The Global Single and Regulated Market Framework of Financial Products and the International Economic Policies: Mathematical Approach of the Model

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Abstract

This research paper examines whether and how much the regulations through the Community Directives and Regulations at European level as well as the laws which govern Money and Capital Markets in the United States helped, strengthened, protected the international financial system, if other markets were developed by moving transactions and if they contributed to the change of the world economic circles. The investigation of the impact on investors and national jurisdictions, namely, whether they are protected and whether all the factors in the system are affected, has concluded that the realization of a actually international single regulatory framework for all financial products is far away from reaching its ultimate and realistic achievement. However, the theoretical existence of a unified regulated market framework and model of organized markets, as long as, with a set of regulatory, organizational and economic policies that will shield it up to the point of a balanced regulation, offering equal information to the participants, with less transaction costs and thus increased transparency, liquidity and reducing market abuse cases and manipulation, is proved as feasible and can be implemented.

Keywords: single regulated framework, surveillance, dealership, auction, financial products, world supervisory authority

1. Introduction

The efforts to make economic policy interventions in connection with market regulation are the challenge in our days, whether and how they can interact with each other and depict their effect on the economic reality. Market efficiency and price transparency are factors that reflect economic prosperity. Even the involvement of financial institutions in these systems must be seen in the regulatory context of increasing their competition and offering higher levels of service to final customers. The conclusions of our research paper have led us to adopt the notion that the logic of making specific economic policy decisions must always be in line with the international market environment.

The overriding task of international financial regulation is to minimize the systemic risk arising from the operation of capital and derivatives markets. At the same time, the regulator authorities must avoid creating a risk of non-ethical behaviour. It is vital to provide protection against the failure of private companies, which jeopardizes the effective operation of the market as a whole. However, stockbrokers and financial intermediaries that make bad decisions should be allowed to fail.

A strong political support for the efforts of the supervisory authorities is important if we are to succeed in providing an effective communication network between the European Union supervisory authorities and the other international supervisory centers. This network must adopt innovative means of communication to address co-operation between home and host supervisors and to strengthen a common supervisory culture. The next impact of political developments on European economic issues, is another target, which needs further research.

The important procedures of a World Supervisory Authority regarding the harmonization of law cases (EU Directives and Regulations, US legislation), standards, recommendations and consultations (by BIS, IMF, FSB, ISDA etc), its supervisory means, its authorizations or consents, the consultations with market participants, the

incorporation of new financial products into the single framework and, more generally, the management of responsibility, the smooth functioning of a single framework, are certainly fields for additional research.

In the same research context, we also mention the concentration and attempt to resolve barriers, products' unification and trading, liquidation, etc., between the Western-style financial markets and products and the Islamic markets and products covered by Sharia'a.

2. Methodology of Research and Literature Review

In our methodology, we've studied initially the new global financial environment and its operating and influence factors, the role of the central banks, the role of the state in the activities of financial institutions and the role of financial products in the existing frameworks, as long as, with the existed national and international economic policies. We focused on the existing national and international economic policies in order to end-up with conclusions from these policies.

The institutional and operational role of financial products has already be studied and how they behave alongside the basic arrangements of the international financial system and the other components (markets, institutions and money).

Then, we analyzed the trend to a single regulatory framework, on the basis of the above approaches and we described it by divided it into two main stages: a set of proposals for a consolidated view of the regulatory framework for all financial products and a general description of the Single Regulatory Framework (the model "Theoretical Model of the Unified and Regulated Market" – or "The.M.U.Re.M." as will be used interchangeably in this paper) and its related interfaces with the international regulatory systems and jurisdictions.

After that, and based on our methodology, we will desribe the structure of the single regulated framework, i.e. the proposed model of the unified market for financial products (The.M.U.Re.M).
Then, the intended result of the policies will be presented, emphasizing important conclusions regarding the transparency of the markets, the liquidity, but also the important role of the human factor for the implementation of the projects and the management of individuals through innovation and technology processes as well as additional research fields.

At the end (Appendix) we'll present the mathematical proof and of the existence of the theoretical model of the unified and regulated market of financial products with its advantages, the realization of which could be achieved (so as not to remain in the theoretical sphere), through the necessary policies (institutional, operational and financial) at national and international level, as already mentioned.

In our methodology we made an analysis and a review of the international literature.

The increasing globalization and intensifying regional and operational co-operation have created a greater interest in the role of international organizations and, by extension, once they have played an important role in global governance as a kind of government with "super-powers", there is more and more willingness, for transferring to them more competencies or for a need for cooperation with them [Joachim Jutta, 2008].

The common difficulty of international organizations [J.C. Sharman, 2008], in the attempt to develop institutional changes, for credit institutions and the protection of markets and investors, is basically the lack of appropriate tools to give them the appropriate incentives (or even disincentives). As an example, we mention that the Financial Stability Forum (FSF), the OECD and the Financial Action Task Force (FATF) since 2000 have been pushing the governments of all non-tax havens to reform their tax regimes on a blacklist institutions that do not comply with tax standards. Thus, in fact, there appears to be no institutional and international "tool" or organization (except for the "blacklist") that works effectively.

Carlin Bruce (2009) states that given the importance of excellent guidelines in the retail markets and the fact that financial institutions in the process of providing such advisory services are using outsourcing, who should be the legal rules that will maximize the financial markets social wealth? This question was addressed (Carlin Bruce) by creating a theoretical retail financial model, where the firm and the broker face a dilemma of action, where they try to satisfy customers in this market. All market participants are rational and financial product prices are based on the firm's belief that the actions taken by the company and the broker are balanced. The model analyzes the best distribution of legal obligations to all market participants. An analysis is also provided on how complexity in customer management and conflicts of interest can affect the law. Ultimately, it turns out that the impact is greater on wealth creation, given that the markets are sufficiently large.

At the same time, the supervision of financial institutions has developed to a great extent in complexity for three main reasons [Mikdashi, 2003]: initially because financial institutions tend to use business strategies combining

multiple sectors (banking, insurance, stock market), secondly, the specific products handled by these organizations have been associated with high risk/performance relationships, requiring adequate control and management and thirdly, the cross-border difference in the activities of these organizations has caused several problems (in time gathering and transfer of data, use of commonly accepted accounting and other measurement methods, cross-border effectiveness checks).

With the liberalization of the financial markets, the prices of financial assets from different regions are in fact equalized (apart from the different transaction costs), while the negotiators in different regions will have access and the possibility of trading from also different regions but also the possibility to decide to borrow, invest and offset the risk. In effect, the result is an increase in availability and diversification, resulting in the independence of investment decisions and, moreover, the investment position can be adjusted smoothly and offset current imbalances [Key, S.J. 2009].

Dale (1993b) adds that deposit insurance may be declining in those countries where other forms of intrusive supervision to protect depositors are being used. However, these alternative protective interventions, which are likely to distort competition, can be eliminated mainly by national (or international) policies with significant standards, which are difficult to implement at the present time.

Iqbal, M. and Molyneux, P. (2005), report in parallel that the Islamic financial industry has similar characteristics to conventional funding, albeit with some differences. Similar to conventional institutions, Islamic banks fulfill the role of an intermediary among depositors and users of capital. Therefore, they allow society to maintain a reasonable rate of economic growth. However, an Islamic bank will have to comply with the principles outlined in Sharia'a. This means, for example, that an Islamic bank should follow moral guidance as well as avoid charging and receiving interests (riba), unnecessary uncertainty (gharar) and speculation (maysir).

Pagano and Röell (1996) demonstrate the high correlation between the degree of transparency and the increase in transaction costs. In markets where there is greater transparency, liquidity is rising, due to the reduction in opportunities that would benefit some operators as opposed to others with less information. They compared the process of price formation to different trading systems with different degrees of transparency.

These trading systems that were inspected (in Pagano-Röell's above-mentioned study) were ***either*** *dealership markets, where dealers exist (interbank, bilateral)* ***or*** *auction markets (secondary markets, with multilateral trading and with brokerage platforms).* They also concluded that greater transparency produces lower transaction costs for traders on average, although it is not necessary for some trading sizes to apply. Additionally, the strategy followed by each trader is an endogenous piece and does not affect their case. They have not answered, as they say (pp. 597), whether the above applies to even more general and consolidated markets (at least in a theoretical-mathematical model), whether in a unified system of markets and financial products, there are even less costs and consequently greater liquidity due to the transparency and the better (due to product integration) and equal dissemination of information to traders (using the same trading strategy on these consolidated trading platforms).

The Pagano and Röell study, saying that the traders' strategy is endogenous and does not affect product price spreads and liquidity, was based on a previous study by Glosten-Milgrom (1985), which also proves it, but only for fixed trading orders size (pp 590). Easley-O'Hara (1987) had additionally proven (this said by Pagano-Röell) that an increase in liquidity exists due to the transparency and equal information of traders, but to the auction market (multilateral trading , secondary market) which is even greater (pp 593).

In particular, the above study is important in this research paper, in order to prove additionally based on Pagano-Röell's work, that in a unified and regulated market model (i.e. an auction market with also a dealer market together), there is an even greater reduction in transaction costs for the average and equally and uniformly informed trader and hence greater liquidity through increased transparency. This unified model should be described by an institutional framework (product and supervisory rules), and implemented through specific international (or supranational) and national policies.

3. The Construction of a Single and Regulated Market Framework for the Financial Products

We suggest a consolidated view of the regulatory framework for all financial products. This single (unified) and regulated market framework will take into account:

- the need to ensure that independent regulators consistently enforce the rules, particularly with regard to combating economic crimes,
- the need to encourage innovation in the financial markets, in order to be dynamic and efficient,

- the need to ensure market integrity by carefully and actively monitoring of the financial innovations,
- the importance of reducing capital costs and the increasing access to capital,
- the long-term cost-benefit balance of all implementing measures for market participants (including small and medium-sized enterprises and retail investors),
- the need to promote the international competitiveness of financial markets, without prejudice the particularly necessary expansion of international cooperation,
- the need to ensure consistency with existing legislation, because any imbalances in information and lack of transparency may jeopardize the functioning of markets and, above all, harm the interests of consumers and retail investors.

The Single Regulatored Market Framework will follow, also, the following principles:

- to ensure investor confidence in the financial markets by promoting a high level of transparency in the financial markets,
- to provide investors with a wide range of alternative investments and a level of publicity and protection tailored to the circumstances,
- to ensure a high level of transparency and consultation of all market participants within the EU and the other international regulators,
- to achieve a level playing field for the activity of all market participants by introducing regulations at international level where necessary,
- to respect differences in national markets when they do not unduly detract from the coherence of the international market.

Major characteristics of the proposed Single and Regulated framework:

- Cross-border co-regulation at geographic levels, on products and market participants,
- The concept of "*unified regulation*" of the theoretical model of "*consolidated*" financial products (of the two markets: Dealership and Auction),
- Resolving restrictions at national level on the activity of dealers and market makers (Giovannini barrier no. 10),
- Settlement of disputes (within the single regulatory framework) of the legal handling of bilateral clearing and collateral of financial transactions and the general uniform application of national laws regarding the regulations on conflict of laws (Giovannini barriers no. 14, 15),
- Required technical infrastructure (global 24h trading venues, OTC products' trading),
- Linking products of the organized stock market and the interbank bilateral market (market traders vs dealers) at a legislative and technical level,
- Institutional - Functional requirements for the intermediaries in the Single Regulatory Framework (institutionally speaking, these roles of intermediaries should be strengthened through institutional and regulatory case laws by national and supranational authorities),
- The balanced relationship between the single regulated framework with financial products and the Islamic financial markets,
- Levels of prudential supervision of the single and regulated trading framework, participant and product relationships with regulated markets,
- Legislative status (through directives, regulations, national legislation) and the role of CRAs. Institutional and operational procedures and difficulties. Publication of directives, regulations and national laws.

Advantages of the The.M.U.Re.M.:

- Reduction of the final transaction costs of investors,
- More professional and integrated management of investor portfolios management,
- Greater diversification of investment options (and therefore risk spreading),
- Better control of the spillover effects on the markets with interbank and listed financial products,

- The through high-performance IT applications, detection of market abuse, which will give greater confidence to the investing public.

Disadvantages of the The.M.U.Re.M.:

- High cost of creating trading systems, for market abuse control and risk management,
- Cost of changes in the operating systems of clearing, reconciliations, internal control and accounting, of the products, given that an intermediary can now trade on both markets (dealership and auction),
- A higher level of knowledge of traders is required, which should have a direct understanding of all products,
- Higher level of investor education (both private and institutional) for the products of both markets.

4. The Implementation of International Economic and Non-economic Policies to Support the Framework

The design of an international governance structure to effectively regulate systemic risk in international financial markets, which could maximize the social advantage for open global financial markets, should be based on principles, which in turn will be the foundations for an international financial architecture. Namely:

- An overall knowledge of the social costs of externalities of the systemic risk, particularly of its macroeconomic impact, should be considered,
- The homogeneity of market behavior should be seen as a threat to liquidity, especially in periods of high volatility, when there are breaks in international cooperation agreements,
- In order to strengthen the stabilizing force provided by international cooperation agreements, they are required several stages of preparation,
- Due to the fact that financial markets are nowadays international, the policymaking and their implementation must also be implemented at international level, and
- Decision making at international level and setting standards should be effective in designing effective regulatory principles and also responsible for market transparency and decision-making divisions of supervisor authorities. They must also be sufficiently and legally valid, to the extent that all countries can assume responsibility for ownership, for the standards they adopt.

There are issues to be mentioned about ***regulatory changes*** and ***challenges***, the proposed supervisory framework and the related policies. Policies are indispensable in terms of the emerging trend (with its positive and negative effects) of unifying the regulatory framework for financial products.

(a) The first challenge concerns the *sharing of relevant information*. For a Financial Group operating cross-border, the number of supervisory authorities is increasing. As a result, shared information to supervisory authorities has slower acquisition rates. Also, the functional structure of such groups is much more complex than groups operating at national level, and therefore the analysis and collection of information is more difficult. The same concerns the application of their supervision, which becomes more complicated. If such a group, has all its credit obligations or facilities in a single country, it is difficult for a supervisory authority in another (in consideration) country to assess the risks if it can not implement effective supervisory cooperation and exchange of information.

(b) The second challenge is related to the *increase of conflicts of interest*. Problems in financial groups can be very costly and the final guarantee for financial stability can only be given by the government, given that the government has such responsibilities (i.e. on taxation). But in most countries, deposit-guarantee schemes can fund solutions to such problems when they are related to smaller companies. If there is a systemic issue, the government is the one which is responsible to intervene. In particular, in the cases of cross-border groups, the question still remains: to what extent is it desirable and tolerable for taxpayers of a country to effectively support the depositors of another country? But also the depositors of this second country, to what extent will they wish to rely on the future support of taxpayers of the first country? A similar conflict of interests exists in the case of banking groups restructuring.

(c) The third challenge concerns the *success in shared management and crisis assessment*. In Europe, there is an agreement to share views and considerations when there are financial crises. This is not enough. In the event of a crisis, the most countries are more likely to come up with assessments and policies that will support their national interests. Therefore, the current supervisory framework involves the risk that ending up and common assessments and policies will be time consuming, while time is an important but inadequate source in crisis management situations.

(d) The fourth challenge concerns the *coordination of decisions between supervisory authorities*. For cross-border financial groups, where there are several supervisory authorities, finance ministries and central banks, it is complicated to achieve such coordination in a timely manner. Even the linguistic differences and the differences in legal regimes intensify the problem. It is also exacerbated by interdependencies between countries, because the decisions of a country's supervisory authority may have an impact on several other countries.

(e) Inadequacies and differences in national insolvency frameworks also create legal uncertainty, barriers for recovering the value of credit institutions and obstacles to effective restructuring of viable companies in the EU, including cross-border groups.

In the above challenges, the following policies (economic and institutional) are also proposed:

(i) a first policy at national and international level is the signing of Memoranda of Understanding (MoUs) between the supervisors of different countries. These agreements are only a beginning. Essentially, we also need general standardized contracts between financial entities, especially for product transactions that are not traded in organized trading platforms established by legal rules (as provided by MiFID I and MiFID II Directives). However, these contracts (essentially their templates) must be issued and handled by supranational supervisor authorities rather than associations and private organizations (Note 1).

(ii) a second policy is to increase the share of responsibility of the country of origin by giving it additional supervisory powers not only for cross-border and international financial groups, but also for its foreign subsidiaries. A supervisor authority could undertake the gathering of information, the making of joint assessments and the coordination of decisions, either at the level of the subsidiaries of the cross-border groups or at the level of the group. But the problem of conflicts of interests continues to exist.

(iii) a third policy is the establishment of supervisory colleges. The idea is to create specific standing committees for each separate financial cross-border group, with representatives from the related audit and supervisory authorities (Note 2).

(iv) a fourth policy is the extension of the supervisory powers of the authorities of the country of origin (cross-border groups), whereby certain specific mandates from supranational organizations (i.e. the EU) take into consideration the other countries (countries hosting the activities of the groups) their supervisory authorities, their decisions and assessments and having a say in dealing with problems within host countries. This is likely to create difficulties, as national supervisors have been appointed by national governments and they’re accountable to them. It is difficult to see how the supervising authority of the host country could make the supervisory authorities of the country of origin, to make them responsible for taking those decisions, especially if the impact of the decisions concerns the host country.

(v) a fifth policy is the establishment of a supranational supervisory authority (i.e. at EU level, if we refer to Europe), which will have both the *mandate* and the *responsibility* for overall supervision at this level, of the cross-border groups, which responsibilites will have been transferred to it by the Member States. The creation of a European Securities and Exchange Commission, for example, in the supervision of secondary markets, with real powers, decisions making on crisis and situations, etc (Note 3). This policy proposal, of course, has some issues of political considerations, because it will essentially transfer a part of national sovereignty to a European level.

(vi) a sixth policy, it should be, the existence of a minimal international auditing, supervisory framework, which deals with deposit guarantees. It is sufficient that it be accompanied by agreed powers, to the supervisors, of the country of origin of the cross-border banking group so that it can take responsibility for centralized oversight (of the group at national and international level).

(vii) as a technical policy proposal, we also suggest the creation of a global secondary market of securities on a 24-hour basis. The rapid growth of securitizations, IT advances and the high degree of cross-border mobility of investment funds, have increased the international *supply side* of the secondary market industry. There is an urgent need for the development of a

scheme that will support the international *demand side*, before the time at we consider that the "end of Geography" and the regulatory implications, have taken place.

(viii) a policy of the creation of *mutual recognition agreements* and *Memoranda of Understanding* (MoUs), should be continued between national regulatory authorities but should not be regarded as substitutes of a lower value, compared to the harmonization of regulatories, but as valuable regulatory tools that have autonomous legal value and power.

(ix) an additional policy of eliminating restrictions at national level regarding the legislation on withholding taxes, which has as result the disadvantage of foreign intermediaries, since the local intermediaries can deduct them. All financial intermediaries established within the EU (initially) should be allowed to offer brokering services (with the advantage of tax deduction of withholding taxes) to all Member States in order to ensure an equivalent level of competition between foreign and local intermediaries. In order to implement this policy, the responsibility lies within national governments and should be coordinated by the European Council (in the case of the EU). Moreover,

(x) policy to eliminate differences in the legal treatment of netting and to eliminate disputes over conflicts of laws in the rights of securities. Although the *EC Directive on financial collateral arrangements* (2002/47/EC), which establishes an effective and simple regime for the provision of financial instruments or cash as collateral, (while protecting them from some of the effects of insolvency), there is no harmonized legislation applicable to rights relating to securities held within an intermediary as a collateral. It is provided that the property rights in relation to securities held by an intermediary are deemed to be subject to the legal system chosen by agreement between the account holder and the intermediary. Thus, the different legal systems do not ensure a uniform use of rights on collateral, combined with a different interpretation of netting (especially under the bankruptcy law of each country), there is a problem with the use of collateral, for cases of insolvency between counterparties, which makes vulnerable, in times of crisis, a large part of the financial system.

(xi) policies for the elimination of *conflicts of law principles* (Giovannini's barriers n. 14, 15, which are also existed at international level). More specifically, regarding the uniform application of the Hague Securities Convention, 5th July 2006 and the Directive 2002/47/EC, in addition to the signing of the Convention by the EU Member States, it should be accompanied by specific political guidelines from the EU. In fact, the EU it should recommend to the Member States to give directions in turn and to implement policies whereby investors based in a Member State of the EU, to sign agreements with intermediaries (who are also domiciled in the same or other Member State) for the rights of their securities and who have deposited them with an account of the said intermediary (whose account is also in a Member State), to recognize (the investors and intermediaries concerned) *that the applicable law (for the rights of the securities) is of the country the account is located*. If the intermediary's account or the intermediary himself is located outside the EU (or the investors concerned), then in the agreements signed by the investors with the intermediary concerned, should recognize that the *applicable law* (for the rights of the securities) *is of the country that will agree on the signed contract between them*. Essentially, this policy applies to the Hague Convention, but ***only*** in the case where either the investors or the intermediaries (the accounts, actually, in which the investors' securities are deposited) are outside the EU. If they are all within the EU (investors, intermediaries), the applicable Directive (applicable law) applies.

(xii) policies for eliminating barriers (Giovannini barrier n. 10, which is also existed at international level) in the single regulatory framework so that there is a unified participation of Primary Dealers and Market Makers, in all supervised markets. National and supranational authorities are required, on the one hand, to take specific initiatives and measures to supervise them, but also to protect local negotiators, from the point of view of competition, due to the possible differences in their sizes. Therefore, *surveillance* policies and *protection* policies are needed. The *supervisory policies* include: the cooperation of regulators for exchange of information between the country of origin and the country of operations and also the design and implementation of legislative initiatives for their operation and organization in various

negotiation structures. Regarding the *protection policies* we suggest: the definition of specifications and requirements at the level of size, the involvement of primary dealers and market makers in different countries and markets, the minimum quantitative thresholds for their trading orders (in the primary and secondary markets) and the minimum fees (different fees) that have to be paid by the domestic (non-international) relevant traders.

(xiii) we have to realize that over-the-counter derivatives (OTC) markets need to be more transparent. Therefore, policies for regulatory changes in the jurisdictions of international capital markets are necessary. In order to meet the various requirements (data maintenance, reporting, etc.), it is necessary either the standardized OTC products (those ultimately standardized) to be cleared through a CCP or the non-standard and bilateral OTC transactions to be fully reported of transactions through a regulated reporting system.

(xiv) as a last policy, in order to improve market efficiency and price transparency, in particular in the derivatives market, we suggest the transfer of standardized OTC contracts (since they can now be centrally cleared) in stock exchanges (or in other trading venues and electronic trading platforms not regulated). We can imagine such a system with members participating credit or banking institutions, where there will be a continuous flow of transaction reports and direct reference of prices and other information and in communication with information vendors (Reuters, Bloomberg, etc). Such systems can be designed with the logic of supply "price / quantity".

Essentially, the stake is the success of the political surveillance of the country of origin of the cross-border banking group so that it can control it globally for its activities, its ability to ban the creation of corporate structures that would hinder uniform supervision and, finally, to be able to prevent banks from establishing branches (or subsidiaries) in vague or even suspicious jurisdictions.

5. The Mathematical Approach of the Single Market Model and the Results of Its Application (Theoretical Model for a Unified and Regulated Market – The.M.U.Re.M. Market Model)

For the creation of the single market mathematical model, we use the *Multivariate Inverse Normal Gaussian* (MNIG) distribution, based on the study of Ole Barndorff-Nielsen (Note 4) [Barndorff-Nielsen, 1997], as the most appropriate distribution for the valuation of assets, regarding the interbank and the stock market (i.e. for OTC and listed derivatives). (Notes 5, 6)

We assume that the distribution is symmetric and addresses to the following markets for financial products (for the proposed mathematical model): the *Dealership Market* (bilateral interbank) and the *Auction Market* (multilateral brokerage). The Auction Market as a purely stock market (secondary) has an adequate number of competent traders, well-informed, who operate simultaneously and manage a sufficient number of orders for a financial product (listed and non-listed), and the Dealership Market is a bilateral interbank market where each time a competent dealer , properly informed, manages an order of a financial product, too.

In the Unified (Single and Regulated) Market (The.M.U.Re.M.), we will also be able to accept (technically and legally) orders for all of the said financial products as being a superset of the two mentioned markets (Dealership and Auction). As an example, we assume that an investor (through a broker) may enter into the unified market (TheMUReM), a trading order i.e., either an OTC derivative, a listed derivative product, or an OTC bond, or a bond listed on the secondary market, or any other combination of a financial product (even commodities).

We also consider the strategy of the traders and dealers to be stable during the handling of the orders, for all markets and all sizes of orders, as well as entering the order in the unified market, taking into account the specificities of each market (Auction Market or Dealership), being "within" the The.M.U.Re.M. market. (endogenous).

Using the Pagano-Röell model and their work (Note 7), we know that Auction Market trading costs (we will now denote it as "A") are lower than those in the Dealership Market (we will now denote it as "D"), for the above conditions, and the liquidity of A is greater than of the D.

We'll prove (using the MNIG distribution) the following mathematical proposal, which is:

Theorem The.M.U.Re.M.: the transaction costs in a unified and regulated market (we will now denote it as "U"), are even smaller than A (and thus also than D). Consequently, with more price setters and smaller dispersion of estimated product prices in the U market in comparison to the A market, the traders / dealers are better protected,

they get more transparency and more information, and thus lower risks (bid-ask spread narrower) and therefore more liquidity is diffusing the U market than in the A (Note 8).

Let's note as $\boldsymbol{v}$ the information, which a trader (or a Price Setter, or dealer), who has received an order from an investor, for the price of a product in the TheMUReM (U market) and $\boldsymbol{X}$ his trading order. Let be as $\boldsymbol{X(u)}$ the strategy followed by the trader/dealer firmly in all markets (U, A, D). In fact, the trading order is executed by the trader/dealer depending on the product and the sub-market (A, D).

We consider the trading order $\boldsymbol{X}_D = x_0$, when one dealer in the D market receives the trading order and it is handled by one dealer (dimension 1), x_0 is the way the dealer handles this order.

We also consider the order $\boldsymbol{X}_A = (x_1, x_2, x_3, ..., x_n)$, when n dealers in the A market receive the trading order and it is handled by n dealers (dimension n), x_i are the ways the dealers receive and handle this order. The x_i are independent between them (i=1,…, n).

We consider a multi-dimensional stochastic vector-trading order $\boldsymbol{X}_U = (x_0, x_1, x_2, x_3, ..., x_n)$ describing practically a trading order in the The.M.U.Re.M. market (U market) when they receive it *n+1* number of traders/dealers in the A market and they handle it (*n+1* dimension). x_i = the ways traders/dealers receive and handle the trading order, x_i independently of each other (i = 0,1, ..., n). Essentially, it depicts the logic of entering a trading order and handling it in the U market rather than autonomously and independently in one (A) or the other (D) market. It includes both command handler cases: either be dealt by one dealer (1-dimension), or handled by n traders (n- dimension). So overall it has, *n+1* dimension.

So, the $\boldsymbol{X}_U$, $\boldsymbol{X}_A$, $\boldsymbol{X}_D$, are "trading order vectors" and under the property, that:

$\boldsymbol{X}_U$, $\boldsymbol{X}_A$ ~ MNIG (α, β, δ, μ, Γ) or in other words, they are Gaussian vectors, in the The.M.U.Re.M. market, with dimensions *d+1* and *d*, respectively (we use the symbol $\boldsymbol{d}$, to be compatible with the use of MNIG symbols as presented in the international literature). These vectors are essentially dimension tables (1x *d+1*) and (1x *d*) respectively and can be written as follows: $\boldsymbol{X}_U = (x_0, x_1, x_2, x_3, ..., x_n)^T$ and $\boldsymbol{X}_A = (x_1, x_2, x_3, ..., x_n)^T$ respectively (transposed matrices with 1 line and *d+1* and *d* columns respectively). These are *continuous* variables-vectors, due to the complexity in the area of TheMUReM, which can receive any price (from the price setting of traders / dealers).

We assume that the dimension *d* should also be sufficiently large (particularly, d>=8, without harming the generality) in the sense that we consider a high number of traders / dealers participating in the TheMUReM.

Concluding: $\boldsymbol{X}_U$, $\boldsymbol{X}_A$ ~ MNIG (α, β, δ, μ, Γ), as Gaussian stochastic continuous multidimensional variables, α> 0, δ> 0, β, $\mu \in \mathbb{R}^d$, $\Gamma \in \mathbb{R}^{dxd}$. $\boldsymbol{X}_U$ *d+1*-dimension, $\boldsymbol{X}_A$ *d*-dimension. (Γ is the Gamma function)

We will also estimate and consider that the $\boldsymbol{\delta}$ *of MNIG, in our case, is sufficiently large and the* $\boldsymbol{\alpha}$ *sufficiently small.* In this case and using the study of the relevant literature, it has a practical meaning and application, the financial market allocation, in product valuation, in portfolio management and dispersion of expected prices. The form of the probability density function (pdf) of the MNIG, describes the relative probability that the random continuous variable **X** (*d* and *d+1* trading order vector) will receive values in a given space, is analyzed as *symmetrical* ($\boldsymbol{\beta}$=0), as a *platykurtic* ($\boldsymbol{\alpha} = (c^4/(\sigma^2)^2) - 3$) with α < 3, and generally with sufficiently small pdf tail, but mainly with "heavy" tail. The $\boldsymbol{\delta}$ describes the *dispersion* (or σ^2) of the prices of the U market assets, which is analyzed as sufficiently *large*, giving a large dispersion of values in the area of the pdf curve, around the average ($\boldsymbol{\mu}$). Therefore, it is depicted a dispersed sample of U market share prices, as the price setting given by traders / dealers. In this case it is $\boldsymbol{\delta > \alpha}$, so that the large and uniform dispersion of product prices in the U market to be applicable. Similar reasoning and assumptions also apply in the case of the probability density function for the A market (Note 9).

The trading order's price (price setting) in the A market is $P(\boldsymbol{X}_A)$, as the expected value by the traders and its cost is given, by the formula:

$x \cdot P(\boldsymbol{X}_A)$, where x is the size of the order.

The trading order's price (price setting) in the U market is $P(\boldsymbol{X}_U)$, as the expected value by the traders and its cost is given, by the formula:

$x \cdot P(\boldsymbol{X}_U)$, where x is the size of the order.

We'll prove that:

$$x \cdot P(\boldsymbol{X}_U) < x \cdot P(\boldsymbol{X}_A) \text{ or } P(\boldsymbol{X}_U) < P(\boldsymbol{X}_A), \ \forall \ \boldsymbol{X}, \boldsymbol{x} \text{ in every market.} \quad (1)$$

This clearly shows the difference of the price calculation (price setting) in the U market in comparison to the A market. Essentially, the costs in the U market are lower than those in the A market (which in turn are lower than those in the D market).

The (1) can be written as:

$$E(u|\boldsymbol{X}_U) < E(u|\boldsymbol{X}_A) \quad (2)$$

u = information, $\boldsymbol{X}_U$, $\boldsymbol{X}_A \sim$ MNIG(α, β, δ, μ, Γ)

and after using the probability density functions the (2) is written:

$$f_U(\boldsymbol{X}_U) < f_A(\boldsymbol{X}_A) \quad (3)$$

where f_U and f_A, are the probability density functions of the MNIG distribution, for the U and A markets respectively, $\boldsymbol{X}_U$ *d+1*-dimensional trading order vector in the U market, and $\boldsymbol{X}_A$ *d*-dimensional trading order vector in the A market (d>=8).

Thus, essentially regarding *The.M.U.Re.M.* theorem's proof, it is adequate to proof of relationship no. (3), whereby by substantially increasing by one the dimension of a trading order vector (or in terms of *TheMUReM*) switching from a market (the A market) with a *d* dimension to a market with a dimension *d+1* (essentially by "adding" to the A market the D market which is the one-dimensional trading order market), we move to the unified market U, where its probability density function is smaller of the corresponding of market and therefore, with a greater probability of trading orders accumulating in the U market, with higher price setting and therefore lower costs.

Conclusively:

If the formula n. (3) applies, then the aforementioned theorem of the The.M.U.Re.M. market model, also, applies. (the mathematical proof is provided in the Appendix).

If we graphically depict the probability density functions for the U and A markets, we'll notice that the dispersion of f_A is greater, and while checking the price dispersion for f_U, we can conclude that the smallest and better concentration of the prices of the products in the U market, and therefore their price setting, is easier and the transaction costs are lower.

So, therefore:

Thus, the expression of The.M.U.Re.M. Theorem, as a descriptive model demonstrates that by switching from a market of multilateral trading (Auction trading market), to a market that we have, essentially, incorporated into it the market of bilateral negotiations (Dealership/ interbank market), we move to a Unified (Single) market, where there is a greater probability of trading orders aggregation and a higher probability of price finding and hence lower costs, within a smaller range of theoretical valuations.

6. Concluding Comments and Further Research

This research paper first examines whether and how the adjustments through EU Directives and Regulations at European level and also of the Money and Capital Markets Act in the US, helped, strengthened, protected the international financial system, whether other markets developed through business movements and whether contributed to change the global economic circles. We investigated, also, the effects on investors and national jurisdictions and whether all market participants (stock exchanges, repositories, investors, listed companies, credit institutions, capital markets, institutional investors, Hedge Funds, etc.) are protected.

The research was focused on whether and to what extent it is possible to create a single framework of regulations that will regulate all financial products at a global scale in relation to all market participants and what are the effects of its interaction with national and international economic policies.

The results show that the realization of an *actually international single regulatory framework* for all financial products is away of its final and realistic attainment. However, the theoretical existence of a unified institutional model of a trading and organized market and a set of regulatory and organizational policies that will protect it up to a point of balanced regulation, offering equal information to the participants, with less transaction costs and hence increased transparency, increasing liquidity and reducing cases of market abuse and manipulation, can be proved that it is feasible and can be implemented. Whether this theoretical model can be applied in practice is depended on the intention, the views, the economic practices and the dominant position in the global financial market of the countries of the world.

Financial risk is a concern for public policy makers because risk taking creates external effects on the economy, that is to say, significant cost risks that are imposed on the whole of society, which, however, are not valued by the

individual investor or by the market. In an economy where there are significant externalities, the competitive markets become as inadequate risk assessment mechanisms and formation of competitive pricing.

In this context, the objective of public policy (in the sense of regulating financial activity) is to limit these market failures. In the financial system, there are, also, other market failures, such as asymmetry in the disclosure and use of information by financial service providers (banks, investment services companies) to users of these services (borrowers, investors).

An important conclusion that we have reached with this research is the proposed separation of responsibility for the monitoring of the regulation of the financial products by the respective supervisory authorities. At this point, we have to realize that the Central Banks of the states and their respective secondary market regulators will play an important role. This is necessary due to a possible overlapping of their responsibilities, because credit institutions (under central banks' supervisory) will be engaged in transactions involving standardized and regulated market products (secondary capital market). Overlapping of competences should be resolved under the cooperation of supervisors and not by separation and isolation. Probably the creation of joint Supervisory Control Committees or other mechanisms would be a solution to be considered (which again requires technological infrastructure and clearly high-level and sophisticated staff).

An important conclusion is also the unresolved Giovannini barriers (n. 11, 12 and 13) concerning tax issues. Whether we are talking about a European or an international level, the reality is that taxation is part of the so-called "hard core" of state policy and therefore possible compromises or retreats for harmonization purposes are quite difficult.

The large number of competent authorities in the states, with different powers, may create confusion to the economic participants. Each state should designate a single competent authority to undertake at least the ultimate responsibility for supervising the compliance to the provisions adopted under a single institutional framework as well as for an international cooperation. This authority will be of an administrative nature, which will be guaranteeing its independence in relation to economic participants and avoiding conflicts of interest. In accordance with their national legislation, states shall ensure that the competent authority is adequately funded. This authority should have an appropriate system of consultation on possible changes of national legislation, such as an advisory committee made up of representatives of issuers, providers and consumers of financial services, so that they are fully informed of their views and concerns.

The integration of the markets (Dealership and Auction) into a single regulatory framework also goes through the "acceptance" of the key participants in these two markets. These key participants are large international investors and large Hedge Funds, mainly. We must realize that these global-level investors have as one of their key criteria (for the adaptation of a single regulatory framework), whether its creation is of their interests over time. Although accepting it or not such a framework, seems like a secondary parameter, we must realize that their influence on global decision-making centers for strategic and financial decisions is extremely important.

Besides, all authorities (national and supranational) are supposed, always, that make significant changes at a technical and institutional level, only after receiving the opinion of the participants through consultation procedures (as these participants are key parameters in the functioning of the global financial markets). Thus, in this case, the World Supervisory Authority should, through an extremely careful and strategic consultation process, liaise and take into account the views and /or possible objections on the design of the single framework structures by these participants. Otherwise (if it completely ignore them or come into direct conflict with their interests, using loose arguments and amateur approach), it will encounter their strong reactions, which will lead to the delay in the implementation of the design of the single framework (since their influences - even at the political level of Heads of States - will detour the plans of regulators).

Regarding the Islamic economy, it has to be said that it is closely linked to the principles of the modern economy but with a strong social consciousness. Unlike to the Western world, where the economy grew as a science by itself far away from religion, Islam as a religion and finance are still interconnected. The main guiding principle of Islamic law is the goal of achieving and maintaining justice, order and stability in society.

Therefore, the logic of a *genuinely international single regulatory framework* for all financial products is far enough to be finally and realistically achieved. But its theoretical existence and theoretical advantages can be proved that exist and can work (see at Appendix the mathematical proof of the The.M.U.Re.M. model). Whether this theoretical model can be applied in practice, depends on the attitude, views, economic practices and the dominant position in the global financial market of the countries of the world.

Therefore, responding to the question posed by the researchers, on *the real need for harmonized international regulations and standards* and *on where we can safely leave room on the regulated market*, after our research, we

can say that it is in the regulatory integration of products within the markets (Western capitalist economies) under a specific regulatory framework, applying it through national and / or international policies, as we argue. This regulatory unification, will take into account possible controversial Law cases, too.

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Appendix

The complete mathematical proof of the "The.M.U.Re.M." theorem-model

We'll prove the aforementioned no (3) equation, namely:

$$f_U(\boldsymbol{X}_U) < f_A(\boldsymbol{X}_A)$$

We'll assume that it applies (true hypothesis) and we'll attempt to end up to a true conclusion which already applies or we have accept it by our initial assumptions.

Using the study of: Tor Arne Øigård, Alfred Hanssen, Roy Edgar Hansen, "*The Multivariate Normal Inverse Gaussian distribution: EM-estimation and analysis of synthetic aperture sonar data*", XII. European Signal Processing Conference, EUSIPCO 2004, September 6-10, 2004, Vienna, Austria, ISBN: 3-1433-1436, pp. 1, the probability density functions $f_U(\mathbf{X}_U)$, $f_A(\mathbf{X}_A)$, and therefore the (3), is written (4):

$$\frac{\delta}{2^{\frac{(d+1)-1}{2}}}\left[\frac{a}{\pi q(x)}\right]^{\frac{(d+1)+1}{2}}\exp\left[p(x)\right]\left[K_{\frac{(d+1)+1}{2}}(aq(x))\right] < \frac{\delta}{2^{\frac{d-1}{2}}}\left[\frac{a}{\pi q(x)}\right]^{\frac{d+1}{2}}\exp\left[p(x)\right]\left[K_{\frac{d+1}{2}}(aq(x))\right] \quad (4)$$

where:

$p(x) = \delta \sqrt{\alpha^2 - \beta^T \Gamma \beta} + \beta^T (\boldsymbol{X}-\mu)$, $p(x) > 0$, $\beta \in \mathbb{R}^d$, $\forall \boldsymbol{X}$ in every financial market

q(x) = $\sqrt{\delta^2 + \left[(\mathrm{X}-\mu)^{\mathrm{T}}\Gamma^{-1}(\mathrm{X}-\mu)\right]}$, q(x) > 0, $\forall \boldsymbol{X}$ in every financial market

and

$$\mathrm{K}_{\frac{d+1}{2}}\left[aq(x)\right] = (\alpha q(x))^2 \frac{d^2 y}{d(aq(x))^2} + (\alpha q(x)) \frac{d\ y}{d(aq(x))} + \left((i\alpha q(x))^2 - \left(\frac{d+1}{2}\right)^2\right) y,$$

which is a modified Bessel function of a 2nd kind with order *d*, and the *i* is the i= $\sqrt{-1}$, (complex differential equation).

$\boldsymbol{K}_{\frac{d+1}{2}}(\cdot)$ has order *d* and the $\boldsymbol{K}_{\frac{d+2}{2}}(\cdot)$ has order *d+1*, and the *ix is the complex argument.*

We set: s = $\frac{\alpha}{\pi q(x)}$, so therefore the (4) is written as follows:

$$\frac{\delta}{2^{\frac{d}{2}}}\left[\mathrm{s}\right]^{\frac{d+2}{2}} \exp\left[p(x)\right]\left[K_{\frac{d+2}{2}}\left(aq(x)\right)\right] < \frac{\delta}{2^{\frac{d-1}{2}}}\left[s\right]^{\frac{d+1}{2}} \exp\left[p(x)\right]\left[K_{\frac{d+1}{2}}\left(aq(x)\right)\right], \text{ or}$$

$$\frac{2^{\frac{d-1}{2}}}{2^{\frac{d}{2}}}\ s^{\frac{1}{2}} < \frac{\left[K_{\frac{d+1}{2}}\left(aq(x)\right)\right]}{\left[K_{\frac{d+2}{2}}\left(aq(x)\right)\right]}, \text{ or, } 2^{-\frac{1}{2}}\ s^{\frac{1}{2}} < \frac{\left[K_{\frac{d+1}{2}}\left(aq(x)\right)\right]}{\left[K_{\frac{d+2}{2}}\left(aq(x)\right)\right]}, \text{ or}$$

$$\sqrt{\frac{s}{2}} < \frac{\left[K_{\frac{d+1}{2}}\left(aq(x)\right)\right]}{\left[K_{\frac{d+2}{2}}\left(aq(x)\right)\right]}, \text{ or, } \sqrt{\frac{\alpha}{2\pi q(x)}} < \frac{\left[K_{\frac{d+1}{2}}\left(aq(x)\right)\right]}{\left[K_{\frac{d+2}{2}}\left(aq(x)\right)\right]} \tag{5}$$

We'll study, essentially, the relation between $\left[K_{\frac{d+1}{2}}\left(aq(x)\right)\right]$ and $\left[K_{\frac{d+2}{2}}\left(aq(x)\right)\right]$, which are modified Bessel functions of 2nd kind with orders $\frac{d+1}{2}$ and $\frac{d+2}{2}$ respectively. We know that regarding the modified Bessel 2nd kind with integer order *n*, the following relationship-property applies: 0 < $K_n(x)$ < $K_{n+1}(x)$, $\forall x \in \mathbb{R}$. Obviously, in our case, the aforementioned orders $\frac{d+1}{2}$ and $\frac{d+2}{2}$ are not integer expressions at the same time, neither have a difference of 1 event though $\frac{d+1}{2} < \frac{d+2}{2}$, and therefore the aforementioned property of Bessel functions (in our case) is not obvious. Therefore, we'll *prove* this relationship, namely, that:

$$\left[K_{\frac{d+1}{2}}\left(aq(x)\right)\right] < \left[K_{\frac{d+2}{2}}\left(aq(x)\right)\right] \text{ ή } \left[K_{\frac{d+1}{2}}\left(aq(x)\right)\right] - \left[K_{\frac{d+2}{2}}\left(aq(x)\right)\right] < 0 \tag{6}$$

with d > 0 integer and $\forall$x $\in \mathbb{R}$.

We set ρ = αq(x)>0 and developing the modified Bessel functions of 2nd kind, as per their integral expression, due to their non integer order, we have:

$$K_{\frac{d+1}{2}}(\rho) = \frac{\sqrt{\pi}(\rho/2)^{\frac{d+1}{2}}}{\Gamma\left(\frac{d+1}{2}+\frac{1}{2}\right)} \int_0^{\infty} \sinh^{2\frac{d+1}{2}}(t)\, e^{-\rho\cosh t}\, dt, \quad (7)$$

and

$$K_{\frac{d+2}{2}}(\rho) = \frac{\sqrt{\pi}(\rho/2)^{\frac{d+2}{2}}}{\Gamma\left(\frac{d+2}{2}+\frac{1}{2}\right)} \int_0^{\infty} \sinh^{2\frac{d+2}{2}}(t)\, e^{-\rho\cosh t}\, dt \quad (8)$$

The (7) is written:

$$K_{\frac{d+1}{2}}(\rho) = \frac{\sqrt{\pi}(\rho/2)^{\frac{d+1}{2}}}{\Gamma\left(\frac{d+2}{2}\right)} \int_0^{\infty} \sinh^{d+1}(t)\, e^{-\rho\cosh t}\, dt, \quad (9)$$

and the (8) is written:

$$K_{\frac{d+2}{2}}(\rho) = \frac{\sqrt{\pi}(\rho/2)^{\frac{d+2}{2}}}{\Gamma\left(\frac{d+3}{2}\right)} \int_0^{\infty} \sinh^{d+2}(t)\, e^{-\rho\cosh t}\, dt \quad (10)$$

Where Γ (·) is the Gamma function, with properties:

a) Γ (n) = (n-1)!, n integer with distinct values and

b) $\Gamma(z) = \int_0^{\infty} t^{z-1}\, e^{-t}\, dt$, for continuous values

Given that in our case, the orders $\frac{d+2}{2}$ and $\frac{d+3}{2}$ are not integers *at the same time*, we'll use the above expressions of the Gamma function, depending on the value of *d*, as follows:

- if *d* is even, so, d=2k (k positive integer), then:

1. $\frac{d+2}{2} = \frac{2k+2}{2}$ = k+1, integer, and therefore

$$\Gamma\left(\frac{d+2}{2}\right) = \left(\frac{d+2}{2}-1\right)! = \left(\frac{d}{2}\right)! \quad (11)$$

2. $\frac{d+3}{2} = \frac{2k+3}{2} = \frac{2k+2+1}{2}$ = k+$\frac{3}{2}$, non integer, and therefore

$$\Gamma\left(\frac{d+3}{2}\right) = \int_0^{\infty} t^{\frac{d+3}{2}-1}\, e^{-t}\, dt \quad (12)$$

- if *d* is odd, so, d=2k+1 (k positive integer), then:

3. $\frac{d+2}{2} = \frac{2k+1+2}{2} = k+\frac{3}{2}$, non integer, and therefore

$$\Gamma\left(\frac{d+2}{2}\right) = \int_0^\infty t^{\frac{d+2}{2}-1} e^{-t}\, dt \tag{13}$$

4. $\frac{d+3}{2} = \frac{2k+1+3}{2} = \frac{2k+4}{2} = k+2$, integer, and therefore

$$\Gamma\left(\frac{d+3}{2}\right) = \left(\frac{d+3}{2}-1\right)! = \left(\frac{d+1}{2}\right)! \tag{14}$$

Therefore, if d is *even* (we call it as the 'A' case), we have, that the (9) and (10) using (11) and (12) become (and so their difference, which is the equation (6)):

A case.

$$\frac{\sqrt{\pi}(\rho/2)^{\frac{d+1}{2}}}{(\frac{d}{2})!} \int_0^\infty \sinh^{d+1}(t)\, e^{-\rho\cosh t}\, dt - \frac{\sqrt{\pi}(\rho/2)^{\frac{d+2}{2}}}{\int_0^\infty t^{\frac{d+3}{2}-1} e^{-t}\, dt} \int_0^\infty \sinh^{d+2}(t)\, e^{-\rho\cosh t}\, dt \tag{15}$$

If *d* is odd (we call it as the 'B' case), we have, that the (9) and (10) using (13) and (14) become (and so their difference, which is the equation (6)):

B case.

$$\frac{\sqrt{\pi}(\rho/2)^{\frac{d+1}{2}}}{\int_0^\infty t^{\frac{d+2}{2}-1} e^{-t}\, dt} \int_0^\infty \sinh^{d+1}(t)\, e^{-\rho\cosh t}\, dt - \frac{\sqrt{\pi}(\rho/2)^{\frac{d+2}{2}}}{(\frac{d+1}{2})!} \int_0^\infty \sinh^{d+2}(t)\, e^{-\rho\cosh t}\, dt \tag{16}$$

Then, the (15) can be written as follows:

$$\sqrt{\pi}(\rho/2)^{\frac{d+1}{2}} \left(\frac{1}{(\frac{d}{2})!} \int_0^\infty \sinh^{d+1}(t)\, e^{-\rho\cosh t}\, dt - \frac{(\rho/2)^{\frac{1}{2}}}{\int_0^\infty t^{\frac{d+3}{2}-1} e^{-t}\, dt} \int_0^\infty \sinh^{d+2}(t)\, e^{-\rho\cosh t}\, dt\right) \tag{17}$$

and the (16) can be written as follows:

$$\sqrt{\pi}(\rho/2)^{\frac{d+1}{2}} \left(\frac{1}{\int_0^\infty t^{\frac{d+2}{2}-1} e^{-t}\, dt} \int_0^\infty \sinh^{d+1}(t)\, e^{-\rho\cosh t}\, dt - \frac{(\rho/2)^{\frac{1}{2}}}{(\frac{d+1}{2})!} \int_0^\infty \sinh^{d+2}(t)\, e^{-\rho\cosh t}\, dt\right) \tag{18}$$

We will prove that the integrals $\int_0^\infty t^{z-1} e^{-t}\, dt$ *converge*, and in order to prove this, we'll use the property of Γ function:

$\Gamma(n+\frac{1}{2}) = \sqrt{\pi}\,\frac{1.3.5...(2n-1)}{2^n} = \sqrt{\pi}\,\frac{(2n-1)!!}{2^n}$, where n is an integer.

So, if *d* is even, the $\frac{d+3}{2}$ is non integer, the $\frac{d+2}{2}$ is an even integer and therefore the relation (12) could be substituted (upon the aforementioned property), as follows:

$$\Gamma(\frac{d+3}{2}) = \Gamma(\frac{d+2}{2}+\frac{1}{2}) = \sqrt{\pi}\ \frac{1.3.5...(2\frac{d+2}{2}-1)}{2^{\frac{d+2}{2}}} = \sqrt{\pi}\ \frac{1.3.5...(d+1)}{2^{\frac{d+2}{2}}} = \sqrt{\pi}\ \frac{(d+1)!!}{2^{\frac{d+2}{2}}} \quad (19)\ (\text{Note } 10)$$

Moreover, if *d* is odd, the $\frac{d+2}{2}$ is non integer, $\frac{d+3}{2}$ is an even integer and therefore the relation (13) could be substituted (upon the aforementioned property), as follows:

$$\Gamma(\frac{d+2}{2}) = \Gamma(\frac{d+1}{2}+\frac{1}{2}) = \sqrt{\pi}\ \frac{1.3.5...(2\frac{d+1}{2}-1)}{2^{\frac{d+1}{2}}} = \sqrt{\pi}\ \frac{1.3.5...d}{2^{\frac{d+1}{2}}} = \sqrt{\pi}\ \frac{(d)!!}{2^{\frac{d+1}{2}}} \quad (20)$$

Regarding the convergence of the integrals $\int_0^\infty t^{z-1}\ e^{-t}\,dt$, we have:

$\int_0^\infty t^{z-1}\ e^{-t}\,dt = \int_0^1 t^{z-1}\ e^{-t}\,dt + \int_1^\infty t^{z-1}\ e^{-t}\,dt$, for z > 0 and values in the $\mathbb{R}$ set.

Regarding with the convergence of the first integral, we note that:

$0 < t^{z-1}\ e^{-t} \le t^{z-1}$, it applies for every t $\in (0,1]$. Therefore, for ε > 0, adequate small number, we have:

$\int_\varepsilon^1 t^{z-1}\ e^{-t}\,dt \le \int_\varepsilon^1 t^{z-1}\,dt = \frac{t^z}{z}\ |_\varepsilon^1 = \frac{1}{z} - \frac{\varepsilon^z}{z}$. Therefore, for every z > 0, the first integral converges.

Regarding with the convergence of the second integral, we note that:

$e^{-t}\ t^{z-1} = \frac{1}{\sum_{k=0}^{\infty}\frac{t^k}{k!}}t^{z-1} \le \frac{1}{\frac{t^n}{n!}}t^{z-1} = \frac{n!}{t^{n-z+1}}$, for every n $\in$ ℕ and t $\ge$ 1. The last, proves us, that:

$\int_1^A t^{z-1}\ e^{-t}\,dt \le n!\int_1^A \frac{1}{t^{n-z+1}}\,dt = n!\ \frac{t^{-n+z}}{z-n}\ |_1^A = \frac{n!}{z-n}\left(\frac{1}{A^{n-z}}-1\right)$, given that the A is adequate big number and the n $\ge$ z+1. Thus, the second integral also converges and therefore the $\int_0^\infty t^{z-1}\ e^{-t}\,dt$, too.

So, based on (19) and (20) and due to the convergence of the integrals of the Gamma function, the above (17) and (18) respectively, can be rewritten, as follows:

$$\sqrt{\pi}(\rho/2)^{\frac{d+1}{2}}\ (\frac{1}{(\frac{d}{2})!}\int_0^\infty \sinh^{d+1}(t)\,e^{-\rho\cosh t}\,dt - \frac{(\rho/2)^{\frac{1}{2}}}{\sqrt{\pi}\ \frac{(d+1)!!}{2^{\frac{d+2}{2}}}}\int_0^\infty \sinh^{d+2}(t)\,e^{-\rho\cosh t}\,dt) \quad (21)$$

$$\sqrt{\pi}(\rho/2)^{\frac{d+1}{2}}\ (\frac{1}{\sqrt{\pi}\ \frac{(d)!!}{2^{\frac{d+1}{2}}}}\int_0^\infty \sinh^{d+1}(t)\,e^{-\rho\cosh t}\,dt - \frac{(\rho/2)^{\frac{1}{2}}}{(\frac{d+1}{2})!}\int_0^\infty \sinh^{d+2}(t)\,e^{-\rho\cosh t}\,dt) \quad (22)$$

Now, let's set: $I_1 = \int_0^{\infty} \sinh^{d+1}(t)\, e^{-\rho \cosh t}\, dt$ and $I_2 = \int_0^{\infty} \sinh^{d+2}(t)\, e^{-\rho \cosh t}\, dt$.

It is known, from the properties of the hyperbolic trigonometric functions, that:

$$I_1 = \frac{1}{2}(\sinh^{d+1}(t) - \cosh^{d+1}(t))\, e^{-\rho \cosh t} + C \quad (23)$$

and

$$I_2 = \frac{1}{2}(\sinh^{d+2}(t) - \cosh^{d+2}(t))\, e^{-\rho \cosh t} + C \quad (24)$$

So, the (21) and (22) based on the (23) and (24), are rewritten, as follows:

The (21) becomes: $\sqrt{\pi}(\rho/2)^{\frac{d+1}{2}} \left(\frac{1}{(\frac{d}{2})!} I_1 - \frac{(\rho/2)^{\frac{1}{2}}}{\sqrt{\pi}\, \frac{(d+1)!!}{2^{\frac{d+2}{2}}}} I_2\right)$ or

$$\frac{\sqrt{\pi}(\rho/2)^{\frac{d+1}{2}}}{2}\, e^{-\rho \cosh t} \left(\frac{1}{(\frac{d}{2})!}(\sinh^{d+1}(t) - \cosh^{d+1}(t)) - \frac{(\rho/2)^{\frac{1}{2}}}{\sqrt{\pi}\, \frac{(d+1)!!}{2^{\frac{d+2}{2}}}}(\sinh^{d+2}(t) - \cosh^{d+2}(t))\right)$$

we call it as (25).

The (22) becomes $\sqrt{\pi}(\rho/2)^{\frac{d+1}{2}} \left(\frac{1}{\sqrt{\pi}\, \frac{(d)!!}{2^{\frac{d+1}{2}}}} I_1 - \frac{(\rho/2)^{\frac{1}{2}}}{(\frac{d+1}{2})!} I_2\right)$ or

$$\frac{\sqrt{\pi}(\rho/2)^{\frac{d+1}{2}}}{2}\, e^{-\rho \cosh t} \left(\frac{1}{\sqrt{\pi}\, \frac{(d)!!}{2^{\frac{d+1}{2}}}}(\sinh^{d+1}(t) - \cosh^{d+1}(t)) - \frac{(\rho/2)^{\frac{1}{2}}}{(\frac{d+1}{2})!}(\sinh^{d+2}(t) - \cosh^{d+2}(t))\right)$$

we call it as (26).

We know that: $\sinh^d t < \cosh^d t$, for d > 0.

Moreover, the expression: $(\sinh^{d+1}(t) - \cosh^{d+1}(t))$ and the: $(\sinh^{d+2}(t) - \cosh^{d+2}(t))$, obey to the polynomials law: $x^n - y^n = (x-y)(x^{n-1} + x^{n-2}y + \ldots + xy^{n-2} + y^{n-1})$, and therefore we can rewrite them as follows:

$\sinh^{d+1} t - \cosh^{d+1} t = (\sinh t - \cosh t)(\sinh^d t + \sinh^{d-1} t \cosh t + \ldots + \sinh t \cosh^{d-1} + \cosh^d t)$ ή $\sinh^{d+1} t - \cosh^{d+1} t = (\sinh t - \cosh t)\, hyp1$.

(where $hyp1 = \sinh^d t + \sinh^{d-1} t \cosh t + \ldots + \sinh t \cosh^{d-1} + \cosh^d t$), and

$\sinh^{d+2} t - \cosh^{d+2} t = (\sinh t - \cosh t)(\sinh^{d+1} t + \sinh^{d} t \cosh t + \ldots + \sinh t \cosh^{d} + \cosh^{d+1} t)$ ή $\sinh^{d+2} t - \cosh^{d+2} t = (\sinh t - \cosh t)$ *hyp2.*

*(*where *hyp2* = $\sinh^{d+1} t + \sinh^{d} t \cosh t + \ldots + \sinh t \cosh^{d} + \cosh^{d+1} t$)

Therefore the (25) is written as follows:

$$(\sinh t - \cosh t) \frac{\sqrt{\pi}(\rho/2)^{\frac{d+1}{2}}}{2} e^{-\rho \cosh t} \left(\frac{1}{(\frac{d}{2})!} \, hyp1 - \frac{(\rho/2)^{\frac{1}{2}}}{\sqrt{\pi} \frac{(d+1)!!}{2^{\frac{d+2}{2}}}} \, hyp2 \right) \quad (27)$$

and the (26) respectively:

$$(\sinh t - \cosh t) \frac{\sqrt{\pi}(\rho/2)^{\frac{d+1}{2}}}{2} e^{-\rho \cosh t} \left(\frac{1}{\sqrt{\pi} \frac{(d)!!}{2^{\frac{d+1}{2}}}} \, hyp1 - \frac{(\rho/2)^{\frac{1}{2}}}{(\frac{d+1}{2})!} \, hyp2 \right) \quad (28)$$

We have to remind here that the (27) is becoming from the *A* case, when the *d* is even and the (28) is becoming from the *B* case, when the *d* is odd.

Regarding the (27) we note (*d* is even) that for the complex argument t = ix (from the aforementioned Bessel functions):

- The expression *hyp1* is positive, because: $\sinh^{d} t = \sinh^{d} (ix) = (-1)^{d} \sinh^{d} x = \sinh^{d} x > 0$ and $\cosh^{d} t = \cosh^{d} (ix) = \cosh^{d} x > 0$ and since the parts of the *hyp1* (namely, $\sinh^{d} t + \sinh^{d-1} t \cosh t + \ldots + \sinh t \cosh^{d-1} + \cosh^{d} t$), are comprised by more (over 1) and greater factors of positive products in the Complex set, for t = ix (namely, $\sinh^{d} t$, $\cosh^{d} t$, $\sinh^{d-2} t \cosh^{2} t$, etc), which are in total d+1, in multitude.
- The expression $\frac{1}{(\frac{d}{2})!}$ is also positive,
- The product $(\sinh t - \cosh t) \frac{\sqrt{\pi}(\rho/2)^{\frac{d+1}{2}}}{2} e^{-\rho \cosh t}$ is negative, due to: $\sinh^{d} t < \cosh^{d} t$, for $d > 0$ (the rest factors are positive)
- The expression $\frac{(\rho/2)^{\frac{1}{2}}}{\sqrt{\pi} \frac{(d+1)!!}{2^{\frac{d+2}{2}}}}$ converges to 0 and doesn't affect, essentially, the sign of *hyp2 (negative)*, because: for adequate big number *d*, the expression of the double factorial (d+1)!!

converges rapidly (to $+\infty$), comparing to the exponential $2^{-\frac{d+2}{2}}$ (which converges to 0^{+}) and therefore the ratio which has the expression $\frac{(d+1)!!}{2^{\frac{d+2}{2}}}$ in the denominator, converges to 0.

We conclude to the evidence that the (27) is a NEGATIVE expression, at its whole.

Regarding the (28) we work as follows:

we note (*d* is odd) that for the complex argument t=ix (from the aforementioned Bessel functions):

- the expression $\frac{(\rho/2)^{\frac{1}{2}}}{(\frac{d+1}{2})!}$ *hyp2,* is negative (and therefore with the minus sign "–" becomes to a positive), because: the *hyp2* is equal to: sinht *hyp1* + $\cosh^{d+1} t$, and thus we write it: $\frac{(\rho/2)^{\frac{1}{2}}}{(\frac{d+1}{2})!}$ (sinht *hyp1* + $\cosh^{d+1} t$). Under the reasoning that the $\frac{(\rho/2)^{\frac{1}{2}}}{(\frac{d+1}{2})!} > 0$ for d, ρ > 0, we're aware about the sign of the: sinht *hyp1* + $\cosh^{d+1} t$. Indeed, the sinht *hyp1* + $\cosh^{d+1} t$, is negative, because the *hyp1* is negative (*d* is odd and $\sinh^{d} t = \sinh^{d}(ix) = (-1)^{d} \sinh^{d} x = \sinh^{d} x < 0$) and given that the parts of *hyp1,* (namely, $\sinh^{d} t + \sinh^{d-1} t \cosh t + \ldots + \sinh t \cosh^{d-1} + \cosh^{d} t$), are comprised by more (over 1) and greater negative products in the Complex set, for t = ix (namely, $\sinh^{d} t$, $\sinh^{d-2} t \cos^{d} h$, etc, which are in their whole d+1), so the: sinht *hyp1* < - $\cosh^{d+1} t$, which is written: sinht *hyp1* < $\cosh^{d+1}(-t) = \cosh^{d+1} t$, with $\cosh^{d+1} t > 0$. Besides: sinht *hyp1* < sinht < cosht < $\cosh^{d+1} t$.
- the expression $\frac{(\rho/2)^{\frac{1}{2}}}{(\frac{d+1}{2})!}$ is positive,
- the product (sinht - cosht) $\frac{\sqrt{\pi}(\rho/2)^{\frac{d+1}{2}}}{2}$ $e^{-\rho \cosh t}$ is negative, due to the $\sinh^{d} t < \cosh^{d} t$, for d > 0 (the rest factors are positive),

- the expression $\frac{(\rho/2)^{\frac{1}{2}}}{\sqrt{\pi}\ \frac{(d)!!}{2^{\frac{d+1}{2}}}}$ converges to 0 and doesn't affect, essentially, the sign of *hyp1 (negative)*, because: for adequate big number *d* the expression of the double factorial (d)!! converges rapidly (to $+\infty$), comparing to the exponential $2^{-\frac{d+1}{2}}$ (which converges to 0^{+}) and therefore the ratio which has the expression $\frac{(d)!!}{2^{\frac{d+1}{2}}}$ in the denominator, converges to 0.

We conclude to the evidence that the (28) is, also, a NEGATIVE expression, at its whole.

Under the reasoning that the (27) and (28) are both negative expressions, the aforementioned '*A' case* and '*B' case* (the (15) and (16)) are negative expressions, so the (6) for all cases of the *d* (even or odd). Therefore:

$$\left[K_{\frac{d+1}{2}}(aq(x))\right] < \left[K_{\frac{d+2}{2}}(aq(x))\right] \text{ or } \left[K_{\frac{d+1}{2}}(aq(x))\right] - \left[K_{\frac{d+2}{2}}(aq(x))\right] < 0 \qquad (6)$$

applies and it is correct.

Continuing on the (5), namely the $\sqrt{\frac{\alpha}{2\pi q(x)}} < \frac{\left[K_{\frac{d+1}{2}}(aq(x))\right]}{\left[K_{\frac{d+2}{2}}(aq(x))\right]} < 1$, we proceed as follows:

We'll prove that $\sqrt{\frac{\alpha}{2\pi q(x)}} < 1$, otherwise that $\frac{\alpha}{2\pi q(x)} < 1$, otherwise that: $\alpha < 2\pi q(x)$ or

$$q(x) > \frac{\alpha}{2\pi} \qquad (29)$$

If the (29) ends up to a true conclusion, the (3) and (4) will apply, and therefore the soundness of the theorem-model "*The.M.U.Re.M.*" ("Theoretical Model of the Unified and Regulated Market")

The $q(x) = \sqrt{\delta^2 + \left[(X-\mu)^{T}\Gamma^{-1}(X-\mu)\right]}$, $q(x) > 0$, $\forall \boldsymbol{X}$ in every financial market.

Studying the q(x) we can see that:

$q(\mu) = \delta$ and the $q'(\mu) = 0$ (namely, at the point (μ,δ), the function q(x) has extremity, due to the first derivative function is equal to zero at this point).

The $q'(x) = \frac{1}{2}\left(\delta^2 + \left[(X-\mu)^{T}\Gamma^{-1}(X-\mu)\right]\right)^{-\frac{1}{2}} \left[\frac{\left[(X-\mu)^{T}\right]'\Gamma(X-\mu) + (X-\mu)^{T}\Gamma'(X-\mu)}{\Gamma^{2}(X-\mu)}\right]$, and given that $\left[(X-\mu)^{T}\right]' = \frac{\partial(X-\mu)^{T}}{\partial x} = 0$, $\mu \neq f(x)$.

For $x < \mu$ the q(x) is tending decreasing (strictly decreasing) and for $x > \mu$ is tending increasing (strictly increasing). Therefore,

$$q(x) \geq \delta \qquad (30).$$

We have claimed by our hypothesis, that for δ adequate large number και for α adequate small number, satisfying $\delta > \alpha$, so as to have great dispersion (and with $\beta = 0$, symmetrical and with skewness = 0), the α, has the property $\alpha_4 = \frac{\mu^4}{(\sigma^2)^2} - 3$, where the dispersion σ^2 is the *d* and the $\alpha < 3$ (as they defined, also, by the Normal Inverse Gaussian distribution). Moreover, with α adequately small number (<3) a platykurtic curve of the probability density function (with broad tail) is achieved and under combination with the high value of δ, a value dispersion it is, also, achieved. But, since, $\delta > \alpha$, it means that $\delta > \alpha > \frac{\alpha}{2\pi}$ and given (from the (30)) that $q(x) \geq \delta$, we have that: $q(x) \geq \delta > \alpha > \frac{\alpha}{2\pi}$, and therefore $q(x) > \frac{\alpha}{2\pi}$, which is what we wanted to prove (the (29)).

We end up that the hypothesis of the "*The.M.U.Re.M.*" theorem-model, is correct and applies.

Briefly:

The hypothesis of existence and the "*The.M.U.Re.M.*" theorem-model, as a descriptive model, shows that by switching from a market (Auction-trading market) based on a multilateral trading, to a market that we have, essentially, incorporated into it, a market with bilateral negotiations (Dealership-interbank market), we move to a Unified (Single) market, in which there is a greater probability of trading orders aggregation, as long as with a higher probability of price finding and hence lower costs, within a smaller range of theoretical valuations.

Notes

Note 1. An example of such Unions is ISDA, which has issued standardized contracts ISDA Master Agreement, CSA, etc.) for its members (banks, Hedge Funds, etc.) for financial products traded in the over-the-counter market (OTC), only.

Note 2. One kind of such a committee is the European Banking Authority (EBA), but with issues such as the complexity and dispersion of the supervisory framework.

Note 3. It should not be confused with the existent EU authority, ESMA, which role is mainly, consulting, coordinating, intermediating and technical. Besides, its unique supervisory duty in an EU level, is the surveillance of the Credit Rating Agencies (CRAs) and of Trade Repositories.

Note 4. Barndorff-Nielsen Ole E.,"Normal Inverse Distributions and Stochastic Volatility Modelling", Scandinavian Journal of Statistics, Blackwell Publishers Ltd,, 1997, vol. 2, 1-13

Note 5. Tor Arne Øigård, Alfred Hanssen, Roy Edgar Hansen, "The Multivariate Normal Inverse Gaussian distribution: EM-estimation and analysis of synthetic aperture sonar data", XII. European Signal Processing Conference, EUSIPCO 2004, September 6-10, 2004, Vienna, Austria, ISBN: 3-1433-1436

Note 6. Stankovic Vedran, "Normal Inverse Gaussian Distribution applied in Finance and Economics", Semester Project supervised by the Swiss Banking Institute (ISB), by Prof. Thorstern Hens, University of Zurich, 2007

Note 7. Pagano M., Röell A., "Transparency and Liquidity: A Comparison of Auction and Dealer Markets with Informed Trading", The Journal of Finance, vol. LI, no 2, June 1996.

Note 8. Karlis D., Papadimitriou A., "Maximum likelihood estimation for the multivariate Normal Inverse Gaussian model", Department of Statistics, Athens University of Economics and Business, Technical Report No 202, September 2003

Note 9. Regarding the proof, we'll use the working paper for the MNIG distribution and its density probability function, of: Tor Arne Øigård, Alfred Hanssen, Roy Edgar Hansen, "The Multivariate Normal Inverse Gaussian distribution: EM-estimation and analysis of synthetic aperture sonar data", XII. European Signal Processing Conference, EUSIPCO 2004, September 6-10, 2004, Vienna, Austria, ISBN: 3-1433-1436

Note 10. The double factorial is defined, for a ν natural odd, as: $\nu!! = 1 \cdot 3 \cdot 5 \cdot 7 \ldots (\nu-2) \cdot \nu$ and for a ν natural even, as: $\nu!! = 2 \cdot 4 \cdot 6 \cdot 8 \ldots (\nu-2) \cdot \nu$