Sweden	3	4	▼	4	▶
Norway	5	6	▼	6	▶
Switzerland	5	6	▼	7	▼
Bahrain	4	5	▼	5	▶
Canada	6	7	▼	9	▼
France	13	15	▼	15	▶
UK	10	7	▲	8	▼
Belgium	12	12	▶	12	▶
Oman	6	9	▼	8	▲
Germany	8	8	▶	10	▼
Japan	14	15	▼	16	▼
Morocco	4	5	▼	5	▶
Thailand	5	5	▶	6	▼
South Africa	6	7	▼	7	▶
Portugal	13	15	▼	15	▶
Jordan	9	8	▲	8	▶
Mauritania	6	6	▶	7	▼
China	7	6	▲	8	▼

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South Korea	8	9	▼	10	▼
Spain	12	13	▼	13	▶
Israel	8	10	▶	9	▲
Nigeria	10	11	▼	11	▶
Tunisia	10	10	▶	10	▶
Czech	11	8	▲	9	▼
Colombia	7	7	▶	7	▶
Mexico	9	8	▲	10	▼
E. USA	13	14	▼	14	▶
Turkey	12	15	▼	15	▶
Brazil	15	20	▼	20	▶
Lebanon	15	17	▼	18	▼
Kuwait	12	12	▶	11	▲
India	14	18	▼	17	▲
Russia	13	15	▼	16	▼
Poland	13	16	▼	16	▶
Romania	14	16	▼	17	▼
Algeria	15	16	▼	19	▼
Italy	18	19	▼	19	▶
Argentina	16	19	▼	19	▶
Venezuela	17	20	▼	20	▲
Egypt	17	21	▼	21	▶
Syria	18	21	▼	22	▼
Greece	19	22	▼	23	▼

From these results that measure the sensitivity thresholds preferences of decision makers on the results, we interpreting that behaviourism has an effect on the results. Indeed, a decision maker is more risk averse and sensitive to small changes in the levels of criteria, unless he finds ex eco at country rankings. Instead, the decision maker is less sensitive to the results, the more he will be indifferent in the choice and ranking of countries.

Therefore, it is important to take the system a value decision maker for him to build a decision support model. Indeed, despite a total rationality of actors and their belonging to the same category (state governors, investors,) individual preferences can influence the results giving an individual decision that meets its objectives.

IV. CONCLUSION

This article focuses on the behavioural component of financial actors in their assessments of the degree of international financial integration of the countries. Indeed, by the application of multi-criteria decision aid

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approach and more specifically by the sensitivity analysis (changing discrimination thresholds and change the weights of the criteria that represent stakeholders value systems in the evaluation financial integration), we showed that the value systems (preferences) policymakers influence the results of the evaluation of financial integration. Indeed, the results of the integrated country rankings change with the changing preferences of the categories of decision-makers considered. That is to say, the evaluation of degrees of financial integration constraint value considered system.

Moreover, if we follow the rationality of decision makers in the same category (investors or households or governments), we find different assessments of the degree of integration of the countries. Therefore the degree of financial integration is dependent on the rationality of the decision maker and his risk aversion.

In summary, our financial integration evaluation model is a multicriteria decision aid allowing introducing any behaviour to present specific results. Indeed, these results, may each decision maker propose its decisions to achieve its objectives and therefore its specific preferences: governance decisions for governor, or investment for an investor...)

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