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Highlights

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Discovering Thoughts, Inventing Future

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Quality of Products: Problems and Solutions

By Lyudmila M. Kupriyanova
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Abstract- The article is devoted to the problems of products quality improvement. It is focused on the integrated management of product quality and production efficiency. Foreign experience in standardization (England, Germany, the United States, France, Japan), quality requirements and issues of national significance related to energy-saving, environmental protection, ensuring safety of life, the safety of conditions in the workplace were studied. The characteristics of public and private functions in the system of quality management and recommendations for evaluation of the quality were given. The basic principle of achieving dynamic stability of business was highlighted, oriented on active response and measurement of internal and external risk factors. The conclusion is made that there is a need to identify and use reserves to ensure the competitiveness of manufactured products, the opportunity to improve the quality using breakthrough innovations, and intellectualization that provides the creation of new products that affect the survival of producers and business development.

Keywords: quality, competitiveness, quality management, business processes, quality requirements, standards, certification, consumer price, consumer preference, the concept of risk management, international standards, profitability, business resilience, business competence, kaizen-reserves, kairyo-reserves, intellectualization.

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Quality of Products: Problems and Solutions

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"None of the standards remains forever; any standard can be improved"
Patricia Wellington,

I. Introduction

Modern companies use their resources to continuously improve the quality and modernize technology. It is important for them to keep their products at a high level of quality. Quality assurance requires combining the creative potential and practical experience of specialists. Organizations have to provide accessibility and after-sales service to keep their customers. Modern consumer is becoming more discriminating in the choice of goods. Quality, as a combination of properties and characteristics of goods, determines its suitability for use and purpose, these properties are formed when creating goods depending on the requirements of customers, and are provided with the understanding of the formation of the necessary properties of products, and the result of the quality provided, corresponding to quality standards.

The quality requirement is established by normative and normative-technical characteristics fixed in documents of state and industry standards, technical specifications and technical assignments for the design or modernization of products, drafts and process charts, technological regulations and control cards, and other documents, including company standards[1] [1,6,7].

Foreign standardization organizations are characterized by the creation of committees, institutes and standardization associations. For example, Japan's National Standards Organization is represented by the Japan Industrial Standards Committee (JISC[2]), founded in 1949, as an advisory body to the Ministry of Internal Trade and Industry. The committee is subordinate to the Office of Science and Technology, which approves all JISC work plans. The Committee includes: a standardization council (holds conferences of the Committee, plans work and monitors the implementation of the plan), councils of branch departments and technical committees (develop standards for the main industries and construction). All members of councils and technical committees, as a rule, are composed of representatives of scientific and business circles, practitioners, government employees, specialists of organizations producing products and consumers of products. Japan has national industry standards, industry standards for industry associations, and company standards under Japan's Standardization Law.

In the United States, the National Institute of Standards and Technology (NIST) is the national standardization body. This non-governmental non-profit organization coordinates the work on voluntary standardization, directs the activities of organizations that develop standards, makes decisions on the recognition of status of a national standard, or an intersectoral standard, if firms with different sectoral interests are interested in this. NIST is the only U.S. authority to adopt (approve) national standards. Its main task is to contribute to the solution of problems of national importance, in particular related to energy

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[1] Corporate standards are developed on the basis of national and industry standards, but, as a rule, the requirements of corporate standards differ from national ones due to the production capabilities of the company, its desire to satisfy the needs of certain consumer groups (for example, the target segment), focus on competitors, and others. Standardization departments lead standardization work in companies. The draft standard is necessarily sent to the company's departments for feedback and comments, after which the final draft of the corporate standard is drawn up, which is approved by the management of the company.

[2] JISC is funded by the government. According to the Law on Standardization, Japan has national industry standards, industry standards for industry associations, and company standards.

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saving, environmental protection, ensuring the safety of life and the safety of working conditions.

In Germany operates The German Institute of Standards (DIN)[3], established in 1975. This was preceded by a committee of normals for general engineering, created in 1917. The German Institute of Standards has created committees, as working bodies, to develop national standards. DIN provides the work of committees at the international and European levels, based on national standardization in the sectors: construction, electronics, chemical production, precision mechanics, optics, photography and cinematography, healthcare, nuclear technology, agriculture, mechanical engineering and shipbuilding, aviation, sports, leisure jewelry manufacturing and some others. It is important to highlight the role of standardization in the field of ensuring the safety of goods and services, environmental protection, and the creation of fundamental standards. The German Institute of Standards, in the framework of an agreement with the German Government, acts in the interests of German society, contributes to the removal of technical barriers in trade, protection of consumer and environment. German standards – "generally recognized rules of technology" - a measure of impeccable technical behavior, are recognized as the national standard when extending them to areas where federal legislative norms are applied. DIN represents national interests in Europe and around the world.

In England operates the British Standards Institute (BSI), established in 1901. Today, BSI is coordinating standards development through stakeholder agreements. The automated system "Standardline" in the structure of the central reference service with the participation of BSI is engaged in information support for standardization and dissemination of information about standards. The PERINORM service databank in cooperation with Germany and France provides information on the standards of three countries: international standards ISO and IEC, and regional standards CEN and CENELEC.

In France, the national standardization organization is the French Association for Standardization (AFNOR), whose activities include standardization, metrology, management and quality control. AFNOR has created the Espace Information and Exhibition Center for consulting and informing on all standardization issues. AFNOR Association provides methodological assistance to firms and enterprises manufacturing products, holds seminars and internships on problems of standardization and quality, provides technical documentation on the production system, product quality management, efficiency of commercial activities, etc.

In Russia, the national standardization organization is the Committee of the Russian Federation for Standardization, Metrology and Certification. The committee is engaged in standardization - it establishes norms, rules and characteristics. The State Standardization System of the Russian Federation (GSS RF) includes a set of fundamental standards that regulate standardization work across the country, at all levels of production and management based on a set of state standards. The Committee or the Gosstroy of the Russian Federation adopts the State Standard of the Russian Federation (GOST R). Standards establish the forms and methods of interaction between enterprises, entrepreneurs and government bodies[4].

The development concept of the national standardization system of the Russian Federation for the period until 2020[5] defines strategic goals and objectives, development principles and priority areas, in particular: "aviation and shipbuilding industry; space technology; telecommunication and information technology; technologies based on the use of the GLONASS satellite navigation system; medical devices; medical technology and pharmaceuticals; biotechnology; nanotechnology; energy efficiency; development of engineering and technology in the oil and gas and mining industries; construction; the creation of "smart" networks and digital substations in the electric power industry, including those aimed at ensuring reliable and uninterrupted power supply, reducing costs, increasing productivity and energy efficiency of the country's electric grid complex; ensuring labor safety and maintaining health ", ... and others, as well as:" ... enterprise management, conformity assessment, consumer protection; environmental protection, including environmental regulation, determination of levels of harmful effects on the environment and humans, environmental assessment and environmental management of business entities, a methodology for assessing health and environmental risks, and the disposal of products and industrial waste."[6]

The concept of developing a national standardization system in the Russian Federation provides for the need to implement measures to improve the system of training specialists and experts in the field of standardization.

To ensure a high level of national standardization, successfully represent Russia in organizations at the international and regional level, as

[3] (DIN) Deutsches Institut für Normung e.V. - German Institute of Standards: http://www.din.de/cmd?level=tpl-home&contextid=din

[4] State standardization as a form of development and standardization is carried out under the guidance of state bodies according to unified state standardization plans. National standardization is carried out on a state scale without a state form of leadership.

[5] Tekhekspe®t: http://docs.cntd.ru/document/902371448// - professional reference system "Ecology. Prof. "[Date of access June 11, 2015]

[6] In the same place.

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well as to increase the efficiency of using standardization documents in economic sectors, it is necessary to train highly qualified engineers and economists who have knowledge of standardization issues. It is important to update or introduce into the educational institutions of higher and secondary professional engineering and economic education standardization disciplines in the relevant areas; to organize additional education programs in the field of standardization in parallel with the development of the main educational program, and involve practitioners in the field of standardization in the formation of professional competencies of bachelors and masters, to ensure the extension of the practice (internships) of professional development of staff working in standardization areas in the economy with the participation of business communities.

For Russia, the quality problem is especially important. In many areas, entrepreneurs seek to meet international standards. The solution of the problem is possible through the efforts of the state, scientists, designers, enterprise managers, as well as consumers. The state is capable and should maintain at the optimum level the efficient work of domestic producers, and for this, to establish requirements for product safety, monitor the conformity of its declared and real quality, and determine standardization and certification procedures.

Implementing the basic principles of standardization, the principle of balancing the interests of the parties, developers, manufacturers and consumers of products is highlighted. The developer seeks to create the most perfect product, the manufacturer takes care of the manufacturability and cost of production, and the consumer (buyer) wants to satisfy his needs by purchasing a product (service). The principle of consistency and complexity of standardization considers each object as part of a complex system. For example, a PC consists of hardware and standard programs, therefore, when developing them, it is important to pay attention to certain standard requirements in combination.

The dynamism and the accelerated development of standardization as a principle has been formed in modern fundamental laws on standardization and is focused on taking into account the possibility of appearance of new products and new technological processes. New products that do not meet current standards cannot be used effectively. In case of the possibility of appearance of new products, in the law "On Standardization" the principle of the advancing development of standardization, the ability to cover new, unknown achievements of science and technology is formed. The application of standards should provide economic (due to saved resources, increasing reliability, increasing technical and information compatibility) or social effect (ensuring the safety and health of people, the environment, etc.). The main attention should be paid to the priority of developing standards that contribute to the safety, compatibility and interchangeability of products and services, as well as the implementation of the principle of hormonization.

The principle of hormonization provides for the development of hormonization of standards - standards at all levels from international to individual company standards should be composed uniformly and without contradictions, which guarantees unhindered interaction between ministries, departments, enterprises, and partners in international trade. To make rational management decisions to improve the quality of production, it is necessary not only to know the problems and bottlenecks in production, it is necessary to apply a systematic approach to quality management, international[7] and domestic standards, mastery of organizational and methodological foundations of certification and metrology, and take into account the specifics of industries.

When assessing quality, one should take into account the general trends of physical and moral aging, as well as deviations of quality from established requirements, in particular: violation of the rules and operating conditions, mistakes of developers and manufacturers, violation of production discipline, equipment defects, etc. It is also important to take into account the instability and variability of needs. Provided that the quality meets all standards and technical conditions, and the requirements of consumers change, the quality with constant parameters deteriorates. This objective reality shows that quality is an unstable object, which focuses on the study of problems, the collection of information and the development of measures to improve quality.

The market economy makes special demands on the quality of products, and this is justified by the need to ensure its competitiveness. In turn, competitiveness is characterized by a large number of factors, and in particular the level of prices and product quality. At the same time, product quality - operational safety, reliability, design, level of after-sales service should be put in the first place. Quality, being a synthetic indicator, reflects the combined manifestation of such factors as: the dynamics and level of development of the national economy, the ability to organize and manage the production of quality products, identify and use kaizen and kairyo reserves, which ensure the competitiveness of products[8], as

[7] International Standard - A standard adopted by an international standardization organization. The development of international relations leads to the need for the development and widespread use of international standards. In 1946, the International Organization for Standardization (ISO) was established, the main activity of which is the development of international standards.

[8] Kaizen reserves are series of small, ubiquitous and continuous improvements that do not require large investments. Kairyo - radical

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opportunities to improve quality for account of breakthrough innovations. Practice shows that in a market economy there are factors in a competitive environment that can affect the survival of producers and the results of business development.

The modern approach to business development is objectively associated with the understanding of quality as an effective means of satisfying the requirements of consumers and manufacturers interested in reducement of production costs. Therefore, characterizing quality as a set of properties of products that can satisfy the needs of customers (users), it should be understood that quality as a product of labor is a category inextricably linked to consumer value, which characterizes the ability of the acquired product to satisfy a need. Consumer value objectively forms the basis of quality, and quality characterizes the measure of consumer value, the degree of suitability and usefulness of the goods.

As a result of the evolution of the concepts of quality, social needs and production opportunities for satisfying them have increased. Aristotle (III century BC) formulated the definition of quality as the difference between objects, differentiated on the basis of "good-bad." In the XIX century AD Hegel said that "Quality is, first and foremost, a certainty identical with being, so that something ceases to be what it is when it loses its quality." According to the Chinese version - quality, which is indicated by a hieroglyph of two elements, is characterized by the equality of "balance" and "money", as a model:

QUALITY = EQUILIBRIUM + MONEY, therefore the quality of production of products is identical to the concept of "upscale" and "expensive".

In practice, an equal sign is often put between quality and competitiveness, and often no distinction is made between them. Moreover, the concept of competitiveness is broader than the concept of quality. Quality, which is important to understand, is not the only component of product competitiveness that predetermines its level (Fig. 1).

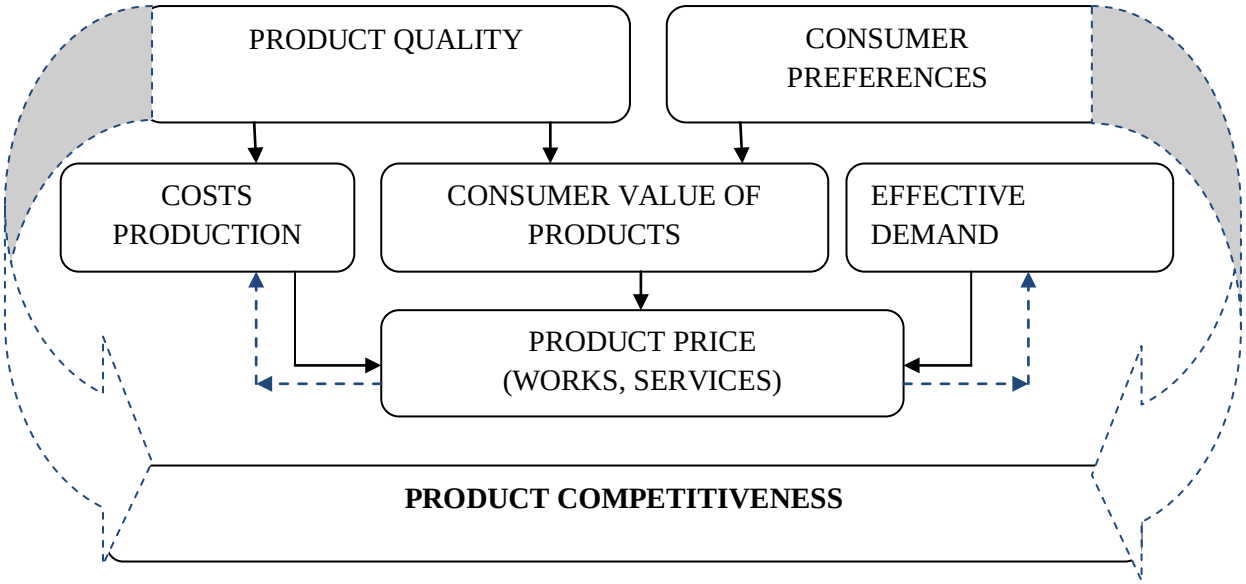


Fig. 1: Formation of product competitiveness

improvement - major improvements, involving one-time cardinal organization of the process and requiring large investments.

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In 1931, Walter Schuhart, an American scientist and consultant in the theory of quality management, identified two aspects of quality: objective physical characteristics, and subjective (how good is the product). Scientist Ishikawa Kaoru in 1950 wrote that quality should really satisfy the needs of consumers, he was convinced that the success of Japan in conquering world markets largely depends on the belief in the effectiveness of quality control methods[9].

Control of safety of quality and products on the Russian market is based on regulations, this is a check of compliance of the quality indicators of a particular product with the requirements, standards, technical conditions, as well as the requirements specified in the supply contract. Monitoring is carried out in order to verify a limited number of indicators and establish the variety of the product. At the same time, a broader concept than control is quality assessment.

Quality assessment as a set of operations includes the selection of the nomenclature of quality indicators of the evaluated products, the determination of the values of these indicators and their comparison with the basic ones, the determination of the quality level. Level assessment is carried out when making decisions on choosing the best product for sale, planning quality indicators of goods, etc.

To study consumers means to analyze their most important values, characteristics, behavior, specifics of making decisions about the purchase of goods. Working on targeted markets, developing a marketing strategy focused on customer satisfaction, it is important for the company to determine the goals of its activities and ways to achieve them, to minimize risks when introducing new products. The information and knowledge obtained help to predict the future needs of consumers, increase their satisfaction, receive financial benefits in the form of a higher market value [5.18].

It is important to understand the difference in the characteristics of the product from its value, which gives the product to the consumer, which is important for business development. It is necessary to evaluate the values of the company itself, striving for success and the values that are significant for the consumer. Each consumer has its own set of values. The study of value is carried out using various methods, for example, according to the scale of values of M. Rokich, S. Schwartz, two classes of values are evaluated: terminal (value of the goal) and instrumental (value-means). In the diagnosis of personal value orientations, as terminal values, we can distinguish: financial status, creativity, social contacts, self-development and personal prestige, preservation of individuality and others, which together can be represented in various areas of life: professional life, training and education, family and social life [2,8].

The analysis of value and ranking of indicators by importance, allows to identify indicators on which it is necessary to concentrate business efforts in the field of quality assurance. When planning quality, at a strategic level, one determines the promising areas of quality development. Current planning includes: a plan for the removal from production of obsolete and non-competitive products, a plan for the modernization of manufactured products with high quality, a plan for the development of new types of products. Moreover, the implementation of quality improvement plans requires material and financial support, economic justification, taking into account the results of studying current and future demand and customer reviews and the results of product specifications; compliance with standards and specifications, development of R&D, patent materials, etc. It is also important to coordinate these plans with other production plans aimed at improving, including sets of measures to improve quality, and based on the principles of a systematic approach, covering all levels of management and all stages of the product life cycle.

Every year, in Russia, at the Expo Control exhibition, Russian specialists demonstrate the multifaceted nature and variety of the latest solutions and technologies for measuring, testing and quality control in industrial production and in scientific research. Among the participants of Expo Control in Moscow there are specialists from more than 80 companies from Russian regions and foreign countries - Germany, Italy, the USA, Switzerland and other countries of the world[10]. At conferences in business circles, fundamentally new requirements for the quality of products (works, services) are discussed. This is objectively due to the fact that the survival of any company, its stable position in the market for goods is determined by the level of competitiveness. It should be noted that competitiveness is associated with several factors, in particular, the price level and product quality, and more important factors are related to product quality and labor productivity, while saving all resources used in production is giving way to product quality.

But the quality problem has been and remains relevant. This is a strategic problem, the solution of which determines the stability of the state economy. Therefore, the most important task of product quality management is to ensure the optimal level of quality by determining the economic effect of its increase at all stages (production and sale, consumption and operation).

Studying foreign experience, American business management experience based on individual and entrepreneurial initiative is of interest. In developing the concept of increasing competitiveness, Americans pay great attention to:

[9] http://magazine.hrm.ru/klassiki-menedzhmenta-isikava-kaoru

[10] «Expo Control» exhibition website: http://expo-control.com/uchastie/o-vyistavke/

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The development of science, engineering and technology; the sphere of education, which has become the locomotive of the socio-economic development of American society; development of quality management systems and successfully implementation of models of continuous improvement of business processes (personnel management, production management, information systems management, finance, accounting and marketing).

Much attention is also paid to the competencies of managers such as: strategic competence (global and systemic thinking, the ability to see and solve problems, security relationships); social competence (such skills as teamworking, including in international teams, the ability to motivate and convince colleagues, learning and innovate skills, personal charm, the ability to resolve conflicts); functional competence (the ability to make managerial decisions, initiative, working skills and flexibility in work, endurance in work), managerial competence (organizing skills, the ability to bear responsibility, the strength of beliefs, the authority of the leader, the behavior of the leader); professional competencies (university education, experience in linear and staff work, work experience in most functional areas and work experience abroad, knowledge of at least two foreign languages).

Today, professional managers can build their teamwork abilities in business games and consulting projects, solve cases developed on real practical situations from a business, start studying with an essay, and finish with master's theses, develop a personal strategy and achieve the goal - prestigious work. Studying the problems of quality management, entrepreneurs create a productive network of developing and implementing high quality standards, using the best modern approaches, and achieve success in business in a spiral of success: high quality, low costs, higher profits, more reinvestment; higher quality, lower costs, etc. [9,10,11].

Today, Gazprom and Rosstandart have embarked on the implementation of the best practices of standardization, metrology and ensuring the quality of products (works, services). In the coming years Gazprom plans to develop national corporate standards for the production of highly efficient technological equipment for Gazprom[11](2016-2018); to take measures to synchronize the corporate regulatory framework with the latest standards in the energy sector, and by 2018 to introduce a product quality management system, increase production management efficiency, optimize costs, coordinate and implement investment projects.

Practice shows that in the competitive environment, product quality and associated costs become important factors in the economic situation of a company, business development, and in particular such an indicator as profit. The intensive effectiveness of the quality system can be manifested in reducing the cost of production by minimizing the total costs for all cost groups. New approaches to the quality problem require manufacturers to take into account the market factor, organizational and economic measures of quality management and the transition to the more flexible standardization system. This will allow manufacturers to quickly respond to rapidly changing requirements of the internal and external market environment for the quality of goods, for the organization of work to ensure high quality products.

To assess the quality level, one can use the differential (comparison of unitary quality indicators of new products with identical basic quality indicators) and complex (comparison of actual complex indicators with basic and complex indicators) methods. Traditionally, numerical values of quality indicators are established using various methods for assessing and measuring product quality indicators: objective (measuring, registration, calculation), and subjective (organoleptic, sociological, expert) (tab. 1).

[11] Official website of Gazprom: http://www.gazprom.ru/press/news/2014/may/article191681/

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Table 1: Methods for determining the quality of products

Method	Characteristic
Objective methods	
Measuring method	It is based on information obtained using technical measuring instruments and devices, equipment, chemicals and utensils. It requires specially equipped premises and specialists trained for analysis. For example, in the food and cosmetic industry, the mass of a product, the content of fats and carbohydrates, emulsifiers, esters, and others; in mechanical engineering - engine speed, product size, vehicle speed, amperage, etc.
Registration method	Based on the use of information obtained by recording and counting the number of certain events, items, costs. For example, product failure during testing; the number of defective containers, defective products in a batch during acceptance, storage, sale, reconciliation of inventory items. Used to determine indicators of unification, patent law indicators, etc.
Calculation method	It is based on the use of information obtained by theoretical and empirical dependencies of product quality indicators on its parameters. For example, when designing products, when objectively there is no product, and experimental research is impossible. Used to determine values: product mass, performance indicators, power, strength, etc.
Subjective methods	
Organoleptic method	Based on the analysis of the perception of the senses - vision, smell, hearing, taste. The value of the indicators is determined by analyzing the sensations obtained on the basis of existing experience and is expressed in points. The accuracy and reliability of the assessment depends on the qualifications, skills and abilities of the specialist and on the conditions for the analysis. Advantage: fast, cheap, affordable. The disadvantage of this method is subjectivity (inaccuracy). Used to determine the performance of confectionery, perfumes and other products.
Expert method	Based on a decision made by experts (scientists, designers, technologists, product experts), etc., it allows to objectively evaluate the quality of products. It means the production of special experiments, tests in appropriate - created or selected - conditions. It is used in forensic research, investigative and judicial practice, in the production of forensic examinations.
Sociological method	Based on the collection and analysis of the opinions of actual and potential consumers of products. The attitude of consumers to the quality of products is revealed by taking into account the questionnaires completed by them, holding consumer conferences, sales exhibitions, tastings, and other events.

Improvement of the quality of products and services is the most important area of increasing business efficiency. In this regard, the role and importance of integrated management of product quality and production efficiency is growing. Assessing the level and quality of products is objectively the basis for taking managerial influence in the quality management system.

Quality assessment system as a set of responsibilities, procedures and resources providing a general guide to quality assessment is based on a quantitative measurement of the defining properties of product quality indicators (purpose, reliability, manufacturability, standardization and unification, ergonomics, aesthetics, transportability, environmental friendliness, safety, patent indicators). Quantitative indicators are determined by experimental, organoleptic and sociological methods. In aggregate, all indicators for various objects are regulated in the relevant regulatory legal acts and documents - laws, standards, norms, rules. Such quality assessment system is used to determine the level of quality at all stages of the innovation process, it allows making effective management decisions that are justified: objective assessment of product quality at various stages of reproduction, taking into account the relationship between quality, quantity and price; an objective reflection of the properties and indicators characterizing quality in regulatory technical documents for products; objective data on the quality, technical level and competitiveness at all stages of the product life cycle.

In the quality assessment system, the appropriate place is taken by the ISO 9000 International Standards (ISO 9001, ISO 9002 and ISO 9003), focused on a specific policy and the achievement of goals. These fundamental documents of quality management system contain a quality assurance methodology, models of functional (organizational) relationships between suppliers and consumers; Standards 9000 and 9004 define the requirements for a quality system and quality management.

Compliance with the requirements of ISO 9001:2011 will provide organizations with the opportunity to enter the market, based on the assessment of commercial activities on the principles of

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transparency and standardization of the rules by which production is carried out. The document confirming such compliance is a certificate[12]. The certification of the quality management system (QMS) in Russia is carried out by organizations accredited to the State Standard, that issue certificates for compliance with GOST ISO 9001-2011, which are valid in the Russian Federation. To work on the European market, certification of QMS compliance with ISO requirements from a Western certification body is required, in particular: BSI (British Standard Institute) (Great Britain), Det Norske Veritas (Norway), Societe Generale de Surveillance (Switzerland), etc.

Practice shows that the implementation of the QMS contributes to an increase in the volume of production (90%), the expansion of the customer base and the assortment range of products (85%), and the reduction in the number of complaints about product quality (60%) [3].

The certification procedure provides for a preliminary audit of the company by the certification body, a thorough check of the object for which the Certificate is issued. The presence of the Certificate is confirmed by documentary evidence of the quality of work performed, by the presence of the effectively working quality management system at the enterprise [4,5].

The modern quality management system objectively focused on business performance, not only ensures participation in many state tenders and competitions of certified enterprises, but also opens up opportunities for entering international markets where it is impossible to state the serious intentions of the company without a Certificate.

Practice shows that obtaining a Quality Certificate not only makes it possible to attract large investments or credit resources, increase the reputation of the brand, but also is a good advertisement of products, it attracts customers (buyers, customers), and, which is most important - makes it possible to significantly increase profits. The company receives the opportunity to increase profits through the optimization of business processes, thereby increasing sales and reducing costs. For buyers, the presence of a Certificate is a guarantee of product quality. ISO certification all over the world is the evidence of effective quality management, the key to the competitiveness of the company and its products on the national and international market.

The achievement of dynamic business sustainability remains the principle of an active response to the measurement of internal and external risk factors. External destabilizing factors of stability in relation to the enterprise are determined by the stability of the economic environment, internal dynamics and trends over time of indicators characterizing the results of production, management, personnel and financial and economic activities of the organization. Internal and external risks, as vectors of development, show the achieving of goals, at the same time acting in opposite directions: the higher the stability, the lower is the risk in terms of deviation from the expected result, and vice versa. Therefore, risk assessment is objectively related to the probability of occurrence of events and the effect caused by this event, which can be negative (loss) and positive (gain) [13,14].

Accepting the concept of risk management, a model of dynamic stability is adopted - increasing organization and efficiency, with a set of goals, expressed by streamlining indicators of the economic condition of the organization [15,20]. For example, at the micro level - the level of small and medium business structures, the new quality of economic growth should be characterized by dynamic stability and efficiency, combining economic and social characteristics of business development into a single system. At the same time, the concepts of sustainable growth are generalized, reflecting not only the economic growth, but also a new quality and efficiency in unity and development [16, 17].

Poor product quality can objectively be the reason for buyers' refusal to purchase goods, it can lower the financial stability of the enterprise, and lead to bankruptcy. The consistent application of quality management tactics is necessary, in practice it is called quality control. The fulfillment of all requirements of conformity to quality is ensured by product quality management, which should be implemented systematically. The product quality management system should function as an organizational structure that distributes responsibility and procedures, processes and resources necessary for quality management. The Quality Management Services operating in the structure of the company solve the main tasks, in particular: they protect the reputation of the company, protect consumers from defective products, as well as reduce unproductive work and prevent spoilage at the enterprise.

The quality policy is formulated in the form of business principles and long-term business development goals. For example, to improve the economic situation of an enterprise; to expand the market, to gain new sales markets; to achieve a high technical level of products, to increase the level of leading enterprises in the industry; to focus on customer satisfaction by industry or region; to develop products, taking into account the implementation of new

[12] Standardization and certification together form a single and clear quality management system. In this aggregate, standardization is the regulating element, which regulates quality requirements, and certification is an important element in monitoring compliance with these requirements.

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principles, an increase in warranty service and the development of service.

World experience shows that it is quality that is the most important factor in overcoming the economic crisis, and the determining vector is the innovative vector of development in the areas of: technological, benchmarking, intellectually creative, informational, integration reserves; kaizen reserves - the involvement of each employee in work to improve the quality of products, works and services; Kairyo reserves - ensuring competitiveness - improvements that demand a radical organization, requiring more investment to improve the quality of enterprise management and the quality of products [12,19,20].

Objectively high results of the effectiveness of business development will be ensured by the intellectualization of the enterprise - orientation of the activity to the acquisition, creation, use of knowledge and competencies, with the aim of transforming them into new products, services or business models. Intellectualization requires operational and strategic decisions, the creation of competency models that focus on the ability to develop and improve the human resource, and the answer to the questions: why a business competency model is needed, and why it is a link in the personnel management system, why it is necessary to start with competencies, if the company faces with issues of increasing the efficiency of business processes.

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Management of Kuwait Investments and it's Impact on the Performance of Amman Stock Exchange

By Dr. Mohammad Abdulmajeed Alrgaibat

Abstract- The financial markets need the availability of good information enables investors to choose the best alternatives available for the right price system, This view is supported by many researchers when they assert that the internal information is considered one of the main ingredients for an investor when making its decision shall be served as the main information for the investor in making his decision, and the foundation will build it all resolutions available in the market and traded investment and the time period for retaining each alternative. (Khalil, 2005) Jordan realized early the importance of foreign direct investment and its role in influencing the overall economic development through the funding of development projects and create jobs and increase competitiveness in foreign markets efforts.

Keywords: management, kuwait investments, performance, amman stock exchange.

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Dr. Mohammad Abdulmajeed Alrgaibat

Abstract- **The financial markets need the availability of good information enables investors to choose the best alternatives available for the right price system, This view is supported by many researchers when they assert that the internal information is considered one of the main ingredients for an investor when making its decision shall be served as the main information for the investor in making his decision, and the foundation will build it all resolutions available in the market and traded investment and the time period for retaining each alternative. (Khalil, 2005) Jordan realized early the importance of foreign direct investment and its role in influencing the overall economic development through the funding of development projects and create jobs and increase competitiveness in foreign markets efforts.**

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I. Introduction

States moving recently toward market economies, through many of the tools and means to ensure the provision of necessary economic development funds. Therefore it resorted to revitalize the capital market and the development of financial instruments and the development of new methods and tools of investment funds held, which fit in with the local environment and the stage of growth experienced by the national economy and its requirements. (Scarf, 2009).

The financial markets need the availability of good information enables investors to choose the best alternatives available for the right price system, This view is supported by many researchers when they assert that the internal information is considered one of the main ingredients for an investor when making its decision shall be served as the main information for the investor in making his decision, and the foundation will build it all resolutions available in the market and traded investment and the time period for retaining each alternative. (Khalil, 2005).

Jordan realized early the importance of foreign direct investment and its role in influencing the overall economic development through the funding of development projects and create jobs and increase competitiveness in foreign markets efforts. In order to encourage investors and attract more investment, Jordan has taken a pivotal step was to provide a legislative and administrative environment and to provide the incentives and facilities for foreign investments and to ensure its success and to achieve the desired objectives. (Annual Report of Jordan Kuwait Bank for the year 2017) Amman Stock Exchange and is an important step in the economic development in Jordan through the Investment and Financial Savings best investment to serve the Jordanian economy. And managed the financial market of Oman in creating a favorable investment climate and increase the trust between the investor and the market through different tools and devices within the legislative and regulatory flexible framework enabling the achievement of awareness on the part of individuals and institutions that help assemble Savings and directed towards young projects that need. (Abu Radi 2014).

II. Research Problem

Play the stock markets in developing countries, including the Amman Financial Market role Brza in supporting economic development in Jordan plans depending on the compilation of the savings of individuals and providing economic units to be employed in the production of goods and services, and several studies have pointed out that the stock market of the organization's performance success depends on how accurate quantitative and financial information provided by this market in terms of that, as well as the accuracy of special economic restricted units of accounting information in this market on the other. In spite of the Treasury to receive Arab and foreign grants good, could not the Jordanian economy to come out of the bottleneck during 2013 and remained under pressure, did not achieve the economic reform program of all the objectives set and achieved many cons in terms of inflation and the budget deficit, rising debt ratio to an unprecedented level and including equivalent to 80% of GDP, and remained low self-reliance in the range of 85% of the index. Therefore Jordan must take the initiative in facilitating external investment activities, particularly Kuwait, so I figured the problem of research to identify the impact of the Kuwait Investment size on the performance of the Amman Stock Exchange during the period (2000-2017).

Research questions: The key question: Is there a statistically significant impact at the level of ($\alpha \leq 0.05$) to

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the size of the Kuwaiti investment performance of the Amman Stock Exchange for the year (2000-2017)? The fork to the following sub-questions:

1. Is there a statistically significant effect of the volume of Kuwaiti investments in the Amman Stock Exchange on net profit during the period (2000-2017)?
2. Is there a statistically significant effect of the number of shares of the investment on the net profit in the Amman Stock Exchange during the time period (2000-2017).
3. Is there a statistically significant effect of the market value of the investments on Nsafa profit in the Amman Stock Exchange during the time period (2000-2017).

III. Research Hypotheses

The main premise: There is a statistically significant impact at the level of ($\alpha \leq 0.05$) to the size of the Kuwaiti investment performance of the Amman Stock Exchange for the year (2000-2017). And subdivided them the following assumptions:

- There is a statistically significant effect of the investment on the net profit in the Amman Stock Exchange during the time period (2000-2017).

Research Goals: The primary goal of this study is to demonstrate the impact of the volume of Kuwaiti investments in Jordan on the performance of the Amman Stock Exchange for the period (2000-2017), namely the aim of the research to reveal:

- The impact of a statistically significant investment on the net profit in the Amman Stock Exchange during the time period (2000-2017).

Research Importance: The importance of the study of the importance of the topic that is addressed, as is the stock market as an intermediary between investors and play an important role in the recovery of the national economy, and identify the impact of the Kuwaiti investment in Jordan on the financial performance of Oman, including its importance is to recognize the volume of Kuwaiti investments in Jordan and its role in Jordan's economic situation for the period (2000-2017), and the impact of investment on the market value and the percentage of debt and net profit in the Amman Stock Exchange during the time period (2000-2017).

Definition of Terms Foreign Investment: Intended to invest a natural or legal person in the town of Balad, using his experience or his or his money to carry out economic projects, whether alone or in combination with a natural or legal person, local or foreigner, or with the state or with its citizens in creating a project or joint ventures. The concept Last movements of capital from the investing country to the recipient country with a view to the creation or development of a project for the production of goods and services. (Taan, 2016, p. 5)

The stock market: a market continuing work is done through which the securities in the official working hours, and characterized the stock market usually as a full market economic sense and perfect sense in this regard the availability of knowledge of buyers and sellers of market conditions by virtue of full contact with each other, and the homogeneity of the securities trader where homogeneous full, and provide freedom of buying and selling, and the ability of market participants on Thin possible opportunities to benefit from fluctuations in actual and projected prices. (Abu Musa, 2015).

Search limits: Spatial boundaries: includes Kuwaiti investments in the Amman Stock Exchange. Time limits: covering the period of 2000 -2017 m.

Constitute the Kuwaiti investments in Jordan, an important tributary of the Kingdom economically enhances the added value of the various production sectors and alleviate unemployment and contributing to sustainable development in the governorates of the Kingdom taking advantage of the climate of security and safety, political stability and economic enjoyed by Jordan. And works of Kuwaiti investments and spread over several sectors including industry, hotels, hospitals, real estate and financial market, and the Kuwaiti grant Jordan in the GCC grant and which amounts to the state budget framework and have had a significant impact in the funding and delivery of Kuwait's share of which 25.1 billion contributed in support of developmental priority projects .It should be noted that the relationship between the Kuwait Fund for Arab Economic Development in Jordan, where the first agreement Fund signed after its founding in 1961, was with Jordan and has in 1962 totaled projects that the fund was carried out in Jordan so far about 25 projects with a total value of $ 650 million. *Kuwaiti investments in the Amman Stock Exchange (the annual report to Jordan Kuwait Bank in 2013www.jkb.com)* Private investment figures have shown markets Arab capital at the end of the year 2013 that Kuwait was ranked first as the most important foreign and Arabic in Arab stock portfolio investor, valued at $ 20.1 billion and a share of 18.23% followed by the United Kingdom in second place with $ 20.9 billion and a share of 18.21% then the United States came in third place with $ 12 billion and a share of 10.9%. As for the volume of Kuwaiti investments in the Amman Stock Exchange indicate numbers that Kuwait occupies the first place in the volume of investments at the level of Arab and foreign countries has reached the proportion of Kuwaiti investments to the total Arab investments in Jordan is about 60.7%, as they exceed 57% of the total investment by State of Kuwait in the Arab financial markets to up to about 3.2% of the size of those markets. On the other hand, the total Kuwaiti investments in Jordan constitute approximately 37% of the total size of the backlog of Arab investments in the

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Jordanian market and with balances amounted to about 9.16 billion since the end of 2011, built with today's slight increases make it nearly ten billion dollars by encouraging Foundation figures to invest in Jordan, which means that more than one-third of Arab investments in the Jordanian economy is the State of Kuwait, a result that suggests that the State of Kuwait is the first Arab state in the volume of Arab investments in the country, as they form an external investor for the Jordanian economy.

IV. Previous Studies

1. *Study (Scarf, 2016) entitled: "The role of foreign investment in the development of Palestine Exchange performance.".*

States moving recently toward market economies and one to you through many of the tools and means to ensure the provision of necessary economic development funds. Therefore it resorted to revitalize the capital market and the development of methods and tools are new to investing, which fit in with the local environment and the stage of growth experienced by the Palestinian national economy and its requirements.

Focus on the development and revitalization of the stock has begun through a number of measures and laws, most recently issued No. (1) for the year 2003 on the promotion of investment in Palestine and the consequent procedures and rules of organization to work within the capital market so as to reach the market is active and effective. However, the focus on the one side does not meet the special purpose under the conditions of developing countries in general, and the conditions of the Palestinian environment is particularly characterized by a low per capita income and thus lower the size of savings. This study is trying to highlight the role of the financial market in an attempt to attract foreign investment in the Palestinian financial market and the Palestinian economy, and try to upgrade it to match the modest size of the Palestinian market in the light of all the obstacles it faces.

The study was conducted on listed companies financial market which operates 36 companies were distributed to 54 watts questionnaire recover 47 questionnaire which accounted for 87% of the target sample. The study concluded from the survey that the financial market does not fully turn in foreign investment to support and encourage them to invest in Palestine due to the economic and political situation is precarious in Palestine. In light of the result of the study of this study it suggested some recommendations, notably to try to financial market by setting specific laws to protect foreign investors and maintain the rights of the financial market and to provide more facilities to attract foreign investors to Palestine that the financial market is trying to partial separation of politics from the economy and so with the help of the Ministry of Economy.

2. *Study (Lozi 0.2013) entitled: "The effect of the exercise of earnings management on stock prices experimental study of the companies listed at the ASE industrial companies.".*

This study aims to earnings management in public companies listed on the ASE industrial companies analysis and its impact on the stock of these companies in the financial market price, the study shows the concept of earnings management and the models used to detect whether management profits moral justification to be used to influence the stock prices in the listed industrial companies in the Amman Stock Exchange. The study also illustrates the effect of some other variables along with the earnings management in its impact on stock prices in companies listed on the ASE industrial companies such as company size, size of the Audit Office, and the proportion of debt. Researcher used descriptive and analytical approach which is based on the description of certain characteristics of the phenomenon and collect information about them was through a case study and as descriptive and analytical approach is by reference to various documents such as books, magazines and other materials in order to reach the objectives of the research. It has also been relying on the historical method's review in the previous studies. The nature of the study are experimental study where to study the problem of predominantly analytical nature of the Group of variables that affect stock prices. The study population of industrial companies listed on the ASE 77 company and the number of companies as a guide to the year 2011 which provide their financial reports for the period prescribed by the researcher for the period from 2008 to 2015 made up. Was chosen as this sector given the importance of this sector in the national economy and why this sector has the characteristics relating to the availability of large opportunities for senior management to manage earnings. Some accounting standards give the company's management several alternatives to deal with the same item a lot of resilience, was chosen as a representative random sample of community study. The researcher reached a number of results, including:

- The average closing prices of industrial companies with Jordan 3025 Jordanian dinars in 2008, and in the closing stock price levels rose to reach up to 4.30 Jordanian dinars, and after closing low prices resumed slightly to settle in 2010-2011, at an average of 4.00 Jordanian dinars.- The overall average for optional benefits for 2008 was close to 29%, and rose to 29.5% in 2009, to fall in 2010 to below 28% shortly, but in 2011, he averages optional dues amounted to 27.5%. In general, we

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find that there is a convergence between the rates on different years.

- Indebtedness industrial companies size in Jordan were close during the years 2008-2009, the debt ratios broadly to rise in 2010, with an average height of nearly 4 million Jordanian dinars, while in 2011 fell an average debt of industrial companies Jordanian size to nearly 15 million dinars Jordanian.
- It was classified auditing offices where large offices ratio of 10.7%, 89.3% were classified as small offices.
- The results indicated that 53.5% of the industrial companies of the study sample exercised subject of earnings management, while 46.5% did not practice earnings management.

The researcher recommends the following:

- The need to broaden the application of earnings management among all industrial companies, to link it to the financial performance of the companies. The importance of the expertise of the big audit firms to link with the appropriate application to manage earnings.
- Conducting recent studies on the impact of earnings management to the reservation policy variables.
- Work to provide consulting for industrial companies on the scientific and methodological foundations in order to work on the application of earnings management effectively.

3. *Study (Radi, 2015) entitled: "Analysis of banks listed on the Amman Stock Exchange trading volume of the shares using a time series model*".

1. This study aimed to analyze the reality of the stock in the ASE in the banking sector Using time series analysis model, through the following objectives: analyze the direction of the arrows on the Amman Stock Exchange in the banking sector by using time series analysis model.
2. Access to an efficient market to apply the conditions in the market.
3. The reality of the general trend of stock prices in the Amman Stock Exchange analysis through turnover ratio Over the twelve months to over eight years (2007-2000) to find the variables affecting the performance.
4. Reached to identify the most important time series are affected by stock prices on the Amman Stock Exchange components (seasonality, and periodic, and random) identified with any of these components, which are subject to a price changes for stocks.
5. Try to determine the general orientation of the direction of the time series of stock prices for the coming period through the use of basic components model.

This study was done on three hypotheses boss, the study sample consisted of banks listed on the Amman Stock Exchange and consisting of 17 banks, has been using Excel software to analyze the data rate of turnover of shares on the ASE to achieve results.

The study found many of the most important conclusions:

1. The results showed that the turnover ratio for the banks listed on the Amman Stock Exchange sector affected by irregular variables was clear, in addition to the impact of changes on the overall direction of the seasonal and cyclical variables and variables.
2. The results showed that trading volume plays a big role in changing the course of the direction of prices, in the case of higher prices, increased circulation something required size.

In the case of low prices, the junk is to reduce the volume. Based on the above findings, the researcher presented a set of recommendations for the appropriate use of time series analysis in the analysis of the reality of the stock in the ASE model.

4. *Study (Anzi 0.2014) entitled: "The legal system for foreign direct investment, a study in the Kuwaiti Investment Law No. (8) of the year 2001*".

Foreign direct investment is the first goal that Kuwait seeks to pull him to the inside, and that is what provided the crucial advantages.

Kuwait has become a look at the overall development a major goal to get out of its problems, and the tool of this development is foreign direct investment, and in particular that the investment plays a key role in the technological flows in the development process, the State of Kuwait does not need financial flows but require technology flows that holds investment.

Hence, this study was to shed light on the legal provisions governing foreign direct investment under the Foreign Capital Investment Law in Kuwait No. 8 for the year 2001.

5. *Study (Omoush, 2015). banoan: "The relationship between financial performance indicators and stock prices, Empirical Study on Jordanian industrial companies in the Amman Stock Exchange.".*

This study aimed to identify the relationship Pim financial performance and price the stock indices, as well as to identify any of the performance indicators most influential and linked to stock prices, by testing the correlation between the built-up performance indicators on accounting earnings and indicators based performance on the cash flows as well as modern performance at the stock gauges. Researcher relied on the analytical method and the equations financial ratios in the test and measurement of the relationship between performance and stock prices metrics, and The study population consisted of industrial companies listed on the Amman Stock Exchange during the period 2004-

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2008, as it has been selected Sample of 54 industrial company.

The researcher used statistical methods within the Social Sciences statistical package ((SPSS in data that has been collected through the data of manufacturing companies listed on the Amman Stock Exchange during the period between 2004 to 2008 analysis.

The study found a number of the results highlighted by the presence of a statistically significant relationship between financial performance indicators combined stock prices, since the change of financial performance indicators combined lead to a change in stock prices, and that there is a difference in the correlation between financial performance indicators combined variable independently and stock prices as a variable He, as the results showed that the correlation was strong in 2004, 2007 and 2015, while there was no relationship between the independent and dependent variables in 2005 and 2015.

V. Research Methodology

This research supports descriptive and analytical approach to identify the impact of the Kuwaiti Aleighttmarat on the Amman Stock Exchange. The reference to the theoretical studies and books related to the subject of the study was the use of financial ratios and indicators related to the subject of study in order to extract the results.

a) Research community

Research community consists of financial Alebanat trading volume and the number of shares traded and the number of shares subscribed by Kuwaiti investors, and market value, net profit, and the proportion of debt in the Amman Stock Exchange during the time period (2000-2017).

b) Data collection methods

We have adopted this research primary sources and secondary schools to obtain the data necessary for the preparation of this research and information, where the reference to the books and studies related to the subject of the study, extract financial data listed in Amman own independent variables and subsidiaries in the period Financial Market (2000- 2017 AD).

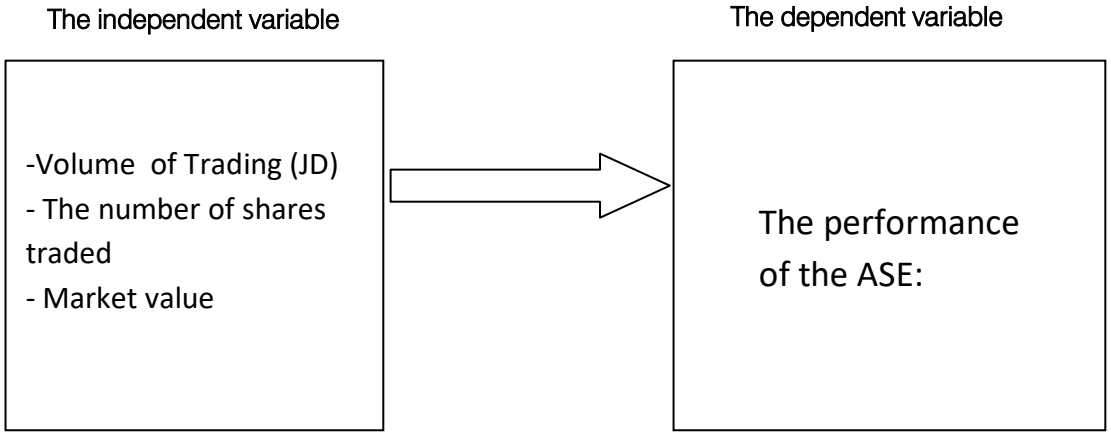
c) Statistical methods

The use of appropriate statistical treatments, and through the multiple regression analysis (Multiple Regression) to detect the effect of the independent variables of subsidiaries and testing hypotheses.

The variables of research Independent variables: Kuwaiti investment in Jordan ((volume, number of shares traded, the number of shares subscribed)).

*The dependent variable:*The financial performance of the Amman Stock Exchange (market value, net income, indebtedness) ratio.

d) Research model



e) Search hypothesis testing results

This chapter includes a detailed statistical analysis and financial results of the study, which aims to identify the impact of the Kuwaiti investment in Jordan on the performance of the Amman Stock Exchange during the time period (2000-2017), and will display the results based on the assumptions of the study.

First hypothesis: There is a statistically significant effect of the investment on the market value at the Amman Stock Exchange during the time period (2000-2017). To test this hypothesis, the use of multiple regression analysis (Multiple Regression) to detect the effect of investment, represented by (volume, number of shares traded, the number of shares subscribed) on the market value at the Amman Stock Exchange during the time period (2000-2017), and the table (1) illustrates this.

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Table 1: Results of multiple regression analysis (Multiple Regression)

The result of hypothesis	Statistical significance of f	The value of F	The value of R^2	The value of R	The value of Beta	Statistical significance of T	The value of T	Independent variable
Acceptance	0.00	25.488.	0.622	0.788	1.472	0.000	4.622	The volume of trading
					-1.138	0.001	-3.498	number of shares traded

The dependent variable: market value

The table shows (1) the existence of the effect statistically significant investment and represented by (volume, number of shares traded, the number of shares subscribed) on the market value at the Amman Stock Exchange during the time period (2000-2017), as the value of (f) (25.488) and is statistically significant (0.00). Totaled (R), which represents the total correlation model (0.778), and value (R2), which represents the impact strength of the independent variable (investment) on the size (market value) (0.605); and thus accept the first premise of the study.

The second hypothesis: There is a statistically significant effect of the investment on the net profit in the Amman Stock Exchange during the time period (2000-2017). To test this hypothesis, the use of multiple regression analysis (Multiple Regression) to detect the effect of investment, represented by (volume, number of shares traded, the number of shares subscribed) net profit in the Amman Stock Exchange during the time period (2000-2017), and Table 2 ( ) illustrates this.

Table 2: The results of multiple regression analysis (Multiple Regression)

The result of hypothesis	Statistical significance of f	The value of F	The value of R^2	The value of R	The value of Beta	Statistical significance of T	The value of t	Independent variable
Acceptance	0.00	29.404	0.638	0.799	1.431	0.00	4.696	The volume of trading
					1.174-	0.00	3.779-	Number of shares traded

The dependent variable: net profit

The table shows (2) the existence of the effect statistically significant investment and represented by (volume, number of shares traded, the number of shares subscribed) net profit in the Amman Stock Exchange during the time period (2000-2017), as the value of (f) (29.404) and is statistically significant (0.00). Totaled (R), which represents the total correlation model (0.799), and value (R2), which represents the impact strength of the independent variable (investment) on the size of the (net profit) (0.638); and thus accept the second hypothesis of the study.

The Third hypothesis: There is a statistically significant effect of the investment on the proportion of debt in the Amman Stock Exchange during the time period (2000-2013).To test this hypothesis, the use of multiple regression analysis (Multiple Regression) to detect the effect of investment, represented by (volume, number of shares traded, the number of shares subscribed) on the proportion of debt in the Amman Stock Exchange during the time period (2000-2017), and (Table 3) illustrates this.

Table 3: The results of multiple regression analysis (Multiple Regression) the impact of investment on the debt ratio

The result of hypothesis	Statistical significance of f	The value of f	The value of R^2	The value of R	The value of Beta	Statistical significance of T	The value of t	Independent variable
Acceptance	0.00	50.245	0.799	0.894	0.874	0.006	2.884	The volume of trading
					-0.659	0.041	-2.117	Number of shares traded

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The dependent variable: Gearing ratio

The table shows (3) the existence of the effect statistically significant investment and represented by (volume, number of shares traded, the number of shares subscribed) on the proportion of debt in the Amman Stock Exchange during the time period (2000-2017), as the value of (f) (50.245) and is statistically significant (0.00). Totaled (R), which represents the total correlation model (0.894), and value (R2), which represents the impact strength of the independent variable (investment) on the size of the (debt) ratio (0.799); and thus accept the third hypothesis of the study.

VI. Summary of Results

After a process of statistical analysis and examination of the premises was reached the following conclusions:

- There is a statistically significant effect of the investment on the net profit in the Amman Stock Exchange during the time period (2000-2013).

VII. Recommendations

Based on the results that have been reached, the study recommends the following:

- The need for attention by the government and foreign Alodrnah Yalasttmarat as they have a significant impact on the Jordanian economy and the market value of the financial markets.
- Conduct studies on the credit facilities granted to foreign investors to encourage them to invest in Jordan, especially from the Arab Gulf states. Action by decision-makers to follow the policy of encouraging foreign investors, the study of the local market to offer in terms of the necessary investment it needs.
- And offer investment offers the tax breaks of up to zero, or to give the first two years without any taxes to encourage foreign investment.

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The Privatization of State-Owned Enterprises in Islamic Perspective: Case of Indonesia

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Abstract- In Indonesia, the last few years have seen the privatization of many industries previously owned by the state. The surge was requirement of International Monetary Fund (IMF) to lend its fund in order to support Indonesian economy after monetary crises between 1997 and 1999. However, this phenomenon causes some novel polemics amidst stakeholders. Most of nation"s wealth is brought by multinational companies to overseas without rendering great benefit to citizen. Therefore, inhabitant cannot savour many adventages from their abundant natural resources. In line with this privatization case, Islam as a way of life which is universal and comprehensive has a particular discussion on assets ownership that should be utilised according to its status. There are three concepts of ownership in Islam, namely individual, public and government ownership. The main objective of this paper is to point out the best scheme of natural resources ownership, whether should be owned by public, private or state based on *siyāsah sharī„ah* approach. The author utilizes descriptive qualitative methodology to find the appropriate pattern of natural resources management in Indonesia, particularly firms which manage the basic need of human being.

Keywords: privatization; natural resources; privatization of state-owned enterprises; islamic ownership concept; public policy.

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The Privatization of State-Owned Enterprises in Islamic Perspective: Case of Indonesia

Sebastian Herman[1]

Abstract- In Indonesia, the last few years have seen the privatization of many industries previously owned by the state. The surge was requirement of International Monetary Fund (IMF) to lend its fund in order to support Indonesian economy after monetary crises between 1997 and 1999. However, this phenomenon causes some novel polemics amidst stakeholders. Most of nation"s wealth is brought by multinational companies to overseas without rendering great benefit to citizen. Therefore, inhabitant cannot savour many adventages from their abundant natural resources. In line with this privatization case, Islam as a way of life which is universal and comprehensive has a particular discussion on assets ownership that should be utilised according to its status. There are three concepts of ownership in Islam, namely individual, public and government ownership. The main objective of this paper is to point out the best scheme of natural resources ownership, whether should be owned by public, private or state based on *siyāsah shar„ah* approach. The author utilizes descriptive qualitative methodology to find the appropriate pattern of natural resources management in Indonesia, particularly firms which manage the basic need of human being.

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I. Introduction

Indonesia is the largest Muslim majority country in the world which is blessed by Allah with an abundance of natural resources. It consists of 13.466 large and small islands that make Indonesia being the largest archipelagic country in our earth[2]. Definitely, Indonesia can become tremendously rich nation, if Indonesian"s government can manage its natural resources truly. Indonesia has significant natural gas reserves and supplies 20 percent of the world's tin and has considerable copper, nickel, gold, and coal resources[3]. Oil and gas are found in Aceh, Riau, South Sumatra and East Kalimantan. Mineral ores such as copper and gold are abundant in Papua, coal in most of Kalimantan and West Sumatra, tin on the island of Bangka, and nickel in South Sulawesi and North Maluku. At the same time, as a tropic country, it has very diverse forest and marine resources. Indonesia"s vast rainforests account for over 50 per cent of the tropical forests in the Southeast Asian region and more than 10 per cent of the world"s total tropical forests. In them, there are found extremely diverse flora and fauna with abundant nutrients and untapped medicinal potential. Similarly, for marine resources, fish stocks in Indonesian waters provide a source of income and livelihood for at least 5 million fishermen. Fish provide more than 60 per cent of the animal protein intake of the average Indonesian and are the only affordable source of protein for the majority of the population[4].

On the other hand, almost of them, particularly underground mine and agricultural sector, are owned by foreign corporates which purchase through privatization policy which has been made by authority. There are several nations which extremely dominate natural resources management in Indonesia such as United State of America, China, England, France, and Canada. America, for instance, is main player in gold mine, oil and gas sector which has many big enterprises operating in Papua and Nusa Tenggara. In 2012, Newmont, one of American companies, could reach $ 4.17 million in NTT. Moreover, Freeport McMoran, a gold mine company, is able to produce 220.000 ton seed of gold and silver every day in Mimika, Papua. However, those cannot contribute more to make people prosperous owing to privatization[5]. Therefore, inhabitant cannot savour many *manfaah* from their abundant natural resources.

The exploitation of Indonesia"s natural resources intensified greatly after Soeharto came to power in 1966–1967. But, the massive surge happened after facing monetary crises from 1997 to 1998. The currency crisis in the region, which began in mid-1997, destroyed the expectation that rapid growth would continue. In this climate, the loss-making state companies were a serious financial burden, and privatisation has been promoted as a quick solution. In response to IMF and World Bank pressure and its own

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[2] Good News for Indonesia https://www.youtube.com/watch?v=HwS53KtXmIA accessed date 18/02/2017

[3] Natural Resources Government Institute http://www.resourcegovernance. org/our-work/country/indonesia

[4] Budy P. Resosudarmo, eds., *The Politics and Economics of Indonesia's Natural Resources* (2005), 2-3

[5] Hizbut Tahrir Indonesia http://hizbut-tahrir.or.id/2013/06/25/5-negara-yang-meraup-untung-dari-kekayaan-alam-indonesia/

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fiscal difficulties, the government took several measures to reform the state sector. Policy makers privatized some potential companies like which had been in great financial burden by low price. PT Indosat, PT Semen Gresik, PT Aneka Tambang, PT Tambang Timah, PT Angkasa Pura II, PT Telkom, PT Pelindo II dan III, PT Jasa Marga, PT Perkebunan Nusantara IV, PT Tambang Batu Bara Bukit Asam and PT Krakatau Stell. This phenomenon is in line with the tendency of global economy which wants a less role of state in economy and this role will be replaced by market mechanism like what was done in British and USA before 1980s decade by capitalism system.

This privatization policy applied by current government is deterioration compared with what founding fathers have done by nationalizing colonists" companies managing natural resources in the beginning of independence. Nationalization of ex-Netherlands"s corporates was undertaken with the aim of equity distribution. The main task of state-owned companies is to equalize welfare for people. It produces several functions which can be categorized to become two goals, both social oriented and commercial oriented. To conduct both functions, those should be source of government income[6].

In line with this privatization discourse, Islam as a way of life which is universal and comprehensive has a particular discussion on assets ownership that should be utilised according to its status. There are three essences of belonging in Islam. First and Foremost, Allah is the only creator of the universe owning all of asset. Secondly, wealth is facilitation from Allah to ease mankind live in the earth. Thirdly, Allah has graced the ownerships of natural resources to human. There are three concepts of ownerships according to Islamic perspective, namely individual, public, and state possessing. These terms extremely relate to privatization policy and natural resources management in Indonesia since every categorization of ownership has consequences of management and utilizing processes[7].

Looking in the detail way at phenomenon of privatization in state-owned companies leading to many polemics among stakeholders, author argue that it should be discovered the best scheme of natural resources ownership, based on Islamic perspective.

II. Theories of Privatization and Islamic View Towards Ownership

There are several definitions which are given by experts regarding to term of Privatization. Generally, privatization is defined as the transfer of ownership control or functions from the public to a private sector.[8] Meanwhile, according to Savas (1987) privatization means changing to an arrangement where the private sector plays a more dominant role.[9] To privatize means to rely more on the private institutions of society and less on government to satisfy people's needs. More narrowly, privatization is the act of increasing the role of the private sector, or decreasing the role of government, in an activity or in the ownership of assets. [10]

On the other hand, based on Presidential Decree No. 122/2001, privatisation means a transfer of part of state enterprise control to private hands through an initial public offer, direct sale to strategic partners, sale to workers, or via other appropriate means. According to Gupta, privatisation, in the present context, refers not only to the transfer of ownership of public assets but also the abandonment of some of the functions that the government had taken upon itself in the recent past.[11]

The most commonly used methods of privatization are:

1. Public Offering of Share
2. Public Sale of Shares
3. New Private Investment in Public Enterprises
4. Sale of Government or Public Enterprises Assets
5. Reorganization (Or Break-up) into Component Parts
6. Management Employee Buy Out
7. Lease and Management Contract[12]

Islam includes a set of principles and doctrines regulating a Muslim's relationship with God and community. Islam is not only the service of God as well as Judaism and Christianity, but also unifying the rules which organize people both in the human and spiritual life material. In the view of Islam, owner of all property with all of stuff is Almighty God because He is the creator and owner of all existing in this universe, as His word in surah Al-Maidah verse 17:[13]

> "*And to Allah belongs the dominion of the heavens and the earth, and all that is between them. He creates what He wills. And Allah is Able to do all things*"

While humans are the ones who get the power of Allah to own and ultilise the natural resources, Allah says in surah Al-Hadid verse 7:[14]

[6] Yulizar D. Sanrego Nz & Rusdi Batun, "Pandangan Islam Terhadap Privatisasi BUMN," *La-Riba Jurnal Ekonomi Islam,* Vol. III, No. 2 (2009), 133

[7] *Ibid*, P 134

[8] N Beyamen Supit, "Privatization in Indonesia: One Economic Strategy to Accelerate Economic Growth, 1996-06" (PhD diss., Naval Postgraduate School Monterey, California, 1996) P V

[9] *Ibid,* P 28

[10] *Ibid,* P 31

[11] Yasmin Sungkar, Indonesia's State Enterprises: from State Leadership to International Consensus Journal of Indonesian Social Sciences and Humanities http://www.kitlv-journals.nl/index.php/jissh/index Vol. 1, 2008, pp. 95–120

[12] N Beyamen Supit, *Op. Cit* P 31-32

[13] Yulizar D. Sanrego Nz & Rusdi Batun, Op. Cit P 135

[14] Ibid

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"*Believe in Allah and His Messenger, and spend of that where of He has made you trustees. And such of you as believe and spend (in Allah's Way), theirs will be a great reward*"

In Islam, everything belongs to God and so the accumulation of wealth is not a goal, but a source of pleasing God. What individuals consume or give away to charity is what they own[15]. A person who has been fortunate to have wealth essentially only receives the mandate to be distributed and spent in accordance with the owner's will actually, God Almighty, either in developing or utilizing. From the beginning God has ordained the wealth should be used for public interest, even if it is not excessive said that in the beginning it is society that is authorized to use the property as a whole, then Allah bestows some of it to individuals and institutions that seek acquisition according to their respective needs. So that an ownership wealth can be regarded as valid if they have earned the permission of Allah SWT to have it, this means that the ownership and utilization of a property must be based on Qur'an and al-*Sunnah*.[16]

Islamic economics has explained everything matters relating to the ownership acquisition mechanism, the procedures for managing and develop ownership, as well as how to distribute that wealth in the midst of men in detail by statute laws. On that basis, the laws concerning economic issues in Islam built on common economic rules of Islam that includes three rules, namely: ownership, wealth management mechanism and distribution wealth among human-being.[17]

III. Ownership Classification in Islamic Perspective

According to *sharī„ah* perspective, there are three kinds of ownership in Islam which are classified, namely: Individual, public and government ownership.

a) Individual Ownership

Private ownership of resources is recognized as God has created the world with natural resources for people to enjoy. Private owners are entitled to returns on their labor and capital investments. Also individuals involved in free trade must be rewarded for their investments and willingness to take risks. But, they all must contribute to the betterment of the community by making tax and charity payments. Unproductive hoarding of resources is prohibited and profit making is encouraged. Collective ownership of resources is not recognized as absolute ownership is only limited to God.[18]

Private ownership is *sharī„ah* stipulation which allows the owner to take advantage of those goods, as well as obtain a good compensation for usefulness taken by others such as rent or consumption of the goods. Their authority rendering to people to spend and perform various forms of transactions on property owned, such as trade, mortgage, lease, grant, wills, and others is a roof recognition of Islam on their individual ownership rights.[19]

b) Public ownership

Common ownership is the provision of *sharī„ah* to a community to jointly utilize the objects, while the objects that belong to the category of common ownership are objects that have been declared by God as objects owned by the community together and should not be controlled by only one man or a certain group.

Due to public property, then each individual can use but are forbidden to have it. At least, objects can be grouped into common ownership; there are three types, namely:

i. *Public Facilities*

These objects belong to the kind of public ownership owning to becoming a staple of society and if not met can cause disputation. This property type described in the hadith of the Prophet relating to public facilities[20]:

"Muslims associate (together own) in there things: water, pastures, and fire[21] (in the another hadith there are additional :) and the price is haram[22]"

In the hadith above water is still not taken, either out of springs, wells, and flowing in a river or lake water is not owned by an individual at his home. Therefore, the discussion of the jurists of the water as a common property is focused on water that has not been captured. As for *al-kala*' is meadows, either wet grass or green (*al-Khala*') and hay (*al-hashish*), which grows in the ground, mountains or streams that has no owner, while the question of al-Nar is material fuel and everything associated with it, including the firewood.

[13] Yulizar D. Sanrego Nz & Rusdi Batun, *Op. Cit* P 135
[14] Ibid
[15] Amir Kia, "A Non-Technical Primer on Private Ownership in Islam", *Journal of Business Inquiry* , Utah Valley State College (2007) 72
[16] Yulizar D. Sanrego Nz & Rusdi Batun, *Op. Cit* P 138
[17] Ibid

[18] https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&cad=rja&uact=8&ved=0ahUKEwjJofbl5tDSAhURTY8KHZe-BAoQFggzMAM&url=http%3A%2F%2Fwww.csub.edu%2F~agrammy%2Fcourses%2Fecon312%2FIslamic%2520Economic%2520Principles.pdf&usg=AFQjCNEOWEZc1s_22210aKhwqOWNem593Q&sig2=QWkV8RlT-HYoPK2XF649Hg DR Grammy Econ 312 received date : 20/03/2017
[19] Ibid
[20] Muhammad Al-Syaukani, *Nailul Authâr* (Beirut: Dâr el-Fikr.), vol 6 (1994) 48.
qf : Yulizar D. Sanrego Nz & Rusdi Batun, "Pandangan Islam Terhadap Privatisasi BUMN," *La-Riba Jurnal Ekonomi Islam,* Vol. III, No. 2 (2009), 139
[21] Narrated by Ahmad and Abu Dawud
[22] Narrated by Ibnu Majah

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Forms of public ownership is not just limited to the three kinds of the object, but also includes everything needed by the public. This is because there is an indication related to this such issue looked at objects that are categorized as public property due to certain properties contained therein categorizing them as common ownership. According *Sholahuddin*, the state must provide public infrastructure facilities so that all people can enjoy and use it as a shared ownership, such as:

1. Means of postal services, correspondence, telephone, television facilities, satellite intermediary and others.
2. Payment instrument in the form of a medium of exchange, deposit services, currency exchange, gold and exchange of money printing.
3. Means of public transport, such as trains.
4. The factory or industry. The state must set up a factory as an obligation of the state in regulating human benefit.

First, factories associated with an object belong to public property. The types of this plant may be used as common ownership, following the law of objects produced by the plant and related to it. Second, the factory plant related to heavy industry and military industry. This type of plant can be owned by individuals, as part of individual ownership. But this type of factory requires a very large capital so hard to do individual. So it is the state that should be established manufacturers/ military industry and heavy industry, but that does not mean it prevents a person to set up factories/ industries.[23]

ii. *Natural resources which are forbidden to be owned by individual or certain group*

Even though they are same as public ownership of the first kind, but there is a difference between the two. If the ownership of the first kind, character formation and origin does not preclude a person to have it, then this second type, in character and origin of its formation, prevents a person to have it personally. As the hadith of the Prophet SAW

"City of Mina is place residence for everyone who comes first" [24]

Mina is a place located outside the city of *Makkah al-Mukarramah* as a haven Hajj people fafter completing standing at Padang Arafah with the intention of carrying out the symbols of the pilgrimage that time is determined, like throwing *jumrah*, *hadd* slaughtering animals, cutting sacrificial, and overnight there. Meaning of "*place residence for everyone who comes first*" in the hadith above is that Mina is where all the Muslims, he who firstly reachs the place in Mina and he occupies it, then part of it is a part and not owned by individuals so that others may not have it (occupied).

Similarly with Common Street, everyone has the right passing over it. Therefore, the use of the road that can harm others should not be permitted by the authorities.[25] It also applies to the mosque, are included in this category is the train, the installation of water and electricity, pillars electricity, drains and pipes. Those are public property in accordance with the status of a public road itself as the common property, so he should not be privately owned.[26]

iii. *Unlimited mining*

Basic Argument which is used for this kind of goods is the *hadeeth* of the Prophet narrated by Abu *Daud* on *Hamal ibn Abyad* who asked the Prophet that he would be allowed to manage the salt mines in the area *Ma'rab*:

"That he came to the Prophet asking for (mine) salt, then he gave it. After he left, there was a man who asked him: "O Messenger of Allah, do you know what you give him? Look, you have to give something like water flowing ". Then he said: Then the Messenger pulled back from her mine"

According to Al-Maliki, the ban is not limited to the salt mines alone but includes all minerals that amount of deposit a lot (like running water) or unlimited, this also includes ownership of all types of mines, both of which appear on the surface of the earth like salt, precious stones or mines that are in the bowels of the earth like mine gold, silver, iron, copper, oil, tin and others.

Such minerals become public domain so that should not be owned by an individual or a few people and should not be legal to give privileges for a specific person or institution to exploit, but authorities shall allow them as common property for all citizens. It is the state that must dig and separate from other objects, sell and store the result in the bait al-mâl.[27]

Meanwhile minerals that deposit is small or very limited can be owned by individuals or trusts. It is based on the hadith of the Prophet which allowed the Bilal bin *Harith al-Muzani* for having a mineral that already is at the Najd and *Tihamah*, just that they are obliged to pay the *khums* (one-fifth) of which produced the bait al-mâl.[28]

[23] Yulizar D. Sanrego Nz & Rusdi Batun, *Op. Cit* P 140
[24] Narrated by At Tirmidzi, Ibnu Majah, and Al Hakim

[25] Abu Ya'la al-Farra', 1994, *Aa-Ahkâm al-Sulthâniyyah,* (Beirut: Dâr el-Fikr.), 253 qf : Yulizar D. Sanrego Nz & Rusdi Batun, "Pandangan Islam Terhadap Privatisasi BUMN," *La-Riba Jurnal Ekonomi Islam,* Vol. III, No. 2 (2009), 141
[26] Yulizar D. Sanrego Nz & Rusdi Batun, *Op. Cit* P 141
[27] *Ibid* P 142
[28] Ibid

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c) *State ownership*

According to Al-Nabhani state properties are treasure that is the right of all Muslims (the people) and the management of the authority becomes the caliph"s (state) right, where the caliph (state) grants or devotes them to some Muslims (the people) in accordance with *ijtihad*. It means, this is the power of the caliph to manage them.

State ownership includes all types of property that cannot be classified into types of public property, but sometimes can be classified into individual types of property ownership. In the *sharī„ah* there are some of the treasures that can be categorized into types of ownership and the state is entitled to manage them with a view of *ijtihad*.[29]

1. Treasure ghanimah, *anfâl* (assets acquired from the spoils of war with kafir), *fay'* (treasure obtained from the enemy without fighting) and *khums*.
2. Treasure comes from *kharaj* (the rights of the Muslims over land acquired from kafir, either through war or not).
3. Treasure from the *jizyah* (the rights given by God to the Muslims of the ka? R as their subjection to Islam).
4. Treasure from taxes.
5. Treasure from *'ushr* (sales tax taken by the government of merchants beyond its boundary with levies that classified by religion).
6. Treasure no heirs or excess property from the rest of the inheritance (*amwâl al-fadla*).
7. Treasure left by *murtad* people.
8. Assets acquired illegally by rulers, state employees, treasure obtained is not in line with *sharī„ah*.
9. Other Assets belonging to the state, such as deserts, mountains, beaches, sea and dead land that has no owner.[30]

Sharī„ah outline the government has a strong role in the economy, so it should not be leaving the hands of the rights of its people. *Sharī„ah* said the government should be able to be a regulator and steward public affairs as that relates to what the prophet Muhammad (PBUH) said:

> "*An imam (caliph) is a maintainer and regulatory affairs (of the people), and he will be held accountable to the people* ".[31]

To be able to organize and serve the affairs of society, the government must have the tools and means, one of them by setting up agencies in charge of exploring minerals, producing vital goods and dominate the life of the people, producing capital goods/ machinery needed by the community in carrying out their industrial and agricultural activities. Government should has an institution that ensures the distribution of goods and services needed by society.[32] *Rasulullah* said:

> "*A rulers is like a shepherd and he alone is responsible for the flock (people)*" [33]

Privatization of state-owned enterprises, which has been conducted by government, categorized public property and strategic industrial sectors are not allowed in Islamic law. the Prophet Muhammad (PBUH) said:

> "*The Muslims of association in three things: water, pasture and fire*" [34]

According to *Al-Nabhani*, public property generally includes public facilities, tremendously large number of mineral, the natural resources that the nature of its formation has made it impossible controlled by the individual, while other strategic industry is an industry that produces products/machines required by the activities of the sector economy such as manufacturing, agriculture, transportation, and telecommunications.

[30] Abd al-Qadim Zallum, 1986, *al-Amwâl _ Daulah al-Khilâfah*, p39 and Abu 'Ubaid ibn Salâm, *Al-Amwâl,* (Beirut: Dâr el-Hikmah el-'Ilmiyah.), p21 qf : Yulizar D. Sanrego Nz & Rusdi Batun, "Pandangan Islam Terhadap Privatisasi BUMN," *La-Riba Jurnal Ekonomi Islam,* Vol. III, No. 2 (2009), 143

[31] Bukhari and Muslim

[32] Yulizar D. Sanrego Nz & Rusdi Batun, *Op. Cit* P 143

[33] Narrated by Muslim

[34] Narrated by Ahmad and Abu Dawud

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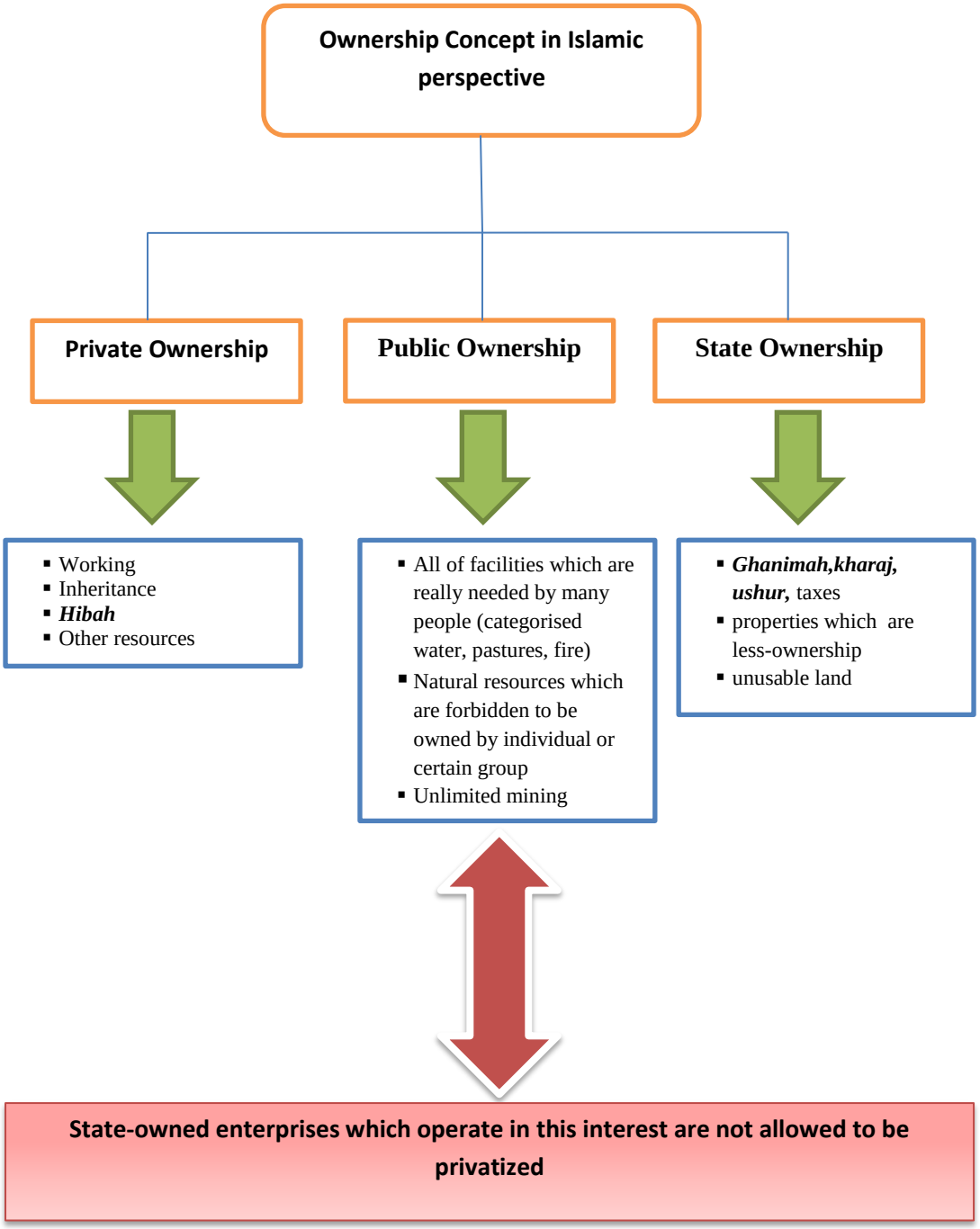


Figure 1: Privatization of State-owned Enterprises According to Ownership Concept of Islam

Brief Explanation about State-owned Enterprises in Indonesia

Nowadays, according to the data of the state minister for State-owned enterprises, there are 118 companies which belong to government. Since 2012, the number of SOEs declined continously from 140 to 118 in 2016. 2004 saw the most significant offering to public.

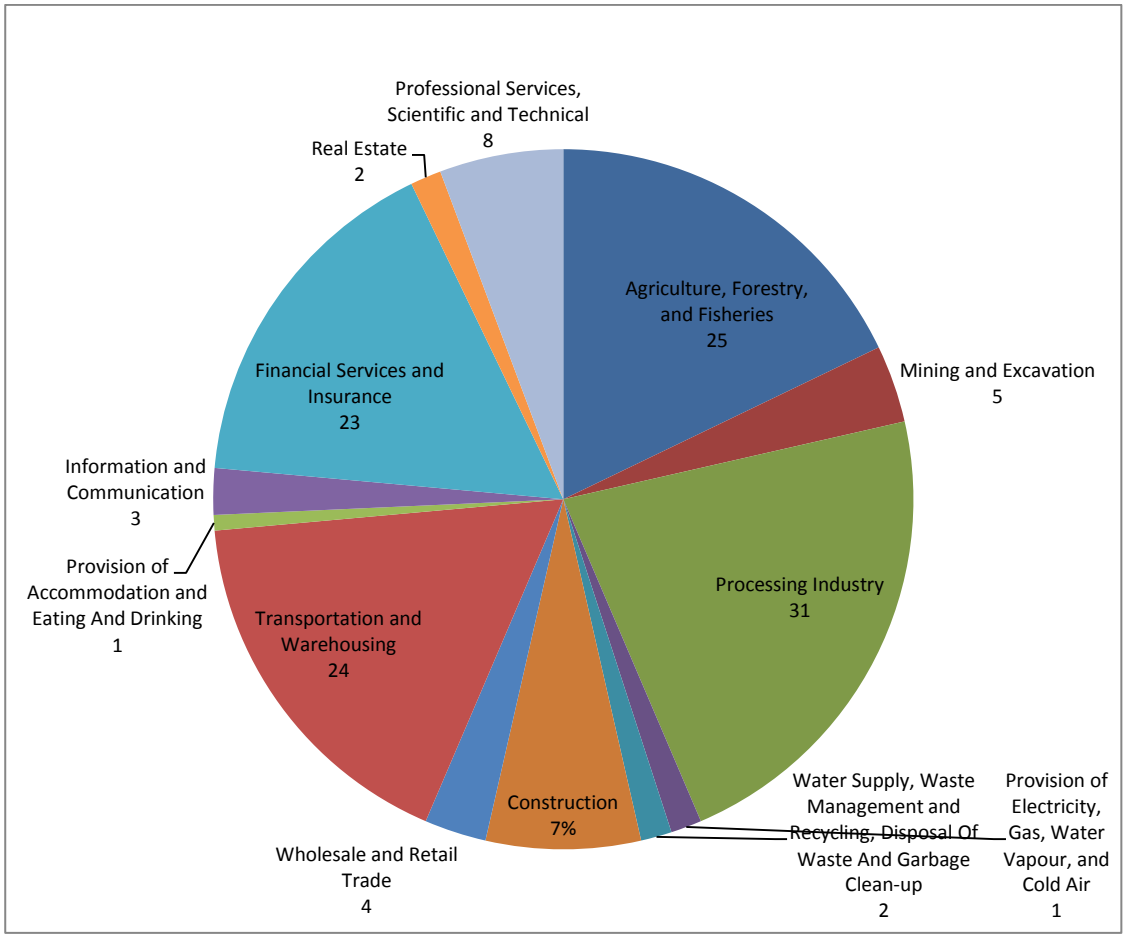
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	2012	2013	2014	2015	2016
Listed/Public SOEs	18	20	20	20	20
Non Listed SOEs	108	105	85	84	84
Special Purpose Entity	14	14	14	14	14
Total Number of SOEs	140	139	119	118	118
Enterprises With Minority Government Ownership	13	12	24	24	24

Source: The State Minister for State-owned Enterprises, Republic of Indonesia[35]

Meanwhile, those can be categorized into 13 types based on each on operation sector. Those are: [36]

1. Agriculture, Forestry, and Fisheries
2. Mining and Excavation
3. Processing Industry
4. Provision of Electricity, Gas, Water Vapour, and Cold Air
5. Water Supply, Waste Management and Recycling, Disposal Of Waste And Garbage Clean-up
6. Construction
7. Wholesale and Retail Trade
8. Transportation and Warehousing
9. Provision of Accommodation and Eating And Drinking
10. Information and Communication
11. Financial Services and Insurance
12. Real Estate
13. Professional Services, Scientific and Technical



Source: The State Minister for State-owned Enterprises, Republic of Indonesia [37]

Figure 2: Categorizing of SOEs Based on Operation Sector

[35] http://www.bumn.go.id/halaman/0-Statistik-Jumlah-BUMN received date 10/04/2017
[36] https://www.sahamok.com/daftar-perusahaan-bumn/ received date 10/04/2017
[37] http://www.bumn.go.id/halaman/0-Statistik-Jumlah-BUMN received date 10/04/2017

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The chart above shows that the number of state-owned enterprises based on its categorization. Indonesian goverment has 31 SOEs which oparate in processing industy sector, whereas the number of SOEs in accomodation, electricty, waste management, real estate, information and communication, and retail trade sector are relatively small which are less than 4. Meanwhile, the figure for sectors which can obtain large amount of fund like mining, constraction and techical and scientific service are 5, 7,8 subsequently. However, the number of financial service and insurance, agriculture, forestry, fisheries and transportation witness fairly similar around 23-25 SOEs.

However, 20 companies have been offered to public in the Indonesian Stock Market. These are enterprise which a portion of its stock has belonged to public:

	Name of SOEs	Sector	Status	IPO Date	Stock Code
1	PT Indofarma	Pharmacy	Go Public	17/04/2001	INAF
2	PT Kimia Farma	Pharmacy	Go Public	04/07/2001	KAEF
3	PT Perusahaan Gas Negara	Energy	Go Public	15/12/2003	PGAS
4	PT Krakatau Steel	Metal Industry	Go Public	10/11/2010	KRAS
5	PT Adhi Karya	Construction	Go Public	08/03/2004	ADHI
6	PT Pembangunan Perumahan	Housing	Go Public	09/02/2010	PTPP
7	PT Wijaya Karya	Coustruction	Go Public	29/10/2007	WIKA
8	PT Waskita Karya	Construction	Go Public	19/12/2012	WSKT
9	PT Bank Negara Indonesia	Banking	Go Public	25/11/1996	BBNI
10	PT Bank Rakyat Indonesia	Banking	Go Public	10/11/2003	BBRI
11	PT Bank Tabungan Negara	Banking	Go Public	17/12/2009	BBTN
12	PT Bank Mandiri	Banking	Go Public	14/07/2003	BMRI
13	PT Aneka Tambang	Mining	Go Public	27/11/1997	ANTM
14	PT Bukit Asam	Mining	Go Public	23/12/2002	PTBA
15	PT Timah	Mining	Go Public	19/10/1995	TINS
16	PT Semen Baturaja	Semen	Go Public	28/06/2013	SMBR
17	PT Semen Indonesia	Semen	Go Public	08/07/1991	SMGR
18	PT Jasa Marga	Transportation	Go Public	12/11/2007	JSMR
19	PT Garuda Indonesia	Transportation	Go Public	11/02/2011	GIAA
20	PT Telekomunikasi Indonesia	Telecommunication	Go Public	14/11/1995	TLKM

Source: The State Minister for State-owned Enterprises, Republic of Indonesia [38]

IV. Discussion

In this part, the author will elaborate more regarding to the status for every categorizing of SOEs based on operation sector, which SOEs can be privatized according to Islamic perspective about ownership.

[38] http://www.bumn.go.id/halaman/0-Statistik-Jumlah-BUMN received date 10/04/2017

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a) Agriculture, Forestry and Fishery

	State-Owned Enterprises	Sector	Privatization
1	Perum Perhutani	Forestry	Not allowed
2	PT Inhutani I (Persero)	Forestry	
3	PT Inhutani II (Persero)	Forestry	
4	PT Inhutani III (Persero)	Forestry	
5	PT Inhutani IV (Persero)	Forestry	
6	PT Inhutani V (Persero)	Forestry	
7	PT Pertani (Persero)	Forestry	
8	PT Perikanan Nusantara	Fisheries	Allowed
9	Perum Prasarana Perikanan Samudera	Fisheries	
10	PT Pekebunan Nusantara I	Agriculture	allowed by note
11	PT Pekebunan Nusantara II	Agriculture	
12	PT Pekebunan Nusantara III	Agriculture	
13	PT Pekebunan Nusantara IV	Agriculture	
14	PT Pekebunan Nusantara V	Agriculture	
15	PT Pekebunan Nusantara VI	Agriculture	
16	PT Pekebunan Nusantara VII	Agriculture	
17	PT Pekebunan Nusantara VIII	Agriculture	
18	PT Pekebunan Nusantara IX	Agriculture	
19	PT Pekebunan Nusantara X	Agriculture	
20	PT Pekebunan Nusantara XI	Agriculture	
21	PT Pekebunan Nusantara XII	Agriculture	
22	PT Pekebunan Nusantara XIII	Agriculture	
23	PT Pekebunan Nusantara XIV	Agriculture	
24	PT Rajawali Nusantara Indonesia	Agriculture	Allowed
25	PT Sang Hyang Sari (Persero)	Agriculture	

Government has 25 enterprises which operate in this sector, whereas 7 companies run in forestry area, 2 are in fisheries and others produce agricultural products. Regarding to their status, firm running in forestry arena are not allowed to be privatized since those can be analogized as pasture. Thus, those are categorized as public ownership which should be managed by authority in order to give prosperous to people. Meanwhile, PT Perkebunan Nusantara I-XIV classified as state ownership, but may be privatized since everyone is allowed to have land. The permission of privatization is allowed by note that government can guarantee the availability and stability of agricultural product. It also happed with fishery sector because of similar characteristic.

b) Mining and Excavation

	State-Owned Enterprises	Sector	Privatization
26	PT Aneka Tambang	Diversified of Mining and Metal	Not allowed
27	PT Bukit Asam	Coal Mining	
28	PT Pertamina	Petroleum and Natural Gas	
29	PT Sarana Karya	Asphalt Product	
30	PT Timah	Tin and Mining	

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Based on stipulation above, all of SOEs operating in mining and mineral industry may not be privatized definitely. This is because mining and mineral can be analogised as flame like what the Prophet said that Muslim associate in three things; water, pastures and fire. As such, the meaning of fire in this *hadeeth* is all fuel and everything which are associated with fire, such as petroleum, tin, natural gas, and coal. Those are public ownerships which are not allowed to be privatized. Moreover, in this case in Indonesian authority should pull out the licences of mining management which have been given to private. Government have to abolish exploitation licences of giant company like Chevron and Freeport.

c) Processing Industry

	State-Owned Enterprises	**Sector**	**Privatization**
31	Batan Teknologi	Atom	Not allowed
32	Industri Telekomunikasi Indonesia	Electronics	allowed
33	LEN Industri	Electronics	
34	Bio Farma	Pharmacy	
35	Indofarma	Pharmacy	
36	Kimia Farma	Pharmacy	
37	PT Garam	Salt	
38	Cambrics Primissima	Garment	
39	Industri Sandang Nusantara	Garment	
40	Industri Gelas	Glasses	
41	Boma Bisma Indra	Sugar	
42	Dok & Perkapalan Kodja Bahari	Shipping	
43	Dok and Perkapalan Surabaya	Shipping	
44	Industri Kapal Indonesia	Shipping	
45	PAL Indonesia	Shipping	
46	Industri Kereta Api	Train System	not allowed
47	Kertas Kraft Aceh	Papers	allowed
48	Kertas Leces	Papers	
49	Barata Indonesia	Metal	
50	Krakatau Steel	Metal	allowed
51	Balai Pustaka	Media	allowed
52	Percetakan Negara Indoensia	Media	allowed
53	Pecetakan Uang Republik Indonesia	Money printing	Not allowed
54	Pradnya Paramita	Media	allowed
55	Dirgantara Indonesia	Aerospace	allowed
56	Pupuk Indonesia Holding Company	Fertilizer	allowed by note
57	Semen Baturaja	Semen	
58	Semen Indonesia	Semen	
59	Semen Kupang	Semen	
60	Dahana	Weaponary	allowed
61	Pindad	Weaponary	

This is the widest sector that government has many SOEs which consist of 31 companies. Basically, almost of firms operating in this field is permitted to be offered to public. However, there are three enterprises which may not be sold to individual or certain groups, namely Batan Teknologi running in atomic and uranium area, Industri Kereta Api operating in train system and Perum PERURI printing both paper and metal currency. Industri Kereta Api and PERURI are not allowed to be privatized because these two are categorized as public facilities which absolutely needed by public, while Batan Teknologi is classified as fires and fuel. Meanwhile, Pupuk Holding Company, Semen Baturaja, Semen Indonesia, and Semen Kupang are permitted to be sold to public, but the ownership is not more than 55%. This is because their products are really determine other price.

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d) Provision of Electricity, Gas, Water Vapour, and Cold Air

	State-Owned Enterprises	Sector	Privatization
62	PT Perusahaan Gas Negara	Gas Vapour	not allowed
63	PT Perusahaan Listrik Negara	Electricity	

The SOEs in this sector surely are not allowed to be offered to public. As such, their products are classified as public facilities which dominate people needs and also analogised like fire.

e) Water Supply, Waste Management and Recycling, Disposal of Waste and Garbage Clean-up

	State-Owned Enterprises	Sector	Privatization
64	Perum Jasa Tirta I	Waste Management	allowed
65	Perum Jasa Tirta I	Waste Management	

This area operation is allowed to be privatized due to classifying as individual ownership.

f) Construction

	State-Owned Enterprises	Sector	Privatization
66	Perum Pembangunan Perumahan Nasional	Housing	allowed
67	PT Adhi Karya	Construction	
68	PT Amarta Karya	Construction	
69	PT Brantas Abipraya	Construction	
70	PT Hutama Karya	Construction	
71	PT Istaka Karya	Construction	
72	PT Nidya Karya	Construction	
73	PT Pembangunan Perumahan	Housing	
74	PT Pengerukan Indonesia	Exvacation	
75	PT Wijaya Karya	Construction	

Fundamentally, corporates running in this business are permitted to be sold to individual or groups. Nevertheless, the author suggest that when government construct various infrastructure, such as railway, bridges, institutional buildings and others, it is preferable to utilised SOEs in order to economize budget.

g) Wholesale and Retail Trade

	State-Owned Enterprises	Service	Privatization
76	PT Perusahaan Perdagangan Indonesia	Retail Trading	Allowed
77	PT PP Berdikari	Insurance	
78	PT Sarinah	Retail Trading	

This operation area is allowed to be privatized due to classifying as individual ownership.

h) Transportation and Warehousing

	State-Owned Enterprises	Service	Privatization
79	Perum Bulog	Logistic of Basic Food	not allowed
80	Perum Damri	Transportation	allowed
81	Perum Pengangkutan Penumpang	Transportation	
82	PT Angkasa Pura I	Air Traffic Service & Business Airport	not allowed
83	PT Angkasa Pura II		
84	PT ASDP Indonesia Ferry	Marine Transportation	allowed

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85	PT Bhanda Ghara Reksa	Courier	
86	PT Djakarta Lloyd	Shipping Line & Logistic Service	
87	PT Garuda Indonesia	Airplane	
88	PT Jasa Marga	Highway	not allowed
89	PT Kawasan Berikat Nusantara	Management of Industry Area	
90	PT Kawasan Industri Makasar		
91	PT Kawasan Industri Medan		
92	PT Kawasan Industri Wijaya Kusuma		
93	PT Kereta Api Indonesia	Train Transportation	
94	PT Merpati Nusantra Airlines	Airplane	allowed
95	PT Pelabuhan Indonesia I	Harbor Management	not allowed
96	PT Pelabuhan Indonesia II		
97	PT Pelabuhan Indonesia III		
98	PT Pelabuhan Indonesia IV		
99	PT Pelabuhan Indonesia V		
100	PT Pelayaran Nasional Indonesia	Sailing	allowed
101	PT Pengembangan Daerah Industri Pulau Batam	Management of Industry Area	not allowed
102	PT Pos Indonesia	Postal Service	
103	PT Varuna Trita Prakasya	Logistic Service	allowed

Government has 24 corporates which run in this service. Some company are allowed to be owned by individual or groups but others are not. For those which are not permitted to be privatized to public, the reason is because such firms are facilities which satisfy public interest and which structuring character forbid to owned by private. Taking PT Angkasa Pura I & II as an example, these are companies managing all of airports in Indonesia. Hence, this business is advisable to be administered by authority.

i) Provision of Accommodation, Food and Beverage

	State-Owned Enterprises	**Service**	**Privatization**
104	PT Hotel Indonesia Natour	Accomodation, Food & Bavarage	Allowed

This is the only one SOE doing this business and it is categorized as private ownership. So, it is allowed to be offered to public.

j) Information and Communication

	State-Owned Enterprises	**Service**	**Privatization**
105	Perum LKBN ANTARA	News	Allowed
106	Perum Produksi Film Negara	Filmming	
107	PT Telekomunikasi Indonesia	Information & Communication	

This field are allowed to be privatized owing to be categorized as private ownership.

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k) Financial Service and Insurance

	State-Owned Enterprises	Service	Privatization
108	Perum Jamkrindo	Credit for SMEs	Allowed
109	PT Asabri	Insurance for Military	
110	PT Askrindo	Credit for SMEs	
111	PT Asuransi Ekspor Indoensia	Insurance	
112	PT Asuransi Jasa Indonesia	Insurance	
113	PT Jasa Rahardja	Insurance	
114	PT Asuransi Jiwasraya	Insurance	
115	PT Asuransi Kesehatan Indonesia	Insurance	
116	PT Bahana PUI	Loan for SMEs	
117	PT Bank Mandiri	Banking	
118	PT Bank Negara Indonesia	Banking	
119	PT Bank Rakyat Indonesia	Banking	
120	PT Tabungan Negara	Banking	
121	PT Biro Klasifikasi Indonesia	Marine Trading Control	
122	PT Danareksa	Venture	
123	PT Kliring Berjangka Indonesia	Clearinghouse	
124	PT PANN Multi Finance	Finance	
125	PT Pegadaian	Fiduciary	
126	PT Permodalan Nasional Madani	Finance	
127	PT Perusahaan Pengelolaan Aset	Asset Management	
128	PT Reasuransi Umum Indonesia	Insurance	
129	PT Taspen	Pension Fund Management	
130	PT Jamsostek	Insurance	

Essentially, this service area is allowed to be offered to public since such operational businesses categorized as state ownership. However, government may not sell most of stock, at least less than 45%. This is because these corporates have significant role in country‟s economy. If owners do not manage carefully, it has domino effect financial sector.

l) Real Estate

	State-Owned Enterprises	Service	Privatization
131	PT Bali Tourism & Development Corporation	Real Estate	allowed
132	PT TWC Borubodur, Prambanan Dan Ratu Boko	Real Estate	

This sector is allowed to be privatized because individual or certain groups can have it.

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m) Professional, Scientific and Technical Services

	State-Owned Enterprises	Service	Privatization
133	PT Biro Klasifikasi Indonesia	Marine Trading Control	not allowed
134	PT Energy Managemnt Indonesia	Energy Conservation and Management Consulting Services	allowed
135	PT Indah Karya	Technical Consultation	
136	PT Sucofindo	Superintend	not allowed
137	PT Survey Udara Penas	Airplane	allowed
138	PT Surveyor Indonesia	Survey and Consultation Services	
139	PT Virama Karya	Technical Consultation	
140	PT Yodya Karya	Technical Consultation	

Generally, this sector is allowed to be offered to public, but PT Sucofindo and PT Biro Klasifikasi Indonesia are not. The reason is because both companies hold control in their each area. While Sucofindo has role in securing foreign exchange in international trade, PT Biro Klasifikasi Indonesia is the only one company which is assigned to classify commercial ships either domestic or foreign operating in ocean of Indonesia.

V. Conclusion

From such elaboration in this article, author can summarize some pivotal points:

1. Islam as a comprehensive and universal way of life provides different economic system from either capitalism or socialism. In this noble concept, Islamic economics harmonizes and protects two interests, both present and hereafter by involving state as deputy of God in the world (*khalifatullah*) and also as holder of people trustworthiness based on primary resources, *Alqur"an* and *Sunnah*.
2. Islamic Economics has known privatization before and it can be done for properties which are classified as individual and state ownership only if government is able to ensure the stability and availability of other products. However, it cannot be permitted for natural resources which categorized as public ownership. Allah has created and presented this universe to all people with the aim of achieving welfare, not only for certain groups.
3. Privatization are not enabled for SOEs which are categorized as; firstly, SOEs managing public facilities which dominant people needs like classifying as water, pasture and fire, secondly, SOEs operating natural resources which its structuring characteristic forbid to owned by private, thirdly, SOEs producing unlimited mining such as gold, silver, petroleum, metal, tin, coal and so on.

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The Influence of the Brazil Cost in the Direct Investments in the Country from 2012 to 2018

By Daiane Rodrigues Dos Santos, Marco Aurélio Sanfins,
Daiana Da Silva Rodrigues, Joyce Oliveira Do Da Silva
& Leonardo Dos Santos Cunha
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Abstract- Widely used by economists in Brazil; the "Brazil Cost" concept refers to costs that hinder development, as they burden production, removing its competitive character, indispensable in a globalized economy. Brazil Cost may imply major obstacles to Foreign Direct Investment in the Country (FDI) and consequently impact the country's growth and development. The study evaluated the influence of variables that are part of the Brazil Cost in Foreign Direct Investment over the last six years. For this, the DMA - Dynamic Model Averaging methodology was used, which allowed the modeling of the dependent variable, FDI, as a function of its past and other variables dynamically over time. These results contribute to the evaluation of the assumptions made about the relationship between the components of Brazil Cost and the volume of direct investment in the country.

Keywords: brazil cost; direct investments; dynamic model averages; bayesian DMA method; brazilian infrastructure.

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The Influence of the Brazil Cost in the Direct Investments in the Country from 2012 to 2018

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Abstract- **Widely used by economists in Brazil; the "Brazil Cost" concept refers to costs that hinder development, as they burden production, removing its competitive character, indispensable in a globalized economy. Brazil Cost may imply major obstacles to Foreign Direct Investment in the Country (FDI) and consequently impact the country's growth and development. The study evaluated the influence of variables that are part of the Brazil Cost in Foreign Direct Investment over the last six years. For this, the DMA - Dynamic Model Averaging methodology was used, which allowed the modeling of the dependent variable, FDI, as a function of its past and other variables dynamically over time. These results contribute to the evaluation of the assumptions made about the relationship between the components of Brazil Cost and the volume of direct investment in the country.**

Keywords: brazil cost; direct investments; dynamic model averages; bayesian DMA method; brazilian infrastructure.

I. Introduction

From the decade of 1990, the Brazil Cost has become a topic with great importance that is discussed the main hindrances that break the growth of the country imposing additional costs to the companies. In parallel, the Brazilian economy arises like the country that recaps the flow of the international capitals in the middle of the decade of 1990. Among the extern resources it shows the role of the foreign direct investment (IED), currently known as the direct investment in the country the (IDP), its volume, is from the second half of the decade, it overcome the of the entrance of the capitals in the short term, establishing a significant change in the infrastructure of properties from capital in Brazil.

For Peres and Yamada (2014) the inflow of IED is more and more elevated in the Brazilian economy, and they played a fundamental role throughout the decade of 1990, to seek the support of the volumes deficits of the transactions in the account and the view to the value exchanged after the currency Real Plan.

The objective of this article is to study the influence of the variables that make up the Brazil Cost in the direct investment of the country. It's structured in six topics, starting with the introduction. Intosequence, section 2 is discoursed about the journey of the foreign direct investment (or Direct Investment of the Country) in Brazil. In portion 3 will bring forward the cost in Brazil in the direct investment of the country. Section 4 talks about the influence of Brazil Cost in the direct investment in the country. Section 5 will show the methodology DMA, in section 6, how the methodology is applied and the analysis of the aftermath results. Portion 7 is the conclusion of this article.

II. The Recent Route of the Foreign Direct Investment in the Country

According to Carminati and Fernandes (2013), after the middle of the 1990's decade, the flux of foreign direct investment with destiny to Brazil has arisen expressively. According to the authors, in the year in question, Brazil is ranked in a special position in international capital flows, especially how is destined the IDP and how is done in multinationals companies. According to the author, since 2011 the country is among the five main destinies of the fluxes of the IDP in the world.

In the 1990's decade, the investors came back powerfully, except for the years of 1998 and 1999, motivated by the Brazilian economic instability that was reached with the Real Plan, plus the constitutional amendments of 1995 (Santos *et al.,* 2016). These amendments put an end to the monopoly in the departments of telecommunication, oil, and gas, which later made possible the privatization process, which was promoted in the renewal of the flux of the IED for Brazil. Ever since the Brazilian economy started to be more and more destined to these resources, the privatization program made it possible for Brazil to attract the interest and the great record of the entrance of IDP, making the Brazilian economy attractive to the foreign capital.

According to the report of Brazilian Central Bank, the position of the IDP at the end of 2016 reached US$703 billion (25,0% of the gross domestic product – PIB). Considering the annual position 2010 a 2016, The maximum value occurred in 2012, US$731billions (26, 2% from PIB), and the minimum value was, in 2015, US$568 billion (23, 6% from PIB).

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III. Brazil Cost

The Brazil Cost is a term used to describe the group of structural difficulties, bureaucracies and economical that make expensive the investment in Brazil, making it difficult to the national development, the rising unemployment, informal work, tax evasion, and foreign exchange evasion. Being pointed as the set of factors that compromises the competitiveness and the efficiency of the national industry. For Mancuso (2004), the Brazil Cost is an expression used to point factors that affect the competitiveness of domestic companies against companies located in other countries.

The Brazil Cost with its taxation (bureaucracy and tax burden) could contribute to elevating the gap of prices between domestic and imported products. In this article, the Brazilian tax burden is represented for total tax revenues (Coding 7639). The series has monthly frequency and was collected at the site of Brazilian Central Bank.

According to Barbieri *et al.*(2014), the current scenario of the Brazilian infrastructure presents elevated costs for society in general. The inefficiency of the transport infrastructure as part of this scenario affects the competitively of the economy in a systematic. In this article, we use the series containing the monthly investment of the Ministry of Transport. The data are disclosed in the monthly CNI reports.

For Barbieri, the rigidity of work legislation and the high social tax incidence on payroll has been common targets from the discussion created about the Brazil Cost.

To represent the social tax, we use a proxy the net monthly revenue of RGPS (the General Regime of Social Security) available on the site of National Treasury.

The price of energy and your evolution are important for the impact it has on the industry and the competitively of the companies. In this article, we will use the cost of the electrical energy of IPCA a proxy for the cost of energy in Brazil. The data are taken from the site of the Brazilian Central Bank.

The working capital is connected to the tax interests of the country that the company is stablished. The taxation interests could affect directly the companies' activity, and it could affect the cost of the working capital origination from third parties. (Banking financing, for example). The SELIC rate considered a basic interest Brazilian tax, which was used to represent the working capital in this article.

The corruption could be seen as an abuse to the politics power to private gain. For Campos and Pereira (2016) the corruption is related to the incentives and to the problems related the main agent where there are problems in the asymmetric of information. In this article, we use one index of search of the web created by google that reflects in the interest of the world over corruption in Brazil. The keywords used was Corruption Brazil. It is important to note that this variable is a *proxy.* Quantifying concern about corruption in a country isn't an easy task. This is an attempt to quantify this difficult variable to measure.

The components of Brazil Cost the above mentioned are outlined from bibliographic research. Given the difficulty in collecting the data (many exogenous) for the present study, we try to minimize these factors with the use of proxy variables.

IV. The Influence of Brazil Cost in Direct Investments of the Country

Beginning in the 1990s, a decade marked by the commercial opening, implementation of the Real Plan and privatization of sectors previously owned by the public power, we began to talk about Brazil Cost. This term brings together the detrimental obstacles to the economic growth of the Country, and its existence translates into additional costs to the companies that operate here. Thus, this study has a double objective: to identify the components of this cost and to verify if there is any relation with the entry of Foreign Direct Investment (FDI), category of investment constituted when the investor holds 10% or more of the common shares or the voting right company.

The Brazil Cost can imply in a great obstacle for the direct foreign investment and consequently the growth of the country. According to Haddad and Hewings (1992), the cost of doing business in Brazil is one of the main obstacles to economic development and reveals the existence of distortions in the relationship between public and private sector, reflected by inadequate and poor legislation provision of the commonweal.

In general, we can say that IDP brings many benefits to the receiving economy. The country that seeks to attract foreign investment tends to improve its business environment by becoming more transparent. A process of self-segregation of the companies, in its process of expansion, showing that only the most productive companies of a country will seek external markets through direct investments. Thus, the presence of international corporations with high productivity in Brazil can contribute to the improvement of national productivity, providing training to employees, and even establishing a high level of competition with domestic firms.

This research has the objective of studying the interference of the components of Brazil Cost in Direct Investment in the Country, and for this; we will use the DMA Methodology - dynamic model averaging. This allows the modeling of the dependent variable - IDP according to its past and other variables dynamically.

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V. Methodology DMA - Dynamic Model Averaging

The Dynamic Model Averaging method proposed by Raftery *et al.* in 2010 considers the uncertainty concerning the models through Bayesian weighting, additionally allows the parameters and weights of the weighting to change in each period. In this way, the parameters of the model can follow the dynamics of the series over time, and the model can adapt according to the economic conjecture.

Considering initially a regression model, one can specify Direct Investment in the Country as being represented by $y_t$and evolving according to the following equation:

$$y_t = \sum_{k=1}^{p} \theta_{kt} y_{t-k} + \sum_{k=1}^{p} \phi_{kt} x_{t-k} + \varepsilon_t \varepsilon_t \backsim N(0, H_t) \quad (1)$$

In this application, x_t represents the variables that compose the Brazil Cost and explain the Direct Investment in the Country.

The number of predictive variables can be large and therefore, we may have to deal with many model combinations. Thus, the model selection becomes a major challenge. According to Catania and Nonejad (2016), the DMA methodology provides an ideal way to deal with these sources of uncertainty.

The model presented in equation (1) could be representedin the state space form proposed by Durbin, and Koopman (2012).

Equation of observations:

$$y_t = Z_t \alpha_t + \varepsilon_t \varepsilon_t \backsim N(0, H_t) \quad (2)$$

Equation of state:

$$\alpha_t = \alpha_{t-1} + \eta_t \eta \backsim N(0, Q_t) \quad (3)$$

That is $t = 1, \dots T$, $Z_t = [1, y_{t-h}, x_{t-h}]$ are the predictor of variables (y_t) e α_t that represent the vector of weightings.

$$\begin{pmatrix} \varepsilon_t \\ \eta_t \end{pmatrix} \sim NID\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} H_t & 0 \\ 0 & Q_t \end{pmatrix} \right) \quad (4)$$

In other words $\boldsymbol{y_t}$ the interest variable, $\boldsymbol{Z_t^{(k)}} \subseteq \boldsymbol{Z_t}$, with $k = 1, \dots, K$, $\varepsilon_t^{(k)} \backsim N\left(0, \boldsymbol{H_t^{(k)}}\right)$ e $\boldsymbol{\eta_t^{(k)}} \backsim N\left(0, \boldsymbol{Q_t^{(k)}}\right)$, defines $L_t \in \{1,2, \dots, K\}$ that represents each model applied for each period, $\boldsymbol{\Theta_t} = (\boldsymbol{\alpha_t^{(1)}}, \dots, \boldsymbol{\alpha_t^{(k)}})'$ e $\boldsymbol{y^t} = (\boldsymbol{y_1}, \dots, \boldsymbol{y_t})'$,

$$\boldsymbol{y_t} = \boldsymbol{Z_t}^{(k)} \boldsymbol{\alpha_t}^{(k)} + \boldsymbol{\varepsilon_t}^{(k)} \quad (5)$$

$$\boldsymbol{\alpha_t}^{(k)} = \boldsymbol{\alpha_{t-1}}^{(k)} + \boldsymbol{\eta_t}^{(k)} \quad (6)$$

The conditional variances, $\boldsymbol{H_t^{(k)}}$ and $\boldsymbol{Q_t^{(k)}}$, are unknown. Obviously, when $\boldsymbol{Q_t^{(k)}} = \boldsymbol{0}$, $\boldsymbol{\alpha_t}^{(k)}$is constant over time, for $\boldsymbol{Q_t^{(k)}} \neq \boldsymbol{0}$, parameters vary over time, have a distinct model for each point in time. According to Peixoto (2017), the equation permits the state of a better model to be kept for a time, so the prediction of time can be T proceeded exploring the information through time $T-1$ calculating the possibility of the posterior model.

The DMA avoids the difficult task of specifying $Q_t^{(k)}$for each individual model because it has a forgetting parameter, 0 $0 < \delta \leq 1$. This, in turn, simplifies much from the practical point of view; we just need to worry about δ.

When δ. = 1 we have $\boldsymbol{Q_t^{(k)}} = \boldsymbol{0}$, that is, ${\alpha_t}^{(k)}$ is equal to its value at time $t-1$, For $\delta < 1$, we introduce time variation in ${\alpha_t}^{(k)}$. According to Catania and Nonejad (2016), when δ. = 0.99, in the context of quarterly data, observations five years ago receive approximately 80% of the weight of the observation of the last period, which corresponds to the gradual time variation in ${\alpha_t}^{(k)}$. According to the authors, when δ.=0.95, the observations from 20 periods ago receive only 35% of the weight of the observation of the last period, suggesting that a relatively bigger shock reaches the regression coefficients. This, however, increased variability (5) - (6) depends not only on the choice of the predictors in $\boldsymbol{Z_t}^{(k)}$but also on the choice of $\boldsymbol{\alpha_t}^{(k)}$ also results in greater prediction variance. δ.

According to Koop e Korobilis (2012) *apud* Peixoto (2016), he main advantage in using the default factor oblivion in the equation of the model is that it becomes dispensable the use of the algorithm like MCMC to draw the transition between models.

Conditional to δ., the DMA probability of the model M_k is conditional to the current information defined at time t, $\mathbf{Z}_t$, is then defined as:

$$p(M_k|\mathbf{Z_t}) = \frac{p((y_t|M_k, Z_{t-1}) p(M_k|Z_{t-1})}{\sum_{l=1}^{n} p(y_t|M_l, Z_{t-1}) p(M_l|Z_{t-1})} \quad (7)$$

To which $p(M_k|\mathbf{Z_t})$ é a predictive of model M_k rated in y_t, $p(M_k|Z_{t-1}) = p(M_k|Z_{t-1})^{\alpha} / \sum_{l=1}^{n} p(y_t|M_l, Z_{t-1})^{\alpha}$, in which$0 < \alpha < 1$ is the forgetting factor for the whole model e $p(M_k|Z_{t-1})$ is the probability of the model at time $t-1$. In many applications α ∈ {0,98, 0,99, 1} According to Catania and Nonejad (2016), α ∈ {0,98,0,99,1} with works well and generally the results do not change drastically in different values de α.

With the evolution of $\boldsymbol{H_t^{(k)}}$, Koop and Korobilis (2013) it is proposed a simple method in $H_t^{(k)} = H^{(i)}$for all t, in time $t = 0$, specifically one *priori* Normal in ${\alpha_0}^{(k)}$and a priori transformed Gama one *priori* Gama inversed in $H^{(i)}$, i,e, $H^{(i)}|Z_0 \sim \mathcal{GI}\left(\frac{1}{2}, \frac{1}{2} S_0^{(k)}\right)$where $\mathcal{GI} \sim \left(\frac{\nu}{2}, \frac{\kappa}{2}\right)$, being $\mathcal{GI}$ the distribution of Inverted Range with scale parameter (ν) and form (κ). A posterior of $H^{(i)}$

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follows a $\mathcal{GI}$ distribution with parameters, $S_t^{(k)}$ and $n_t^{(k)}$, where time t estimates of$H^{(i)}$ and $S_t^{(k)}$ are given below:

$$S_t^{(k)} = S_{t-1}^{(k)} + \frac{S_t^{(k)}}{n_t^{(k)}}\left(\frac{e_t^{2(k)}}{Q_t^{(k)}} - 1\right) \quad (8)$$

$n_t^{(k)} = n_{t-1}^{(k)} + 1$, $e_t^{(k)}$e $Q_t^{(k)}$ are related to the Kalman recursions for the i-th DLM model. More information on Kalman's recursions in Catania and Nonejad (2016) and Prado and West (2017). It should be noted that the form of evolution of $H_t^{(k)}$presented in equation (8) is not unique; it can evolve as an exponentially weighted moving average (EWMA), for example.

However, in many applications, allowing the time variation in the conditional error variation recommended. Therefore, we can adopt a discount factor to induce the time variation in $\boldsymbol{Q_t^{(k)}}$. Particularly, we do this by imposing a forgetting factor, $0 < \beta \leq 1$, which enters the scale of the Inverted Range distribution, such as: $n_t^{(k)} = \beta n_{t-1}^{(k)} + 1$. In this way, $\boldsymbol{H_t^{(k)}}$ is updated according to new data and information passed to reflect changes in volatility. This approach means that if$\beta < 1$, the estimated time t of $\boldsymbol{H_t^{(k)}}$ is given as:

$$S_t^{(k)} = (1-\beta)\sum_{s=0}^{t-1}\beta^s\left(\frac{S_{t-s-1}^{(k)}e_{t-s}^{2(k)}}{Q_{t-s}^{(k)}}\right) \quad (8)$$

In other words, $\boldsymbol{H_t^{(k)}}$ takes the form of an exponential moving average (EWMA) and the oldest data is discounted over time. When $\beta = 1$, then we retrieve $\boldsymbol{H_t^{(k)}} = H^{(k)}$. The predictive mean of conditional y_{t+1} in $\mathbf{Z}_t$, denoted by $\hat{y}_{t-1}$. This is simply an average of each of the predictive means of the individual model, ie:

$$\hat{y}_{t-1} = \sum_{j=1}^{d} E\left[y_{t+1}^{(j)}|\mathbf{Z}_t\right] p\left(\delta_j|\mathbf{Z}_t\right) \quad (9)$$

To which:

$$E\left[y_{t+1}^{(j)}|\mathbf{Z}_t\right] = \sum_{k=1}^{p} E\left[y_{k,t+1}^{(j)}|\mathbf{Z}_t\right] p\left(\delta_j|\mathbf{Z}_t\right) \quad (10)$$

The predictive density can be described as,

$$p(y_{t+1}|\mathbf{Z}_t) = \sum_{j=1}^{d} p\left(y_{t+1}^{(j)}|\mathbf{Z}_t\right) p\left(\delta_j|\mathbf{Z}_t\right) \quad (11)$$

To which:

$$p\left(y_{t+1}^{(j)}|\mathbf{Z}_t\right) = \sum_{k=1}^{p} p\left(y_{k,t+1}^{(j)}|\mathbf{Z}_t\right) p\left(M_k|\delta_j, \mathbf{Z}_t\right) \quad (12)$$

The posterior estimative is α_t (Equations 2 and 5) in DMA is data in the following way:

$$E[\alpha_t|Z_t] = \sum_{j=1}^{d} E\left[\alpha_t^{(j)}|\mathbf{Z}_t\right] p\left(\delta_j|\mathbf{Z}_t\right) \quad (13)$$

To which:

$$E\left[\alpha_t^{(j)}|\mathbf{Z}_t\right] = \sum_{k=1}^{p} E\left[\alpha_{k,t}^{(j)}|\mathbf{Z}_t\right] p\left(M_k|\delta_j, \mathbf{Z}_t\right) \quad (14)$$

$$(y_{t+1}|\,\mathbf{Z}_t) = Obs_{t+1} + Coef_{t+1} + Mod_{t+1} + TVP_{t+1} \quad (15)$$

The first term (Obs) refers to observe variance, the second (Coef) represents the variance and the errors of the coefficients estimated by the model, (Mod) notes the variance due to the uncertainty regarding the choice of predictors e (TVP) a variance due to the uncertainty as to the choice of the degree of time variation in the regression coefficients.

VI. Application of the Methodology of the DMA to Model the Direct Investment in the Country using Exogenous Variable to the Brazil Cost.

As mentioned above, the Brazil Cost may imply a great obstacle to direct investment in the Country and consequently, the growth of the economy. We will use the Bayesian DMA method presented in section 5 to model the relationship between variables. The descriptive statistics of the series is available for observation in Table 1.

Table 1: Descriptive statistics of the monthly variations of the selected time series (IDP and Brazil Cost).

Descriptive statistics of time series					
Series	Mean	S. D.	Min.	Max.	Median
Direct investment in the country	0.074	0.429	-0.665	1.651	0.002
Tax revenue (Gross collect)	0.064	0.111	-0.971	0.590	0.064
Electric energy cost	0.008	0.044	-0.152	0.221	0.005
Index on world interest in corruption	0.318	0.822	-0.633	1.22	0.144
SELIC rate	0.018	0.278	-0.472	0.473	0.072
Social charge	0.064	0.055	-0.099	0.166	0.063
Investment in transport	0.092	0.823	-0.253	2.815	-0.076

The model described in equations 5 and 6 were applied in the monthly variations (month against the same month of the previous year) of the data described in the previous paragraph. The data cover the period from January 2012 to June 2018. For the application of the above model, we will use the R-project software and the DMA package. Before applying the model, it is necessary to verify the stationarity of the series used in

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the model. The increased Dickey-Fuller test applied to the seven variables; the result is described in Table 2.

Table 2: Stationarity test applied to the monthly variations of the selected variables.

Dickey-Fuller augmented Test	
Variable	P-value
Direct investment in the Country	0.001
Tax revenue (Gross collect)	0.02
Electric energy cost	0.0389
Index on world interest in corruption	0.001
SELIC rate	0,0387
Social charge	0,0285
Investment in transport	0,01

As can be seen, we accept the alternative hypothesis, the stationarity one. The series containing the variances month against the same month of the previous year considered stationary and, we can apply the DMA model and study the dependency structure of the series. We used the Mean Out-of-Sample Error (SEM) and Mean Absolute Deviation (MAD) measures to test some lags for the explanatory variables. Based on this information, we use the lags presented in Table 3.

Table 3: Lags adopted in the modeling.

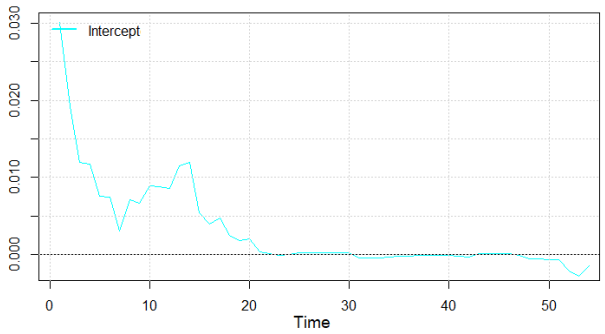
Lags adopted in the model	
Variable	Lags
Direct investment in the country	
Tax revenue	0
Social charge	
Electric energy cost	
Index on world interest in corruption	
SELIC rate	
Investment in transport	1

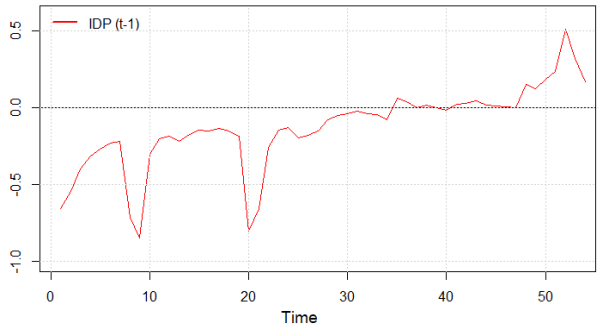
It is worth mentioning that the model requires a period of adaptation to the sample; that is, a test period is required to better fit the model. In this article, the first ten months estimate were disregarded. Table 4 presents the specification adopted for the model.

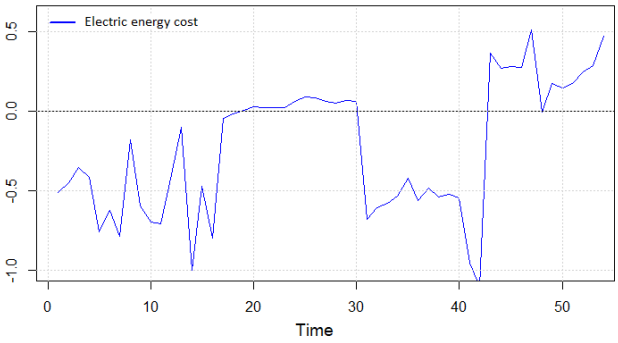
Table 4: Specified adopted model.

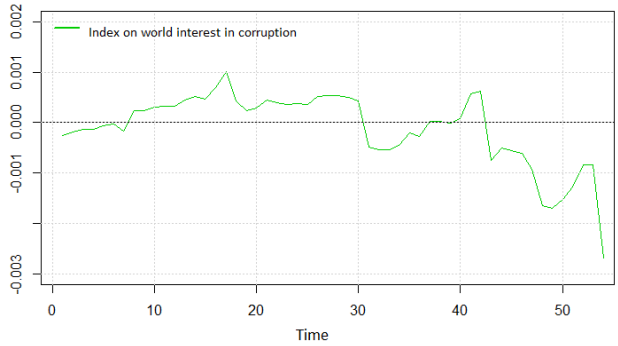
Specified adopted model	
T	65
n	8
d	2
g	3
alpha	0,990
Beta	0,500
Delta	0,1/0,59
Model Combination	256

As mentioned above, different combinations of parameters were tested. We initially considered two possibilities for forgetting factors, ie $\lambda = 0.99$ and $\lambda = 0.95$. Given the greater factor, the results were more parsimonious; we adopted it, as shown in Table 4.









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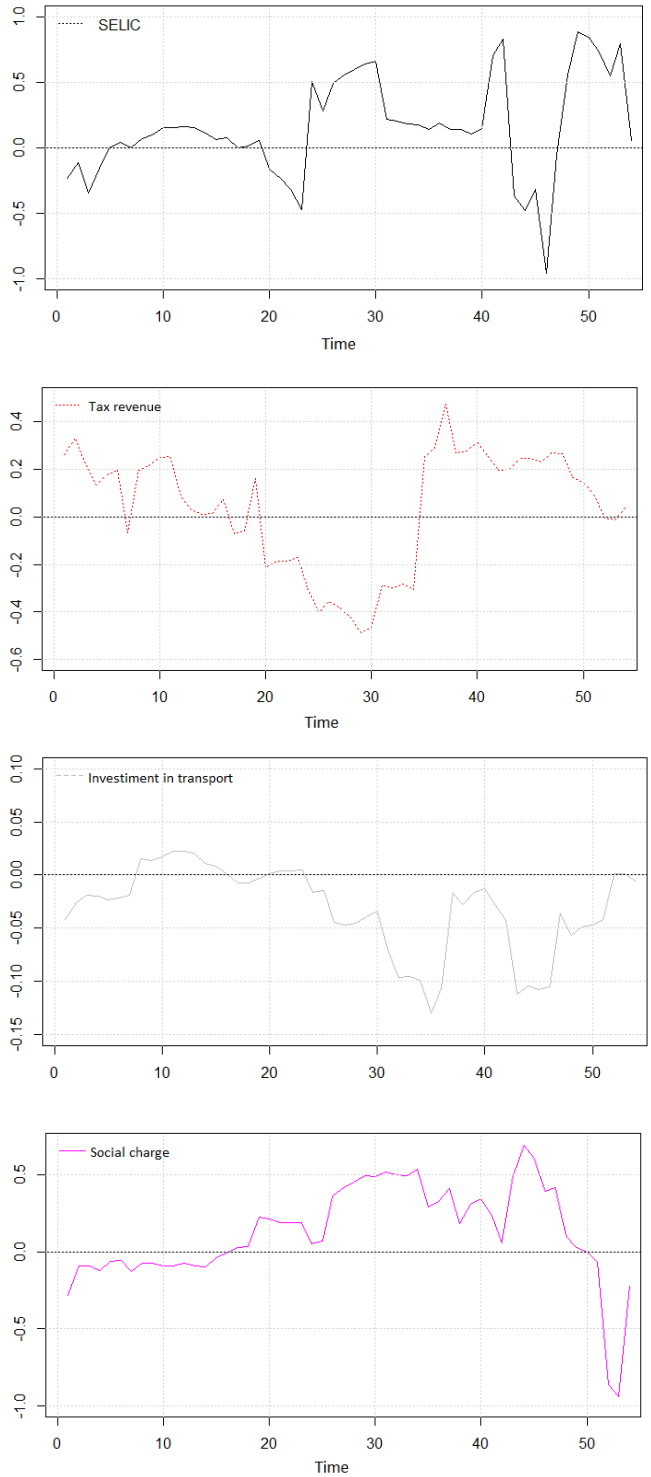


Fig.1: Graphs of the posterior probability inclusions.

The charts show the importance of each return, at each point in time, for each of the variables. As can be seen, the charts contain the probabilities of later inclusion (the weights used by the DMA). That is, the probability of return in time t-1 is useful for forecasting the time-dependent variable t. When analyzing the weights used by DMA (Figure 1), there is evidence of model change; that is, the set of regressors of the model changes over time. Some variables presented very small later probabilities of inclusion (coefficients very close to zero).

The intercept, the Corruption Index, and the Public Investment in Infrastructure and Transport. After this, we removed these variables from the model. However, we did not find improvements in the adequacy of the model to the data. Also, in the DMA, the changes can be gradual or abrupt. That is, there are many cases where the subsequent inclusion of probability associated with a regress of increases or decreases gradually over time, for example. We can verify abrupt changes mainly in the regressors: Cost of electricity, Taxation and SELIC Rate. As can be seen in the charts, over time, the explanatory variables (PPI, Electricity Cost, Interest Rate, social charges and Taxes) influence the Direct Investment in the country positively, or negatively, depending, possibly, of the conjuncture of the country.

The following table presents the statistical tests applied to model waste.

Table 5: Tests applied to Residues

Statistical tests	
	P-value
Kolmogorov-Smirnov (normality)	0.025
Anderson-Darling (normality)	0.039
Box-Pierce (autocorrelation)	0.579
Box-Pierce (autocorrelation - square)	0.920
heteroscedasticity (Teste F Test)	0.939

According to Table 5, at the significance level of 5%, the p-value did not suggest rejection of the homoscedasticity hypothesis. In the self-correlation tests, there is no evidence to reject the hypothesis in which the residues are de-correlation. In the normality tests, at the level of 1.0%, the hypothesis of normality of the residues is accepted.

For purposes of comparison between the results (Backtest), we applied DMS and the VAR model with the fixed coefficient of variation. The measures (MAD and MSE) presented in Table 6. According to the literature, both models present a better prediction compared with other forecasting models. According to Lasse and Moller (2015) in the DMA, the model probabilities as weights to calculate the average forecast. The DMS puts all the weight in the model with the highest probability. The measures inherent to the models point to better adherence of the proposed model.

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Table 6: Adherence measurements

Performance of applied models Measures	Models		
	DMA	DMS	VAR
MSE (Mean squared error)	0.171	0.184	0.214
MAD (Mean absolute deviation)	0.311	0.312	0.432
Likelihood	-23.923	-24.167	-32.85

VII. Conclusion

The Dynamic Model Averaging has been used in several areas, with great possibilities for applications in Economics and Finance. In the present work, we used the DMA to model the IDP depending not only of its past but of six other variables - SELIC Rate, Electricity Cost, Taxes, Social Charges, Corruption, Infrastructure Investment transport - which according to the literature can influence the decision of the investor.

DMA models are widely used to generating parsimonious models, that is, models that involve the minimum of possible parameters to be estimated and that explain well the behavior of the response variable. In addition to this capability, DMA allows model parameters and specification to change over time. Comparing the performance of the DMA model with that of the DNS and the VAR model, we observed that the model proposed in this article presents satisfactory results. It presented smaller mean square error outside the sample and the smallest mean absolute deviation.

This paper highlights the importance of foreign investment in the Brazilian economy, and how much this is affected by internal factors, especially the cost of electricity, taxation, and interest rate. Most of the components of Brazil Cost were an obstacle to the entry of investment in the country. It is worth mentioning that many of these cost components could be mitigated by the implementation of public policies aimed at making the business environment more attractive and opportune for new investors.

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Mechanisms and Countermeasures of Precise Poverty Alleviation in Contiguous Destitute Areas - A Study based on Solow-Swan Economic Growth Model

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Abstract- China has made achievements on world interest in anti-poverty work since the reform and opening-up, with a drastic decrease in rural poor population nationwide, but poverty presents new characteristics. Based on Solow-Swan Model, this paper suggests that contiguous destitute areas are in low equilibrium and precise poverty alleviation is an external mechanism of introduction of capital, technologies and labor. Whether contiguous destitute areas, as the target of China's poverty relief program, can jump at the chance of precise poverty alleviation to acquire the capability of self-development with the help of external forces and make great strides in development is the key to whether China can complete the building of a moderately prosperous society in all aspects by 2020. Finally, the paper brings forward four countermeasures based on international experience in poverty alleviation: efficient use and accurate management of invested capital, accelerated improvement of labor quality and strict control of fertility rates, precise technological support and establishment of central towns.

Keywords: *solow-swan model, contiguous destitute areas, precise poverty alleviation.*

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Mechanisms and Countermeasures of Precise Poverty Alleviation in Contiguous Destitute Areas A Study based on Solow-Swan Economic Growth Model

Linna [α] & Zhengxia Tang [σ]

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I. Introduction

Eliminating poverty is one of China's important strategic tasks and China has successively implemented the National Seven-Year Poverty Alleviation Program, China Rural Poverty Alleviation and Development Program 2001-2010 and China Rural Poverty Alleviation and Development 2011-2020 and made notable progress in poverty alleviation and poverty since the reform and opening-up. According to estimates based on the current national rural poverty standards, the poverty incidence among rural residents registered 97.5% and rural poor population reached 770 million in 1978; in 2015, rural poor population reduced to 55.75 million and the poverty incidence fell to 5.7%, much lower than the data in 2014 (see Table 1)[1].

Table 1.1: Status of Poverty in Rural Areas Measured by the Current Standards

Year	Poverty incidence (%)	Size of poor population (in 10,000 people)
1978	97.5	77039
1980	96.2	76542
1985	78.3	66101
1990	73.5	65849
1995	60.5	55463
2000	49.8	46224
2005	30.2	28662
2010	17.2	16567
2014	7.2	7017
2015	5.7	5575

Meanwhile, China's poverty has new characteristics. Firstly, contiguous poverty is observed at provincial borders. As planned in China Rural Poverty Alleviation and Development 2011-2020, 14 contiguous destitute areas, including Liupan Mountain Area, Qinba Mountain Area, Wuling Mountain Area, Wumeng Mountain Area, Yunnan- Guangxi- Guizhou Rocky Desertification Area, West Yunnan Border Mountain Area, Southern Foothills of Great Khingan Mountains, Yanshan Mountain-Taihang Mountain Area, Lvliang Mountain Area, Dabie Mountain Area and Luoxiao Mountain Area as well as Tibet, Tibetan areas in Sichuan Province and South Xinjiang where special policies have

[1] Source: Official website of National Bureau of Statistics.

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been explicitly implemented, should be regarded as main battlefields of poverty alleviation, altogether 680 counties involved.[2] These areas are characterized by severe natural conditions, undeveloped infrastructure, long distances from central cities and lack of a sound market system. Secondly, contiguous destitute areas are mostly inhabited by minorities and 11 out of the 14 areas, except Lvliang Mountain Area, Dabie Mountain Area and Luoxiao Mountain Area, are minority areas. Statistics show that the 11 areas cover 373 poverty-stricken autonomous counties, accounting for 54.85% of the total number of poor counties in contiguous destitute areas.[3] Thirdly, different contiguous destitute areas vary in cause of poverty and environment and the situation even varies greatly from household to household. During an investigation in Hunan Province, General Secretary Xi Jinping proposed the anti-poverty policy of precise poverty alleviation based on the poverty status quo, which has been fully put into effect since 2012, with a view to precisely identifying, assisting and managing targets of poverty alleviation through scientific and effective procedures. China is increasingly concerned about poverty alleviation and is determined to complete the building of a moderately prosperous society by 2020, with specific tasks defined in the 13th Five-Year Plan (FYP).

Solow-Swan economic growth model analyzes the dynamic mechanism of economic growth from perspectives of capital, technology and labor. It is believed that an economy will be long in a steady state without external impacts or significant changes. Based on this view and in the light of characteristics of poverty in China's contiguous destitute areas, this paper suggest that these areas are currently in low equilibrium as described by Solow Model while precise poverty alleviation can impact such low equilibrium, so that it can jump to a better level and a higher steady state. Contiguous destitute areas should seize the opportunity to improve their self-development capacity and achieve the best development. Finally, the paper puts forward specific countermeasures by drawing international experience in poverty alleviation.

II. Literature Review

a) *Economic growth and China's anti-poverty*

Development economists believe that the history of mankind is a process of constant development and poverty elimination. Adam Smith, the father of economics, was the first to study economic development, but the concept of anti-poverty was not directly proposed by the research at that time. It was not until 1800 or so, when both world population and per capita income had stagnated for quite a long time, that Braudel (1920) put forward the "Malthusian Trap" to describe the situation. Later, this equilibrium was broken by the Industrial Revolution, enabling the economy to take off, and many economists such as Harrod-Domar (1939) and Diamond (1997) began to study how the economy could step out the "Malthusian Trap" under market conditions and enter the development stage. John Maynard Keynes (1936) argues that the free market is not always effective and economic development requires government intervention. Later, Robert M. Solow (1957) believes that economic growth consists of labor, capital and technological advances.[4] The development gap between countries and regions was gradually widening due to different factors of production they had. At the end of the 19th century, scholars like Rowntree began to focus on slowly developing economies and put forward the concept of poverty. In the 1990s, Amartya Sen summed up characteristics of poverty, analyzed the mechanism of poverty from the perspective of rights and therefore broke new ground in the measurement of poverty.[5] Angus Deaton (2015) believes that the answer to how to "shake off poverty" should be derived from the nature of political institutions and the quality of their services: "shaking off poverty" requires efficient governance and rule of law, effective tax system and property rights protection, and public confidence, among others[6]

The research on anti-poverty is accompanied by the course of poverty alleviation and development in China, mainly following the implementation of the reform and opening-up. In the light of the implementation of poverty alleviation in different stages, scholars such as Jiang Wansheng and Song Jianxin (2011) believe that the anti-poverty campaign simply involves: the stage of pushing poverty alleviation through structural reforms from 1978 to 1985, the stage of large-scale focused poverty alleviation from 1986 to 1993, the crucial stage of poverty alleviation from 1994 to 2000 and the new stage of poverty alleviation and development from 2001 to 2011.[7] On this basis, there is one more stage, i.e., the stage of precise poverty alleviation mainly in contiguous destitute areas from 2011 to this day and beyond. Zheng Changde (2016) argues that contiguous destitute areas inhabited by minorities experience low level of economic development and are the most underdeveloped of the underdeveloped in China.[8]

[2] Zheng Changde and Shan Depeng. Report on Regional Development and Poverty Alleviation in Contiguous Destitute Areas Inhabited by Minorities [M]. Beijing: China Economic Publishing House, 2014: 8-10.

[3] Zheng Changde and Shan Depeng. Report on Regional Development and Poverty Alleviation in Contiguous Destitute Areas Inhabited by Minorities [M]. Beijing: China Economic Publishing House, 2014: 8-10.

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b) Research on precise poverty alleviation

Since General Secretary Xi Jinping proposed the policy of precise poverty alleviation in 2013, the idea of precise poverty alleviation has become the guideline for anti-poverty in the new era (Tang Renwu, 2015)[9]. Wang Sangui (2015) believes that precise poverty alleviation is a necessary measure to offset the decline in poverty reduction and will become a main approach to rural poverty alleviation in China.[10] According to the research on relevant reviews (Gong Yanyong, 2015), precise poverty alleviation is mainly found in news reports on interpretation of the precise poverty alleviation policy and introduction to local experience and achievements in precise poverty alleviation.[11] Relevant papers summarize some problems in precise poverty alleviation in rural areas, analyze main causes of poverty and put forward corresponding countermeasures and suggestions, like strengthening the construction of grassroots Party organizations (Kong Debin, 2015), purchasing social services from independent third parties (Deng Weijie, 2014) and establishing a mechanism for allocation of poverty alleviation resources that responds to people's needs and tilts towards the unprivileged (Zheng Baohua, Jiang Jingmei, 2015). Many other papers mainly sum up local precise poverty alleviation and study relevant practices. Yang Bo (2015) stresses the role of the Internet and big data in precise poverty alleviation in Gansu while Feng Mingyi (2015) studies precise poverty alleviation in Wumeng Mountain Area.

c) Research review

The theory of economic growth analyzes the economy as a whole and is dominated by views of western scholars. China's anti-poverty path is, relative to the poverty in other countries and unbalanced development at home, a process of how to achieve rapid development. The research on precise poverty alleviation further narrows the object of study, but still falls into the scope of the theory of economic growth by its nature. It mainly deals with how to achieve great-leap-forward development with government intervention. However, current research studies precise poverty alleviation from the perspective of relevant phenomena by summing up problems in specific areas, analyzing causes and bringing forward countermeasures, rather than probe into the mechanism of precise poverty alleviation in details.

III. Mechanism of Precise Poverty Alleviation based on Solow Economic Growth Model

a) Concept and connotation of precise poverty alleviation

Precise poverty alleviation is a countermeasure proposed by General Secretary Xi Jinping based on poverty status quo and is the opposite of extensive poverty alleviation. As defined by Wang Sangui, precise poverty alleviation is an approach to poverty elimination whereby targets of poverty alleviation are precisely identified, assisted and managed through scientific and effective procedures according to the environment of different poverty-stricken areas and the situation of different poor rural households; it is a measure and the mainstream means of poverty alleviation.[12] Precise poverty alleviation is intended to guide optimal allocation of various poverty alleviation resources, provide villages and households with access to poverty alleviation, gradually establish a long-term mechanism of poverty alleviation and thus lay a solid foundation for scientific poverty alleviation. Amartya Sen believes that the concept of poverty must contain two different elements, namely identification of poverty and aggregation of poverty. Identification of poverty means selecting the poor from the total population by some means; while aggregation of poverty means reflecting general characteristics of the set of the poor with certain methods.[13] As indicated by its concept, precise poverty alleviation involves not only selection and aggregation, but also implementation of corresponding measures according to aggregate characteristics to help the selected people out of poverty. The main purpose of the paper is to achieve the goal of poverty alleviation and economic growth through targeted measures to alleviate poverty based on aggregate characteristics of poverty. Poverty is a state that reflects low income, low consumption and less education...and can be likened to inertia one can hardly get rid of. It corresponds to low equilibrium in Solow-Swan Model, so poverty alleviation is a difficult task and tends to be in a steady state without external impacts. Meanwhile, poverty is also a process and numerous poor people have shaken off poverty through their own efforts, relatives' assistance and government support, but some are still in poverty, so precise poverty alleviation is necessary, which can push the steady state to a higher level through external forces such as capital, labor and technologies.

in Chinese Ethnic Minority Regions [J]. Ethno-national Studies. 2011, 4.

[9] Tang Renwu. Interpretation of Xi Jinping's Thought on Precise Poverty Alleviation [N]. People's Tribune. 2015, 10.

[10] Wang Sangui and Guo Zihao. On China's Precise Poverty Alleviation [J]. Guizhou Social Sciences. 2015, 5.

[11] Gong Yanyong. Research Review on Precise Poverty Alleviation [J]. Journal of Shandong Agricultural Administrators' College. 2015, 3.

[12] Wang Sangui and Guo Zihao. On China's Precise Poverty Alleviation [J]. Guizhou Social Sciences.2015, 5.

[13] Wang Zhibiao. Review on Poverty Thought of Amartya Sen [J]. Journal of Beijing University of Technology. 2005, 9.

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b) Dynamic equilibrium of Solow-Swan economic growth model and analysis of influencing factors

1. Solow-Swan Model

Solow-Swan Model established by American economists R. Solow and T. Swan based on the classical theory of economic growth suggests that economic growth generally tends towards equilibrium. Problems to be solved include: what determines economic growth and the trend of economic growth, why there is an income gap between countries or regions and whether a poor country can catch up with a rich one. The production function is:

$$Y(t) = F(K(t), A(t)L(t))$$

Where, $Y(t)$ standards for yield, $K(t)$ stands for capital, $L(t)$ stands for labor, $A(t)$ stands for the effectiveness of knowledge or labor and t stands for time. Additionally, $A(t)L(t)$ stands for effective labor and means the role of technology is labor enhancement. Capital, labor and technology jointly determine economic growth and $A(t)$ is multiplied by $L(t)$ to influence $Y(t)$; three conditions are met at the same time: firstly, the marginal product of each input is positive and on the decrease; secondly, returns to scale are constant; thirdly, Inada conditions are met:[14]

$$f(0) = 0,\ f'(k) \succ 0,\ f''(k) \prec 0$$
$$\lim_{k\to 0} f'(k) = \infty, \lim_{k\to\infty} f'(k) = 0$$

Due to constant returns to scale $F\left(\frac{K}{AL},\ 1\right) = \frac{1}{AL}F(K,\ AL)$, $\frac{K}{AL}$ stands for the average amount of capital per unit of effective labor and $\frac{F(K,\ AL)}{AL}$ means the average yield per unit of effective labor. Given $k = \frac{K}{AL}$ and $y = \frac{Y}{AL}$, then $y = f(k)$. See Fig.3-1 for the graph of the function.

2. Steady state in Solow economic growth model

In Solow Model, changes in labor and knowledge are exogenous, so change in per capita capital is a main variable to be considered. Changes in production input and labor and knowledge grow at a constant rate, with labor growth rate expressed as n, knowledge growth rate as g, the proportion of the yield used for investment as s and capital depreciation rate as δ. Due to $k = K/AL$, the following steady state condition can be obtained according to the chain rule:

$$\dot{K} = sf(k) - (n + g + \delta)k$$

The equation above indicates that the rate of change in the average amount of capital per unit of labor is the difference between the average actual investment per unit of effective labor $sf(k)$ and break-even investment $(n + g + \delta)k$, i.e., investment (social savings) required to keep k at the current level.

According to the analysis in Fig.3-2, $(n + g + \delta)k = sf(k)$, in which case the line $(n + g + \delta)k$ is intersected with the curve $sf(k)$, and the per capita capital and per capita yield at the point of intersection A are k_A and y_A respectively, when the per capita savings exactly equal the demand of break-even investment. To the left of A, the curve $sf(k)$ is higher than the line $(n + g + \delta)k$, indicating that savings are higher than the demand of break-even investment, which will lead to a higher per capita capital k and a higher yield. k will approach k_A until savings for break-even investment finally equal all savings, while per capita capital remains unchanged and economic growth reaches a steady state. The situation is quite the opposite to the right of A. Social savings cannot satisfy break-even investment, so per capita capital decreases at the current level of savings, resulting in a smaller y and finally a steady state. This is the dynamic mechanism of economic growth convergence to a steady state.[15]

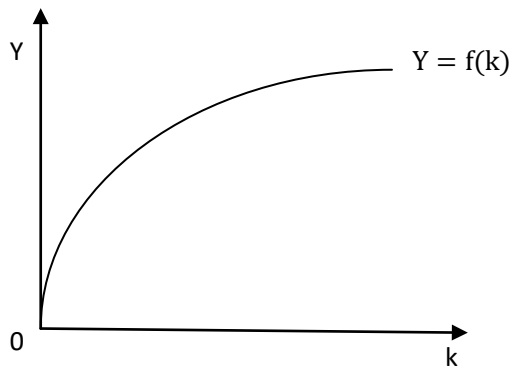


Fig. 3.1: Per Capita Capital-Per Capita Income Curve

[14] Zhang Su. Macroeconomics [M]. Tsinghua University Press. 2014, 8.

[15] Zhang Su. Macroeconomics [M]. Tsinghua University Press. 2014, 8.

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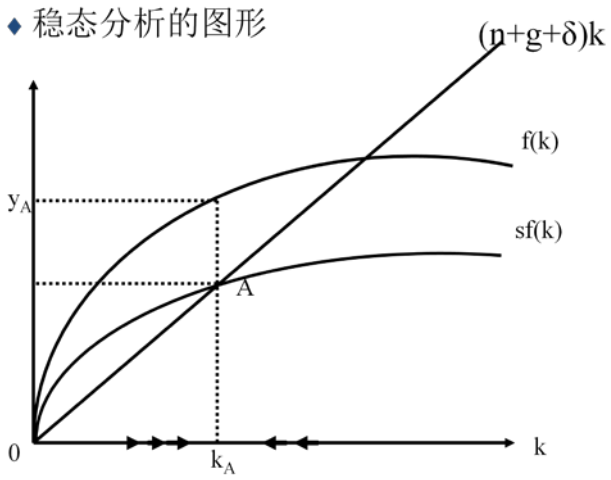


Fig.3.2: Steady State Analysis Chart

3. Analysis of influencing factors

1) Effects of the saving rate on steady state

When per capita capital is very low, capital investment will trigger a process of high economic growth, as $sy > (n + g + \delta)k$, and within the interval of $0 - k_0$ in Fig.3-3, both per capita capital and per capita income will increase until they reach a steady state and converge to k_0; when the initial capital is not very low and stands at C_0, an increase in the saving rate will raise the yield, resulting in a process of high growth. After an increase in the saving rate, $(n + g + \delta)k < s_1 f(k)$, there are surplus savings after capital loss is offset and the actual investment increases and exceeds break-even investment, namely $\Delta k > 0$, thus bringing about a process of continuous economic growth until a new steady state occurs, that is, the level of C_1 (see Fig.3-3). A higher saving rate means more resources for investment, so the line indicating actual investment moves up. The result is the actual investment exceeds effective depreciation, so k continues to rise to a new steady-state value (but not jump to such value). As people save more, the economy will turn from the initial steady state C_0 to the new one C_1, so that per capita capital increases from k_0 to k_1 and per capita yield also increases. Fig.3-4 depicts the dynamic process more clearly. In the upper part, per capita yield changes at t_0 as savings change and reaches at a new steady state at t_1. In the lower part, per capita yield growth rate changes at t_0 as savings change and reaches at a new steady state at t_1.

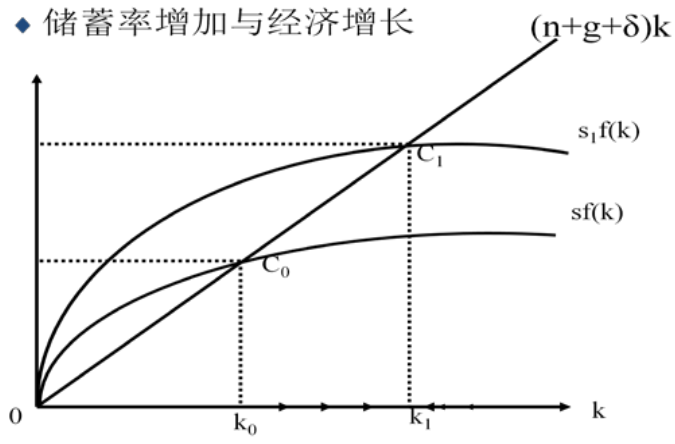


Fig. 3.3: Saving Rate Increases and Economic Growth

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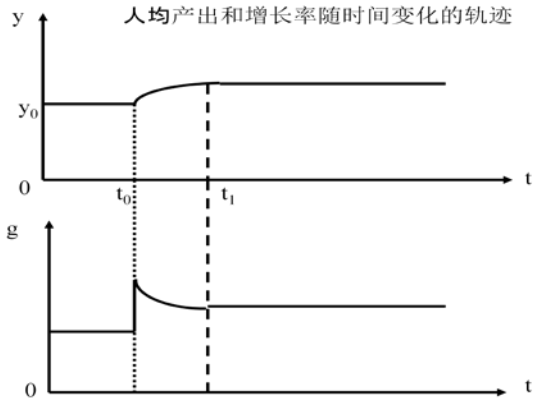


Fig.3.4: Track of Changes in Per Capita Yield and Growth Rate over Time

2) Effects of technological advances on steady state

In Solow Model, the role of technology in economy is labor enhancement. In case of technological advances, in a steady state, the growth rate of per capita capital equals that of per capita income, namely $\frac{\Delta k}{k} = \frac{\Delta y}{y} = g$. The growth rate of economic volume $\frac{\Delta Y}{Y} = g + n$, indicating that an increase in per capita income y leads to a rise in both growth rate of economic volume and per capita income.

3) Effects of labor growth rate on steady state

The steady state of initial capital stock is D. Following the implementation of family planning, population growth rate decreases from n to n'. The depreciation line $(n + \delta)k$ rotates downward to $(n' + \delta)k$, in which case investment exceeds depreciation and k continues to grow until the economy finally reaches the new steady state D_1. (Fig.3-5) At this point, both labor capital and yield increase, but the long-term growth rate remains 0.

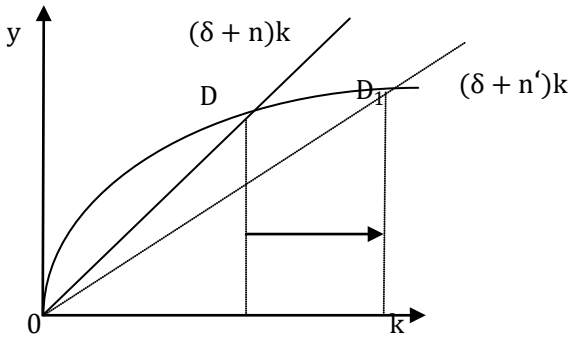


Fig. 3.5: Effects of labor growth rate on steady state

c) *Solow-Swan Model-based analysis of the precise poverty alleviation mechanism*

Solow-Swan Model analyzes the power mechanism for economic growth from three aspects of capital, technology and labor and thinks that the three elements will be steady for a long time when there is no external impact or big change. On the basis of such viewpoint, combining characteristics of poverty in contiguous destitute areas of China, this paper holds that the areas are in a low-equilibrium state as described by Solow-Swan Model, and precise poverty alleviation is an impact to the low equilibrium in the areas, with the purpose of making them transit to a better level. The areas should take this opportunity to improve their development capability and develop to the best level. As shown in Fig. 3-6, poverty is the low equilibrium as Solow-Swan Model describes, and poverty alleviation means to reach a new high steady state under the precise poverty alleviation measures. This may be a progressive process, but more tends toward transition, namely development by leaps and bounds or leap-forward development. Precise poverty alleviation is the mode to realize transition and can be achieved through capital, labor or technology or through joint action of the three elements.

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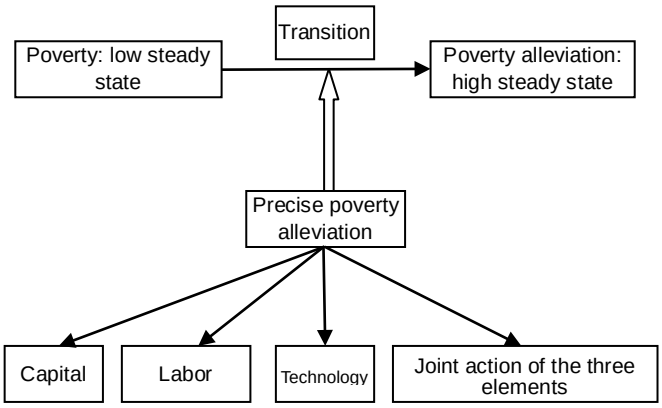


Fig. 3.6: Solow-Swan Model-based precise poverty alleviation mechanism

IV. Countermeasures for Precise Poverty Alleviation in Contiguous Destitute Areas

The program of precise poverty alleviation has been conducted for several years, and the government has made a lot of efforts in the field, particularly in the process of precise identification, but many problems and difficulties remain. After completion of precise identification, the focus will be shifted to precise implementation and management. Due to involving more complicated, professional and long-term works, precise poverty alleviation can be finally implemented in manner of government-third-party cooperation instead of previous government-led implementation. According to Solow-Swan Model, specific measures can be analyzed from the following four points:

a) *Effective use and accurate management of the capital input*

China had made great efforts to develop poverty-alleviation projects, particularly after the program of precise poverty alleviation. Massive human and material resources have been channeled toward contiguous destitute areas. In 2014, the central government appropriated 43.3 billion yuan special for poverty alleviation, up 10% compared with that last year; in 2015, the government budget arranged 46.09 billion yuan of the subsidy for local poverty alleviation works, up 8% on the basis of the amount last year.[16] Great achievements have been made, but many bottlenecks exist, of which funds management and use is one. Relevant case-based analysis is described below.

Case 1: Mayi Village, Lamuajue Township, Meigu County, Liangshan Prefecture, Sichuan Province has the average altitude of 2,515m, covers an area of 3.8 km^2, administrates 5 villagers' groups consisting of 127 farmer households with 573 villagers from Yi ethnic group, and is supported with 744.1 mu farmland. In June 2015, a report by Xinhua News Agency disclosed actual situations of poor and backward life in Mayi Village, such as the great difficulty of getting an education, poor sanitation and man-animal mixed residence and so on, making the Village become a highlight of public opinions and a focus of various social circles and governments at various levels. The government arranged a lot of funds and NGOs and individuals made many donations of funds and goods, with total value of 8.6 million yuan.[17] It was a huge amount of money for Mayi Village, and meant about 70,000 yuan per household on an average. But such inputs for several consecutive years made less distinct effect.

International experiences: The role of a NGO in development –BRAC Model. Bangladesh Rural Advancement Committee (BRAC), established in 1972 by Sir Fazlé Hasan Abed for making up for the deficiency of government and private sector in poverty alleviation, is the largest and most successful NGO in the world. By June 2015, it had reported employees of more than 126 million, about 70% of whom were female. They recognize that poverty in rural area is a long-term and structural problem, focus on education, nutrition, health, credit, lawful rights and other issues of the residents in poor areas, and teach them how to read, think, pool resources and start their undertakings.

China can completely follow the model of BRAC to establish its special NGOs for precise poverty alleviation to manage and guarantee virtuous operation of the funds. The practice of granting relevant funds directly to the poor, regardless of the source from national transfer or donations of social organizations and individuals, is unfavorable for long-term continuity of poverty alleviation. By 2020, when China reaches the goal of finishing building a moderately prosperous

[16] Source: Official website of the Ministry of Finance of the People's Republic of China

[17] Source: Statistical data of Mayi Village, Lamuajue Township, Meigu County, Liangshan Prefecture.

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society in all respects and relevant counties lose the status of poverty-stricken counties, there will be no massive national transfer payments and other sources of funds available, then such areas will be very liable to become poor again. On the other hand, government's management of all funds will cause many limitations. First, government employees are limited, and many of them are not good at funds operation and management. From the assumptions of Solow-Swan Model, savings are not efficient until they are transformed into investment fully. When the funds become savings but cannot be transformed into investment, they will be inefficient for economic growth. In addition, there exists the risk of corruption in government. So establishing sound special NGO is a good choice, through which government can focus their attentions on supervision. Moreover, in view of experiences, NGO can work better in improving motivation of the poor. However, there are many problems in personnel quality, funds source and relations with government of NGOs in China, meaning more efforts needing to be made further.

b) *To speed up improvement of labor's quality and strictly control fertility rate*

First, to greatly improve labor's quality. Precise identification has achieved clear statistics of labor's structure in every area. Basic education is the first task in contiguous destitute areas. Currently, China has popularized 12-year compulsory education, which is very important for future development of the areas; second, to carry out re-education and training of persons with labor capacity. Specific training courses should be carried out according to potential industries in local areas or target areas, in a down-to-earth manner rather than superficially and in a manner of formalism, as such groups serve as leading players in the development of the areas. Only when they are equipped with self-development capabilities can the areas cast off poverty really.

According to the analysis based on Solow Swan Model, increase of labors is efficient for growth of aggregate economy, but cannot increase per capita capital, so rise of population should be strictly controlled. In contiguous destitute areas, many rural families have 3 or 4 children, even more. The 6th national population census data show that Liangshan Prefecture reported the population growth rate of 8.53‰, much higher than 2.31‰ of Sichuan Province and 4.79‰ of China (See Table 1),[18] with the growth of Yi people and poverty-stricken population as main contributors.[19]

Table 4.1: Population Growth Rate of Liangshan Prefecture

Area	Birthrate ‰	Mortality ‰	Natural Growth Rate ‰
China	11.9	7.11	4.79
Sichuan Province	8.93	6.62	2.31
Liangshan Prefecture	14.44	5.91	8.53

First, based on model unreasonableness, the case that more people vie for limited resources is not the most efficient. Meanwhile, more children mean that their parents have no more time for work, leading to decrease of per capita capital. Second, poverty of the families causes no guarantee for health, education and nutrition of their children and adults and poor physical and cultural quality of them. Third, such case increases the possibility of intergeneration transmission of poverty. Human capital investment is very important for casting off poverty. But data show that, compared with high-income families, low-income families are generally unable or unwilling to let their children have higher-level education.[20] Such practice is particularly distinct in contiguous destitute areas. After all, under the situation that basic living needs cannot be met, who is willing to let their children go to school, and how many children can feel at ease to study in school? The fact carries a foreshadowing of continuous poverty and makes precise poverty alleviation more difficult.

Case 2: Changyan Village, Zhenxiong County, Zhaotong City, Yunnan. The Village is in mountain region, more than 110km away from the county seat and 22km from the town, covers an area of 21.40 km^2, enjoys an altitude of 1,400m, average annual temperature of 12.00℃ and annual precipitation of 1,100mm, suitable for growing corn, flue-cure tobacco and other agricultural crops; and is equipped with farmland of 6,465 mu, or per capita farmland of 1.6 mu, without any plot larger than one tenth mu; 924 farmer households and 4,034 residents consisting of an agricultural population of 4,028 and labors of 2,331. In 2013, the Village reported total income of 9.0673 million and farmers' per capita net income of 1,447 yuan.[21] Moreover, the Village is also limited by adverse conditions, completely agricultural population, low productivity, extremely soil, fragile ecological environment and serious soil erosion. All contiguous destitute areas almost face situations of

[20] Zou Wei, Zheng Jie. *Why do Children from Poverty-stricken Families not Go to School: Risk, Human Capital Intergeneration Transmission and Poverty Trap* [J].Economics Information. 2014 (6).

[18] Data of the 6th national population census.

[19] Zheng Changde. *Study on Changes in Ethnic Minority Population in Liangshan Yi Autonomous Prefecture*[J]. *Northwest Population Journal*. 2008 (4).

[21] Source: Website of Changyan Village Committee, Wanchang Township, Zhenxiong County, Zhaotong, Yunan

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serious ecological degradation and overload of population.

Drawing on the experiences: Mexican "Opportunity" project. Facing severe social poverty and unbalanced regional development, the Mexican government mapped out "Education, Health and Food Program", which was renamed to "Opportunity Program" in December 2001. The core of the poverty-alleviation project lies in "Money for Action", aiming to promote improvement of its human capital level by providing poverty-stricken group with cash subsidy subject to additional conditions, so as to reach the goal of reducing poverty. "Opportunity Program" is the first social policy for poverty alleviation from the angle of human capital investment in Latin America. Based on the starting point that pure economic growth cannot effectively eradicate poverty but human capital plays an extremely important role in eradicating poverty, the Program focused on education, health and food of poverty-stricken population and other fields which may make far-reaching influences on their future. With direct cash subsidy, the Program can stimulate the beneficiaries' investment in education and health of their families while alleviating instant demands of poverty-stricken households, effectively combine short-term goals with long-term ones and give play to human capital to break intergeneration transmission of poverty. The most important innovation of the "Opportunity Program" is that it transforms the sole responsibility of government in poverty alleviation into a common responsibility of the benefited households.[22] Different from traditional subsidy programs under which the beneficiaries received relief fund passively, beneficiaries of the "Opportunity Program" must perform the family agreement concluded with relevant authorities and undertake certain "corresponding obligations". Such practice reflects new breakthroughs in design idea of the Program, relies on "conditional" arrangement to promote poverty-stricken households' investment in education, health and nutrition, and helps improve health and education situations of families, thus to greatly increase possibilities for poverty-stricken population to get more development opportunities.

China's goal of precise poverty alleviation at present is just to arouse the poor's enthusiasm and subjective initiative and transit to "development-oriented" and "blood-making" poverty alleviation from traditional "blood-transfusion" poverty-alleviation approach. How to realize the transition from the sole responsibility of government to the common responsibility of government and the benefited households in precise poverty alleviation? We can follow Mexico's innovative idea of "conditional support", to let poverty-stricken households realize that "waiting, dependence and request" do not work and all supports are subject to their hard works.

c) To support with precise technology

Technology is the most fundamental measure to improve self-development ability of poverty-stricken areas, and the importance of technology can be found in Solow-Swan Model. Precise poverty alleviation in contiguous destitute areas can be started with two aspects: first, technology introduction by establishing industrial park or accepting industrial transfer to expand technology introduction channel. But it is a challenge to poverty-stricken areas itself regardless of regional development conditions or personal quality of local labors; second, labor training and output. Contiguous destitute areas mainly feature mountains with numerous gullies or places restricted from development, hard transport since ancient times and other infrastructure poorer, forming extremely adverse conditions for economic development in the areas, particularly in high-altitude Yi-people villages like Mayi Village, which are in the situation of being deeply marginalized due to remote geographic position and more backward transport conditions. Therefore, it is impossible to promote local economic development by introducing technologies and labor training and output is more practical. Relevant training can be based on personal wish and be carried out through other channels besides government. Considering very high quantities of work, in order to guarantee efficiency and quality, what the government needs to do is to build an enterprise-poor people coordination mechanism, under which enterprises or social organizations can carry out job-oriented training and thereby enjoy some subsidy. Naturally, the precondition for the practice is the long-term coordination mechanism of poverty alleviation between government, enterprise and individual.

The role of rural women in precise poverty alleviation cannot be ignored, and improving poor situation of rural women is a strategic key link in eradicating poverty. Women undertake tasks of population reproduction, household duties and increasing family income. Situations of women first influence birth behavior and quality, and poverty of women is directly related to rise of fertility rate, fall of educational level and deterioration of family environment, and leads to intergeneration transmission and vicious circle of poverty.[23] For this reason, it will be one of keys for successful precise poverty alleviation to give play to advantages and roles of rural women in precise poverty alleviation as far as possible.

[22] Michael P. Todaro. Translated by: Nie Qiaoping, et al. *Economic Science Classics Series: Economic Development (11th Edition)*. Beijing: China Machine Press. 2014 (4).

[23] Liu Xin. *Summary of the Studies on Women Poverty in China over the Past 40 Years* [J]. *Collection of Chinese Women's Studies*. 2015 (1).

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d) To establish central towns

Funds support, population quality improvement and technology support are the analysis results based on Solow-Swan Model. In practice, joint action of the three elements is the most effective. Contiguous destitute areas has too low urbanization rate, about 20% generally, and many rural areas are far from urbanization at all. Due to scattered residence in mountains, not all families and farmers can be benefited by road, hydropower station, hospital, school and other public goods and public services. They have very poor residential and sanitary conditions, no access to highway and relatively closed living area. Central towns can actively encourage poverty-stricken households far from towns to move to local county seats or towns as the nodes and carriers for development. Migration and relocation, though subject to many queries and occurrence of some problems in practice, is undeniably an effective measure for development-oriented poverty reduction. It can expand migrants' living and exchange space, serve as a people-centered practice, change their income structure, and make them go out of the complete farming and closed space. However, establishment of central towns should ensure follow-up interest security of the relocated farmers, centralized construction of education, health and other living infrastructure and lower transport cost.

V. Conclusions

In China, contiguous destitute areas are main theaters to poverty alleviation and precise poverty alleviation is the main measure in the field. By analyzing the precise poverty alleviation mechanism through three dimensions of funds, technology and labor in Solow-Swan Model, this paper reveals that such areas are still at a low-equilibrium level. To take the opportunity of precise poverty alleviation to realize leap-forward economic development, we must carry out effective use and accurate management of the capital input, speed up improvement of labor quality, strictly control fertility rate, provide precise technology support and establish central towns.

Precise poverty alleviation is the main measure that may help contiguous destitute areas realize economic development from low equilibrium to high equilibrium. Poverty is not only an economic issue, but includes multi-dimension angles of society, culture and ecology. Therefore, precise poverty alleviation cannot be limited to only emphasis of economic growth, though it is undeniable that economic growth is the most important way to address poverty. In the process of economic transition, poverty-stricken areas will face many active or passive factors and meet many difficulties and problems, but in the long run, precise poverty alleviation will surely be favorable for contiguous destitute areas and future development of China.

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Technology-Intensive Trade, Economic Growth and CO2 emissions: ARDL Bounds Test Approach and Causality Analysis for BRICS

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Abstract- This study identified long-run and short-run relationship as well as causal direction of medium and high tech (MHT) trade (proxy for tech-intensive trade), economic growth and CO2 emissions in BRICS for the period of 1992-2015 applying ARDL bound test approach and error-correction based Granger causality. The disequilibrium (non-stationary) characteristics of CO2 emissions in China during 1992-2014, along with unavailability of MHT trade data prior to 1992, constrained the analysis of short-run and long-run relationship among the variables for the country. The study found that structural change did not affect CO2 emissions in India and Russia in the long-run but it did in the short-run in India. The study did not find any long-run cointegration among the variables for South Africa. It identified long-run causality running from MHT trade and growth to CO2 emissions for India and Russia, whereas long-run causality directed from MHT trade and CO2 emissions to growth was found in Brazil and India, and causality running from CO2 emissions and growth to MHT trade only held for India.

Keywords: medium and high tech (MHT) trade; economic growth; CO2 emissions; brics; ARDL bound test; structural breaks.

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Technology-Intensive Trade, Economic Growth and CO2 emissions: ARDL Bounds Test Approach and Causality Analysis for BRICS

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Abstract- This study identified long-run and short-run relationship as well as causal direction of medium and high tech (MHT) trade (proxy for tech-intensive trade), economic growth and CO2 emissions in BRICS for the period of 1992-2015 applying ARDL bound test approach and error-correction based Granger causality. The disequilibrium (non-stationary) characteristics of CO2 emissions in China during 1992-2014, along with unavailability of MHT trade data prior to 1992, constrained the analysis of short-run and long-run relationship among the variables for the country. The study found that structural change did not affect CO2 emissions in India and Russia in the long-run but it did in the short-run in India. The study did not find any long-run cointegration among the variables for South Africa. It identified long-run causality running from MHT trade and growth to CO2 emissions for India and Russia, whereas long-run causality directed from MHT trade and CO2 emissions to growth was found in Brazil and India, and causality running from CO2 emissions and growth to MHT trade only held for India. The most critical policy suggestion provided by this study is that there is no generalized proposition when it comes to the nexus between MHT trade, economic growth and CO2 emissions.

Keywords: medium and high tech (MHT) trade; economic growth; CO2 emissions; brics; ARDL bound test; structural breaks.

I. Introduction

After the instigation of Sustainable Development Goals (SDGs) as the successor of Millennium Development Goals (MDGs), the nexus between international trade, economic growth and Carbon dioxide emissions (Henceforth, trade-growth-CO2 emissions) has drawn significant research interests to academics and policy-makers alike. The 2030 Agenda for sustainable development acknowledges international trade as a pivotal mechanism for achieving a number of specific goals and targets of SDGs (Hoekman, 2016). According to Tipping and Wolfe (2015), as trade is the critical engine of economic growth and is highly related to each of the three dimensions of SDGs it has to be a part of coherent policy framework of sustainable development. Moreover, environmental degradation and climate change have been a significant concern for a sustainable world which is given a noteworthy focus in SDGs. Ever-growing CO2 emissions and other greenhouse gasses in the atmosphere are considered one of the key threats to environmental sustainability. As international trade results in higher economic growth and is considered as a vital tool for achieving SDGs, the effects of trade and economic growth on the environment is a critical research issue.

Grossman and Krueger (1991), for instance, argued that the effects of trade on the environment can be explained in three different ways such as scale effect, technique effect, and composition effect. According to scale effect, growing trade upsurges global economic activities which consequently affects the environment. This effect of trade is "ceteris paribus" type that means the higher the international trade, the higher the global economic activities and environmental pollution considering other factors constant such as trade composition and technological progress. The technique effects suggest that growing foreign direct investment (FDI) and international trade in developing countries are accompanied with technology-based asset from developed to developing countries which in turn results in higher human capital accumulation and technological progress to the latter. These positive spill-over reduces pollution per output through technological innovation.

The composition effect argues that countries should master in production and export of the goods in which they enjoy a comparative advantage. Thus composition effect suggests a mixed effect of trade on the environment. This effect can be further explained by the pollution haven hypothesis (Copeland and Taylor (1994) which postulates that due to strict environmental regulations in developed countries pollution-intensive industries tend to establish in developing countries where environmental regulations are either non-existent or relaxed. Thus growing trade makes developing counties a pollution haven.

On the other hand, pollution halo hypothesis, proposed by Zarsky (1999), suggests that FDI and trade are accompanied with the transfer of environment-friendly technological products and management from developed to developing countries which consequently results in environmental benefits for the latter.

Trade- growth- CO2 emissions nexus is best explained by environmental Kuznets curve (EKC),

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proposed by Kuznets (1955), providing a better understanding of the linkages between trade, economic growth and CO2 emissions. This hypothesis suggests an inverted U-shaped relationship. According to EKC, trade raises economic activity of a country which results in environmental degradation up to a threshold level. However, economic growth also increases per capita income of a country which raises the ability to invest in environment-friendly technology and better production process. Thus, after the threshold point economic growth reduces environmental pollution.

Having said this, this study aims at making several contributions to the literature pertaining to trade-growth- CO2 emissions nexus. First, following the argument of technique effect and EKC hypothesis this paper takes technology intensive trade as a proxy of trade variable to identify the short-run and long-run relationship as well as casual direction as far as trade-growth- CO2 emissions linkage is concerned. It verifies the proposition as to whether growing trade in medium and high-tech (henceforth, MHT) sectors reduces environmental pollution and raises economic growth, as suggested by EKC and technique hypothesis.

Second, rather than concentrating on single country or panel of countries this study focuses on country-specific linkages of trade-growth-CO2 emissions for BRICS, the acronym for an association of five major emerging economies: Brazil, Russia, India, China and South Africa. It provides policy insights as to whether the linkage and casualty are different across countries.

The motivation behind studying BRICS is that since 1990s these countries have been playing significant role in the world economy. Moreover, it is predicted that BRICS could play even greater role in decades to come. According to Wilson and Purushothaman (2003), BRICS economies could become a much more substantial force of the world economy than G8 by 2050. Moreover, these economies passed through significant structural changes over the last few decades as far as GDP growth, share of world GDP and world trade are concerned. They are also becoming a major source of CO2 emissions. According to the Emission Database for Global Atmospheric Resources, while in the 1990s these economies constituted around 19% of global CO2 output in 2015 their share augmented to 43.7%. Along with higher economic growth these countries have witnessed the change in trade composition. Thus, identifying the nexus between trade, growth and CO2 emissions, this paper provides significant policy suggestions.

Methodologically this study contributes to different aspects of the literature concerning trade-growth-CO2 emissions linkages. We identified reciprocal short-run and long-run relationship and casual direction among these variables based on three different models: CO2 as a function of MHT and growth, growth as a function of CO2 and MHT, and MHT as a function of CO2 and growth. We also identified long-run and short-run relations as well as strong causalities for these variables. In this pursuit, an error-correction based unrestricted vector error correction model (UVECM) is employed to identify the reciprocal casual direction in different dimensions.

Second, in the analysis we strictly take into account the issue of structural break both in variables and in the model given its (structural break) growing importance. Moreover, EKC and technique effect hypothesis assume structural change or U-shaped relationship concerning the nexus between economic growth and CO2 emissions. We applied structural break unit root test to deal with structural break issues in stationary analysis. We also applied CUSUM and CUSUMSQ test to check the stability of the model and identify the break in the model.

The remainder of the study proceeds as follows. The next section reviews literature followed by section three that describes the data and variables used in this study. Section four discusses econometric methodology. The results of the analysis are reported and discussed in section five. The last section draws conclusion and provides policy suggestions.

II. Review of Literature

The literature concerning trade- growth- CO2 emissions nexus can be grouped into several strands. The first strand of literature focuses on the linkages between trade and economic growth. This field is rich in terms of academic work which is surveyed by several influential papers (Edwards, 1998; Giles & Williams, 2000a, 2000b; Lewer & Berg, 2003). The literature strongly supports the nexus between trade and economic growth. However, very few studies are conducted to identify the effects of trade composition of different sectors on economic growth. Mazumdar (1996)identified that pattern of trade is a crucial catalyst for economic growth. According to his findings, a country substantially gains from trade if it imports consumption good and exports capital good, although trade may not necessarily lead to higher economic growth. Lewer and Den Berg (2003) found similar results. . According to Lall (2000), low-technology products cause slower economic growth, whereas highly technology-intensive products result in rapid growth. Export growth in high tech sector contributes to output growth markedly when countries have a more significant share of manufacturing exports than the world average (Aditya & Acharyya, 2013).

The second strand of literature provides evidence on the economic growth-CO2 emissions nexus. This area is highly extensive, and a large number of studies have been conducted to identify the nexus between economic growth and CO2 emissions. An

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extensive literature on growth-CO2 emissions linkage focuses on environmental Kuznets curve (EKC) which postulates that the relationship between growth and CO2 emissions is inverted U-shaped. Antonakakis, Chatziantoniou, and Filis (2017)argued that although there exist an exhaustive list of studies in the field of growth-CO2 nexus, the findings of those studies are inconclusive and differ across countries or regions. The pioneer studies in this area focused on basic EKC model to identify the linkages between economic growth and CO2 emissions. Without identifying any explanatory factors studies suggest an inverted U-shaped relationship between these two variables (Beckerman, 1992; Dinda, 2004; Gani, 2012; Grossman & Krueger, 1991, 1995; Heil & Selden, 2001; Moomaw & Unruh, 1997; Schmalensee, Stoker, & Judson, 1998). Moreover, several empirical studies have been performed to examine growth-CO2 nexus, and they identified U-shaped relationship as proposed by EKC model (Panayotou, 1993; Selden & Song, 1994; Stern, 2004).

On the contrary, a number of studies suggested an N-shaped EKC in the growth-pollution linkage (Grossman & Krueger, 1995; Shafik & Bandyopadhyay, 1992; Torras & Boyce, 1998). It is argued that in the preliminary stage of development there is a positive linkage between growth and environmental pollution, and the nexus becomes negative after a threshold level of economic growth. However, this relationship is reverted to positive after another turning point. This N-shaped relationship was further elaborated by several other studies (Álvarez-Herránz, Balsalobre, Cantos, & Shahbaz, 2017; Johansson & Kriström, 2007; Lorente & Álvarez-Herranz, 2016) suggesting that the second turning point of the positive relationship between growth and pollution occurs due to technology obsolescence that reemerges the 'scale effect' of growth on the environment.

A number of studies analyzed the growth-CO2 emissions nexus using panel data models (Al-Mulali & Sab, 2012; Azam, 2016; Balsalobre-Lorente, Shahbaz, Roubaud, & Farhani, 2018; Heidari, Katircioğlu, & Saeidpour, 2015; Holtz-Eakin & Selden, 1995; Narayan & Narayan, 2010; Ozcan, 2013; Özokcu & Özdemir, 2017; Richmond & Kaufmann, 2006; Salahuddin & Gow, 2014; Salahuddin, Gow, & Ozturk, 2015; Sebri & Ben-Salha, 2014; S. Wang, Li, & Fang, 2017). Most of these studies, nevertheless, offer inconclusive results. However, Azevedo, Sartori, and Campos (2018) found that the effects of economic activity on the environment is at best mixed and growth-environment pollution nexus should be identified on country basis or case-by-case basis. A vast number of papers also identified the growth-CO2 emissions nexus studying specific country. They include, Chang (2010) and Long, Naminse, Du, and Zhuang (2015)for China; Ozturk and Acaravci (2010) for Turkey, Alam, Begum, Buysse, and Van Huylenbroeck (2012) for Bangladesh; Jayanthakumaran, Verma, and Liu (2012) and Govindaraju and Tang (2013) for China and India, Farhani, Chaibi, and Rault (2014) for Tunisia, Yang and Zhao (2014) for India, Alshehry and Belloumi (2015) for Saudi Arabia; Begum, Sohag, Abdullah, and Jaafar (2015) for Malaysia. However, these studies provide inconclusive and sometime contradictory results. It is fairly obvious from the review of existing literature that previous studies did not address several important aspects in identifying the nexus between trade, growth and CO2 emissions. International trade is the critical engine of economic growth and trade in general affects CO2 emissions via growth. Moreover, the 'composition effect' of trade proposed by Grossman and Kruger (1991) suggests that trade composition has a differential effect on CO2 emissions. Other notable studies such as (Aditya & Acharyya, 2013; Lall, 2000; Lewer & Den Berg, 2003; Mazumdar 1996) argued that trade composition affects economic growth of a country. As composition of trade affects growth, the linkages between economic growth and CO2 emissions could also have implications for the SKC hypothesis. These issues are overlooked by the studies mentioned above.

The third strand of literature concerns trade-technology-CO2 emissions nexus. Grossman and Krueger (1991)argued that growing trade results in higher global economic activities which may cause environmental degradation implying that higher trade results in higher level of pollution. However, endogenous growth theories (Aghion & Howitt, 1990; Grossman & Helpman, 1991; Romer, 1990) suggest that the higher engagement of a country in international trade is accompanied with knowledge-based technology transfer in developing countries. Such technology transfer reduces pollution having positive effect on the environment. Zarsky (1999)argued that international trade has a beneficial effect on the environment in developing countries as international trade also brings environment-friendly technology in host countries. Moreover, some studies argued that technology obsolescence will turn EKC into N-shaped as after the second turning point the growth-CO2 nexus will be positive owing to the growing pollution from technology desuetude (Álvarez-Herránz et al., 2017; Johansson & Kriström, 2007; Lorente & Álvarez-Herranz, 2016).

This study introduces several new issues to the existing literature of trade-growth-CO2 emissions nexus. It uses technology-intensive variables that involve trade of medium and high tech products followed by the identification of technology-intensive trade- growth- CO2 nexus. The variables used in the study address two critical effects of trade on the environment: 'technique effect' and 'composition effect'. The tech-intensive trade-CO2 emissions linkages could offer an important insight as to whether technological progress as represented by MHT trade reduces CO2 emissions. Moreover, the study offers another important insight as

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to whether trade composition has a differential effect on CO2 emissions as changes in MHT trade is associated with the transformation of trade composition of a country.. Moreover, rather than focusing on panel data or single country-based analysis, the study focuses on country-specific analysis for BRICS exploring as to whether tech-intensive trade-growth-CO2 emissions nexus differs across countries.

Although several studies focused on growth-CO2 emissions nexus and trade-growth-CO2 emissions nexus for BRICS (Azevedo et al., 2018; Cowan, Chang, Inglesi-Lotz, & Gupta, 2014; Pao & Tsai, 2010, 2011; Sebri & Ben-Salha, 2014), those studies did not address some significant issues. Most of the studies on BRICS, for instance, identified trade-growth-CO2 emissions linkages using panel data models (Cowan et al., 2014; Pao & Tsai, 2010, 2011), whereas Azevedo et al. (2018) argued that environmental effects of trade and growth is mixed and must be looked into country-specific perspectives. Azevedo et al. (2018)focused on country-specific analysis, but the study did not consider the effects of technology-intensive trade on the linkages between trade, growth and CO2 emissions. However, trade statistics shows that these economies notably China, India and Brazil experienced a substantial increase in medium and high tech trade over the last two and a half decades. Moreover, none of the previous studies examined the effects of MHT trade on growth and CO2 emissions. Nevertheless, several studies reported that trade composition has differential effects on growth (Aditya & Acharyya, 2013; Lall, 2000; Lewer & Den Berg, 2003; Mazumdar 1996) as well as on the environment(Grossman & Krueger, 1991; Panayotou, 1993; Zarsky, 1999).

III. Data

The data for per capita CO2 emissions (in metric tons) and GDP growth were collected from the World Bank Development Indicators database of World Bank. We define technology-intensive trade as the export and import of medium and high tech (MHT) products. Technology-based classified data is not readily available. As the involvement of technology level in the production process as well as technology upgrading cannot be defined and measured fairly, it is pretty challenging to divide products based on technology intensity. Moreover, highly classified trade data based on technology- involvement is not available.

In this study, we followed technology based classification of products proposed by Lall (2000) and further applied by UNIDO (2014)andHatzichronoglou (1996). Lall (2000) classified products into four groups based on technology-intensity in the production process such as high tech (HT), medium tech (MT), low tech (LT) and primary products (PP) based on product classification of SITC rev 3. Lall (2000) defined high tech products that require advanced and fast-changing technology with greater investment in R&D. MT products also require complex technology with high concentration of R&D, technical skills and changing technology. The fundamental difference between MT and HT products is that MT products include those heavy low technology products that cannot be reallocated to low wage categories as well as high tech categories. The product wise classified data was collected from UNCOMTRADE database based on SITC rev 3[1]. Due to unavailability of classified trade data for the entire period, we considered a sample of 1996-2015 for Russia and 2000-2015 for South Africa.

Table 1: Summary statistics

		China	Brazil	India	Russia	South Africa
CO2	Mean	4.34	1.89	1.12	11.48	8.83
	Maximum	7.55	2.59	1.73	13.97	10.0
	Minimum	2.30	1.42	0.77	10.1	7.77
	Std. Dev.	1.91	0.29	0.28	0.95	0.60
	Change % 1992-2000 2001-2014	 16.77 175.11	 31.03 36.66	 26.99 78.03	 -23.98 11.13	 8.04 10.16
	Observations	23	23	23	23	23
GROWTH	Mean	10.01	2.79	6.84	1.05	2.71
	Maximum	14.23	7.52	10.25	10.00	5.60
	Minimum	6.90	-3.76	3.80	-14.53	-2.13

[1] The detail test of HT and MT products with their SITC number was provided in Appendix A.

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	Std. Dev.	2.22	2.55	1.99	6.92	1.91
	Observations	24	24	24	24	24
MHT	Mean	8.39E+11	8.77E+10	7.26E+10	1.04E+11	4.59E+10
	Maximum	5.51E+11	1.82E+11	1.83E+11	2.28E+11	7.32E+10
	Minimum	2.15E+12	2.03E+10	8.25E+09	2.14E+10	1.84E+09
	Std. Dev.	6.51E+10	5.46E+10	6.82E+10	7.59E+10	2.22E+10
	Change % 1992-2000	238.68	148.77	101.23		
	2001-2014	733.67	158.62	905.42	377.01	190.37
	Observations	7.72E+11	24	24	20	17

Note: The MHT trade data covers period of 1996-2015 for Russia and 2000-2015 for South Africa. MHT Trade figures are in US$ and CO2 emissions are in metric tons per capita.

The summary statistics of variables (before taking log for MHT) are reported in Table 1 which shows a number of interesting trends. Russia has the highest per capita CO2 emissions followed by South Africa, China, Brazil and India (also see Figure 1). However, change in CO2 emissions shows an entirely different scenario for the period 1992-2000. Brazil had the highest percentage increase in per capita CO2 emissions, whereas per capita emissions decreased markedly in Russia. However, from the beginning of 21st century, the CO2 emissions skyrocketed in China, notably in the last one and a half decade.. China stands top in GDP growth followed by India (6.84%). However, growth is other three countries have been relatively low.

China had the highest average of MHT trade share followed by Russia, Brazil, India and South Africa. The change in MHT trade shows that in the period of 1992-2000 China witnessed the highest increase in its share, however, during 2000-2015; the highest increase was recorded for India.

IV. Methodology

a) Preliminary Analysis

This study applies ARDL (Autoregressive distributed lag) bound testing approach as proposed by Pesaran, Shin, and Smith (2001). Before applying ARDL approach, it is necessary to determine the order of integration of the variables using unit root test. The ARDL is applicable only for the variable that is stationary either at level or at first difference [I(0) or I(1)]. If any variable has an order of integration greater than one such as I(2), we cannot apply ARDL model for that variable as the critical bounds provided by Pesaran et al. (2001) are not valid for variables with the order of integration greater than one.

In this study, we applied three different types of unit root tests: (i) unit root test without structural break (ii) unit root test with one structural break (iii) unit root test with two structural breaks. Among the traditional unit root tests, we applied Augmented Dickey-Fuller (Dickey & Fuller, 1979) and Philips-Perron(Phillips & Perron, 1988) tests as these methods are are widely applied in time series analysis.

Traditional unit root tests (without structural break) assume that random shocks would only have temporary effects on the economy and would not affect long-run position. Nelson and Plosser (1982)argued that economic fluctuations are not temporary and random shocks have a permanent effecton economies. According to Perron (1989), traditional unit root tests such as ADF provide biased results towards the non-rejection of the null hypothesis of a unit root in the presence of structural break(s). Moreover, Barros, Gil-Alana, and Payne (2011)showed that variables such as energy, GDP, growth and CO2 emissions undergo structural changes , especially in emerging economies. Considering the significance of structural change in macroeconomic series, we applied both one structural break and two structural breaks unit root tests proposed by Lee and Strazicich (2013), and Lee and Strazicich (2003). These studies provide two models of structural break namely Model (A) known as crash model that allows change in intercept, and Model (C) known as trend model that allows a shift both in intercept and trend. Lee and Strazicich (2003)argued that ADF type endogenous break unit root test (Clemente, Montañés, & Reyes, 1998; Lumsdaine & Papell, 1997; Zivot & Andrews, 2002) are subject to size distortions and causes too much rejection of null hypothesis. They also estimate that break incorrectly leading to spurious rejection of null hypothesis (Lee & Strazicich, 2003; Ozturk & Acaravci, 2011; Vogelsang & Perron, 1998). The minimum Lagrange Multiplier (LM) unit root test (Lee & Strazicich, 2003, 2013) endogenously identifies structural breaks as well as avoids size distortion and spurious rejection of unit root with structural break(s).

b) ARDL Cointegration analysis

This study applies ARDL bound test approach due to its several advantages over other cointegration

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analysis such as Engle and Granger (1987), Johansen and Juselius (1990), and Johansen (1988). The most crucial advantage of ARDL approach is that it does not impose any restriction on the variables to be at the same order of integration. This model is applicable whether the variables are in same or different order of integration, whereas other cointegration approaches require the variables to be at same order of integration.

The ARDL approach is a two-step process for identifying the long-run and short-run relationship between variables of interest. First, we examine the existence of long-run cointegration among the variables used in the study. We then determine the long-run and short-run relationship among the variables using ARDL. The standard log-linear form of ARDL can be specified in three different ways:

$$Model\ A \Delta CO2_t = \alpha_t + \sum_{j=1}^{m-1} \phi_j \Delta CO2_{t-j} + \sum_{l=0}^{p-1} \varphi_l \Delta Growth_{t-l} + \sum_{k=0}^{q-1} \lambda_k \Delta logMHT_{t-k} + \delta_1 CO2_{t-1} + \delta_2 Growth_{t-1} + \delta_3 logMHT_{t-1} + \varepsilon_{1t} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$Model\ B \Delta Growth_t = \alpha_t + \sum_{j=1}^{m-1} \phi_j \Delta Growth_{t-j} + \sum_{l=0}^{p-1} \varphi_l \Delta CO2_{t-l} + \sum_{k=0}^{q-1} \lambda_k \Delta logMHT_{t-k} + \gamma_1 Growth_{t-1} + \gamma_2 CO2_{t-1} + \gamma_3 logMHT_{t-1} + \varepsilon_{2t} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$Model\ C \quad \Delta logMHT_t = \alpha_t + \sum_{j=1}^{m-1} \phi_j \Delta logMHT_{t-j} + \sum_{l=0}^{p-1} \varphi_l \Delta CO2_{t-l} + \sum_{k=0}^{q-1} \lambda_k \Delta Growth_{t-k} + \omega_1 logMHT_{t-1} + \omega_2 CO2_{t-1} + \omega_3 Growth_{t-1} + \varepsilon_{3t} \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where, CO2, growth, and log MHT indicate CO2 emissions per capita (in metric tons), economic growth, and log of medium and high tech trade, respectively. Δ and ε_{it} are the first difference operator and white noise term respectively. m, p, q indicate the number of optimal lags of the variables. ARDL estimates $(m+1)^k$ number of regressions to obtain the optimal lag length of the variables where p and k are maximum lags and number of variables, respectively. We used Schwarz information criteria (SIC) to select appropriate lags for ARDL model as Pesaran et al. (2001) prefers SIC criteria for more parsimonious specifications (Ozturk & Acaravci, 2011).

The long-runcointegration of the variables is determined applying bounds test approach (using F-statistics or Wald coefficient diagnostic test). The null hypothesis of the bounds test assumes that there is no cointegration against the alternative hypothesis of the presence of long-run cointegration. Thus, the null hypothesis is for the three models can be reposted as follows: model A H_0: $\delta_r=0$; H_1: $\delta_r \neq 0$; for model B: H_0: $\gamma_r= 0$; H_1: $\gamma_r \neq 0$; for model C: H0: $\omega_r= 0$; H_1: $\omega_r \neq 0$ where r=1, 2, 3 for all the models. The null hypothesis is accepted or rejected based on the bounds test critical values provided by Pesaran et al. (2001).[2]

Following the identification of long run cointegration, we estimate the short-run and long-run coefficients. The long-run ARDL model can be specified for the three models as follows:

$$CO2_t = \alpha_t + \sum_{j=1}^{m-1} \phi_j CO2_{t-j} + \sum_{l=0}^{p-1} \varphi_l Growth_{t-l} + \sum_{k=0}^{q-1} \lambda_k logMHT_{t-k} + \varepsilon_{1t} \ldots\ldots\ldots\ldots (4)$$

$$Growth_t = \alpha_t + \sum_{j=1}^{m-1} \phi_j Growth_{t-j} + \sum_{l=0}^{p-1} \varphi_l CO2_{t-l} + \sum_{k=0}^{q-1} \lambda_k logMHT_{t-k} + \varepsilon_{2t} \ldots\ldots\ldots\ldots (5)$$

$$logMHT_t = \alpha_t + \sum_{j=1}^{m-1} \phi_j logMHT_{t-j} + \sum_{l=0}^{p-1} \varphi_l CO2_{t-l} + \sum_{k=0}^{q-1} \lambda_k Growth_{t-k} + \varepsilon_{3t} \ldots\ldots\ldots\ldots (6)$$

The short-run relationship in ARDL model of the three models respectively is constructed as follows:

$$\Delta CO2_t = \alpha_t + \sum_{j=1}^{m-1} \phi_j \Delta CO2_{t-j} + \sum_{l=0}^{p-1} \varphi_l \Delta Growth_{t-l} + \sum_{k=0}^{q-1} \lambda_k \Delta logMHT_{t-k} + aECT_{t-1} + \varepsilon_{1t} \ldots\ldots\ldots\ldots (7)$$

$$\Delta Growth_t = \alpha_t + \sum_{j=1}^{m-1} \phi_j \Delta Growth_{t-j} + \sum_{l=0}^{p-1} \varphi_l \Delta CO2_{t-l} + \sum_{k=0}^{q-1} \lambda_k \Delta logMHT_{t-k} + bECT_{t-1} + \varepsilon_{2t} \ldots\ldots\ldots (8)$$

$$\Delta logMHT_t = \alpha_t + \sum_{j=1}^{m-1} \phi_j \Delta logMHT_{t-j} + \sum_{l=0}^{p-1} \varphi_l \Delta CO2_{t-l} + \sum_{k=0}^{q-1} \lambda_k \Delta Growth_{t-k} + cECT_{t-1} + \varepsilon_{3t} \ldots\ldots\ldots (9)$$

Where, ECT is the error correction term that indicates whether the long-run relationship can be restored in the equilibrium point after an exogenous shock in the economy. a, b, and c are the coefficients of ECT for three different models representing the speed of adjustment which means how quickly the relationship converge to the equilibrium point following an exogenous shock. For underlying restoration of the equilibrium relationship, it is assumed that ECT should have statistically significant coefficient with a negative sign.

c) Stability Test

Although we identify the order of integration of the variables using one structural break and two structural break unit root test, there may exist multiple structural breaks in macroeconomic series due to structural change in the economy. Multiple breaks of the variables may question the stability of the model. For this purpose, we applied cumulative sum (CUSUM) and cumulative Sum of Squares (CUSUMSQ) tests to check

[2] If the calculated F-statistics is higher than the upper bound critical value then we can reject the null hypothesis of no cointegration suggesting that there exists long-runcointegration among the variables.

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the stability of long-run and short-run coefficients of ARDL model as proposed by Brown, Durbin, and Evans (1975). While Chow test mandates specified breakpoints, CUSUM and CUSUMSQ tests do not require previously known break points. They plot graph of cumulative sum of residuals and cumulative sum of squares of the residuals of coefficients. All points on graph should remain within the critical bounds at 5% level. If any point on graph crosses the critical bound, the model is not stable and there might have break(s) in the model. We should use dummy variables to make the model stable.

d) Granger causality

The ARDL model determines the existence of long-run cointegration as well as estimates short-run and long-run relationship among variables but it does not identify the direction of causality between variables. To identify the causal direction, we applied error correction based Ganger causality using unrestricted VECM model:

$$\Delta CO2_t = \alpha_t + \sum_{j=1}^{m-1} \phi_j \Delta CO2_{t-j} + \sum_{l=0}^{p-1} \varphi_l \Delta Growth_{t-l} + \sum_{k=0}^{q-1} \lambda_k \Delta logMHT_{t-k} + a_1 ECT_{t-1} + \varepsilon_{1t} \ldots\ldots\ldots (10)$$

$$\Delta Growth_t = \alpha_t + \sum_{j=1}^{m-1} \phi_j \Delta Growth_{t-j} + \sum_{l=0}^{p-1} \varphi_l \Delta CO2_{t-l} + \sum_{k=0}^{q-1} \lambda_k \Delta logMHT_{t-k} + a_2 ECT_{t-1} + \varepsilon_{2t} \ldots\ldots\ldots (11)$$

$$\Delta logMHT_t = \alpha_t + \sum_{j=1}^{m-1} \phi_j \Delta logMHT_{t-j} + \sum_{l=0}^{p-1} \varphi_l \Delta CO2_{t-l} + \sum_{k=0}^{q-1} \lambda_k \Delta\, Growth_{t-k} + a_3 ECT_{t-1} + \varepsilon_{3t} \ldots\ldots (12)$$

Where, ε_{it} is independently and normally distributed residuals with a mean zero and a constant variance. ECT is the error correction term that indicates the restoration of equilibrium relationship. Φ, λ, a, b, and c are the parameters to be estimated. The coefficients of the ECT indicate the speed of adjustment of the equilibrium relationship following any exogenous shock in the economy. We selected appropriate lags using SIC. we identified Granger causality in three different ways for each equation.

Short run or weak granger causality is detected using null hypothesis: (i) H_0: $\varphi_r = 0$ (ii) H0: $\lambda_r = 0$ (iii) H0: $\varphi_r = \lambda_r = 0$ for all three equations where r=1,2,3

Long run causalities are determined by testing the hypothesis : H_0: $a_r = 0$ where r=1,2,3

Strong causalities are determined using the null hypothesis; H_0: $\varphi_r = a_r = 0$ (ii) H_0: $\lambda_r = a_r = 0$ (iii) H_0: $\lambda_r = \varphi_r = a_r = 0$ where r=1, 2, 3 for all three equations.

V. Results and Analysis

We started off the analysis checking the time series properties of the variables using unit root test.

Table 2: Unit Root test (without Structural break)

Series in level												
	ADF (Intercept)			ADF (Intercept & trend)			PP (Intercept)			PP (Intercept & trend)		
	CO2	Growth	Log MHT	CO2	Growth	Log MHT	CO2	Growth	Log MHT	CO2	Growth	Log MHT
China	0.949	1.87	1.548	2.597	1.87	0.122	.796	1.92	1.35	1.57	-1.95	0.67
Brazil	.694	3.77***	2.02	0.561	3.69**	2.78	.796	3.81***	1.92	0.73	-3.71**	1.33
India	.012	3.89***	1.08	0.47	4.08**	3.048	.83	3.82***	1.719	0.25	-4.02**	2.05
Russia	3.07***	2.95**	0.88	3.99**	2.489	1.419	2.97**	2.95**	0.88	7.19***	-2.26	1.42
South Africa	2.289	3.90***	1.756	2.30	3.67**	0.796	2.31	3.90***	2.165	2.38	-3.68**	0.21

*Note: The table reports ADF and PP unit root test results in intercept as well as intercept and trend. The numbers of optimal lags are based on Schwarz Information Criterion (SIC). ***; **; and * indicates rejection of null hypothesis of unit root at 1%; 5%; and 10% significance level respectively.The numbers are reported in two decimal points.*

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Table 3: Unit Root Test at first difference (without Structural Break)

Series in First difference												
	ADF (Intercept)			ADF (Intercept & Trend)			PP (Intercept)			PP (Intercept& Trend)		
	CO2	Growth	LogMHT	CO2	Growth	LogMHT	CO2	Growth	LogMHT	CO2	Growth	LogMHT
China	-1.505	-4.16***	-2.86*	-1.18	-4.08**	-3.03	-1.50	-4.14***	-2.86*	-1.18	-4.05**	-3.03
Brazil	-4.42***	-5.48***	-3.09**	-4.56***	-5.57***	-3.39*	-4.45***	-9.68***	-3.01**	-4.58*	-13.97***	-3.39*
India	-0.783	-5.24***	-3.19**	-4.94***	-5.08***	-3.39*	-3.97***	-15.47***	-3.17**	-4.96***	-15.65***	-3.39*
Russia	-3.23**	-6.62***	-3.22**	-3.207*	-5.07***	-3.11	-3.13**	-6.99***	-3.22**	-3.05	-18.32***	-3.03
South Africa	-4.58***	-5.19***	-3.24**	-4.51***	-5.17***	-3.96**	-4.65***	-6.87***	-3.21**	-4.61***	-9.29***	-7.41***

*Note: The table reports ADF and PP unit root test results in intercept as well as intercept and trend. The numbers of optimal lags are based on Schwarz Information Criterion (SIC). ***; **; and * indicates rejection of null hypothesis of unit root at 1%; 5%; and 10% significance level respectively.The numbers are reported in two decimal points.*

The results of traditional unit root tests such as ADF and PP, reported in Table 2, indicate that growth and logMHT variables are stationary at first difference in all cases. However, both ADF and PP unit root test results suggest that CO2 emissions variable is non-stationary both in level and first difference for China. With regard to Russia and India the variable shows conflicting results. AsPerron (1989) argued that traditional unit root tests provide biased decision toward non-rejection of null hypothesis when there is structural break in variables. Moreover, macroeconomic variables undergo marked structural changes, notably in emerging economies. We checked structural break points of the variables in question for all the countries using Bai and Perron (2003) multiple break point tests. The result reported in Table 4 evidence that the variables under consideration have multiple breaks over 1992-2015. This result is also supported by Barros et al. (2011) that found that emerging economies are subject to structural change over the time. Several other studies also found structural changes in economic time series (Bansal, Dittmar, & Kiku, 2007; Filis, 2010; He, Wang, & Lai, 2010; Hendry & von Ungern-Sternberg, 1981; Plosser, 1982; Zhang & Wei, 2010). It means that with the course of time the mean and variance of these variables tend to change and move away from the given value.

Table 4: Bai-Perron Multiple breakpoint tests

Country	CO2 emissions		Growth		LogMHT	
	No. of Breaks	Break date(s)	No. of Breaks	Break date(s)	No. of Breaks	Break date(s)
China	3	2006;2010;2003	1	1995	3	2003;2007;1999
Brazil	2	2010;1996	0		3	2005;1995;2008
India	5	2008;1999;1996;2012; 2005	0		5	2005;2008;2011;1995; 2002
Russia	0		3	1999;1995;2009	1	2005
South Africa	1	2004	0		2	2005;2010

Notes: The calculated F-statistic of break tests is significant at 5% level as provided by Bai-Perron (Econometric Journal, 2003) critical values.

As traditional unit root tests show biased results and the breakpoint tests indicate the presence of multiple breaks, we applied one structural break and two structural breaks LM unit root test proposed by Lee and Strazicich (2003), and Lee and Strazicich (2013).

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Table 5: LM Unit root test (One Structural Break)

	Trend Break Model (in level)			Crash Model (in level)			Trend Break Model (at first difference)			Crash Model (at first difference)		
Country	CO2	Growth	LogMHT	CO2	Growth	LogMHT	CO2	Growth	LogMHT	CO2	Growth	LogMHT
China	-2.09	-2.40	-2.24	-0.82	-1.58	1.26	-3.01	-4.92***	-4.39***	-1.81	-4.82***	-3.84*
Brazil	-2.31	-5.22***	-1.99	-1.32	-5.10***	-1.96	-7.42***	-7.59***	-5.47***	-5.66***	-5.39***	-5.17***
India	-4.03	-4.44**	-1.87	-1.41	-4.43**	-1.99	-5.35***	-6.07***	-4.57**	-4.62***	-6.24***	-4.25***
Russia	-3.35	-5.35	-2.93	-1.16	-3.41	-1.43	-4.68***	-6.87***	-4.36**	-4.03**	-6.43***	-3.63**
South Africa	-2.73	-3.40	-3.14	-2.60	-3.33	-1.85	-5.20***	-5.31***	-4.15**	-5.57***	-4.93***	-4.39***

*Note: Crash Model allows for a change in level Trend Break Model allows for changes in level and slope of the trend. The optimal lag structure is chosen following a general-to-specific approach starting with max 12 lags. The critical values are from Lee and Strazicich (2003). We conducted the estimation and tests using RATS 9.2. ***; **; and * indicates rejection of the null of a unit root at 1%; 5%; and 10% significance level respectively. The numbers are reported in two decimal points.*

Table 6: LM Unit root test (Two Structural Breaks)

	Trend Break Model (in level)			Crash Model (in level)			Trend Break Model (at first difference)			Crash Model (at first difference)		
Country	CO2	Growth	LogMHT	CO2	Growth	LogMHT	CO2	Growth	LogMHT	CO2	Growth	LogMHT
China	-2.84	-4.95	-3.48	-0.86	-1.83	-1.3723	-3.89	-7.01***	-5.36	-1.97	-4.97***	-5.07***
Brazil	-4.54	-6.32**	-2.79	-1.47	-5.46***	-2.1607	-7.76***	-8.28***	-6.07**	-6.89***	-6.04***	-5.48***
India	-4.91	-5.04	-3.22	-1.65	-4.60***	-2.1783	-8.58***	-6.82**	-10.68***	-4.91***	-6.63***	-4.67***
Russia	-4.17	-5.11	-3.66	-1.24	-4.80***	-1.60	-5.39*	-8.76***	-9.91***	-4.63***	-6.27***	-3.87**
South Africa	-4.26	-4.50	-3.91	-2.85	-3.57	-2.26	-6.25**	-5.31*	-6.02*	-5.98***	-5.07***	-4.33***

*Note: Crash Model allows for a change in level Trend Break Model allows for changes in level and slope of the trend. The optimal lag structure is chosen following a general-to-specific approach starting with max 12 lags. The critical values are from Lee and Strazicich (2003). We conducted the estimation and tests using RATS 9.2. ***; **; and * indicates rejection of the null of a unit root at 1%; 5%; and 10% significance level respectively. The numbers are reported in two decimal points.*

One structural break and two structural breaks LM unit root test results (Table 5 and 6) evidence that both economic growth and logMHT variables are stationary at first difference. However, CO2 emissions variable is non-stationary in all cases for China, but it is stationary at first difference for other countries.

As ARDL bound test approach of cointegration requires that the variables should be either I(0) or I(1), we have to drop China for the analysis of tech-intensive trade-growth-CO2 emission linkage and causality. We can apply the ARDL model for other four countries. The bound tests results along with other diagnostic tests are reported in Table 7.

Table 7: ARDL cointegration and diagnostic test results

	Model A, CO2=f(Growth, LogMHT)				Model B, Growth=f(CO2, LogMHT)				Model C, LogMHT = f(Growth, CO2)			
Country[q]	Model[g]	F[b]	LM[ζ]	HET[ƺ]	Model	F	LM	HET	Model	F	LM	HET
Brazil	(4, 4, 4)	2.499	1.37	0.65	(1, 0, 1)	44.55***	0.893	1.861	(1, 1, 0)	18.53***	0.487	1.39
India	(2, 0, 0)	4.44***	7.82**	14.06**	(2, 0, 0)	7.195***	1.374	0.182	(2, 3, 4)	6.14***	0.05	0.28
Russia	(2, 2, 0)	15.64***	1.541	12.39	(1, 0, 1)	15.42***	0.537	1.021	(1, 2, 2)	9.713***	0.758	7.31***
South Africa	(1, 2, 2)	2.479	0.98	4.516	(2, 1, 1)	1.506	3.944	10.12	(2, 2, 0)	0.812	2.60	4.66

*[g] As per CUSUM and CUSUMQ tests structural break occurs for model A in 2007 and 2009 for India and Russia respectively. Dummy variables are used in ARDL models for these countries for model A. ***; **; and * indicates significance level at 1%; 5%; and 10% respectively. The numbers are reported in two decimal points.*

[q] We exclude China from the analysis due to non-stationary characteristics of CO2 variable in China.

[b] F indicates the ARDL cointegration test using Wald test F-statistics. The critical values for the lower I(0) and upper I(1) bounds are taken from Narayan (2005)

[ζ] LM is the Lagrange multiplier test for serial correlation with a χ^2 distribution with only one degree of freedom.

[ƺ] HET is test for heteroskedasticity with a χ^2 distribution with only one degree of freedom.

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The bound test results suggest that for model A there is no long-run cointegration for Brazil and South Africa. As far as model B is concerned, there exists long-run cointegration for Brazil, India and Russia but this does not hold true for South Africa. Model C also confirms that there exists long-run cointegration for Brazil, India, and Russia but again not for South Africa. So, based on bounds tests results we dropped South Africa for further analysis (and also skipped model A for Brazil).

As Bai-Perronbreak point test evidenced multiple breaks in our variables of interest, we checked the stability of short-run and long-run coefficients of ARDL model using CUSUM and CUSUMSQ tests. These tests found structural break for model A for India and Russia in 2007 and 2009, respectively, whereas the estimated parameters are stable for all other cases.[3] Due to the presence of structural break, we used a dummy variable for model A involving India and Russia. The CUSUM and CUSUMSQ test results suggest that both the ARDL estimates with dummy variables are stable.[4]

a) ARDL short-run and long-run estimates

The long-run ARDL estimation results are reported in Table 8. As far as model A is concerned, it is evident that MHT trade has significant positive association with CO2 emissions both in India and Russia. While growth does not affect CO2 emissions significantly, there exists negative asociation. The statistically insignificant coefficients of the dummy variables evidence that the structural break does not significantly affect CO2 emissions in the long-run.

In case of model B, the long run estimates suggest that MHT trade significantly affects economic growth of India and Brazil, whereas the association between these two variables is negative pertaining to Russia. CO2 emissions have a significant effect on growth for India whereas for Brazil and Russia the effect is insignificant.

Table 8: ARDL long run estimates

	CO2=f (Growth, LogMHT)		Growth=f (CO2, LogMHT)		LogMHT = f (Growth, CO2)	
Brazil [Jb]			CO2 logMHT C	-0.336 1.85** -17.17**	Growth CO2 C	0.60* -0.308 10.19***
India	Growth logMHT Dum C	-0.017 0.61*** 0.36 -5.05**	CO2 logMHT C	-6.518** 5.14** -40.42***	Growth CO2 C	0.04* 1.35*** 8.56***
Russia	Growth logMHT Dum C	-0.006 1.66*** 0.18 -6.84**	CO2 logMHT C	4.73 -11.92** 78.80**	Growth CO2 C	0.098** 0.73*** 2.47

*Note: ***; **; and * indicates significance level at 1%; 5%; and 10% respectively. Dum indicates the dummy variables. The numbers are reported in two decimal points.*

[Jb]We exclude ARDL estimation of model A for Brazil and of all models for South Africa as bounds test did not find any long run cointegration for these models.

The results pertaining to model C also suggest that growth has a significant positive association with MHT trade indicating that higher growth substantially raises MHT trade. CO2 emissions raise MHT trade markedly in case of India and Russia, whereas there is a negative association when it comes to Brazil.

[3] CUSUM and CUSUMQ test results are provided in Appendix B.

[4] CUSUM and CUSUMQ test results including dummy variable for Model A for India and Russia are provided in Appendix C.

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Table 9: ARDL Short Run Estimates

	CO2=F(Growth, logMHT)		Growth=F(CO2, logMHT)		logMHT= F(Growth, CO2)	
Brazil			D(CO2) D(logMHT) Cointeq(-1)	-0.43 30.68*** -1.28***	D(Growth) D(CO2) Cointeq(-1)	0.02*** -0.01 -0.05*
India	D(CO2(-1)) D(Dum01) D(Growth) D(logMHT) Cointeq(-1)	-0.36 0.06** -0.002 0.101** -0.16**	D(Growth(-1)) D(CO2) D(logMHT) Cointeq(-1)	0.32 -9.82* 7.75** -1.51***	D(logMHT(-1)) D(Growth) D(Growth(-1)) D(Growth(-2)) D(CO2) D(CO2(-1)) D(CO2(-2)) D(CO2(-3)) Cointeq(-1)	-0.83* -0.01 0.01* 0.009 -0.64* -0.12 0.002 -0.74* 0.86***
Russia	D(CO2(-1)) D(Dum1) D(Growth) D(Growth(-1)) D(logMHT) Cointeq(-1)	0.398 -0.57 0.006 0.001 1.63*** -0.98***	D(CO2) D(logMHT) Cointeq(-1)	4.75* 17.78 -1.01***	D(Growth) D(Growth(-1)) D(CO2) D(CO2(-1)) Cointeq(-1)	0.01** 0.003 0.13** -0.108** -0.17**

*Note: ***; **; and * indicates significance level at 1%, 5%, and 10% respectively. Dum indicates the dummy variables. "D" indicates the difference operator and "(-)" means the lag number of differenced operator. The numbers are reported in two decimal points. "Cointeq (-1)" indicates the error correction term (ECT).*

The short-run ARDL estimation results are summarized in Table 9. It is generally assumed that the value of error correction term should fall in the range of 0 to -1. However, several studies (Narayan & Smyth, 2006; Samargandi, Fidrmuc, & Ghosh, 2015) reported the range of ECT value could be in the range of 0 to -2. For model A, the results show that ECT has a statistically significant negative sign indicating that the long run relationship of Model A can be adjusted to the equilibrium level following any shock. The speed of adjustment is found to be higher for Russia (98%) than India (16.59%). In both cases, MHT trade contributes to restoration of imbalances. Structural change as indicated by dummy variable markedly affects the relationship in short-run in case of India.

As far as model B is concerned, the ECT is statistically significant at 1% level for all the countries but the value is lower than -1. Narayan and Smyth (2006)argued that when ECT value ranges from -1 to -2 it produces dampen fluctuation in the relationship on the equilibrium path. The short-run results show the values of ECT are -1.288, -1.50, and -1.004 for Brazil, India, and Russia, respectively. This infers that instead of monotonically converging to the equilibrium path directly, the process of error correction vacillates around the long run value in a blunting way. When the process is complete, the ECT converge to equilibrium point hastily (Narayan & Smyth, 2006). MHT trade has a significant positive impact in the restoration of underlying imbalances for India and Brazil, whereas its impact is not significant for Russia. CO2 emissions have significant positive effect for Russia whereas the reverse is true for India.

The results concerning model C show a statistically significant negative signs for Brazil (.054) and Russia (-.17). So, this long-run relationship can be significantly restored to the equilibrium point following any shock in the economy. However, for India ECT shows a positive sign which is statistically significant at 1% level. Model C for India does not suffer from serial correlation or heteroscedasticity problem and appropriate lags of ARDL model was selected based on SIC. Moreover, we also checked the stationarity of the variables using one and two structural break unit root tests. So, this significant positive coefficient of ECT implies that owing to any structural change or exogenous shocks on the variables the long-run relationship will be diverged from the equilibrium.

The ARDL bounds test approach identifies the presence of long-run cointegrationas well as estimates short-run and long-run relationship but it does not determine the causal direction between the variables. To identify the direction of causality we applied UVECM based ganger causality test.

b) Granger causality results

The causality test results reported in Table 10 suggest that there exists long-run causality running from logMHT and growth to CO2 emissions both for India and Russia. This outcome supports the theoretical view that higher economic growth and growing trade in MHT sector could lead to the rise of CO2 emissions. The

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long-run causality derived from MHT and CO2 emissions to growth holds for India and Brazil, whereas causality from CO2 emissions and growth to LogMHT only exists for India. So, the view that growing MHT trade and CO2 emissions cause higher economic growth holds for Russia and India, whereas CO2 and growth cause higher level of trade in MHT in case of India.

Table 10: Long-run causality

Country	CO2	Growth	LogMHT
Brazil		7.76**	0.64
India	21.38***	18.22***	5.33***
Russia	5.20**	2.27	0.61

*Note: ***; **; and * indicates the rejection of null hypothesis at 1%; 5%; and 10% significance level respectively. We exclude Granger causality analysis for model A for Brazil and for all models for South Africa as bounds test did not find any long run cointegration for these models.*

The short-run causality test results reported in Table 11 indicate that growth and MHT trade individually as well as jointly cause CO2 emissions for India, whereas no causality runs from CO2 and MHT to growth. However, growth causes MHT trade significantly in India. In case of Russia, there exists only short-run causality directed from MHT trade to growth. For Brazil, CO2 emission causes growth and MHT trade in the short run.

Table 11: Short run and strong causality results

Direction of causality	Short Run Causality			Strong Causality		
	Brazil	India	Russia	Brazil	India	Russia
Growth→CO2		4.95**	0.48		8.32***	1.77
LogMHT → CO2		3.31*	0.73		7.33***	1.85
Growth, LogMHT → CO2		3.00*	0.52		5.36**	1.19
Dummy → CO2		10.70***	1.40		10.85***	2.79*
CO2→ Growth	6.10**	2.05	0.59	10.21***	9.24***	1.18
LogMHT → Growth	3.12*	0.13	3.30*	4.09**	9.13***	2.74*
CO2 LogMHT → Growth	5.45**	1.05	1.92	7.30***	6.17***	2.59*
CO2→ LogMHT	6.09**	1.13	1.05	4.06**	1.90	0.70
Growth → LogMHT	0.35	4.78***	0.75	0.43	3.94**	0.59
CO2 Growth → LogMHT	3.15**	2.82*	0.74	2.52*	2.66*	0.59

*Note: ***; **; and * indicates the rejection of null hypothesis at 1%; 5%; and 10% significance level respectively. '→' indicates direction of causality.*

It is also reported in Table 11 that both growth and MHT trade strongly causes CO2 emissions in India, whereas growth strongly causes MHT trade. For Russia, strong causality runs from MHT trade to growth. However, in case of Brazil, both CO2 emissions and MHT trade have strong causal effect on growth, whereas CO2 emissions cause MHT trade. Dummy variable has strong causality to CO2 emissions in Russia.

To check the robustness of causality analysis we used variance decomposition approach as proposed by several studies (Shahbaz, Hye, Tiwari, & Leitão, 2013; B. Wang & Wang, 2017). The variance decomposition results[5] indicate that the share of CO2 emissions explained by the external factors not included in the model are 83.35% and 31.14% in India and Russia, respectively. The share of growth and MHT trade in CO2 emissions are 12.26% and 2.19% in India, and 21.37% and 4.87% in Russia, respectively. Structural change represented by the dummy variable contribute to CO2 emissions of 42.60%, whereas this contribution is very low (2.18%) in India. The share of growth due to its own shock is maximum of 53.35% in Brazil whereas this contribution is 51.72% and 34.33% in India and Russia, respectively. MHT trade contributes 58.36% and 30.99% to growth variance in Russia and India, whereas the contribution of MHT trade to growth is negligible in Brazil. The percentage of variance of MHT trade from its own is a maximum of 98.54% in Russia and followed by 39.34% and 18.06% in Brazil and India, respectively. The contribution of other two variables to MHT trade variance is negligible in Russia, whereas CO2 emissions contribute more than 50% in other two countries.

VI. Conclusion and Policy Implication

Considering the growing concerns regarding environmental degradation and importance of trade and economic growth in achieving SDGs this study identified the long-run and short-run relationship as well as causal direction for tech-intensive trade, economic growth and CO2 emissions in BRICS for the period of 1992-2015.

[5] The results of variance decomposition tests are provided in appendix D

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The study offers a number of important findings making contribution to the literature on the nexus between trade, economic growth and CO2 emissions. First, there is a constraint to establish linkages among these variables pertaining to China as CO2 emissions variable is non-stationary both in level and first difference. Nevertheless, this also suggests that CO2 emissions in china have been subject to marked structural change in the last two and a half decades.

As far as South Africa is concerned, the study did not find any long-run cointegration among the variables suggesting that none of the variables significantly affects each other in the long-run. This indicates that CO2 emissions are not the results of economic growth or high trade in MHT in this country. For Brazil, there is no long-run cointegration running from MHT trade and economic growth to CO2 emissions. This infers that CO2 emissions are not caused significantly by MHT trade or economic growth or both.

Moreover, the study found several structural breaks in the variables in question, especially in CO2 emissions and MHT trade that had been subject to structural change in the last few decades. This is a key finding of this study is also backed by Barros et al. (2011) who argued that energy variables showed several structural breaks in emerging economies. Our study also provides policy suggestions whether these structural breaks show significant effect or not. It is found that structural change did not affect CO2 emissions in India and Russia in the long-run but it affected CO2 emissions in India in the short-run.

The findings suggest that MHT trade significantly led to the rise of CO2 emissions in India and Russia both in the short-run and long-run. For these counties it was found that growing trade in MHT trade had significant contribution to rise in CO2 emissions. Growing trade in MHT trade significantly raised economic growth in India and Brazil both in the long-run and short-run. However, both CO2 emissions and growth affected MHT trade markedly in the long run. Granger causality results evidence that MHT trade and growth significantly caused CO2 emissions in India and Russia in the long run, whereas long-run causality running from MHT trade and CO2 to growth holds true for Brazil and India, and causality from CO2 and growth to MHT trade prevailed only for India. Short run and strong causalities aroused from growth to CO2 and MHT to CO2 in India, whereas CO2 emissions caused growth and MHT in Brazil. MHT trade and growth causality directed from growth to MHT existed for India, whereas the causality direction was found opposite for Russia.

The most critical policy suggestion provided by this study is that there is no generalized hypothesis or proposition when it comes to the nexus between medium and high tech trade, economic growth and CO2 emissions. As our study evidenced, these variables have differential effects and causal direction between them. From this analysis, we can infer that although BRICS represents the economic dynamism of emerging markets, there is marked diversity among these economies. This is largely owing to structural change these economies have been undergoing, reflected in three variables that we have analyzed. Thus, policymakers dealing with issues pertaining to trade-growth-CO2 emissions nexus in light of SDGs, in particular, and growth and sustainability trade-off, in general, should take these factors into account while they devise policies. It is advisable to rely on country specific study vis-à-vis studies are conducted on panel of countries.

The exclusion of China from our analysis due to non-stationary characteristics of CO2 emissions data can be considered as a drawback of this study. Nevertheless, it is also an important research finding that the nexus between MHT trade, economic growth and CO2 emissions for China can be studied further using other econometric methods. Moreover, future studies should further disaggregate trade data based on technology intensity as to identify which category of products cause maximum (minimum) economic growth generating minimum (maximum) amount of greenhouse gases.

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Availability of data and materials

All the data and relevant material are available to corresponding author. For any research purpose, he will send the data in excel format through email upon request.

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Appendices

Appendix A: The Classification of trade based on technology-intensity including their SITC number as per SITC rev 3.

High Tech Products

SITC No.	Products/ Commodities	SITC No.	Products/ Commodities
525	Radio-Active Materials	764	Telecomm.Equip.PartsNes
541	Medicines,Etc.Exc.Grp542	771	Elect Power Machny.Parts
712	Steam Turbines	774	Electro-Medcl,Xray Equip
716	Rotating Electric Plant	776	Transistors,Valves,Etc.
718	Oth.Powr.Genrtng.Machnry	778	Electrical Machinery Nes
751	Office Machines	792	Aircraft,Assoctd.Equipnt
752	Automatc.DataProc.Equip	871	Optical Instruments,Nes
759	Parts,For Office Machins	874	Measure,ControlInstrmnt
761	Television Receivers Etc	881	Photograph Appar.Etc.Nes

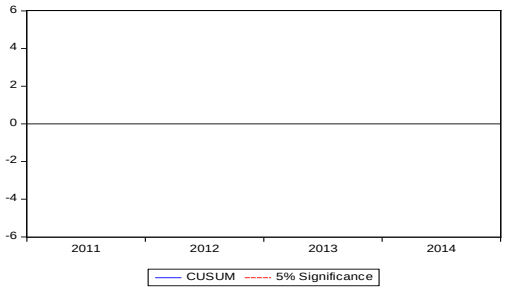
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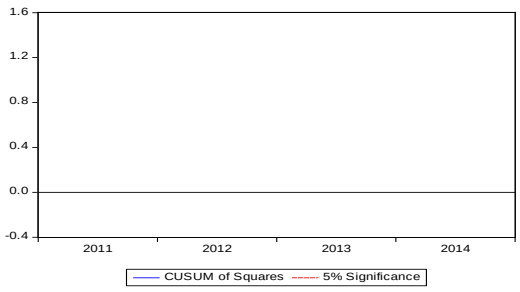
Medium Tech Products

SITC No.	Products/Commodities	SITC No.	Products/Commodities	SITC No.	Products/Commodities
671	Pig Iron,Spiegeleisn,Etc	266	Synthetic Fibres	791	Railway Vehicles.Equipnt
672	Ingots Etc.Iron Or Steel	267	Other Man-Made Fibres	882	Photo.Cinematogrph.Suppl
679	Tubes,Pipes,Etc.Iron,Stl	512	Alcohol,Phenol,Etc.Deriv	737	Metalworking MachnryNes
711	Steam Gener.Boilers,Etc.	513	Carboxylic Acids,Derivts	74	General Industl.Mach.Nes
713	IntrnlCombusPstnEngin	533	Pigments, Paints, Etc.	762	Radio-Broadcast Receiver
714	Engines,Motors Non-Elect	553	Perfumery,Cosmetics,Etc.	763	Sound Recorder, Phonogrph
721	Agric.Machines,Ex.Tractr	554	Soap,Cleaners,Polish,Etc	772	Elec.Switch.Relay.Circut
722	Tractors	562	Fertilizer,Except Grp272	773	ElectrDistribt.EqptNes
723	Civil Engineering Equipt	57	Plastics In Primary Form	775	Dom.Elec,Non-Elec.Equipt
724	Textile,Leather Machines	581	Plastic Tube,Pipe,Hose	784	Parts,Tractors,MotorVeh
725	Paper,Pulp Mill Machines	582	Plastic Plate,Sheets,Etc	785	Cycles,Motorcycles Etc.
726	Printng,BookbindngMachs	583	Monofilament Of Plastics	793	Ship,Boat,Float.Structrs
727	Food-Process.Mch.Non Dom	591	Insecticides, Etc.	812	Plumbng,Sanitry,Eqpt.Etc
728	Oth.Mach,Pts,SpclIndust	598	Misc.ChemicalProdts.Nes	872	Medical Instruments Nes
731	Metal Removal Work Tools	653	Fabrics,Man-Made Fibres	873	Meters,Counters,Nes
733	Mach-Tools,Metal-Working	781	Pass.MotorVehcls.Ex.Bus	884	Optical Goods Nes
735	Parts,Nes,For Mach-Tools	782	Goods,Spcl Transport Veh	885	Watches And Clocks
786	Trailers,Semi-Trailr,Etc	783	Road Motor Vehicles Nes	891	Arms And Ammunition

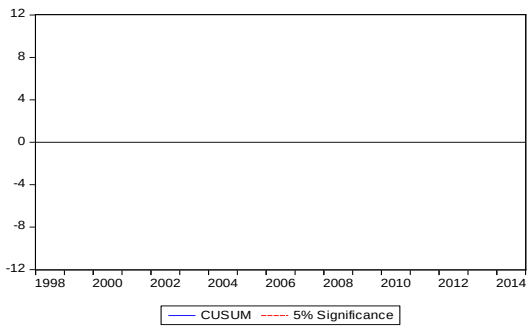
Appendix B: CUSUM and CUSUMSQ test results

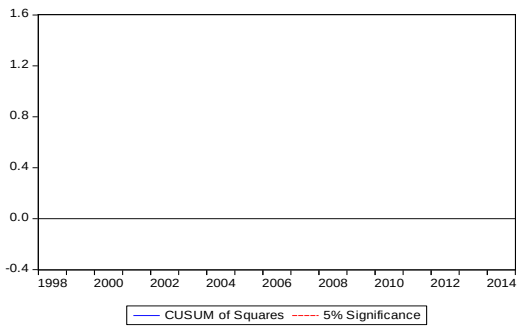
Model A





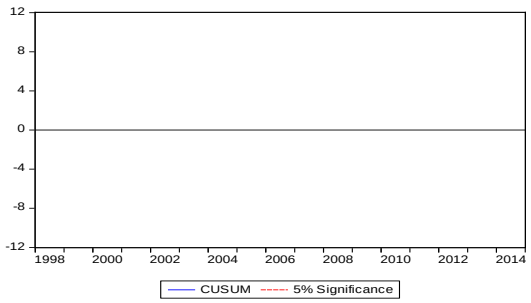
Model B

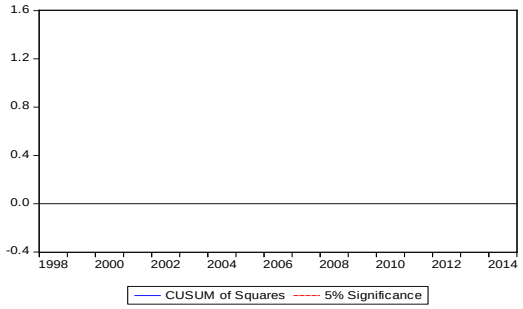




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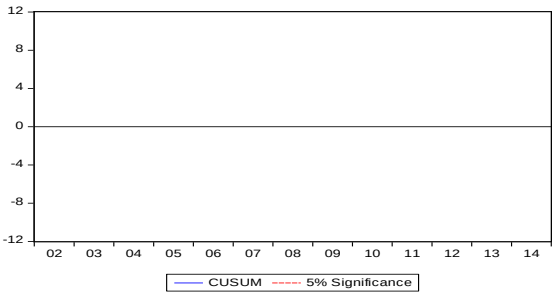
Model C

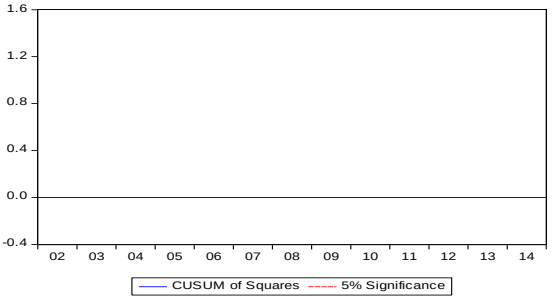




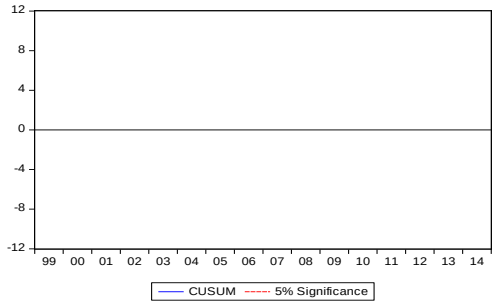
Brazil

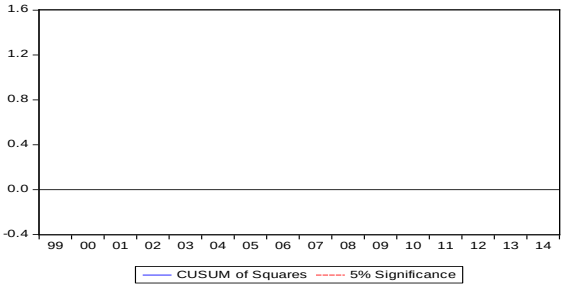
Model A



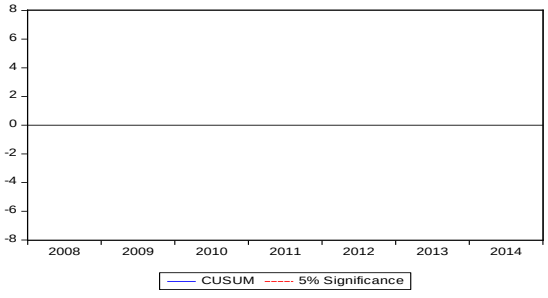


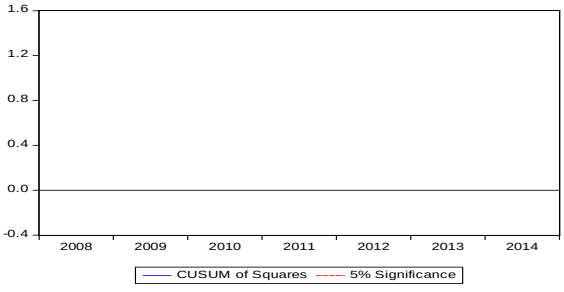
Model B





Model C

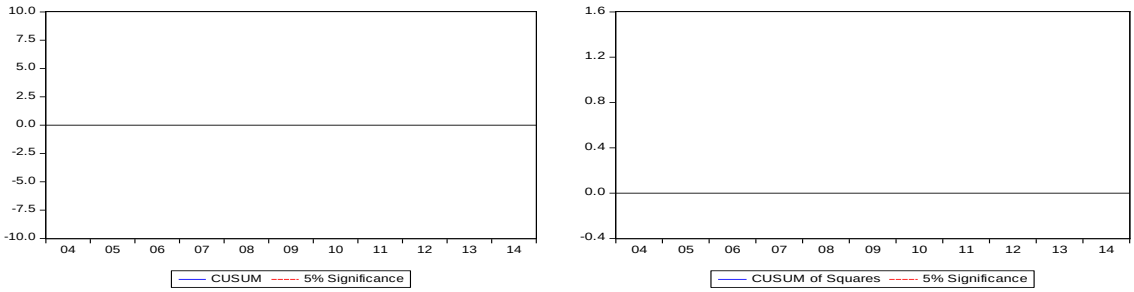




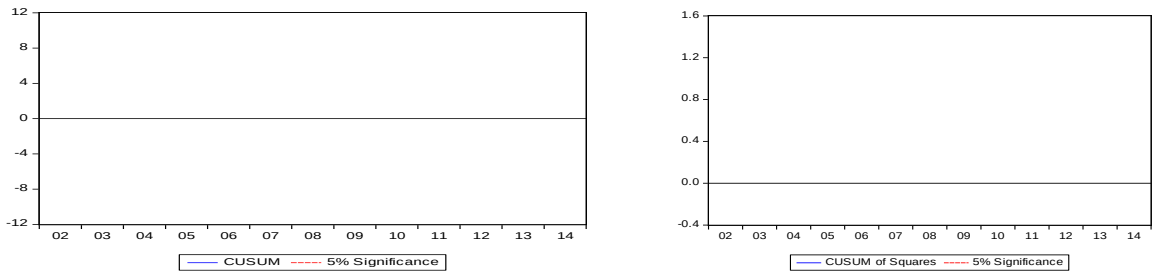
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(b) India

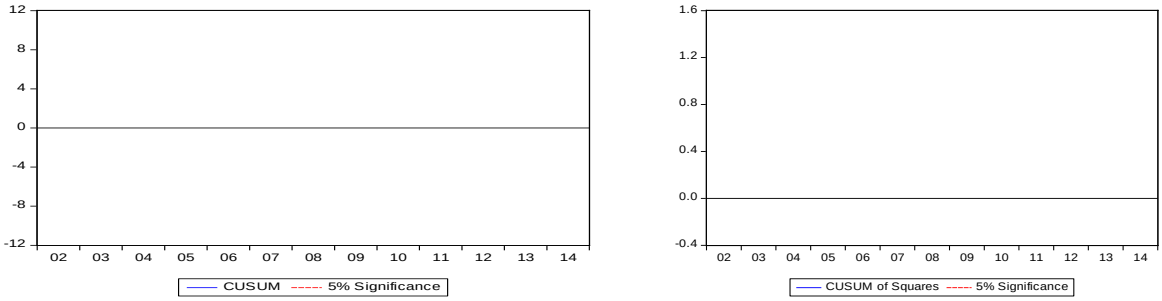
Model A



Model B



Model C

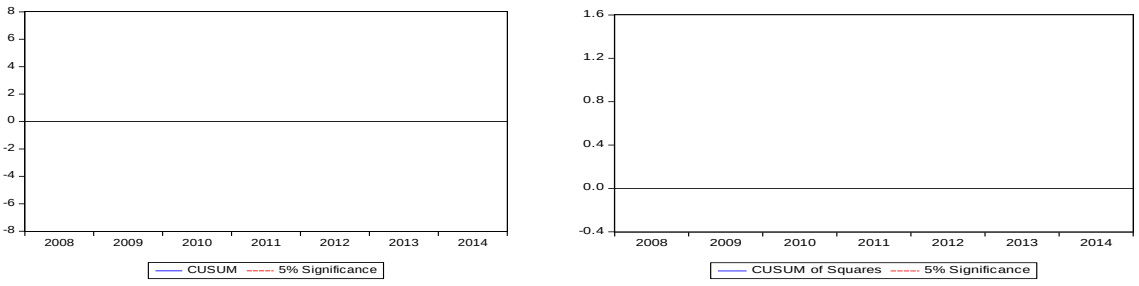


Russia

Note: Plot of CUSUM and CUSUMQ tests for the parameter stability from ARDL models. The straight lines represent critical boundaries at 5% significance level.

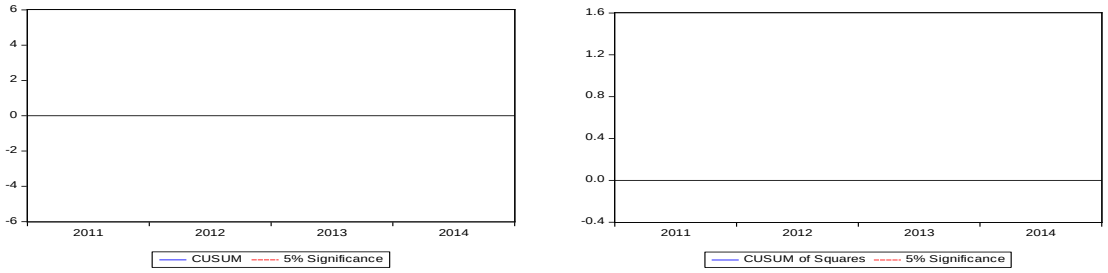
Appendix C: CUSUM and CUSUMQ test results including dummy variable for Model A for India and Russia

Model A: India (after dummy variable due to break)



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Model A: Russia (after dummy variable due to break)



Note: Plot of CUSUM and CUSUMQ tests for the parameter stability from ARDL models with dummy variable. The straight lines represent critical boundaries at 5% significance level.

Appendix D: Variance decomposition analysis.

Variance Decomposition of GROWTH				
Period	S.E.	GROWTH	LOGMHT	CO2
1	1.907580	100.0000	0.000000	0.000000
2	2.343676	68.82256	1.760974	29.41647
3	2.469909	61.98371	3.400482	34.61581
4	2.498792	61.16699	3.432880	35.40013
5	2.531839	59.58832	3.354957	37.05673
6	2.560526	58.38396	3.303336	38.31270
7	2.591029	57.19610	3.227511	39.57639
8	2.624953	55.80876	3.146906	41.04433
9	2.657864	54.54284	3.078553	42.37861
10	2.689953	53.35149	3.011473	43.63704
Variance Decomposition of LOGMHT				
Period	S.E.	GROWTH	LOGMHT	CO2
1	0.057736	72.20515	27.79485	0.000000
2	0.095378	60.42507	21.78345	17.79148
3	0.127840	50.86496	15.23809	33.89695
4	0.153660	45.84432	11.85868	42.29700
5	0.174183	43.07173	10.16390	46.76437
6	0.191630	41.64146	9.194450	49.16409
7	0.207419	40.81258	8.578643	50.60878
8	0.222148	40.20640	8.136835	51.65676
9	0.236037	39.73147	7.789178	52.47935
10	0.249188	39.34405	7.508272	53.14768

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Brazil

Variance Decomposition of CO2:					
Period	S.E.	CO2	GROWTH	LOGMHT	DUM01
1	0.046791	100.0000	0.000000	0.000000	0.000000
2	0.066666	92.96012	1.516106	0.741520	4.782257
3	0.089793	86.45109	8.674103	0.599234	4.275570
4	0.107374	85.20757	10.81905	0.981694	2.991685
5	0.118722	84.81478	11.02999	1.578857	2.576373
6	0.128972	84.27255	11.25439	1.847598	2.625466
7	0.139510	83.86806	11.67605	1.928059	2.527824
8	0.149383	83.65488	11.97421	2.017415	2.353490
9	0.158291	83.50076	12.13150	2.122203	2.245540
10	0.166683	83.35215	12.26010	2.198402	2.189340
Variance Decomposition of GROWTH:					
Period	S.E.	GROWTH	LOGMHT	CO2	
1	1.939181	100.0000	0.000000	0.000000	
2	2.077312	87.18448	12.81093	0.004590	
3	2.404033	73.87503	20.53946	5.585509	
4	2.493435	68.70211	21.97972	9.318171	
5	2.560482	65.46651	23.88656	10.64693	
6	2.661769	61.96373	25.81481	12.22146	
7	2.740038	58.89470	27.20521	13.90009	
8	2.810294	56.32735	28.56560	15.10705	
9	2.887268	53.92585	29.87262	16.20153	
10	2.961045	51.72596	30.99191	17.28213	
Variance Decomposition of LOGMHT					
Period	S.E.	LOGMHT	GROWTH	CO2	
1	0.049567	100.0000	0.000000	0.000000	
2	0.092549	60.62108	15.54328	23.83564	
3	0.153187	49.80877	13.31060	36.88063	
4	0.227190	46.18451	12.27785	41.53765	
5	0.309555	38.09008	14.00108	47.90884	
6	0.378502	32.10522	16.35707	51.53771	
7	0.447881	27.34625	18.12956	54.52420	
8	0.510803	23.46063	20.02738	56.51199	
9	0.561352	20.34797	21.63009	58.02195	
10	0.601147	18.06146	23.18199	58.75655	

India

Variance Decomposition of CO2:					
Period	S.E.	CO2	GROWTH	LOGMHT	DUM1
1	0.396069	100.0000	0.000000	0.000000	0.000000
2	0.495835	81.71673	0.005633	2.251958	16.02568
3	0.602419	58.46589	7.697198	1.984136	31.85278
4	0.688520	47.85013	13.91939	2.740300	35.49018
5	0.744443	44.12621	15.29203	2.843326	37.73843
6	0.802550	41.18174	14.59206	3.013656	41.21255
7	0.864412	37.69892	17.05311	3.354327	41.89364
8	0.916494	34.94042	18.74841	4.000628	42.31054
9	0.963615	32.88652	20.12780	4.379538	42.60614
10	1.010002	31.14738	21.37626	4.872904	42.60346
Variance Decomposition of GROWTH					
Period	S.E.	GROWTH	LOGMHT	CO2	
1	4.654363	100.0000	0.000000	0.000000	
2	5.199594	80.21311	11.04700	8.739890	
3	5.684654	67.45002	24.79954	7.750445	
4	6.054672	59.78734	33.38049	6.832174	

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5	6.409636	53.37288	40.06208	6.565035
6	6.741800	48.35250	44.91181	6.735694
7	7.067525	44.16129	48.95829	6.880423
8	7.400071	40.32014	52.59327	7.086584
9	7.719744	37.07857	55.70381	7.217628
10	8.025976	34.33665	58.36914	7.294210
Variance Decomposition of LOGMHT				
Period	S.E.	LOGMHT	GROWTH	CO2
1	0.117512	100.0000	0.000000	0.000000
2	0.175677	99.68094	0.318618	0.000447
3	0.210447	97.41645	0.224448	2.359106
4	0.243323	97.67790	0.188411	2.133687
5	0.269124	97.95938	0.183065	1.857551
6	0.291442	98.07463	0.157711	1.767661
7	0.314416	98.26391	0.144094	1.591993
8	0.335735	98.38654	0.133737	1.479723
9	0.355584	98.46481	0.123062	1.412133
10	0.374643	98.54473	0.115947	1.339324

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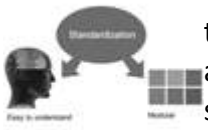
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Once you are designated as MARSBA, you may send us a scanned copy of all of your credentials. OARS will verify, grade and certify them. This will be based on your academic records, quality of research papers published by you, and some more criteria.

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Auxiliary Memberships

Institutional Fellow of Open Association of Research Society (USA)-OARS (USA)

Global Journals Incorporation (USA) is accredited by Open Association of Research Society, U.S.A (OARS) and in turn, affiliates research institutions as "Institutional Fellow of Open Association of Research Society" (IFOARS).



The "FARSC" is a dignified title which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., FARSC or William Walldroff, M.S., FARSC.

The IFOARS institution is entitled to form a Board comprised of one Chairperson and three to five board members preferably from different streams. The Board will be recognized as "Institutional Board of Open Association of Research Society"-(IBOARS).

The Institute will be entitled to following benefits:

The IBOARS can initially review research papers of their institute and recommend them to publish with respective journal of Global Journals. It can also review the papers of other institutions after obtaining our consent. The second review will be done by peer reviewer of Global Journals Incorporation (USA) The Board is at liberty to appoint a peer reviewer with the approval of chairperson after consulting us.

The author fees of such paper may be waived off up to 40%.

The Global Journals Incorporation (USA) at its discretion can also refer double blind peer reviewed paper at their end to the board for the verification and to get recommendation for final stage of acceptance of publication.





The IBOARS can organize symposium/seminar/conference in their country on behalf of Global Journals Incorporation (USA)-OARS (USA). The terms and conditions can be discussed separately.

The Board can also play vital role by exploring and giving valuable suggestions regarding the Standards of "Open Association of Research Society, U.S.A (OARS)" so that proper amendment can take place for the benefit of entire research community. We shall provide details of particular standard only on receipt of request from the Board.



The board members can also join us as Individual Fellow with 40% discount on total fees applicable to Individual Fellow. They will be entitled to avail all the benefits as declared. Please visit Individual Fellow-sub menu of GlobalJournals.org to have more relevant details.

We shall provide you intimation regarding launching of e-version of journal of your stream time to time. This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.



After nomination of your institution as "Institutional Fellow" and constantly functioning successfully for one year, we can consider giving recognition to your institute to function as Regional/Zonal office on our behalf.
The board can also take up the additional allied activities for betterment after our consultation.

The following entitlements are applicable to individual Fellows:



Open Association of Research Society, U.S.A (OARS) By-laws states that an individual Fellow may use the designations as applicable, or the corresponding initials. The Credentials of individual Fellow and Associate designations signify that the individual has gained knowledge of the fundamental concepts. One is magnanimous and proficient in an expertise course covering the professional code of conduct, and follows recognized standards of practice.

Open Association of Research Society (US)/ Global Journals Incorporation (USA), as described in Corporate Statements, are educational, research publishing and professional membership organizations. Achieving our individual Fellow or Associate status is based mainly on meeting stated educational research requirements.



Disbursement of 40% Royalty earned through Global Journals : Researcher = 50%, Peer Reviewer = 37.50%, Institution = 12.50% E.g. Out of 40%, the 20% benefit should be passed on to researcher, 15 % benefit towards remuneration should be given to a reviewer and remaining 5% is to be retained by the institution.

We shall provide print version of 12 issues of any three journals [as per your requirement] out of our 38 journals worth $ 2376 USD.

Other:

The individual Fellow and Associate designations accredited by Open Association of Research Society (US) credentials signify guarantees following achievements:

- The professional accredited with Fellow honor, is entitled to various benefits viz. name, fame, honor, regular flow of income, secured bright future, social status etc.

- In addition to above, if one is single author, then entitled to 40% discount on publishing research paper and can get 10%discount if one is co-author or main author among group of authors.
- The Fellow can organize symposium/seminar/conference on behalf of Global Journals Incorporation (USA) and he/she can also attend the same organized by other institutes on behalf of Global Journals.
- The Fellow can become member of Editorial Board Member after completing 3yrs.
- The Fellow can earn 60% of sales proceeds from the sale of reference/review books/literature/publishing of research paper.
- Fellow can also join as paid peer reviewer and earn 15% remuneration of author charges and can also get an opportunity to join as member of the Editorial Board of Global Journals Incorporation (USA)
- • This individual has learned the basic methods of applying those concepts and techniques to common challenging situations. This individual has further demonstrated an in–depth understanding of the application of suitable techniques to a particular area of research practice.

Note :

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- In future, if the board feels the necessity to change any board member, the same can be done with the consent of the chairperson along with anyone board member without our approval.
- In case, the chairperson needs to be replaced then consent of 2/3rd board members are required and they are also required to jointly pass the resolution copy of which should be sent to us. In such case, it will be compulsory to obtain our approval before replacement.
- In case of "Difference of Opinion [if any]" among the Board members, our decision will be final and binding to everyone.

"

Preferred Author Guidelines

We accept the manuscript submissions in any standard (generic) format.

We typeset manuscripts using advanced typesetting tools like Adobe In Design, CorelDraw, TeXnicCenter, and TeXStudio. We usually recommend authors submit their research using any standard format they are comfortable with, and let Global Journals do the rest.

Alternatively, you can download our basic template from https://globaljournals.org/Template.zip

Authors should submit their complete paper/article, including text illustrations, graphics, conclusions, artwork, and tables. Authors who are not able to submit manuscript using the form above can email the manuscript department at submit@globaljournals.org or get in touch with chiefeditor@globaljournals.org if they wish to send the abstract before submission.

Before and during Submission

Authors must ensure the information provided during the submission of a paper is authentic. Please go through the following checklist before submitting:

1. Authors must go through the complete author guideline and understand and *agree to Global Journals' ethics and code of conduct,* along with author responsibilities.
2. Authors must accept the privacy policy, terms, and conditions of Global Journals.
3. Ensure corresponding author's email address and postal address are accurate and reachable.
4. Manuscript to be submitted must include keywords, an abstract, a paper title, co-author(s') names and details (email address, name, phone number, and institution), figures and illustrations in vector format including appropriate captions, tables, including titles and footnotes, a conclusion, results, acknowledgments and references.
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6. Proper permissions must be acquired for the use of any copyrighted material.
7. Manuscript submitted *must not have been submitted or published elsewhere* and all authors must be aware of the submission.

Declaration of Conflicts of Interest

It is required for authors to declare all financial, institutional, and personal relationships with other individuals and organizations that could influence (bias) their research.

Policy on Plagiarism

Plagiarism is not acceptable in Global Journals submissions at all.

Plagiarized content will not be considered for publication. We reserve the right to inform authors' institutions about plagiarism detected either before or after publication. If plagiarism is identified, we will follow COPE guidelines:

Authors are solely responsible for all the plagiarism that is found. The author must not fabricate, falsify or plagiarize existing research data. The following, if copied, will be considered plagiarism:

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- Findings
- Writings
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- Illustrations
- Lectures

- Printed material
- Graphic representations
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- Any other original work

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2. Drafting the paper and revising it critically regarding important academic content.
3. Final approval of the version of the paper to be published.

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The corresponding author should mention the name and complete details of all co-authors during submission and in manuscript. We support addition, rearrangement, manipulation, and deletions in authors list till the early view publication of the journal. We expect that corresponding author will notify all co-authors of submission. We follow COPE guidelines for changes in authorship.

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Unless specified in the notification, the Editorial Board's decision on publication of the paper is final and cannot be appealed before making the major change in the manuscript.

Acknowledgments

Contributors to the research other than authors credited should be mentioned in Acknowledgments. The source of funding for the research can be included. Suppliers of resources may be mentioned along with their addresses.

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Preparing your Manuscript

Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.

Manuscript Style Instruction (Optional)

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11'", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

Structure and Format of Manuscript

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

a) A title which should be relevant to the theme of the paper.
b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
d) An introduction, giving fundamental background objectives.
e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
f) Results which should be presented concisely by well-designed tables and figures.
g) Suitable statistical data should also be given.
h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
j) There should be brief acknowledgments.
k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.



Format Structure

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, “What words would a source have to include to be truly valuable in a research paper?” Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

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Tips for writing a good quality Management Research Paper

Techniques for writing a good quality management and business research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of management and business then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.



6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.
Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.



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- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.



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Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

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If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

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- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

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Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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