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CONTENTS

OPEN INNOVATION IN SLOVENIA: A COMPARATIVE ANALYSIS OF DIFFERENT FIRM SIZES

KAJA RANGUS[1]
MATEJA DRNOVŠEK[2]

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ABSTRACT: *This article investigates the state of open innovation in Slovenia, using qualitative and quantitative research. Based on in-depth interviews with domestic and foreign experts in the field of open innovation, we identify the main advantages and reasons open innovation should be introduced in Slovenian companies, the main barriers that companies can encounter in the implementation of open innovation and suggestions for the successful development and implementation of the concept among Slovenian companies. A quantitative analysis of Slovenian companies shows that differences exist in implementing open innovation dimensions among micro, small, medium and large firms, as well as between manufacturing and service companies. We conclude by suggesting the steps to be taken to stimulate the development and implementation of open innovation in Slovenian companies, the implications for managers and policy-makers, as well as the limitations of our study, and future research.*

Key Words: *Open innovation, Large companies, SMEs, Manufacturing and service sector*
JEL Classification: O31, O32

1 INTRODUCTION

International competition, constantly changing environments and the rapid development of technology require adaptive and flexible responses from the companies facing such challenges (Eisenhardt & Tabrizi, 1995). While innovation itself is quite challenging, many once pioneering innovations rapidly become obsolete; therefore, companies must also innovate in the field of innovation itself (Selly Brown, 2003). Academics and business practitioners stress the importance of open innovation for sustaining competitive advantage in innovation and overall organizational performance. For example, Rogier van der Heide, Chief Design Officer of Philips Lighting (2011) once asserted, "Innovation doesn't happen in a vacuum. You're never alone. No one has the key just by himself."

Open innovation was initially observed in large multinationals and high-tech sectors, as well as in more mature and traditional industries in the US (Chesbrough & Crowther,

[1] **University of Ljubljana, Faculty of Economics, Slovenia, Ljubljana, PhD student, e-mail: kajarangus@yahoo.com**

[2] University of Ljubljana, Faculty of Economics, Slovenia, Ljubljana, e-mail: mateja.drnovsek@ef.uni-lj.si

2006). Recently, trends towards more open ways of innovation have been also seen in European Union (EU) countries (Schroll & Mild, 2011). Despite the growing evidence of open innovation among European companies, there is a lack of studies related to open innovation regarding new member states of EU. Although they are trying to achieve equality with the old member states, some developmental differences remain between the two groups (Eurostat, 2011). The first gap in the literature thus concerns the investigation of the state of open innovation in the new member states of EU. Second, it is still not clear what the main reasons for the underdeveloped open innovation community in these countries are and how to stimulate the implementation of the concept.

In order to contribute to a better understanding of open innovation in new member states of EU, we have investigated the state of open innovation among Slovenian companies and suggested some proposals for stimulating open innovation practices. Despite the fact that Slovenia is a small transition economy, it is classified among innovation followers and outperforms most of the new member states of the EU (European Commission, 2013). Therefore, the findings of our research can also contribute to the development of open innovation in other new member states of the EU, as well as in candidate countries of the EU. Although some studies on open innovation in Slovenia already exist, they primarily focused on the high-tech sector (e.g. Rašković, Pustovrh, & Dakić, 2011) or analysed the supporting environment for open innovation (e.g. Krapež, Škerlavaj, & Groznik, 2012). The unique contribution of this study is the delivery of the first comparative analysis of the adoption of different open innovation activities by Slovenian firms, but we do not limit the study to certain industries or sizes. Moreover, we provide steps to be followed for the stimulation of the concept among Slovenian companies.

The paper proceeds as follows: we first summarize existing literature in the field of open innovation and outline the research questions. As a new member state, Slovenia is used as the case country in the investigation of open innovation, using both qualitative and quantitative research. We start with in-depth interviews with domestic and foreign experts in open innovation, with the aim of obtaining their opinions about the concept, its benefits and weaknesses, and their suggestions for the development of the concept in Slovenia. Furthermore, we carry out a quantitative analysis among Slovenian companies to identify the scope of their implementation of open innovation activities and the extent of their cooperation with different partners. Finally, we suggest some steps to be followed to stimulate the development and implementation of open innovation in Slovenian companies. We conclude with discussion of the implications, as well as the limitations of our study, and future research.

2 LITERATURE REVIEW AND RESEARCH QUESTIONS

2.1 The concept of open innovation

Open innovation has become one of the most frequently discussed concepts in innovation management (Chiaroni, Chiesa, & Frattini, 2010; Huizingh, 2011). It suggests that

companies should use a broad range of knowledge sources, including customers, suppliers, universities, national labs, consortia, consultants, start-ups (Chesbrough, 2003), spin-offs from large established firms, individual inventors (Chesbrough, 2006) as well as firms in unrelated industries, or even competitors (Wallin & von Krogh, 2010) to creatively exploit the firm's knowledge (Chesbrough, 2003). The open innovation approach assumes that links with external partners tend to complement rather than replace a firm's internal research and development (R&D) activities (Chesbrough, 2006; Lichtenthaler & Lichtenthaler, 2010; Tether & Tajar, 2008). The open innovation process also facilitates the processes of identifying new markets and exploiting those market opportunities that companies could not pursue within their current business model (Di Minin, Frattini, & Piccaluga, 2010). The need for the rapid development of new products and services with competitive prices requires companies to search for sources of ideas and innovations inside as well as outside their borders (Li & Kozhikode, 2009). Additionally, the meaning of successful technology transfer is also emphasised by increasing licencing activities, alliances and the outsourcing of R&D activities (Fabrizio, 2006).

The first practical occurrences of open innovation processes can be seen in the 1920s, with the case of Columbia Steel employing an open pattern of cooperation with equipment suppliers (Aylen, 2009). Presently, open innovation is seen in almost all industries and organisations (Chesbrough & Crowther, 2006). More recent practices of open innovation can be observed in the biopharmaceutical industry (Bianchi, Cavaliere, Chiaroni, Frattini, & Chiesa, 2011; Langvardt, 2010), the food industry (Sarkar & Costa, 2008), the automotive industry (Di Minin et al., 2010), open source software (von Krogh, Spaeth, & Lakhani, 2003; West, 2003; West & Gallagher, 2006), the digital amplifier industry (Christensen, Olesen, & Kjar, 2005), and different multinational firms, such as Procter & Gamble (Dodgson, Gann, & Salter, 2006; Huston & Sakkab, 2006), Apple, Nintendo (Pontiskoski & Asakawa, 2009), Nokia (Dittrich & Duysters, 2007; Pontiskoski & Asakawa, 2009), Dell (Di Gangi & Wasko, 2009), Deutsche Telekom (Rohrbeck, Holzle, & Gemunden, 2009) and the materials company DMS (Kirschbaum, 2005).

2.2 Open innovation in SMEs

Although first open innovation occurrences described by Chesbrough (2003) perceive open innovation from the point of view of large, established companies, research is increasingly analysing open innovation in the context of smaller organizations. The first quantitative study exploring the incidence and trends of open innovation in SMEs was provided by van de Vrande, de Jong, Vanhaverbeke, and de Rochemont (2009), who indicated that open innovation activities are increasingly practiced by smaller competitors. This research also identified the main reasons for implementing open innovation by SMEs that are market-related: to serve customers' needs, to open up new markets, to secure revenues and to maintain growth. Lee, Park, Yoon, and Park (2010) support the practices of open innovation in SMEs and emphasize the importance of

intermediate organization in facilitating their innovation capabilities. Finally, Parida, Westerberg, and Frishammar (2012) show that the adoption and utilization of open innovation activities have a positive influence on the innovative performance of SMEs. They state that by performing technology scouting, vertical and horizontal technology collaboration and technology sourcing, SMEs can partly overcome any disadvantages of their small size and perform innovation better than if all innovative activities were done in-house.

2.3 Research questions

The aim of our study is to evaluate the overall state of open innovation in Slovenia, especially a comparison of the implementation of open innovation by Slovenian companies (regarding their size and industry). Previous research revealed that there are differences in implementing open innovation between small and large firms, with larger firms more frequently adopting open innovation activities, whereas there is no significant difference between industries (van de Vrande et al., 2009). The first aim of this study is to identify the reasons open innovation is beneficial for Slovenian companies. Our first set of research questions thus investigates the following reasons:

Research question 1a: What are the main advantages and reasons for the implementation of open innovation?
Research question 1b: How can open innovation best be implemented?
Research question 1c: Which obstacles can companies encounter in the implementation of open innovation?

The second set of research questions relates to the actual implementation of open innovation by Slovenian companies. Prior studies related to the state of open innovation in Slovenia revealed that over 50% of Slovenian firms develop innovation based on solely internal knowledge, which indicates a high level of "innovation closedness" of these firms (Rašković et al., 2011). However, the beginnings of open innovation can be seen in collaboration with different partners, with the most influential source of information when developing new ideas by Slovenian firms being customers and suppliers, followed by research institutions (Krapež et al., 2012; Rašković et al., 2011). The second set of questions refers to executional characteristics of open innovation process:

Research question 2: With whom do Slovenian companies collaborate the most when acquiring new know-how/technologies?
Research question 2a: Are there any differences in collaboration with different partners regarding a firm's size?
Research question 2b: Are there any differences in collaboration with different partners regarding a firm's business sector?

The third set of research questions explores the actual implementation of different open innovation activities by Slovenian firms and the potential differences between the groups

(regarding their size and industry). van de Vrande et al. (2009) reveals that SMEs often involve their customers in innovation processes and acquire new knowledge by external networking, whereas outward and inward intellectual property (IP) licensing, venturing activities and external participations are practiced only by a minority of SMEs. The authors also identified one difference between the manufacturing and service sectors: manufacturing firms are more actively involved in the outsourcing of R&D and the outlicensing of IP. Our third set of research questions is as follows:

Research question 3: Which open innovation dimension is most commonly used among Slovenian companies?
Research question 3a: Are there any differences in the implementation of open innovation dimensions among Slovenian companies regarding their size?
Research question 3b: Are there any differences in the implementation of open innovation dimensions among Slovenian companies regarding their business sector?

According to Krapež et al. (2012), Slovenia has been developing support mechanisms to create a friendlier business environment for open innovation. Therefore, we wanted to identify the main reasons for the underdeveloped open innovation community in Slovenia, and ways to facilitate the development of this community. Our final research questions are thus:

Research question 4: What are the main reasons for the underdeveloped open innovation community in Slovenia?
Research question 5: How can the development of open innovation among Slovenian companies be stimulated?

We used two different methodological approaches in examining our research questions. The first part of our research comprises structured interviews with six domestic and foreign experts in the field of open innovation; the second part presents quantitative research among Slovenian companies. The main advantage of integrating qualitative research with survey research is to increase the quality of the survey instrument, whereas the qualitative approach contributes to understanding the studied concept from the perspective of individuals (Bamberger, 2000).

3 STUDY 1: SETTING THE CONTEXT

The broad assessment of the state of open innovation in Slovenia and partial proposals for its further development are obtained through qualitative research technique. The main aim of the in-depth interviews was to obtain feedback on the concept of open innovation from experts in the field. The interviewees answered questions related to the main advantages and reasons open innovation should be introduced to Slovenian companies, the main barriers that companies can encounter during the implementation of open innovation, and their suggestions for the successful development and implementation of the concept among Slovenian companies.

3.1 Approach

Six in-depth interviews with domestic and foreign experts in the field of open innovation were conducted. Different groups of experts were chosen as respondents in order to capture several viewpoints of the concept. The academic aspect was covered by interviewing a professor conducting research in the field of open innovation, while the director of consultancy firm active in the field of open innovation, a representative of a supporting environment involved in European projects related to open innovation, and the head of business excellence development of a Slovenian company implementing open innovation provided the business practitioners' view. We also selected two foreign experts in the field (directors of consultancy firms from the UK and Italy) who have been active in the area of open innovation for many years and are familiar with the Slovenian environment.

The interviews were carried out in May 2010 and took approximately one hour per respondent. The interviews were semi-structured, allowing open conversation about the topic. However, the basic set of questions that enabled cross-analysis of answers was as follows: As a starting point, we wanted to identify main motivation for introducing open innovation. The interview proceeded with querying the most appropriate ways of introducing the concept in the business, the key elements in initiating it and the essential elements that companies should give most attention to. We were interested in respondents' opinions about the most appropriate way to introduce open innovation, as well as how to extend it as part of the established way of innovating in the firm. Respondents also addressed questions about main obstacles that companies may encounter during the introduction of the concept. The interview concluded with suggestions for the stimulation and implementation of open innovation in Slovenia. In the forthcoming subsections, we present a summary of the respondents' statements and reflections.

3.2 Results

3.2.1 Motivation for implementation of open innovation

From the perspective of the interviewees, the main advantage of open innovation is the possibility of accessing a wide range of knowledge from different sources. "The integration of suppliers and end users in the early process of innovation give the company the ability to identify their needs, aspirations and potential new solutions" (Briški, 2010). Additionally, the concept of open innovation provides a set of skills from many people who would otherwise be difficult to reach. Companies operating with open innovation can enter the market faster, can better exploit internal resources and create more integrated solutions. Open innovation enables wider, faster and better usability of technology, as well as better transfers in practice, which in turn leads to better performance of the company. Moreover, the concept can also contribute to cost reduction since part of the necessary production can be obtained externally and thus reduce the costs of their own development (in terms of both financial and human resources). Competitive advantage and higher chances of entering international markets were also mentioned as key

reasons for bringing open innovation to the company. "In today's era of the internet and advanced technology, it is extremely difficult to maintain professional secrecy; therefore, the importance of quick entering to the market is rapidly growing, which can be achieved by the new way of innovation" (Ollivere, 2010).

3.2.2 Ways of successful implementation of open innovation practices

"Open innovation requires implementation at all levels of the company. The practice should be part of the overall business model, and it should not be isolated in the R&D department of a company" (di Anselmo, 2010). Implementation at all levels within the company "[…] requires a team of people who understand the processes and discipline of innovation and are willing to maintain an open dialogue as well as a business model in which participants feel relaxed, develop their thoughts and ideas and see the achievements of their goals in the work they are doing" (Bulc, 2010). The R&D department should include employees who are familiar with the technology of the anticipated product and know how to find potential partners, as well as how to cooperate with them and serve as a bridge between them and the company. "Successful development requires research, but not always on the principle of "research and development", but increasingly on the principle of "cooperation and development" (Mulej, 2010).

The most appropriate way of implementing open innovation practices is sequential. "External environments can be included in the R&D activities through cooperation with various research institutions, universities, companies […] which have specific knowledge and cutting-edge research results" (Briški, 2010). However, "a company must not forget its internal communication between departments, functions, or between developers, customers and suppliers. The company must introduce the concept of open innovation in all departments and business processes, and must constantly search for and evaluate new ideas" (Ollivere, 2010).

3.2.3 Main obstacles to the implementation of open innovation practices

According to interviewees, the main obstacles to the implementation of open innovation are employee resistance (mainly due to a lack of understanding what open innovation is), a vertical organizational structure, cultural issues and problems related to different partnerships (lack of understanding of each other, different cultures and different modes of thinking). "Additional problems can be raised by employees, who are stimulated to think in creative and innovative ways" (Briški, 2010). "Employees in R&D departments generally oppose sharing or pooling of IP, […] believing that their technology is the best and requires no further development. Moreover, financial directors are not keen to invest extra money into research" (Ollivere, 2010).

Another dilemma of implementing open innovation involves IP protection. The aim of open innovation should be creating additional revenue rather than protecting itself from

competitors' access. The company must clearly distinguish between its business secrets, which deliver a substantial competitive advantage, and the technology and innovation that they want to quickly develop and market and/or require additional assistance and expertise for further development.

3.2.4 The main reasons for the underdeveloped open innovation community in Slovenia

The main reasons for the poor representation of open innovation among Slovenian companies are, in the opinions of the respondents, the philosophies of these companies, which are very closed and conservative. Additionally, Slovenian companies are primarily focused on the domestic market. Interviewees also commented that Slovene companies fear operating openly, lack ideas and knowledge of innovation and innovation processes, and lack the knowledge for effective management and moderation of such teams. In their view, Slovenian companies are not able to identify in which areas it makes sense to work with external partners. Moreover, they stated that Slovenian companies are not familiar with open innovation practices. Therefore, additional problems also arise in the implementation of the practice, since they are not acquainted with the most appropriate tools and strategies for such introductions in their business.

3.2.5 How to facilitate adoption of open innovation practices in Slovenian companies

The final discussion of the interview included a question about the adoption of open innovation in Slovenian companies. Interviewees suggested several steps for implementing open innovation. "It should start with the education and awareness of new generations of students with entrepreneurship, market orientation, and open innovation" (di Anselmo, 2010). Companies have to first become well acquainted with open innovation practices, after which they can start to create a network of partners with whom they want to cooperate. The foreign interlocutors suggested presentations of good practices from abroad, which will show the positive impact of open innovation on firm performance.

In their view, companies have to specialize and focus on their core competencies and find partners and contractors in the areas in which they lack knowledge or have higher costs of production. "It is crucial to connect larger firms with smaller enterprises as the latter often develop inventions that the former are looking for. In this way, both partners are in advantage — small businesses are lacking the financial resources, the right equipment and facilities [...] large companies can more quickly access the market with already developed technology required for their final product. The mutual benefit is the increased flow of knowledge, ideas, creative concepts and development of new products and services for market needs" (Rangus, 2010).

4 STUDY 2: THE STATE OF OPEN INNOVATION AMONG SLOVENIAN COMPANIES

We also conducted a survey among Slovene companies to better understand the state of the art of open innovation. Specifically, we aimed to examine the implementation of different open innovation activities by Slovenian companies and the extent of their co-operation with different partners.

4.1 Methodology

The questions used in this research are part of a larger empirical survey. We randomly selected 2,000 Slovenian manufacturing and service firms from the Business Directory of the Republic of Slovenia (PIRS) and emailed a survey to top executives of these firms in September 2012. We researched companies of different sizes and sectors (e.g. manufacturing, electricity, gas, steam and air conditioning supply, construction, information and communication, professional, scientific and technical activities, etc.). After sending two reminders (one after a week and the second one after three weeks), we received 340 responses (17% response rate). We compared the means of the first 25% of responses to the means of the last 25% of responses and found no significant differences. Two questionnaires had more than 25% of data missing; therefore, we excluded them from the analysis. All other missing values were replaced by using the expectation-maximisation method of imputation. The composition of the sample is presented in Table 1.

Table 1: *Sample composition*

Sample size (number of firms)	**338**
Distribution of firms by size (number of employees)	
Micro (0–9 employees)	26%
Small (10–49 employees)	39%
Medium (50–249 employees)	23%
Large (more than 249 employees)	12%
Distribution of firms by industry	
Manufacturing	53%
Service	47%

We measured different open innovation activities based on the description provided by van de Vrande et al. (2009) defining technology exploration as a firm's activities of acquiring outside technology and know-how and being comprised of external participation, inward IP licensing, external networking, outsourcing R&D, and customer involvement. In contrast, the aim of technology exploitation is to better profit from internal knowledge; it consists of venturing, outward IP licensing and employee involvement. Since micro and small firms find venturing activities difficult to implement, we included a question related to pre-venturing activity instead. Respondents evaluated agreement/disagreement with each statement on a 7-point Likert scale. External networking was measured with the specification of frequency of cooperation with different partners

(with an aim to acquire new know-how/technology) on a 7-point Likert scale (1 = never, 7 = always). The complete list of questions is presented in Appendix 1.

The Kruskal-Wallis and Mann-Whitey U tests were used for the identification of statistically significant differences of implementation of the open innovation dimensions among different groups of companies (regarding their size and industry).

4.2 Results

The results revealed that the most commonly used open innovation activity (regardless of firm's size or industry) is customer involvement, followed by employee involvement and pre-venturing activities. Companies most frequently collaborate with customers and suppliers. Analyses related to groups' comparison are presented in the following subsections.

4.2.1 Open innovation and firm's size

Table 2 shows that there are differences regarding the implementation of different open innovation activities among micro, small, medium and large companies, with large companies more involved in open innovation activities in most cases. An exception is outward IP licensing for which the results suggest that the smaller the company is, the more outward IP licensing is carried out. However, there are only three statistically significant differences among the groups, the first of which is connected to outsourcing R&D from knowledge institutions, with larger firms being the most involved in these services. The second statistically significant difference is related to the inward IP licensing between micro, small and large companies, with larger companies being more frequently involved in these activities. The third statistically significant difference appeared in pre-venturing activities among micro and all other groups of firms, with micro firms being the least involved in these activities.

Table 2: *Differences in implementation of open innovation regarding a firm's size*

	Micro		Small		Medium		Large		Kruskal-Wallis	
	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Chi-Square	Asymp. Sig.
Customer involvement	6.00	5.94	7.00	6.18	7.00	6.18	6.50	6.30	3.729	.292
External participation	5.00	4.19	5.00	4.49	5.00	4.79	5.00	4.90	6.298	.098
Outsourcing R&D	2.00a	2.62	2.00a	2.65	4.00b	3.36	4.00c	4.20	35.398	.000
Inward IP	3.00a	3.10	3.00a	3.10	3.00ab	3.35	4.00b	3.97	8.117	.044
Pre-venturing	5.00a	4.77	6.00b	5.39	6.00b	5.70	6.00b	5.64	16.336	.001
Outward IP	4.38	4.22	4.00	4.21	4.00	4.04	4.00	3.81	1.297	.730
Employee involvement	6.00	5.40	6.00	5.62	6.00	5.54	6.00	6.00	6.566	.087

Statistically significant at $P < 0.05$.

External networking was measured via collaboration with different partners. The results in Table 3 support the abovementioned outcomes with larger companies more actively involved in collaboration with different partners than smaller companies. There are three statistically significant differences among the groups. Such a difference related to collaboration with knowledge institutions is seen between the groups of micro and small companies and medium and large companies, whereas the larger the company is, the more it collaborates with knowledge institutions.

The second statistically significant difference among the groups is related to collaboration with consultancy companies. Micro companies collaborate with them statistically significantly less frequently than medium and large companies do. Furthermore, small companies collaborate with consultancy firms statistically significantly less than large companies do. Moreover, a statistically significant difference also appeared in relation to cooperation with high-tech start-ups: micro and small companies collaborate with these kinds of companies less frequently than large firms do.

Table 3: *Differences in cooperation with different partners regarding a firm's size*

	Micro		Small		Medium		Large		Kruskal-Wallis	
	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Chi-Square	Asymp. Sig.
Customers	6.00	5.37	6.00	5.50	6.00	5.70	6.00	5.83	5.525	.137
Suppliers	5.00	5.15	6.00	5.29	6.00	5.40	6.00	5.61	4.078	.253
Knowledge institutions*	4.00a	3.72	4.00a	3.77	5.00b	4.54	6.00c	5.20	32.253	.000
Consultancy companies	3.00a	2.91	3.00ab	3.20	4.00bc	3.65	4.00c	3.95	16.870	.001
Competitors	3.00	3.16	3.00	2.89	3.00	2.99	3.00	3.09	1.993	.574
Companies engaged in activities different from yours	4.00	3.98	4.00	3.80	4.00	3.86	4.00	3.95	1.009	.799
High-tech start-ups	2.00a	2.66	2.00a	2.53	3.00ab	2.78	3.00b	3.33	10.839	.013
Creative individuals	4.00	4.18	4.00	4.25	4.00	4.00	4.00	4.00	2.326	.508

*Such as universities, faculties, institutes, laboratories, etc.
Statistically significant at $P < 0.05$.

4.2.2 Open innovation and a firm's business sector

Although previous empirical results suggest that there are minor differences regarding a firm's business sector, we identified quite a few differences in the manufacturing and service sectors. These two groups were statistically significantly differentiated in the implementation of more than half of the open innovation activities (Table 4). Surprisingly, the results reveal that service firms are more frequently involved in most open innovation activities. Service firms are statistically significantly more often engaged in external participation, pre-venturing, outward IP licensing and employee involve-

ment. This may be due to the fact that the majority of the surveyed service companies belong to high-tech sector, whereas most manufacturing companies are in the low-tech sector.

Table 4: *Differences in implementation of open innovation regarding a firm's business sector*

	Manufacturing		Service			
	Median	Mean	Median	Mean	Mann-Whitney U	Asymp. Sig. (2-tailed)
Customer involvement	7.00	6.14	7.00	6.13	14070.500	.844
External participation	5.00	4.34	5.00	4.75	12347.000	.033
Outsourcing R&D	3.00	3.06	3.00	2.91	13464.500	.384
nward IP	3.00	3.12	4.00	3.42	12981.500	.156
Pre-venturing	6.00	5.18	6.00	5.49	12619.000	.064
Outward IP	4.00	3.82	5.00	4.47	11311.000	.001
Employee involvement	6.00	5.40	6.00	5.80	11686.500	.003

Statistically significant at $P < 0.05$.

Service companies collaborate more with more of the listed partners (Table 5) while a statistically significantly difference is related to collaboration with competitors, with companies engaged in activities different from theirs, with high-tech start-ups and with creative individuals.

Table 5: *Differences in cooperation with different partners regarding firm's size*

	Manufacturing		Service			
	Median	Mean	Median	Mean	Mann-Whitney U	Asymp. Sig. (2-tailed)
Customers	6.00	5.57	6.00	5.53	14067.500	.850
Suppliers	5.47	5.33	5.00	5.31	14037.000	.825
Knowledge institutions*	4.00	4.08	4.00	4.13	13937.000	.740
Consultancy companies	3.00	3.19	4.00	3.45	12885.500	.127
Competitors	3.00	2.82	3.00	3.21	11846.000	.006
Companies engaged in activities different from yours	4.00	3.69	4.00	4.09	11814.000	.005
High-tech start-ups	2.00	2.56	3.00	2.89	12642.500	.069
Creative individuals	4.00	3.87	5.00	4.46	10782.000	.000

*Such as universities, faculties, institutes, laboratories, etc.
Statistically significant at $P < 0.05$.

The summary of the results related to specific research question is presented in Appendix 2.

5 DISCUSSION

Although open innovation has received substantial attention in recent years, the research mostly builds on the evidence of how open innovation is adopted in the most developed part of the world (e.g. USA, old member states of EU) while research on open innovation in other EU countries (new member states of the EU) is practically non-existent. The purpose of this study is to contribute to the body of knowledge examining open innovation practices in organizations, by focusing specific attention on open innovation practices in Slovenian companies. Some preliminary evidence on the state of open innovation in Slovenia among high-tech companies has already been presented by Rašković et al. (2011), who showed that most of these companies are still more inclined to "closed" innovation. Krapež et al. (2012) focused exclusively on the Slovenian companies that innovate openly by cooperating with external partners, and found that Slovenia has been developing a friendlier business environment for open innovation. We contribute to the research to this body of literature by providing a comparative analysis on the adoption of different open innovation practices by Slovenian firms. One specific advantage of our research framework is that we do not limit it to certain industries or company sizes. Based on our insights, we have developed some recommendations for facilitating the implementation of open innovation.

Our results suggest that there are differences regarding the implementation of open innovation dimensions in relation to firm's size, with larger companies more involved in open innovation activities, which is in line with the previous results on open innovation (e.g. van de Vrande et al., 2009). An interesting difference (although not statistically significant) appeared in relation to outward IP licensing, which showed that smaller companies are more inclined to selling and/or licensing of their IP. This may be related to the fact that smaller companies often develop product/services that are intermediary components of final products/services developed by another company. Indeed, this is aligned with the statistically significant finding that larger companies more frequently buy and/or license-in IP from other companies. The second statistically significant difference is related to pre-venturing activities, which are the least commonly used by micro companies. When developing the final product/service, micro firms are probably the least inclined to share the profit with other firms only for launching products/services on the market. Statistically significant differences in collaboration with different partners (regarding the firm's size) is shown in collaboration with knowledge institutions, in collaboration with consultancy firms and collaboration with start-ups, with larger firms more actively involved in these kinds of collaborations. The main reason may be connected to the financial resources supporting the collaborations. Larger companies can easily afford to pay for consultancy services or joint R&D development with knowledge institutions and/or high-tech start-ups, which is also evident from the statistically significant difference in outsourcing R&D from knowledge institutions (with larger firms most frequently using these services).

A comparative analysis among manufacturing and service industry revealed that service firms more frequently carry out most open innovation dimensions. However, we believe the results are influenced by the characteristics of the sample, since most high-tech companies in the sample belong to service sector. This is congruent with the findings of Rašković et al. (2011) in which 91.25% of the analysed high-tech companies belonged to service sector. Service firms collaborate more with competitors in a statistically significant manner, with companies engaged in activities different from theirs, with high-tech start-ups and with creative individuals. More frequent collaboration with competitors may be due to the fact that service outcomes are difficult to protect; therefore, these companies avoid IP protection problems. Since these companies develop high-tech services, they often lack knowledge related to technology or knowledge that is beyond their domain. It seems that companies tend to remedy this gap of knowledge by collaborating with high-tech stat-ups or companies engaged in activities other than theirs. Creative individuals can help them with the identification of potential future service solutions or the creation of the service image.

Drawing on previous work on open innovation in Slovenia and our study, we provide some proposals for facilitating the practice among Slovenian companies, which are gathered into three steps and presented in Figure 1.

The first step is related to the raising awareness regarding open innovation practices and its benefits. Successful understanding and learning new ways of innovation requires the organization of workshops and trainings on the topic of open innovation, where companies can become aware of the importance of the concept, its advantages, and benefits. On the basis of good practices from abroad, the progress and positive change in companies that have successfully introduced the concept can be presented, followed by the directions and possible ways of introducing the concept in business.

The second step relates to the introduction and implementation of open innovation, whereas the main changes are required in the organizational structure and culture of Slovenian companies. The starting points are changes in the mentality and understanding of management, since misunderstanding and scepticism about the new concept by the principal management at the outset leads to failure. Therefore, new ways of managing and rewarding are needed for the successful implementation of open innovation. This is followed by a mental shift of all employees, which is necessary to stimulate creative and unconventional thinking. These first two steps can be carried out with the help of experienced (foreign) trainers/mentors.

The decision to switch from closed to open innovation is made by the company itself, but the state can play an important role with direct and indirect financial incentives, and initiatives. Therefore, a successful implementation of open innovation by Slovenian companies also requires support from the state, which should be applied to different types and developmental situations of the industries, which represents the third step in the proposed model of facilitating open innovation.

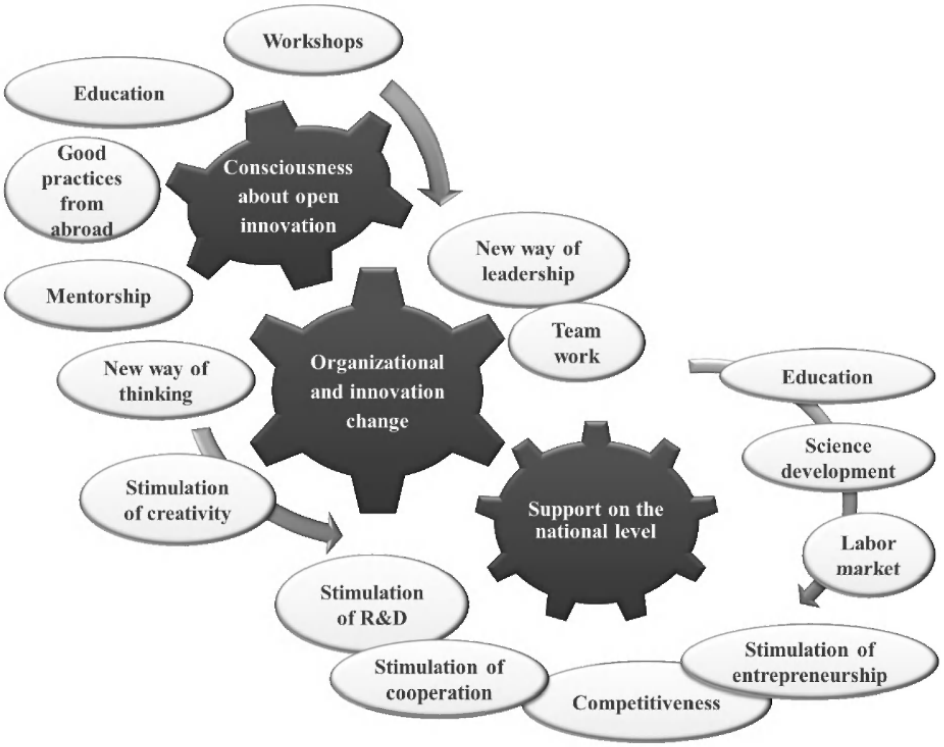

Figure 1: *Perspective of open innovation in Slovenia*

6 IMPLICATIONS, LIMITATIONS AND FUTURE RESEARCH

Many high-tech European and US companies practice open innovation extensively, while open innovation activities are not that common in new member states of the EU, and specifically in Slovenia. There are many possible reasons for the low adoption of open innovation practices in companies, amongst which most likely concern fear of a "hostile" takeover of ideas or already developed technologies, lack of knowledge about the practice, and cultural specificities of Slovenian entrepreneurs. The results of this study show that there have been some initial bursts of activities in the field of open innovation among Slovenian companies, but they require strong stimulation to become genuine open innovators.

We believe this study makes several theoretical and practical contributions. From a theoretical perspective, the paper contributes to the literature in the field of the state of open innovation in European countries that are lagging behind the most developed countries of the world. From a practical point of view, the open innovation perspective can help Slovenian managers in adopting this important practice and policy makers in facilitating open innovation. Additionally, the proposed steps for the facilitating of the

implementation of open innovation are a good starting point for the development of the concept in other less developed European countries.

6.1 Implications for managers

Our results indicate that Slovenian companies are beginning to introduce some aspects of open innovation. Although the existing evidence suggests that any of the open innovation activities may improve firm's performance, each activity can influence the performance outcomes differently (Parida et al., 2012); therefore, a company should approach open innovation as a whole to profit the most from the concept. Additionally, the steps recommended for the implementation of open innovation stress the importance of management and its understanding of the concept. Managers should be aware that delegation in open innovation shifts to co-ordination, the harmonization of ideas and teamwork, the encouragement of creative proposals and ideas, and the development of innovative solutions in which all employees within the company, as well as external partners should be included. Moreover managers should stimulate the creative and unconventional thinking of employees and reward them for finding useful ideas outside the firm's boundaries. Managers should create an environment in which corporate culture, value and reward systems as well as human resources support the development and implementation of open innovation (Krapež et al., 2012).

6.2 Implications for policy makers

The results from Rašković and Pustovrh (2010) indicated that the main barriers that hinder innovation performance of Slovenian companies concern accessing financial resources, tax law and efficiency of market labour. Similarly, Krapež et al. (2012) stressed the importance of supportive business environment, but not exclusively based on governmental financial support, but should also include changes in legislation, tax system, administrative procedures, infrastructure and funding opportunities. Policy makers may want to follow the suggestions provided by de Jong, Vanhaverbeke and Chesbrough (2008), who identified seven areas of legislation that require certain changes to ensure the positive development of open innovation, and apply them to the need of Slovenian companies. Subscribing to the proposals of the Slovenian studies, our findings also emphasize the importance of the help of regional policy makers (especially for smaller companies) in stimulating the incentives in the form of workshops and training programs if possible with the help of foreign mentors. This coincides with the suggestion of de Jong, Kalvet and Vanhaverbeke (2010), who state that policies have to support the networking skills of the companies, which can be reached by improving their knowledge and competences in these areas, by delivering information and by presenting already-established open innovation models and best practices. They suggest tailor-made services moderated by experts with the knowledge and skills in the field of open innovation, as well as the facilitation of go-betweeners, who are matchmakers bringing different partners together.

6.3 Limitations and future research

As with any research, also this study has several limitations. Firstly, limitations related to the in-depth interviews include potential selection bias: it was very difficult to find experts from Slovenia in this field and motivate them to participate in the study. Therefore, we included foreign experts who have wide knowledge and extensive experience in the field of open innovation. Limitations could also be related to the nature of the questions of the interview, since they could include additional and more detailed questions. In addition, the obtained results are based on responses from a relatively small number of interviewees. Future studies would thus contribute by extending the pool of interviewees and questions included in the qualitative research. The main limitation of the quantitative study is the use of a proxy measure for open innovation. All the dimensions of open innovation, except external networking, were based on one question. The use of a more sophisticated and statistically valid and reliable measure could provide more accurate results. Therefore, further analyses examining specific elements of different open innovation dimensions in Slovenian companies are needed to support our findings. Hence, it would be interesting to conceptualize and validate a general scale for open innovation, which would provide foundations for better quantitative analysis between open innovation and other organizational variables and enhance the understanding of different context dependencies and interactions (Huizingh, 2011). A common measurement for open innovation would therefore enable better cross-industry and cross-country analyses, as well as the identification of moderating and mediating effects on the relationship between open innovation and a firm's performance. From the practical point of view, the analyses based on common open innovation measurements would enable managers to understand how to enhance the open innovation outcomes and to know which determinants at the organizational as well as broader level influence the business success. An interesting study would also be an examination of the most appropriate proportion of open and closed businesses. Since the balance between open and closed innovation in diverse firms is very different, it would be worth exploring the key factors that affect the balance and thereby create a universal formula that would assist in determining the extent to which it makes sense to open a firm's innovation process. Finally, future research should focus on the influence of various national governmental policies that stimulate open innovation in organizations (Herstad, Bloch, Ebersberger, & van de Velde, 2010).

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APPENDIX 1: OPEN INNOVATION DIMENSIONS

(7-point Likert scale: 1 = strongly disagree; 7 = strongly agree)

CUSTOMER INVOLVEMENT: Customers/end users are usually involved in the process of new product/service development.

EXTERNAL NETWORKING: In order to acquire new know-how/technology, we are willing to invest in a new company.

OUTSOURCING R&D: We acquire new know-how/technology through research and development services provided by knowledge institutions such as universities, faculties, institutes, laboratories, etc.

INWARD IP LICENSING: To ensure successful development of new products/services, we usually buy the intellectual property of other companies.

PRE-VENTURING: When launching our own new products/services on the market, we cooperate with external partners.

OUTWARD IP LICENSING: We are willing to sell part of our intellectual property (e.g. patent, trademark).

EMPLOYEE INVOLVEMENT: In our company, we actively encourage communication among unrelated groups of employees in the company.

EXTERNAL NETWORKING - Collaboration with different partners (7-point Likert scale: 1 = never, 7 = always)

In order to acquire new know-how/ technology we cooperate with:
…our customers
…our suppliers
…knowledge institutions such as universities, faculties, institutes, laboratories
…consultancy companies
…our competitors
…companies engaged in activities different from ours
…high-tech start-up companies
…creative individuals

APPENDIX 2: SUMMARY OF THE RESULTS RELATED TO RESEARCH QUESTIONS

No.	Research question	Results
RQ1a	What are the main advantages and reasons for the implementation of open innovation?	The possibility of accessing a wide range of knowledge from different sources, faster entrance to the market, better usability of technology, better exploitation of internal resources, creation of more integrated solutions, cost reduction, maintenance of competitive advantage and the possibility of entering the international market.
RQ1b	How can open innovation best be implemented?	The concept should be part of the overall business model and implemented at all levels within the company. This requires a team of people who understand the processes and discipline of innovation and are willing to maintain an open dialogue. Business executives have to be familiar with the concept and understand it.
RQ1c	Which obstacles can companies encounter in the implementation of open innovation?	Employee resistance, a lack of understanding and a lack of knowledge about open innovation, a vertical organizational structure, cultural issues and problems related to different partnerships (lack of understanding of each other, different cultures and different modes of thinking), IP protection.
RQ2	With whom do Slovenian companies collaborate the most when acquiring new know-how/technologies?	Companies most frequently collaborate with customers and suppliers.
RQ2a	Are there any differences in collaboration with different partners regarding a firm's size?	Large and medium sized companies collaborate more with knowledge institutions than small and micro firms. Large companies collaborate more with knowledge institutions than medium companies. Micro companies collaborate with consultancy companies less than medium and large companies. Small companies collaborate with consultancy firms less than large companies. Micro and small companies collaborate with high-tech start-ups less frequently than large firms.
RQ2b	Are there any differences in collaboration with different partners regarding a firm's business sector?	Service companies collaborate more with competitors, with companies engaged in activities different from theirs, with high-tech start-ups and with creative individuals.
RQ3	Which open innovation dimension is most commonly used among Slovenian companies?	Most commonly used open innovation dimension is customer involvement, followed by employee involvement and pre-venturing activities.
RQ3a	Are there any differences in the implementation of open innovation dimensions among Slovenian companies regarding their size?	Larger firms most frequently use outsourcing R&D from knowledge institutions. Larger companies are more frequently involved in inward IP licensing as small and micro firms. Micro firms are the least involved in pre-venturing activities.
RQ3b	Are there any differences in the implementation of open innovation dimensions among Slovenian companies regarding their business sector?	Service firms are more often engaged in external participation, pre-venturing, outward IP licensing and employee involvement.

RQ4	What are the main reasons for the underdeveloped open innovation community in Slovenia?	The philosophies of Slovenian companies, which are very closed and conservative. Slovenian companies are primarily focused on the domestic market, they fear operating openly, have a lack of ideas, knowledge of innovation and innovation processes, and they lack the knowledge for effective management and moderation of such teams. They are not familiar with the concept of open innovation. Additional problems also arise at the implementation of the concept, since they are not acquainted with the most appropriate tools and strategies for introduction in their business.
RQ5	How can the development of open innovation among Slovenian companies be stimulated?	Companies have to first become well acquainted with the concept of open innovation, after which they will start to create a network of partners with whom they want to cooperate; they will have to inspire respect in them, as well as be interested in participating, and then find the areas of common operation. Foreign interlocutors suggested presentations of good practices from abroad, which will show the positive impact of open innovation on firm performance.

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STABILITY OF MONEY DEMAND FUNCTION IN PAKISTAN

HAROON SARWAR[1]
MASOOD SARWAR[1]
MUHAMAD WAQAS[2]

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ABSTRACT: *The role, which money demand function plays in monetary policy formulation has attracted a lot of research studies to analyze this macroeconomic phenomenon. In the wake of current global and local economic and political upheavals, it is imperative to revisit the stability of money demand function. The study used the time series data and applied latest econometric techniques to find out the long run and short run money demand relationship. Moreover, all the three official monetary aggregates were used for finding out the most stable monetary demand relationship, which could provide correct signals for monetary policy formulation. The study found that broader monetary aggregate (M_2) was the proper aggregate, which provided stable money demand function for Pakistan. The real GDP was positively related to the demand for real balances, while opportunity cost of money was negatively related. The study found that the role of financial innovation, in explaining the demand for money warrants attention in formulating monetary policy.*

Keywords: *Stability, monetary aggregates, financial innovation*
JEL Classification: G01, E4, E5

1. INTRODUCTION:

The study and the estimation of demand for money has gained popularity in the econometric and economic literature overtime. The Money demand reflected an important relationship for formulating appropriate monetary policy and targeting related variables. The structural adjustments, entailing financial deregulations and innovations in many countries and Pakistan is no exception, it seems imperative to establish whether the underlying assumptions and the properties of the money demand function still hold (Malnick, 1995).

The financial markets were under pressure worldwide due to the devastating effects of global financial crisis. This global financial crisis not only endangered the giant financial institutions world wide, but also shed doubts on the established economic relations.

[1] University of Sargodha, Department of Economics, Pakistan, e-mail: awan811@hotmail.com
[2] University of Sargodha, Department of Economics, Pakistan, e-mail: economist147@hotmail.com

One of the main reasons for this global turmoil was the liquidity mismanagement in the financial sector. Pakistan as an open economy was not able to safeguard it from the external effects, and the recent global financial crisis coupled with political upheavals and law and order situation further exacerbated the situation. During 2001-2007, the economy showed promising growth of more than 6 percent, gross official reserves rose to $14.3 billion and inflation remained nearly 7 percent (IMF country report, 2008). After mid 2008, the economic situation deteriorated rapidly, foreign exchange reserves melt down quickly, liquidity position aggravated and inflation rose to unprecedented levels. This situation compelled the authorities to sign Stand-by Arrangement (SBA) of $7.6 billion with IMF for 23 months (IMF Survey, 2008). The thorough analysis of these ups and downs of Pakistan economy's recent history depicted that once again liquidity mismanagement and monetary policy flaws were among the main culprits. The boundless consumer financing and leasing at one point of time and severe liquidity crunch later on was the simple evidence of monetary mismanagement. This study explored the root cause of these monetary problems of Pakistan through estimating the stable money demand function and tracing out the true monetary aggregate, which provides support to a sound monetary policy.

One of the important issues confronting the monetary policy was to discover a steady money demand function (Friedman (1959); Friedman and Schwartz (1982); Laidler (1977); Laidler (1982)). Thus, a stable money demand function was a necessary pre-requisite in establishing a one to one relationship between the appropriate monetary aggregates and nominal income. The study and estimation of a stable money demand function enable the monetary authorities and policy makers to stabilize prices. Nevertheless, the empirical evidence for a stable money demand was necessary but not a sufficient condition to uphold the monetarist argument that the money supply was causal in the process of inflation (Kaldor, 1982).

The question for stable and predictable demand function stemmed from results that traditional models for money demand function in many industrialized countries showed instability over time in the 1970s. The empirical findings in developing countries faced similar problems in the traditional specification. The problems included but not limited to serial correlation, over prediction or missing money syndromes, misspecification, wrong signs and insignificant coefficients of the important parameters. Friedman, (1956) revealed that money demand function assumed that there was a stationary long-run equilibrium relationship between real money balances, real income, and the opportunity cost of holding real balances. Several studies for Pakistan reported different aggregates as the stable aggregates for different time periods. The rapidly changing global and local financial scenario calls for revisiting the stability of money demand function. The current study aims at testing all the three official monetary aggregates, and to choose a stable money demand relationship which could serve as a base for sound monetary policy.

Initial studies on the topic were confined to identifying the determinants of demand for money, coupled with the choice of model specification and estimation procedure. Few

studies confined their estimations only to M_1 due to the fact that the broader aggregates might grubby the interest rate effects. Many such studies conducted in developed economies did not perform well, but several studies in the developing economies pointed out that M_1 performed well as compared with broader aggregates. This finding was mainly due to the weak banking and financial sector of the less developed countries (Moosa (1992), Hossain (1994) Hafer and Jansen (1991)). On the other hand, Ericsson and Sharma (1996) showed that narrowly defined aggregates were not really relevant to the policy issues and broader aggregates have better predictive power. This directed many studies to estimate demand for money using M_2 exclusively. However, it is not uncommon to find studies that evaluate the demand for money using both the narrow and broad money aggregates. Judd and Scadding (1982), Goldfeld and Sichel (1990), Boughton (1992), Laidler (1993) Sriram (1999) and Serletis (2001) have surveyed these studies.

The time-series econometric analysis has a pivotal role in the contemporary empirical research on money demand. Initial estimations using these techniques were primarily confined to the industrially developed countries especially United Kingdom, United States and Canada. Later on, this technique was used for both developed and developing countries alike. For example Muscatelli & Papi (1990) for Italy, Ericsson & Sharma (1998) for Greece, Mehra (1993) for United States; and for developing countries Hafer and Kutan (1994), and Lee and Chien (2008) for China, Moosa (1992) for India, Bahmani (1996) for Iran, Arize (1994) for Korea, Ariez (1994), Hossain (1994), Qayyum (1998, 2001,2005) and Zakir, *et al*. (2006) for Pakistan, Reilly and Sumner (2008) for Sri Lanka were few of the long list of literature that used Cointegration technique and Error correction Model for money demand analysis.

In Pakistan most empirical studies found standard economic relationships to hold. The estimates of money demand functions mostly found money demand to be determined by measures of opportunity costs and activity (Modood et al, 1997). Likewise, inflation was influenced by changes in money supply, interest rates, measures of aggregate demand or output, and import prices (e.g., Ahmad and Ali, 1999).

The current study tried to analyze all the three official monetary aggregates of Pakistan, to choose the most efficient and stable aggregate, which could perform well in the midst of global and national financial crisis. Rest study is balanced as, part two discusses about data sources, part three presents the methodology, part four explains the results and last part concludes the study.

2. DATA SOURCES:

In order to estimate the stability of money demand function, annual data for Pakistan economy was used comprising the time period of 1972-2007. Main data sources were Hand Book of Statistics on Pakistan Economy (2005) by State Bank of Pakistan (SBP), various Statistical Bulletins of State Bank of Pakistan and CD-Rom of International Monetary Fund (IMF). State Bank of Pakistan collects these statistics from different fi-

nancial and statistical institutions, as well as different surveys are conducted for data collection exercise.

The main thrust of the study was on finding out the stable money demand function based on the official monetary aggregates namely: Reserve Money (M_0), Narrow Money (M_1) and Broad Money (M2). For the estimation of money demand function for all three official aggregates, rest of the required variables were Gross Domestic Product (GDP) as a proxy for income, opportunity cost of money, and financial Innovation (FI). The proxy variables used for opportunity cost of money and financial innovation were interest rate (I) and ratio of M2 - CC/GDP respectively. GDP deflator was used for obtaining real gross domestic product (RGDP). For capturing the effect of financial sector development, in literature a lot of proxies were in use, but this study used the ratio of difference of M_2 and Currency in Circulation (CC) to GDP. By subtracting the Currency in Circulation from the broadest aggregate, one can get the money with in the banking system, and the ratio of this difference to GDP gave the efficiency of banking system. An increase in ratio indicated increase in efficiency of banking system and vice versa.

The component assets of these Simple sum official aggregates were:
M_0 = Currency in circulation (CC) + Other deposits with SBP (DothSBP) + Currency in tills of scheduled Banks (Ctills) + Bank's deposit with SBP (Dbanks)
M_1 = M_0 + Current Deposits (CD) + Call Deposits (D_{call}) + Other Deposits (D_{oth}) + Saving Deposits (SD)
M_2 = M_1 + Time Deposits + Residents Foreign Currency Deposits (RFCD)

3. METHODOLOGY:

The conventional economic models, which were considered stable for decades, could not sustain the shock and broke down. Granger and Newbold (1974) identified that these models were based on non-stationary data and were 'spurious'. The prime cause of this phenomenon was non-stationary data, so the handling of any time-aeries data calls for a stationarity check.

3.1 Stationarity Check

Any kind of empirical analysis on time-series data requires that it should individually be tested for stationarity. For stationarity of any stochastic process Y_t, it is necessary that, it should be:
1) E (Y_t) = constant for all time period t;
2) Var (Y_t) = constant for all time period t;
3) Cov ($Y_{t,}$ Y_{t-m}) = constant for all $t \neq m$.

There are different variants available for unit root tests. One of the simplest tests is the Dickey – Fuller test proposed in Dickey and Fuller (1979). Many other tests in this regard

are Augmented Dickey Fuller test, Phillips-Perron test (1988), Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test, multivariate Johansen's unit root test etc.

The study used Augmented Dickey Fuller (ADF) test, which has three models. The main difference between the three models was concerning to the presence of deterministic elements b_0 and b_2t.

1 – For testing if Y_t is a pure Random Walk.
2 – For testing if Y_t is a Random Walk with Drift.
3 – For testing if Y_t is a Random walk with Drift and Deterministic Trend.

The test which is the most frequently used is Augmented Dickey Fuller (ADF) test. This study used ADF test, due to the fact that it includes lagged dependent variables to capture autocorrelated omitted variables that would in case of DF, enter the error term. The general form of ADF model was:

$$\Delta Y_t=\alpha+(\rho-1)Y_{t-1}+ \Delta Y_{t-1}+\Delta Y_{t-2}+\ldots+\Delta Y_{t-p}+e_t$$

This model was used for testing the hypothesis:

H_0: $\rho-1=0$ H_1: $\rho-1<0$
t-values obtained were compared with the critical values of Mackinnon (1996). All the series were tested using the ADF test.

3.2 Stability of Money Demand Function:

In this study the long-run real money demand relationship was investigated by the following models:

$$M_0 = f(Y, P, I, FI) \quad (1)$$
$$M_1 = f(Y, P, I, FI) \quad (2)$$
$$M_2 = f(Y, P, I, FI) \quad (3)$$

Where:
M_0, M_1, & M_2: the real money demand dependent variables found by dividing nominal money balances to GDP deflator;
Y = Real Gross Domestic Product;
P = the inflation rate;
I = Interest rate on Time deposit as an opportunity cost of holding money; and
FI = Financial Innovation (Ratio of M2 – CC/GDP)

In case of model selection, general to specific approach (GETS) was adopted. In which one starts with more variables and then keep on dropping the irrelevant variables depending upon their statistical and economic insignificance.

Before going for the stability tests of the above given money demand models, the test for Cointegration was carried out, in order to check, if there exists a long run relationship among the variables.

Johansen and Juselius approach successfully tackles most of the shortcomings of Engle Granger approach, that is why this study followed Johansen and Juselius (JJ) approach. The JJ procedure is based on maximum likelihood estimates and provides trace value test and maximum Eigenvalue statistic for detecting number of cointegrating vectors. This procedure provides framework for Cointegration test in context of Vector Autoregressive models (VAR).

In Johansen's approach, a vector $\mathbf{z}_t$ of n potential endogenous variables is defined as an unrestricted vector autoregression (VAR) involving up to k lags of $\mathbf{z}_t$

$$z_t = A_t z_{t-1} + A_k z_{t-k} + u_t \tag{4}$$

Where $\mathbf{z}_t$ is (n x 1), and each of $\mathbf{A}_i$ is an (n x n) matrix of parameters. This type of model is also advocated by Sims (1980) because it estimates dynamic relationships among jointly endogenous variables with out imposing many restrictions. This model can be reformulated into a Vector Error Correction Model (VECM) as:

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + \Gamma_{k-1} \Delta z_{t-k-1} + \Pi z_{t-k} + u_t \tag{5}$$

where $\Gamma_1 = -(I - A - ... - A_i)(i = 1, ..., k - 1)$ and $\Pi = -(I - A_1 - ... - A_k)$. If Π has full rank i.e. r = n, then the variables in $\mathbf{z}_t$ are I (0) and if Π has zero rank then there is no cointegrating vector. If Π has reduced ranks i.e. r < (n-1), cointegrating relationships are present. Usually two tests are commonly used for finding out the number of cointegrating vectors, namely; Trace test and Maximal Eigenvalue test. Both the tests have different set of hypotheses. Trace statistics test the hypothesis of r=q (where q = 0, 1, 2, …, n -1) against the alternative of r = n, while the maximal Eigenvalue statistic tests hypothesis of r = 0, against alternative hypothesis of r = 1.

Cointegration analysis described the long run relationship among the variables of the model. In order to find out the short run behavior of the variables and to measure their displacement from the equilibrium in the short run, Error Correction Mechanism (ECM) was used. If two variables Y_t and X_t are cointegrated, then according to the definition of Cointegration, the associated error term should be integrated of order zero (i.e. Stationary). Thus, the relationship of these two variables can be expressed in ECM framework as:

$$\Delta Y_t = a_0 + b_1 \Delta X_t + \pi \hat{e}_{t-1} + u_t \tag{6}$$

This model now carried both long run and short run effects, b_1 captured the short run effects and was termed as 'impact multiplier', while π was the adjustment or feedback effect and captured the effect of any adjustments which took place due to disequilibrium

in the previous period. In equation (6) $\hat{e}_{t-1} = Y_t - \beta_1 - \beta_2 X_t$ and here β_1 carried the long run effect. This ECM specification had many advantages and was adopted for this study, because the model was convenient for measuring the displacement from the disequilibrium, as well as the correction of the disequilibrium. This ECM specification could easily fit into the general-to-specific approach, which was being carried out in this study.

4. RESULTS & DISCUSSION:

4.1 Stationarity Check

The results showed that all six series were non-stationary at levels in both models, but at first difference all the series were stationary with both models. In second model LRM_1 was marginally non-stationary, but as it was stationary in first model so that was not of much significance.

Table 1: *Augmented Dickey-Fuller Test for Unit root*

Variables	Levels		First Difference	
	With Intercept but no trend	With Intercept and trend	With Intercept but no trend	With Intercept and trend
LRMo	-2.2843	-2.2382	-5.0365*	-5.2289*
LRM1	0.27832	-1.1794	-2.9750*	-2.6942
LRM2	-1.5082	-2.3244	-3.9582*	-3.8661*
LRGDP	-1.1565	-1.7489	-5.4492*	-5.9439*
LFI	-2.1172	-2.7777	-4.2963*	-4.1886*
Int	-0.77261	-1.7650	-5.0047*	-5.0199*

* The coefficient is significantly different from zero at 0.05 probability level
The ADF statistic are -2.9591 and -3.5615 for models 'with Intercept but no Trend', and 'with Intercept & Trend' respectively at 0.05 probability level.

After testing for stationarity, the next step was to analyze the long run relationship of the model variables. In this study, as the results reported above indicate, all the series were integrated of order one (i.e. I(1)) hence Johansen and Juselius (1990) approach was used for three models of demand for money.

4.2 Money Demand Model Based on Reserve Money:

The first money demand model estimates were based on real reserve money ($RM_{\sim}$). The equation of the model was:

$$LRM_{0t} = C + LRGDP_t + Int_t + LFI_t + u_t \quad (7)$$

The results in table 2 indicated cointegration analysis based on Maximal Eigenvalue and Trace value statistics. The results showed that there was single cointegrating relationship

in the model, because under ME statistics, one tests the hypothesis of 'no cointegration' against having 'one cointegration'. The value of statistic was greater than the critical value at 0.05 probability level, so the null was not accepted. The non acceptance of null hypothesis indicated the presence of one cointegrating relationship. The similar result was shown by Trace value statistic.

Table 2: *Results of Cointegration Test for Reserve Money(LRMo) Model: 'Unrestricted intercepts and no trends'*

Based on Maximal Eigenvalue Statistic					Based on Trace value statistic				
Null	H1	Eigen Statistic	95%Critical Value	90%Critical Value	Null	H1	Statistic	95%Critical Value	90%Critical Value
r = 0	r = 1	34.817*	27.420	24.990	r = 0	r >= 1	55.097*	48.880	45.700
r<= 1	r = 2	15.159	21.120	19.020	r<= 1	r >= 2	20.279	31.540	28.780
r<= 2	r = 3	5.120	14.880	12.980	r<= 2	r >= 3	5.121	17.860	15.750
r<= 3	r = 4	0.008	8.070	6.500	r<= 3	r >= 4	0.008	8.070	6.500

* The coefficient is significantly different from zero at 0.05 probability level

The long run relationship specified by cointegration analysis depicted demand for money function as obtained in equation no 8:

$$LRM_{0t} = \underset{(2.1032)}{0.001} + \underset{(3.3409)}{0.6742\ LRGDP_t} - \underset{(-1.5102)}{0.0182\ Int_t} + \underset{(3.9018)}{0.4876\ LFI_t} \quad (8)$$

The above equation revealed that long run money demand was determined by log of real GDP, interest rate and log of financial innovations. The results showed that real GDP and financial innovations showed significant positive impact on money demand, while interest rate has negative relation with money demand, which was not significantly robust. The analysis depicted that one percent increase in real GDP resulted in a 0.67 percent increase in real money (M_2), while one percent increase in financial innovations showed a 0.48 percent increase in demand for money. These results of positive relationship of money demand and financial innovation were in line with the recent studies of Odularu and Okunriboye (2009) and Columba (2009).

In order to study the short run behavior of the variables and to measure their deviation from the equilibrium in the short run, Error Correction Mechanism (ECM) was used. The results of ECM for Money demand model of Reserve money were given in the table 3:

Table 3: *ECM for variable LRMo estimated by OLS based on Cointegrating VAR (2)*

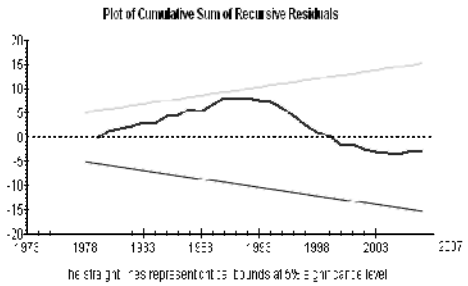
Regressor	Coefficient	Std Error	T-Ratio	Prob.		
Intercept	-0.0551	0.01811	-0.30422	0.763	R-Square:	0.6153
Dint	-0.01248	0.00921	-1.3550	0.186	DW:	2.1222
DLRGDP	1.0304	0.31249	3.2974	0.003	F-Stat:	11.996
DLFI	0.53168	0.09814	5.4175	0.000		
ECM (-1)	-0.35205	0.12184	-2.8894	0.007		

$$DLRMo_t = \underset{(-0.3042)}{-0.0551} - \underset{(-1.3550)}{0.0125}Dint_t + \underset{(3.2974)}{1.0304}DLRGDP_t + \underset{(5.4175)}{0.5317}DLFI_t - \underset{(-2.8894)}{0.3521}ecm_{t-1} \quad (9)$$

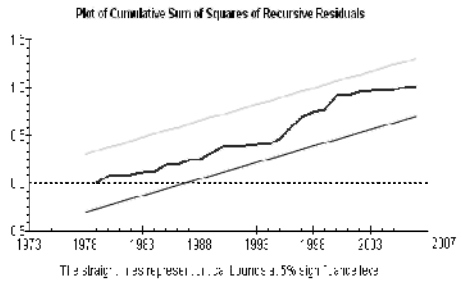
The estimated ECM has many desirable statistical properties. Durban Watson Statistic, F-test and R-square indicated good fit of the model. Moreover, the model was interpretable for short run dynamics and the signs were also consistent with the economic theory. The estimated intercept term had negative sign, indicating the decline in unconditional growth in money demand, but most of the studies pointed out that intercept term did not have strong direct implications.

Although, the magnitude of parameter was low, yet the negative sign of error correction term was consistent with the economic theory. The low value of error correction parameter indicated slow speed of adjustment towards equilibrium. The possible cause for this slow adjustment was perhaps the cost involved in the adjustment of money holdings. Moreover, Thornton (1983) also pointed out that national and international disasters like oil price shocks, earthquakes and natural calamities could also assist long run disequilibrium to prevail. Another reason for slow speed of adjustment was also due to the low saving rate in Pakistan.

A stable money demand function is termed as a valuable tool for monetary policy formulation. In order to find out the parameter constancy, the study applied Cumulative sum (CUSUM) and Cumulative sum of squares (CUSUMSQ) tests of structural stability proposed by Brown *et al.* (1975). The CUSUM test was basically used for detecting systematic changes in the regression coefficients while CUSUMSQ test captured any parameter's departure from constancy. The graphs of both CUSUM and CUSUMSQ for the above equation were shown in graph1 below:



Graph 1: *CUSUM plot of LRMo Model*



Graph 2: *CUSUMSQ plot of LRMo Model*

The graphs indicated that the residuals were within the 5 percent critical bounds for both the graphs, which further indicated that model was stable for the entire sample, and the defined money demand model was stable. This was also a proof of constancy of the regression coefficients in case of any haphazard and sudden shocks.

4.3 Money Demand Model Based on Narrow Money:

In order to find out the most appropriate money demand function, the study estimated the model as discussed in the previous section with log of real Narrow money (LRM_1) as the dependent variable. The model was:

$$LRM_{1t} = C + LRGDP_t + Int_t + LFI_t + u_t \quad (10)$$

The Maximal Eigenvalue indicated two cointegrating vectors at 5 percent level of significance as well as Trace statistic also indicated two cointegrating vectors at 5 percent level of significance.

Table 4: *Results of Cointegration Test for Narrow Money(LRM_1) Model:'Unrestricted intercepts and no trends'*

Based on Maximal Eigenvalue Statistic					Based on Trace value statistic				
Null	H1	Eigen Statistic	95%Critical Value	90%Critical Value	Null	H1	Statistic	95%Critical Value	90%Critical Value
r = 0	r = 1	40.697*	27.420	24.990	r = 0	r >= 1	73.713*	48.880	45.700
r<= 1	r = 2	24.508*	21.120	19.020	r<= 1	r >= 2	33.585*	31.540	28.780
r<= 2	r = 3	7.964	14.880	12.980	r<= 2	r >= 3	9.077	17.860	15.750
r<= 3	r = 4	1.112	8.070	6.500	r<= 3	r >= 4	1.112	8.070	6.500

* The coefficient is significantly different from zero at 0.05 probability level

In case of results of cointegration analysis showing more than one cointegrating relationships, it becomes bit difficult to explain the results. Handa (2000) showed that if there were more than one cointegrating vectors in a model, the econometric technique, by itself did not show that which relationship depicted the long run money demand relationship. Qayyum (2005) argued that in such cases, more often the first vector was interpreted as money demand function after normalization. The present study estimated the long run money demand model by normalizing the first cointegrating relationship.

$$\begin{matrix} LRM_{1t} = -16.9696 + 0.0048int_t + 2.4699LRGDP_t + 0.7636LFI_t \\ \quad\quad\quad (-2.1452) \quad (0.2684) \quad\quad (3.8513) \quad\quad (2.8036) \end{matrix} \quad (11)$$

The long run money demand model based on narrow money had few issues that needed little explanation. The signs of real income and financial innovation were according to the theory, but interest rate parameter had positive sign, which was not consistent with the economic theory. The interest rate was also statistically insignificant; however, magnitude of the parameter was very small. The estimated model results revealed long run demand for money was being determined by the income of the people and the availability of ease in financial transactions and interest rate was not playing any significant role in the decision of a representative person in terms of his money holdings.

In order to analyze the adjustment of the disequilibrium, the study applied ECM methodology on the narrow money demand function.

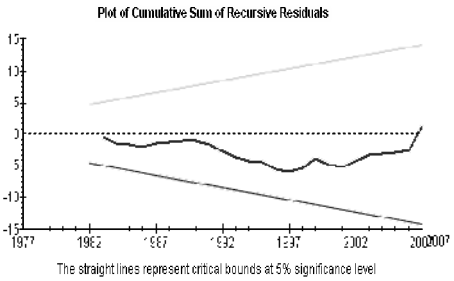
Table 5: *ECM for variable LRM_1 estimated by OLS based on Cointegrating VAR (2)*

Regressor	Coefficient	Std Error	T-Ratio	Prob.	
Intercept	-0.046	0.041	-1,139	0.265	R-Square: 0.5129
Dint	0.009	0.018	0.482	0.634	DW: 1.4774
DLRGDP	2.147	0.689	3.112	0.004	F-Stat: 6.8435
DLFI	0.649	0.248	2.614	0.015	
ECM (-1)	0.283	0.288	0.983	0.335	

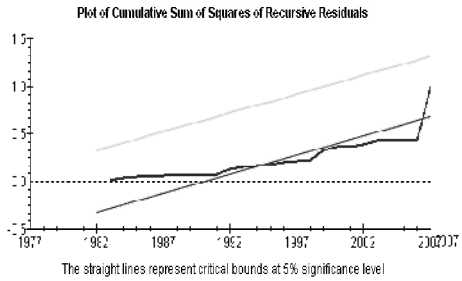
The ECM equation in the light of above results was:

$$DLRM_{1t} = \underset{(-1.1395)}{-0.0458} + \underset{(0.4812)}{0.0088}Dint_t + \underset{(3.1115)}{2.1469}DLRGDP_t + \underset{(2.6144)}{0.6487}DLFI_t + \underset{(0.9827)}{0.2829}ecm_{t-1} \quad (12)$$

These results of short run divergence of equilibrium were also corroborating the wrong sign and insignificant relationship of interest in the long run model. Moreover, the tests of stability of parameters also confirmed the non-stable nature of the model as shown in the graphs 3 and 4



Graph 3: *CUSUM Plot of LRM1 Model*



Graph 4: *CUSUMSQ plot of LRM1 Model*

The graphs 3 and 4 clearly showed that the function was not stable. If all the coefficients in the error correction model were stable, the CUSUM and CUSUMSQ plots would remain within 5 percent critical bounds, but as was evident from the graphs, the plot of cumulative sum of square of recursive residuals crossed the bounds and indicated the instability of the model.

4.4 Money Demand Model Based on Broad Money:

M_2 is the broader aggregate and most of the studies suggested that M_2 the stable demand for money function. In the present study along with narrow and reserve money, broad money function was also estimated. The model used in this regard was given by equation 13:

$$LRM_{zt} = C + LRGDP_t + Int_t + LFI_t + u_t \quad (13)$$

Where:
LRM_2 = log of real M_2 and was the dependent variable.

In the cointegration analysis with order of VAR 2, Maximal Eigenvalue statistic reported two cointegrating vectors, while Trace value statistic indicated one cointegrating relationship as shown by the results in table 6 below:

Table 6: *Results of Cointegration Test for Broad Money(LRM_2)*
Model: 'unrestricted intercepts and no trends'

Based on Maximal Eigenvalue Statistic					Based on Trace value statistic				
Null	H1	Eigen Statistic	95%Critical Value	90%Critical Value	Null	H1	Statistic	95%Critical Value	90%Critical Value
r = 0	r = 1	40.697*	27.420	24.990	r = 0	r >= 1	73.713*	48.880	45.700
r<= 1	r = 2	24.508*	21.120	19.020	r<= 1	r >= 2	33.585*	31.540	28.780
r<= 2	r = 3	7.964	14.880	12.980	r<= 2	r >= 3	9.077	17.860	15.750
r<= 3	r = 4	1.112	8.070	6.500	r<= 3	r >= 4	1.112	8.070	6.500

* The coefficient is significantly different from zero at 0.05 probability level

In case of conflict between Maximal Eigenvalue and Trace statistic, several studies gave preference to the Trace statistic due to the fact that Trace statistic takes into account all of the smallest Eigenvalue. Moreover, Trace statistic has more power as compared with maximal Eigenvalue statistic (Asteriou and Hall, 2007), as well as Johansen and Juselius (1990) also favored the Trace statistic in case of conflict. The long run money demand relationship specified by the cointegration analysis was:

$$LRM_{2t} = \underset{(0.6099)}{0.2738} - \underset{(-0.1062)}{0.0048}int_t + \underset{(23.6325)}{0.9717}LRGDP_t + \underset{(13.5210)}{0.7701}LFI \quad (14)$$

The long run money demand function indicated that real broad money demand had strong and highly significant relationship with real income and financial innovations, while it had a very weak and insignificant relationship with the interest rate in the short run. The results depicted that one percent change in log of real income brought 0.97 percent change in demand for money, and one percent change in financial sector development brought 0.77 percent change in demand for money. As the broad aggregate M_2 included savings accounts of different denominations and saving rates in Pakistan were low in the period under study, so the insignificant relationship of M_2 and rate of interest was not unexpected. On the other hand, highly significant relationship of LRGDP and LFI with money demand was consistent with the economic theory.

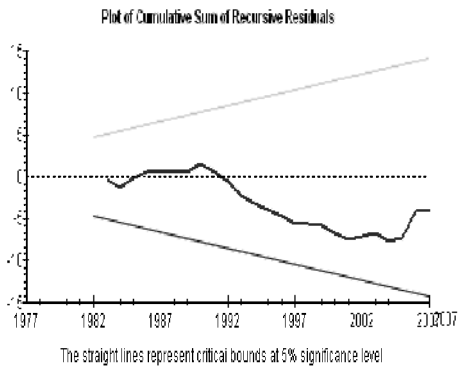
In order to study the disequilibrium adjustment process in the short run and also to complement cointegration analysis, the Error Correction Mechanism was applied. The results of the ECM were reported in the Table10

Table 7: *ECM for variable LRM2 estimated by OLS based on Cointegrating VAR (2)*

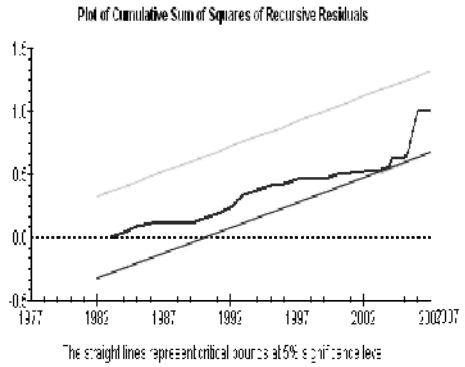
Regressor	Coefficient	Std Error	T-Ratio	Prob.	
Intercept	0.015	0.008	1.081	0.082	R-Square: 0.9277
Dint	0.002	0.004	0.043	0.966	DW: 1.6557
DLRGDP	0.768	0.142	5.182	0.000	F-Stat: 83.4268
DLFI	0.785	0.047	16.813	0.000	
ECM (-1)	-0.244	0.238	-1.025	0.315	

$$DLRM_{2t} = \underset{(1.0812)}{0.0145} + \underset{(0.0432)}{0.0015}Dint_t + \underset{(5.1817)}{0.7678}DLRGDP_t + \underset{(16.8133)}{0.7851}DLFI_t - \underset{(-1.0250)}{0.2442}\, ecm_{t-1} \quad (15)$$

The estimated ECM equation 15 depicted that there was short run disequilibrium in the model. The estimates further pointed out that equilibrium error term was negative, which was in accordance with the expectations of economic theory. The coefficient of error correction term indicated that the discrepancy (disequilibrium) of 0.24 units in the previous period was eliminated in this period. The results also illustrated that the income elasticity of real M_2 was also very high and highly significant. Moreover, financial innovations also had strong power of explaining the variation in short run real money demand.



Graph 5: *CUSUM Plot of LRM2 Model*



Graph 6: *CUSUMSQ Plot of LRM2 Model*

As both the CUSUM and CUSUMSQ statistics stay within critical bounds at 5 percent level of significance, so it was the indication of stability of the long run estimates of the model.

V- Conclusion:

In the nutshell, after analyzing all the simple sum official monetary aggregates (M_o, M_1, and M_2) it was easily concluded that the money demand function based on real narrow money (RM_1) was not stable money demand relation, while reserve money and broad monetary aggregates provided stable money demand functions. The comparison of the results for these two functions illustrated that the broad money aggregate was relatively better in statistical properties. Moreover, as per economic theory and also by definition,

M_2 inclusive of M_o was the proper aggregate for monetary policy formulation. The stability of money demand relationship further implied that instead of interest rate targeting which has devastating impacts on the Pakistan economy in the current scenario, State Bank of Pakistan should control money supply. But this policy shift could be fruitful, after the formulation of true monetary aggregates.

Moreover, financial development also played a significant role in the demand for monetary assets of the individuals; hence the policy makers should take this factor under consideration while formulating the monetary policy.

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INVESTMENT SHOCKS: A SOURCE OF FLUCTUATIONS IN A SMALL OPEN ECONOMY

EMMANUEL O. AKANDE[1]

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ABSTRACT: *This paper contributes to the existing Real Business Cycle (RBC) literature by introducing Marginal Efficiency of Investment (MEI) shocks into small open economic model. Investment shocks are the most important drivers of business cycle fluctuations in small open economy because the fluctuations in all the macroeconomic variables showed a significant response to MEI shocks than productivity shocks. The anticipation of pro-cyclical behavior of the external accounts when the model was augmented with the form of share of consumption in the household utility function, μ, and an appealing, but complex, concave adjustment cost function becomes a standpoint that differentiates this study from other investment shocks literatures. The pattern of the rise in investment in both shocks explains why investment shocks is so important in times of recession and it reveals the main source of fluctuations in a small open economy.*

Keywords: *Real Business Cycle, Marginal Efficiency of Investment, productivity shocks, adjustment cost.*
JEL Classification: E32, E37, F41

1. INTRODUCTION

At the core of the standard Real Business Cycle (RBC), research agenda is the no- tion that economic fluctuations are driven principally by exogenous changes to real factors in the economy. More generally, the primary focus of this research is based on the idea that macroeconomic or business cycle fluctuations are caused by large and cyclically volatile exogenous shocks to Total Factor Productivity(TFP)[2] - which are captured by the Solow residuals. Indeed, since its inception in the 1980s, the RBC research program has metamorphosed to become a significant area of research in macroeconomics, and its concepts and methods becoming well diffused into the mainstream macroeconomic analysis of economic dynamics. In fact, RBC research program success was not only due to the widespread theoretical appeal of this approach but also to its exceptional empirical performance. However, the practice of employing the Solow residuals as the sole source of aggregate productivity innovations in standard small open economy models suffers from numerous inherent deficiencies. Small Open Economic (SOE) models driven by shocks

[1] Florida State University, Tallahassee, USA, e-mail: eoa10@my.fsu.edu

[2] Also known as productivity

to TFP have not been able to account for counter-cyclical movements in ratios of current account to output and trade balance to output without a recourse to a low and simple adjustment cost parameter. In light of this deficiency in the standard models, this paper examines the volatility and persistence of the innovations to TFP and the Marginal Efficiency of Investment (MEI) and discovers that MEI shocks model outperforms the TFP shocks framework in matching the counter-cyclical behavior of the external accounts. For example, a paper by Justiniano, Primiceri, and Tambalotti (2008), (JPT hereafter), show that an investment shock that determines the efficiency of newly produced investment goods, as in Greenwood, Hercowitz, and Human (1988), is the key driver of business cycles in a medium-scale, estimated New-Neoclassical Synthesis model.

Moreover, because consumption accounts for a larger part of the fluctuations in output, the choice of consumption parameter design in analyzing macroeconomic fluctuations becomes crucial in RBC model. So, this paper contributes to the extant literature by introducing the choice of share of consumption in the utility to examine, more closely, the pro-cyclical behavior of investment and output in relation to SOE's external accounts.

With that being said, another objective, therefore, will be to extend the literature on the dynamic performance of the standard small open economy by considering shocks to MEI captured by innovations to a complex form of adjustment cost[3], induced by exogenous movements in the efficient production of next period's capital goods. It can be argued that shocks to MEI can account for a significant fraction of business cycle fluctuations, and thus be regarded as an important propagation mechanism for studying and understanding modern macroeconomic dynamics in the standard small open economy. The ap-proach presented here is particularly important since it provides an empirically relevant measure of productivity innovations that has been largely ignored in the open economy literature.

The paper proceeds as follows: Section 2 presents a general framework of the model Economy. Section 3 discusses the applicability of Mendoza (1991). Section 4 describes the calibration and the result of the Dynamic Stochastic General Equilib- rium (DSGE) model for the small open economy.

2. THE GENERAL FRAMEWORK OF THE MODEL ECONOMY

As it is standard in RBC literature, the author will limit the model to the case of one country with a-two-sector[4] economy receiving the streams of shocks both in technology and in Investment. Consider a small open economy populated by a large number of infinitely-lived identical agents acting as price takers in all markets in which they participate. These residents are connected to the rest of the world only through their

[3] The idea of low adjustment cost will be defeated will be defeated afterwards

[4] A representative household and firm

access to a frictionless incomplete international capital market and a market for a non-tradeable composite consumption good.

2.1 Household

A small open economy populated by a large number of identical households is described with the following preferences of expected utility function:

$$\bar{h} = [(1-\alpha)(\frac{\alpha}{r+\delta})]$$

$$E_0 \sum_{t=0}^{\infty} \theta_t U(c_t, h_t) \tag{1}$$

where c_t denotes consumption, h_t denotes hours worked and θ_t denotes the dis- count factor. The discount factor is written in this general form to allow for an endogenous specification discussed in the later section. Moreover, $\beta_c < 0, \beta_h > 0$.

This preference specification allows the model to be stationary in the sense that the non-stochastic steady-state is independent of initial conditions.

The evolution of financial wealth, b_t, is given by

$$b_{t+1} = (1 + r_t)b_t + tb_t \tag{2}$$

where r_t denotes the interest rate at which domestic residents can borrow in international markets in period t, and tb_t denotes the trade balance. In turn, the trade balance is given by

$$tb_t = y_t - c_t - i_t - \phi(1 - \Psi(\frac{i_t}{k_t}))k_t \tag{3}$$

Following Backus and Crucini (2000), physical capital formation is subject to adjustment costs, where y_t denotes domestic output, i_t denotes gross investment, assuming that Ψ is concave, therefore, in steady state, $\Psi > 0$, $\bar{\Psi}' > 0$ and $\Psi'' < 0$. Furthermore, $\Psi(\frac{I_t}{k_t}) = (\frac{i_t}{i_{t-1}})^{\eta}$ and $\eta \in (0, 1)$. The shocks, captured by φ_t, to the MEI represents an exogenous disturbance to the process by which investment goods are transformed into installed capital to be used in production. It is therefore assume
that MEI follows the stochastic process;

$$\log \phi_t = \rho_\phi \log \phi_{t-1} + \epsilon_{\phi,t} \tag{4}$$

Where $\epsilon_{\varphi,t}$ *is i.i.dN* $(0, \sigma_\phi^2)$

SOE models typically include capital adjustment costs to avoid excessive in- vestment volatility in response to variations in the domestic-foreign interest rate differential. The restrictions imposed on ϕ ensure that in the non-stochastic steady- state, adjustment costs are zero and the domestic interest rate equals the marginal product of capital net of depreciation. Output is produced by means of a linearly homogeneous production function:

$$y_t = A_t F(k_t, h_t) \tag{5}$$

where A_t is an exogenous stochastic productivity shock, its law of motion is given by;

$$\log A_t = \rho_A \log A_{t-1} + \epsilon_{A,t}, t \geq 0 \tag{6}$$

$\epsilon_{A\,t}$ *is i.i.dN* $(0, \sigma_A^2)$

Following Backus and Crucini (2000), the stocks to capital evolve according to

$$k_{t+1} = i_t + (1-\delta)k_t + \phi(1 - \Psi(\frac{i_t}{k_t}))k_t \tag{7}$$

where $\delta \in (0, 1)$ denotes the rate of depreciation of physical capital.

The model can be solved after specifying the functional form of preferences and technologies.

2.2 Endogenous Discount Factor

The most commonly used approach, introduced by Obstfeld (1981), endogenizes the discount factor. Suppose that, instead of being equal to θ_t, the discount rate is given by the following recursive relation:

$$\theta_0 = 1 \tag{8}$$

$$\theta_{t+1} = \beta(c_t, h_t)\theta_t \tag{9}$$

These form of preferences were introduced by Uzawa (1968) and are discussed thoroughly in Obstfeld (1990). Some of the papers using these preferences include Mendoza (1991, 1995), Uribe (1997) and Cook and Devereux (2000). It is assumed that $\beta'(c_t) < 0$ i.e, agents become more impatient the more they consume. The reason for making the steady-state independent of initial conditions becomes clear from inspection of the Euler equation $U'(c_t) = \beta(c_t)(1 + r_t)E_t U'(c_{t+1})$. In the steady- state, this equation reduces to $\beta(c)(1 + r) = 1$, which pins down the steady-state level of consumption solely as a function of r and the parameters defining the function $\beta(.)$.

The budget constraint of the representative household can then be summarized as follows:

$$b_{t+1} = (1 + r_t)b_t - y_t + c_t + i_t \tag{10}$$

Households choose processes $\{ct, ht, yt, it, kt+1, bt+1, \theta t+1\}_{t=0}^{\infty}$

$t = 0$ so as to maximize the utility function (1) subject to Equations (2) and (10)

and a no-Ponzi constraint of the form

$$\lim_{j\to\infty} E_t \frac{b_{t+j}}{\prod_{s=1}^{j}(1 + r_t)} \leq 0 \tag{11}$$

Again Households choose $\{ct, ht, yt, it, kt+1, bt+1, \theta t+1\}_{t=0}^{\infty}$ $t = 0$ so as to maximize the utility function (1) subject to Equations (2), (10) and (11). It can as well be summarized as follows:

$$E_0 = \sum_{t=0}^{\infty} \theta_t U(c_t, h_t) + \lambda_t[(1 + r_t)b_t + A_t F(k_t, h_t) + (1 - \delta)k_t -$$
$$c_t - k_{t+1} - \phi\Psi(1 - (\frac{i_t}{k_t}))k_t - b_{t+1}] + \lambda_t^p[\frac{\theta_{t+1}}{\theta_t} - \beta(c_t, h_t)]$$

Initial condition for exogenous state variables(A_0, ϕ_0)
Initial condition for endogenous variables(k_0, b_0)

and the first-order conditions of the household's maximization problem which hold with equality becomes;

$$\lambda_t = \beta(c_t, h_t)(1 + r_t)E_t\lambda_{t+1} \tag{12}$$

$$\lambda_t = U_c(c_t, h_t) - \lambda_t^p\beta_c(c_t, h_t) \tag{13}$$

$$\lambda_t^p = -E_t U(c_{t+1}, h_{t+1}) + E_t\lambda_{t+1}^p\beta_c(c_{t+1}, h_{t+1}) \tag{14}$$

$$-U_h(c_t, h_t) + \lambda_t^p\beta_h(c_t, h_t) = \lambda_t A_t F_h(k_t, h_t) \tag{15}$$

$$\lambda_t = \beta(c_t, h_t) + E_t\lambda_{t+1}[A_{t+1}F_k(k_{t+1}, h_{t+1}) + 1 - \delta + \phi_{t+1}(1 - \Psi'(\frac{i_t}{k_t}))k_t] \tag{16}$$

These first-order conditions appear standard, except for the fact that the marginal utility of consumption is now given by $Uc(c_t, h_t) - \beta_c(c_t, h_t)\lambda_t^p$ which replaces the conventional form of marginal utility found in the literature. The first term is the conventional marginal utility of consumption while the second term in this expression reveals the

fact that an increase in current consumption lowers the discount factor $\beta_c < 0$. Consequently, a decline in the discount factor reduces utility in period t by λ_t^p. Intuitively, λ_t^p equals the present discounted value of utility from period $t+1$ onward. This has been explained previously. Additionally, the marginal disutility of labor is capture by $Uh(c_t, h_t) - \beta_h(c_t, h_t)\lambda_t^p$. The interest rate faced by domestic agents in world financial markets is assumed to be constant and given by;

$$r_t = r \tag{17}$$

A competitive equilibrium is a set of processes $\{b_{t-1}, c_t, h_t, y_t, i_t, k_{t+1}, \lambda_t \lambda_t^p\}$ satisfying Equations (2),(3),(4),(5),(7) and (11)-(16).

3 APPLICATION : MENDOZA (1991)

The model mimics Mendoza (1991) and the major contribution of this paper is the introduction of μ, the consumption share of output, and the form of the law of motion for MEI shocks. The baseline model will be closed using the endogenous discount factor approach. Assume that the utility function has the following form:

$$U(c_t, h_t) = \frac{[c_t^{\mu_t} - \frac{h_t^{\omega}}{\omega}]^{1-\gamma} - 1}{1-\gamma} \tag{18}$$

where

$$\omega > 1, \gamma > 1, \mu > 0$$

The functional forms of the period utility function and the discount factor imply that the marginal rate of substitution between consumption and leisure depends only on labor.

$$\beta_t = \beta(c_t, h_t) = [1 + c_t^{\mu_t} - \frac{h_t^{\omega}}{\omega}]^{-\psi} \tag{19}$$

The production function is given by

$$F(k_t, h_t) = k_t^{\alpha} h_t^{1-\alpha} \tag{20}$$

where $\alpha \in (0, 1)$ is the share of capital in national income of capital expenditure. Finally, the cost of adjustment function has the form:

$$\Phi(1 - \Psi(\frac{i_t}{k_t}))k_t = \phi(1 - (\frac{i_t}{k_t})^{\eta})k_t \tag{21}$$

where $\phi > 0$ and $\Psi(\frac{i_t}{k_t}) = (\frac{i_t}{k_t})^{\eta}$

These specifications along with the calibrated parameters in Table 1 follow Mendoza (1991). However, the following sets of equation satisfy the steady state equations,

combining equations (13) and (15) yield

$$h_t^{\omega-1} = A_t F_h(k_t, h_t) \tag{22}$$

The equation impliess that the labor supply depends only upon the wage rate and independent of the level of wealth. The right-hand side is the marginal product of labor, which in equilibrium equals the real wage rate while the left-hand side is the marginal rate of substitution of leisure for consumption.

In steady states,

$$\bar{h} = [(1-\alpha)(\frac{\alpha}{r+\delta})^{\frac{\alpha}{1-\alpha}}]^{\frac{1}{\omega}-1} \tag{23}$$

$$\frac{\bar{h}}{\bar{k}} = (\frac{r+\delta}{\alpha})^{(\frac{1}{1-\alpha})} \tag{24}$$

$$k = \frac{\bar{h}}{\frac{\bar{h}}{\bar{k}}} \tag{25}$$

$$i = \delta k \tag{26}$$

$$y = \bar{k}^{\alpha}\bar{h}^{1-\alpha} \tag{27}$$

$$\bar{c} = ((1+r)^{\frac{1}{\psi}} + \frac{\bar{h}^{\omega}}{\omega} - 1)^{\frac{1}{\mu}} \tag{28}$$

$$\bar{\lambda} = (\bar{c}^{\mu} - \frac{\bar{h}^{\omega}}{\omega})^{-\gamma} \tag{29}$$

$$tb = y - c - \bar{i} \tag{30}$$

$$n\bar{f}a = \frac{\dot{t}\bar{b}}{r} \tag{31}$$

$$tb_y = \frac{tb}{\bar{y}} \tag{32}$$

$$ca_y = \frac{-r * nfa + \dot{t}b}{y} \tag{33}$$

$$\bar{A} = 1 \tag{34}$$

$$\bar{\phi} = 1 \tag{35}$$

and in equilibrium,

$$\beta_c = \frac{(1 + c_t^{\mu} - \bar{c})^{-\psi}}{1 + r}; \psi \geq 0 \tag{36}$$

since $\frac{1}{c_t} = (1 + r)\beta_c E_t \frac{1}{c_{t+1}}$

Therefore, the set of equations that will characterize first-order log-linearization includes

$$\lambda_t = \beta(c_t, h_t)(1 + r_t)E_t\lambda_{t+1} \tag{3.1}$$

$$\lambda_t = U_c(c_t, h_t) - \lambda_t^p \beta_c(c_t, h_t) \tag{3.2}$$

$$\lambda_t^p = -E_t U_(c_{t+1}, h_{t+1}) + E_t \lambda_{t+1}^p \beta_c(c_{t+1}, h_{t+1}) \tag{3.3}$$

$$-U_h(c_t, h_t) + \lambda_t^p \beta_h(c_t, h_t) = \lambda_t A_t F_h(k_t, h_t) \tag{3.4}$$

$$\lambda_t = \beta(c_t, h_t) + E_t\lambda_{t+1}[A_{t+1}F_k(k_{t+1}, h_{t+1}) + 1 - \delta + \phi_{t+1}(1 - \Psi'(\frac{i_t}{k_t}))k_t] \tag{3.5}$$

$$tb_t = y_t - c_t - i_t - \phi(1 - \Psi(\frac{i_.}{k_t}))k_t \tag{3.6}$$

$$\log A_t = \rho_A \log A_{t-1} + \epsilon_{A,t}, t \geq 0 \tag{3.7}$$

ϕ_i can be comparable to a form of technological progress restricted to the produc- tion of investment goods in a representation of economy that follows the stochastic process.

$$\log \phi_t = \rho_\phi \log \phi_{t-1} + \epsilon_{\phi,t} \tag{3.8}$$

This procedure allows us to rewrite the non-linear original system of the form

$$E_t f(x_{t+1}, x_t) = 0 \tag{37}$$

where all the variables are elements of the vector x_t, to a linear system of the form

$$AE_t x_{t+1} = Bx_t \tag{38}$$

where A and B are 8x8 matrices whose elements are functions of all the structural parameters. The 8 equations that form the linearized equilibrium model contain 4 state variables, $\hat{k}_t, \hat{b}_t, \hat{\theta}_t$ and $\ddot{A}_t$ and 4 control variables $\dot{c}_t, \dot{h}_t, \ddot{\lambda}_t$, and $\ddot{\lambda}_t^p$}. Finally, the system has 4 initial conditions $\hat{k}_0$, $\ddot{b}_0$, $\hat{A}_0$ and $\hat{\theta}_0$. However, the author imposes the boundary condition;

$$\lim_{j \to \infty} |E_t x_{t+j}| = 0 \tag{39}$$

4 CALIBRATION AND THE RESULT OF SMALL OPEN ECON- OMY

The calibration of the model implies choosing values for the model parameters such that certain features of the model match the corresponding values observed in the time series of the real economy over a certain time horizon[5]. The parameters of the model are chosen such that features of the non-stochastic steady state of the model match as much as possible the data averages over certain time period. In addition, the parameters of the shock processes are set such that the simulated stochastic properties of the model match the statistical properties of the fluctuation in the observed data, the observed data are found in extant RBC literatures. The capital adjustment cost parameter η is set so that the standard deviation of investment is about three times that of output. The values of parameters σ and ρ are chosen to mimic the variability and the first order serial autocorrelation of output, Gross Domestic Product(GDP) to be approximately 3% of the fluctuations, values of the parameters can as well be determined by the Solow residuals but McCallum (1989) opined that once adjustment costs and fluctuations in the terms of trade are con- sidered, Solow Residuals are not a good proxy for productivity shock. The world interest rate r is set to the values suggested by Kydland and Prescott (1982) for the U.S economy. The parameter γ takes two different values in an attempt to avoid confusion in using point estimates. Prescott (1986) opined that γ is not likely to be greater than 1. The depreciation rate, δ has the value commonly used in the RBC literature. The parameter ω is in the range of the estimates of James Heckman and Thomas Macurdy (1980) obtained for the inter-temporal elasticity of substitution in labor supply and this value enables the model to mimic the percentage variability of hours. β is determined by the steady state condition that equates the rate of time preference with the world interest rate.

The function Ψ captures the presence of adjustment costs in investment which can be evaluated in η while ϕ is the shocks to the MEI which appear to be the basis of this paper. in fact, MEI innovations influence the efficiency with which goods can be turned into capital ready for production. The construction of the adjustment cost in this paper is one of the features that set this model from those in most existing studies.

[5] For the time series data, refer to Mendoza (1991)

Table 1: *Calibrated Parameter Values for the Model Household*

β	0.11	The Consumption Elasticity of the Rate of Time Preference
α	0.32	Share of Capita
δ	0.1	Shopping Time Technology
γ	1.001	Constant Relative Risk Aversion
ω	1.455	1 Plus the Inverse of the Inter-temporal Elasticity of Substitution in Supply
ψ	0.1114	Discount Rate
r	0.04	World Interest Rates
η	0.6	Adjustment Cost Parameter
ρA	0.42	Persistent Parameter in Productivity Shock
ρφ	0.6	Persistent Parameter in MEI Shocks
μ	0.7	Share of Output in Utility
σA	0.01277	Productivity Shocks Process
σΨ	1.00	Share of Consumption in Output
σφ	0.00656	MEI Shocks Process

4.1 Approximate Solution

Though Mendoza (1991) solves the model by iteration, the author approximates the solutions by log-linearizing the equilibrium conditions around the steady-state.

4.2 Standard Deviation Shocks of Productivity ($\in_{A\,t}$)

This subsection presents impulse response functions of the simulated economy and describes some features of the models. Standard solution techniques can be applied once growing real variables are normalized so that all variables in the deterministic version of the model converge to a constant steady state. The responses of all the variables to a positive productivity shocks, *A* is considered in Figure 1. The positive shocks cause the ratio of capital account to output, ratio of trade balance to output and Bonds to decrease but later increase before returning to the steady states, while there is an apparent increase in consumption, capital, labor supply and gross investment sequel to the shocks. Another feature of the impulse response of the productivity shocks is the fact that all variables of the economy capture in this model converge to a steady state after their initial increase. The decrease in investment after the shocks can be explained by the impulse responses of the ra- tio of capital account to output, ratio of trade balance to output and bonds. The results are plausible as the reaction of economy to the technology shocks is analogous to that published in the real business cycle literature. While output and labor supply sluggishly returns to their steady states in periods 25 and 45 respectively, consumption returns to its steady state very slowly making consumption response non-contemporaneous . The responses of trade

balance,current account investment and bonds are contemporaneously observed and they all return to their steady faster and quicker than consumption, labor supply, output and productivity. The slow adjustment to steady states of consumption is actually affected by, first, the endoge nous time preference and, secondly, its relative share of utility. The closer the share of consumption in utility is to zero, the faster the consumption returns to its steady state and the closer it is to 1, the longer it takes for consumption to return to its steady states. The intuition behind these results is simple; in this economy, agents become more impatient as consumption increases but less impatient as consumption decreases. Thus, as the elasticity of the discount factor increases, the representative household is willing to trade off a lower consumption today for the future.

4.3 Impulse Response: Productivity Shocks

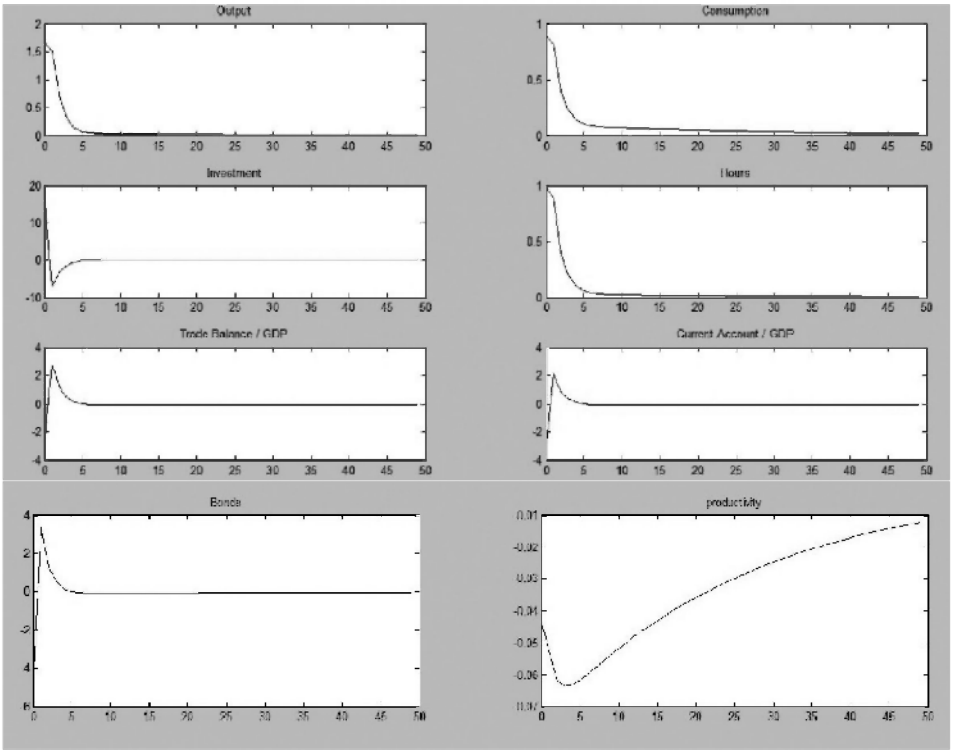

Figure 1: *Impulse Response: Productivity Shocks*

The expansion in consumption, investment and labor supply are caused by productivity shocks . The implication of this is that as investment and consumption increase, trade balance is expected to decline because of the inverse relationship that exists between them. Moreover, since the relationship between bonds and trade balance is positive and

because trade balance indicates a negative response to the increase in consumption and investment thus, bonds is also negatively responsive to the shocks. The same effect is obtained in current account; the pro-cyclical responses of these economic variables are strongly determined by cycles of investment. So, holding every other thing constant, an increase in output with corresponding increase in do- mestic investment and consumption will cause labor schedule to rise[6]. Because the increase in output is larger than the increase in consumption and because a rise in investment occurs through an increase in savings so, in good times, a small open economy will do well by saving. Increase in saving consequently, deteriorates trade balance, current account and bonds[7] . The deterioration results in countercyclical responses that freeze the opportunity for foreign exchange earnings.

The volatility of the variables in one percent standard deviation shocks is captured in Table 2 and Table 3 below. In table 2, the fluctuations of the variables are examined with $\gamma = 1.001$ while in table 3, the fluctuations are considered with $\gamma = 2.0$

Table 2: *Standard Deviation, Correlation Co-efficient and Serial Auto Correlation* ($\in_{A.P}$) *when* $\gamma = 1.001$

γ = 1.001	Standard Deviation (%)	Correlation with Output	Serial Correlation	Canadian Data σ Mendoza '91
σy	3.0284	1.00	0.6708	2.81
$\frac{\sigma_c}{\sigma_y}$	0.5686	0.9781	0.7198	2.46
$\frac{\sigma_i}{\sigma_y}$	7.1655	0.3022	-0.2822	9.82
$\frac{\sigma_h}{\sigma_y}$	0.5937	0.9994	0.6776	2.02
$\frac{\sigma_k}{\sigma_y}$	0.7105	0.9442	0.4405	1.38
Ca_t	4.6001	-0.0763	-0.2779	7.31
Tb_y	4.7334	-0.0567	-0.2758	1.87

[6] The contemporaneous rise in consumption is augmented by an increase in investment

[7] Foreign debt holding

Table 3: *Standard Deviation, Correlation Co-efficient and Serial Auto Correlation* ($\in_{A.t}$) *when* $\gamma = 2.00$

γ = 2.0	Standard Deviation (%)	Correlation with Output	Serial Correlation	Canadian Data σ Mendoza'91
σ_y	3.0092	1.00	0.6730	2.81
$\frac{\sigma c}{\sigma y}$	0.5591	0.9763	0.7187	2.46
$\frac{\sigma i}{\sigma y}$	7.0900	0.3071	-0.2822	9.82
$\frac{h}{\sigma y}$	0.5927	0.9970	0.6862	2.02
$\frac{\sigma k}{\sigma y}$	0.7113	0.9462	0.4535	1.38
Ca_y	4.5377	-0.0971	-0.2772	7.31
Tb_y	4.6535	-0.2719	-0.0813	1.87

Tables 2 and 3 above reveal the fluctuations (volatility) of the variables. These results are close to and similar to Mendoza (1991) results with virtually same a-priori expectations. The slight difference in the results is associated with the introduction of 2 other parameters, μ and η, and 1 other equation, law of motion for MEI shocks. The models predict that the components of aggregate demand and hours are pro-cyclical and that the correlation of the trade balance, current account with GDP is very low. The models also estimate the procyclicality of labor in that its correlation with GDP is perfect. In the data, Mendoza (1991) examined the correlation between hours and output to be 0.799 but his models imply a perfect correlation. The same perfect correlation between hours and output is obtained in his study and this is driven by $\frac{w_t h_t}{y_t} = (1-\alpha)$ with $\alpha < 1$.

What can be inferred from this analysis is that when shocks to total factor productivity is considered, the model behavior is generally consistent with the predictions of the neoclassical macroeconomic theory. A significant success of these models framework is its ability to mimic the negative correlation between the $\frac{CA}{Y_t}$ and $\frac{TB}{Y_t}$ ratios and output observed in the data found in mendoza (1991). Moreover, these models provide volatility statistics for output, consumption, investment, bonds, productivity and labor supply that are similar to those found in their empirical counterparts. However, the models generated volatility of output that were considerably higher than those seen in the data. The inverse relationship between trade balance and current account also explains the reason for a subsequent rise in savings which translates into an increase in investment of a small open economy. Investment is more volatile[8] than every other macroeconomic variables especially, consumption, labor supply and capital[9] in the representative economy.

[8] This form the basis of this study

[9] Capital is used synonymously with productivity

4.4 Standard Deviation Shocks of MEI ($\in_{\phi t}$)

This section presents the main results in terms of impulse responses of the macroeconomic variables to one standard deviation shocks of MEI . The results so far suggest that, to understand business cycles, we must understand investment shocks, because these shocks are the largest contributors to fluctuations in several key macroeconomic variables.

Figure 2 displays the impulse response to the MEI shocks $\phi_{.}$. Following a positive shock, output, consumption, labor supply, and investment rise persistently in a hump-shaped pattern. This increase, unlike the productivity shocks, is noncontemporaneous.

4.5 Impulse Response: MEI Shocks

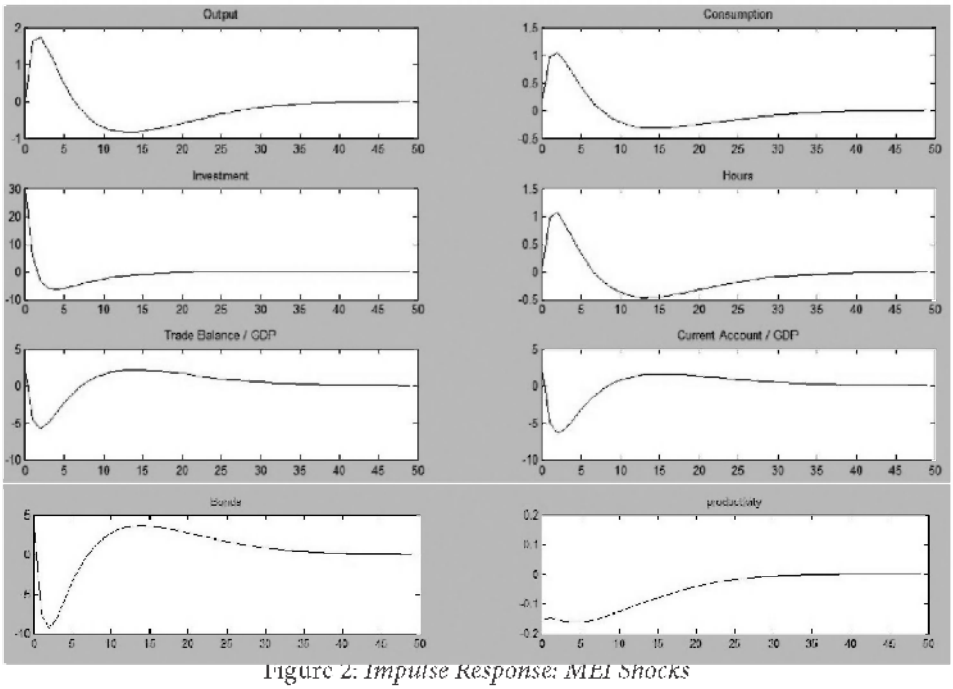

Figure 2: *Impulse Response: MEI Shocks*

There is a co-movement and immediate rise in investment, trade balance, current account and bonds while the increase in output, consumption and labor supply is delayed for one period episode with a very sluggish increase in productivity. A rise in consumption compresses trade balance and current account and the reason for the compression stems from the theoretical modeling of the variables which can be obtained in the computation of its correlation coefficients. These results confirm JPT (2008) conclusion which summarily assume that the observability of the relative

price of investment does not significantly affect the interference on the MEI shock ϕ_t.

The impulse responses in figure 2 support the business cycle fluctuations found in SOE literatures. Therefore, the decrease in output between periods 10 to 20 is associated with the decrease in investment after the shocks. These temporary shocks are typical textbook explanations of investment shocks. One time decrease in investment causes output to experience few episodes of decrease which consequently decreases consumption and labor supply. This period is the actual recession for the simulated economy. So the macroeconomic variables sluggishly recover from recession even when investment recovers faster after hitting recession because of the delay process of the growth transmission mechanism through other macroeconomic variables. The rise in investment is greater than the rise in any other macroeconomic variables; same as what is obtainable in productiv- ity shocks. It is pro-cyclical pattern that explains why investment shocks are so important in times of recession and it reveals the main source of fluctuations in SOE.

A shock to investment results in upward movement in the ratio of trade balance to output and ratio of current account to output. These results are contrary to what the author observed in the productivity shocks. However, there is a deep decrease in these two macroeconomic variables after the initial rise before returning to their steady states. The same explanation is applicable to bonds. One nice feature of these results is the fact that, while output, consumption, labor supply, trade balance, bonds and current account returns to their steady states in 35th period, investment returns to its steady state in 20th period. Moreover, trade balance, current account[10] and bonds experience another episodes of an increase after their initial decrease. These results also explain how sensitive a small open economy can respond to initial experience of recession. An increase in economic output is expected to mitigate the short fall in domestic investment. Additionally, a rise in investment in SOE promotes exportation which further enhances the accumulation of foreign exchange. With that being said, the opportunity cost for such economy is the present consumption that is foregone.

4.6 Second Moments of 1 % Shocks in MEI

In a real Neoclassical model, technology shocks appear to be the main source of business cycles because they can easily spawn same responses of output, consumption, investment, labor supply, etc. To emphasize these results, Barro and King (1984) argue that investment shocks are unlikely candidates to generate recognizable business cycles because the co-movement among the variables in response to the shocks is somewhat problematic. Barro and King (1984) provided a basis that a positive shock to the marginal efficiency of investment will create an increase the interest rate which will consequently, induce agents to postpone or delay consump- tion. With lower consumption, the in-

[10] The author implies the ratio of trade balance to output and ratio of current account to output

crease in marginal utility of income causes a right shift in labor supply while holding the labor demand constant. But contrary to Neoclassical assertion, investment shocks generate pro-cyclical movements in all the macroeconomic variables identified in this study and as such, emerge the important source of business cycles fluctuations. In a Neoclassical baseline model, efficiency equilibrium is attained when the Marginal Rate of Substitution (MRS), which depends positively on consumption and labor, equals Marginal Productivity of Labor (MPL), a decreasing function of labor supply. For an equilibrium to hold in Neoclassical model of Barro and King (1984), a good shock to labor supply must generate a corresponding fall in consumption; which is why the rigidity of investment shocks could not account for the fluctuations in macroeconomic variables. In this study, the author focuses on labor demand schedule instead of labor supply. The share of consumption of output affects the MRS and the shocks to the productivity affect labor productivity and consequently labor supply. There is always a time lag for an increase in income of households to adjust to a change in consumption. This time lag creates a lax willingness that makes it impossible for consumption to fall in the wake of investment shocks.

Moreover, endogenizing capital utilization acts as a shift lever to MPL such that an efficient utilization of new investments - due to a decrease in relative prices- create a rise in the utilization of existing capital and through a functional transmission mechanisms, higher capital utilization causes an increase in MPL which in turn shifts labor demand to the right by holding labor supply schedule constant.

Table 4: *Standard Deviation, Correlation Co-efficient and Serial Auto Correlation* (φ_t) *when* $\gamma = 2.00$

γ = 2.0	Standard Deviation(%)	Correlation with Output	Serial Correlation
σ_y	3.0096	1.00	0.9154
$\frac{\sigma c}{\sigma y}$	0.5338	0.9863	0.9127
$\frac{\sigma i}{\sigma y}$	7.666	0.0367	0.3135
$\frac{\sigma h}{\sigma y}$	3.0744	0.9985	0.9141
$\frac{\sigma k}{\sigma y}$	1.9141	0.9142	0.9164
Ca_y	9.2262	-0.8631	0.8143
Tb_y	9.2528	-0.977	0.8394

Table 5: *Standard Deviation, Correlation Co-efficient and Serial Auto Correlation (φ_t) when $\gamma = 1.001$*

γ = 1.001	Standard Deviation (%)	Correlation with Output	Serial Correlation
σ_y	2.6831	1.00	0.8983
$\frac{\sigma c}{\sigma y}$	0.5284	0.9552	0.9054
$\frac{\sigma i}{\sigma y}$	8.2800	-0.0076	0.3186
$\frac{\sigma h}{\sigma y}$	0.5853	0.9988	0.8987
$\frac{\sigma k}{\sigma y}$	1.8835	0.8962	0.8982
Ca_y	8.5656	-0.8947	0.8065
Tb_y	8.2579	-0.9713	0.8187

Tables 4 and 5 report the contribution of the MEI shocks in the model to the fluctuations of macroeconomic variables at business cycle frequencies. These results are in line with the findings in Schmitt-Grohe and Uribe (2008). The important point that emerges from Tables 4 and 5 is that MEI shocks are the key drivers of business cycle fluctuations with a share of consumption playing a larger role in household utility. The volatilities of the macroeconnomic variables caused by MEI shocks are greater than those obtained in productivity shocks.

The result shows that business cycles are driven primarily by shocks that affect the transformation of investment goods into installed capital (MEI shocks), rather than that of consumption into investment goods (IST shocks) as claimed in Fisher (2005). In the model, the MEI shocks represent disturbances to the process by which investment goods are converted into capital goods. This process explains an excess capacity and inefficient use of physical resources when the rates of investment are determined by adjusting the randomness of the innovations captured by ϕ_t. Sometimes the creation of productive capital is a smooth and efficient process and sometimes it is not.

From Tables 2 to 5 above, where the ability of the two models[11] to mimic key moments in the data is compared, both models perform unsatisfactorily in matching the corresponding statistics observed in the Canadian data. The volatilities and first-order autocorrelation statistics of the variables of interest in both models are lower than those observed in the data - and in some cases the statistics are significantly larger. Comparatively, in the MEI shocks framework, the volatilities of all the macroeconomic variables are even larger in size than those obtained in productivity shocks. So, while some results are different from those obtained in the data, some are closely approximated. In the productivity shocks model setup, the ranking of the volatility of consumption and output departs

[11] Where γ is 2.0 and 1.001

from its counterpart in the data and the volatilities of trade balance and current account surpass that of investment in MEI shock.

Despite having second moments that are somewhat similar, it becomes apparent by looking at the respective impulse responses for the productivity shocks and MEI shocks models provided in Figure 1 and Figure 2 respectively, that the dynamic behavior of the model economy under the two propagating mechanisms are considerably different. In fact, in both models, the dynamic path taken by the variables considered differ appreciably. This outcome is not entirely surprising because the nature and initial impact of the two innovations under consideration are different. It is quite evident that the lack of income effect in the first period from the MEI shocks contribute significantly to these differences in the initial periods. For example, in the case of the standard productivity shocks, current output [12] were affected contemporaneously and consequently, firms respond by increasing the amount of labor allocation in the first period which synchronizes the immediate increase in current output. Whereas in MEI shocks model, the response is not only more delayed but cyclical. Indeed, changes in labor supply and capital decisions will only occur in the second periods onwards and the response of labor supply to that shocks will be more sluggish than it is generally the case. The slow response to MEI shocks explain the hump-shape dynamic path in output, consumption and labor supply compared to the productivity shocks model. There is co-movement in labor supply, consump- tion and output. This co-movement is due to perfect correlation the variables have with output. A different co-movement also occurs in trade balance, current account and bonds; the same justification for the preceding conclusion. So, the shocks to investment in SOE create an immediate rise in foreign exchange earnings due to exportation.

5. CONCLUSION AND SUGGESTED FURTHER STUDIES

Over the course of some years, many of the goods we consume have experienced dramatic changes in quality and taste. Most of these changes have been due to innovations that occurred slowly but steadily but this has become a fact that has been largely ignored by the international real business cycle literature and it is in the author's opinion to explain justifications for the discrepancies that exist between theoretical model predictions and actual data estimates. Interestingly, these discrepancies have dwindled in recent years. How can we arrive at a theory that explains both the reasons for these puzzles as well as their gradual vanishment?

The models described in this study provide some clarifications for looking at the impact of innovations to MEI[13] when the level of investment goods changes in a small open economy. As with the standard productivity shocks model[14], shocks to MEI were able to generate significant macroeconomic fluctuations in the small open economy. The au-

[12] As well as marginal productivity of labor and current capital

[13] Is captured by shocks to adjustment costs

[14] Is generally consistent with Neoclassical economic predictions

thor confirmed this from the second moments of the two (2) shocks and compared it to the Canadian data of Mendoza '91. Most significantly, the model was able to generate the pro-cyclical behavior of the external accounts when the model was augmented with share of consumption in the utility, μ, and an appealing adjustment cost parameter. This is in contrast to the productivity shocks model in which the external accounts remains counter-cyclical; this result supports the empir- ical evidence of the small open economy. Moreover, the conjecture that the standard productivity shocks model requires an artificially low value for the adjustment cost parameter to generate the counter-cyclical movement in the external account has been confirmed otherwise in this paper. In fact, a shock to a complex and appealing adjustment cost parameter produces a profound and valid pro-cyclical pattern of investment and this explains why investment shocks are so important in times of recession and thus, reveals the main source of fluctuations in a small open economy.

Despite these plausible results, the models are limited by some unavoidable deficiencies. First, some of the volatilities of productivity shocks are oversimplified when compared to data especially, output, investment, ratio of trade balance to output and current account while the volatilities of MEI shocks are all oversimplified. Secondly, the choice of frictions used in this paper might as well limit the result of this research work. Therefore, these limitations attract future studies. The author suggests further studies to include frictions in relative price of investment and Investment Specific Technology (IST). Additionally, other sectors of the economy must be studied and this does not exclude the financial sector. Impact of fiscal and monetary policies must also be examined in the future; these policies should consider frictions that have lasting impact on the economy. Extension should also be considered in the area of Moral Hazard.

Above all, this study has helped to attribute investment shocks as the major source of macroeconomic fluctuations in a small open economy by a careful, in a way that has never been done by any author, construction of a continuous adjustment cost function and by embedding the form of the share of consumption in utility. Consequently, the results of the productivity shocks are compared with the MEI shocks and the author established that the variabilities in MEI shocks are more pronounced than the variabilities in productivity shocks. The author's choice of models sets his study apart from other relevant studies.

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AGRICULTURAL TRADE LIBERALISATION AND GROWTH IN INCOME OF RURAL HOUSEHOLD IN BANGLADESH: A QUINTILE-GROWTH APPROACH TO THE ANALYSIS OF DISTRIBUTIONAL CONSEQUENCES

DAYAL TALUKDER[1]
LOVE CHILE[2]

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ABSTRACT: *The study has investigated the growth in income of rural households in Bangladesh with a view to analysing distributional consequences in the post-liberalisation era. Using data from secondary sources, it has applied a quintile-growth approach by dividing each group of households into five income clusters (quintiles) to analyse the incidence of growth in real income. It has found that although all groups of rural households experienced a moderate to high increase in real income, non-farm households experienced a larger increase than farm households due to a large reduction in consumer price. Farm households gained from the increase in productivity but experienced losses from producer price reduction. The two opposite forces – increase in productivity and reduction in producer price – offset the effects of each other, thereby affecting the income growth of farm households. Amongst the farm households, large and medium farmers gained the most and small farmers gained the least from the growth in real income, indicating that rich households experienced a much higher increase in real income than poor households – thereby adversely affecting the distribution of income and widening the income gap between rich and poor households. These findings demonstrated that while agricultural trade liberalisation benefited rural households generally, the benefits were not distributed equally and in fact, inequality increased amongst rural households. This study argues that the growth in real income of rural household was not pro-poor during 1985-86 to 2005. This study suggests that agricultural trade liberalisation contributed to higher growth in the rural economy but it contributed to greater inequality in income distribution amongst the rich and poor income groups (quintiles). Government should reduce inequality through policy interventions with income transfer from the rich to the poor.*

Key words: *Agricultural trade liberalisation, growth in income, inequality, rural households, Bangladesh*
JEL classification code: D31, D63, F19

[1] ICL Business School, Auckland, New Zealand, e-mail: dayal@icl.ac.nz

[2] Auckland University of Technology, Institute of Public Policy, Auckland, New Zealand, e-mail: love.chile@aut.ac.nz

1. INTRODUCTION

Bangladesh went through a series of deregulation and agricultural trade liberalisation measures in the late 1980s and early 1990s with a view to increasing productivity in agriculture and achieving self-sufficiency in food-grain production. Major reforms in agricultural policy included liberalisation of input markets, shrinking the role of government agencies in distribution of inputs, substantial reduction and rationalisation of tariffs, removal of quantitative restrictions, moving from multiple to a unified exchange rate, and from fixed to a flexible exchange rate system (Ahmed *et al.*, 2007: 9; Ahmed and Sattar, 2004: 11, 12; Hoque and Yusop, 2010: 39; Hossain and Verbeke, 2010: 78; Islam and Habib, 2007: 4; Moazzem *et al.*, 2012: 9; Salim and Hossain, 2006: 2569). Agricultural trade liberalisation generated significant impacts on major structural reforms and technological transformation in rice production, enabling the country to achieve self-sufficiency in food-grain production in the early 1990s (Ahmed and Sattar, 2004: 19; Faroque *et al.*, 2013: 2; Islam and Habib, 2007: 4; Klytchnikova and Diop, 2006: 3).

Despite this impressive growth performance, the rate of decline in the incidence of poverty over the two decades 1990-2010 was rather insignificant. The decline in poverty was an average of less than 1 percent (over the twenty-year period), leaving poverty at a remarkably high level – with more than 40 percent of the country's population and the majority of them in rural areas (Ahmed and Sattar, 2004: 18; BBS, 2007b: 57; Klytchnikova and Diop, 2006: 2; Ministry of Finance, 2010: 177). Thus, a significant question arises – to what extent has agricultural trade liberalisation influenced the income distribution (welfare) of rural households in Bangladesh? Therefore, the focus of this study is to examine the growth in real income of rural households in the post-liberalisation era.

The following sections include agricultural trade liberalisation scenarios in Bangladesh, literature review, methodology and research design, result discussion and analysis, and conclusion.

2. AGRICULTURAL TRADE LIBERALISATION SCENARIOS IN BANGLADESH

Like many other developing countries in the world, Bangladesh had pursued inward-looking policies and strategies for trade and development since its independence in 1971. These policies involved high government interventions in almost all economic activities including agriculture (Ahmed, *et al.*, 2007: 2, 7; Draper and Sally, 2005: 3; Hoque and Yusop, 2010: 1; Rahman, 2008: 5). Bangladesh encouraged cooperative farming with a view to developing a socialist system of agriculture during the 1970s. The government controlled the procurement and distribution of seeds, fertilisers, pesticides, irrigation equipment and all other agricultural inputs (Ahmed, *et al.*, 2007: 2, 7; Ahmed and Sattar, 2004: 11; Salim and Hossain, 2006: 2568).

The government adopted import substitution policies with restrictions on imports to protect and support domestic production. It controlled the foreign trade and exchange

rate system for making interventions effective (Ahmed and Sattar, 2004: 11; Krueger, 2010: 2; Nahar and Siriwardana, 2009: 327; Salim and Hossain, 2006: 2568). A series of measures including quantitative restrictions, highly differentiated tariff rates (ranging from 0 to 400 percent), huge production subsidies, and overvalued exchange rates were put in place to protect domestic production from world competition (Ahmed, *et al.*, 2007: 7; Ahmed and Sattar, 2004: 11; Nahar and Siriwardana, 2009: 327; Salim and Hossain, 2006: 2568).

The government reinforced this protective environment with domestic market policy interventions in the form of credit ceilings, price controls, and arbitrary licensing such as import licence. These licences were granted only when there was no domestic source of supply available (Ahmed, *et al.*, 2007: 19; Islam and Habib, 2007: 10, 14; Krueger, 2010: 2; Salim and Hossain, 2006: 2568). Moreover, traditionally, a government department – the Bangladesh Agricultural Development Corporation (BADC) – had the sole authority and responsibility for procurement and distribution of agricultural inputs including fertilisers, irrigation equipment, pesticides and seeds (Ahmed, et al., 2007: 19, 21; Islam and Habib, 2007: 10, 14; Rahman, 2008: 13; Salim and Hossain, 2006: 2568).

However, these inward-oriented trade policies were not successful in terms of trade expansion as well as import substitution. These policies did not result in a sustained increase in production and productive efficiency. Rather, the gap between demand for and supply of agricultural goods widened over the years (Ahmed, *et al.*, 2007: 7; Hoque and Yusop, 2010: 39; Salim and Hossain, 2006: 2568). With a growing dissatisfaction regarding inward-looking trade and development policies, the sustainability of the government interventions towards long-term food-grain availability was questioned due to the increased inefficiency and corruption in the public management system and the heavy budgetary burden imposed by these operations (Ahmed, *et al.*, 2007: 6, 7; Dorosh and Shahabuddin, 2002: 38; Hoque and Yusop, 2010: 39; Krueger, 2010: 5; Salim and Hossain, 2006: 2569).

Realising such inefficiencies as well as constant pressures from the donor countries and international development agencies such as the World Bank and the IMF, the government started to pursue a policy-shift from state intervention to more market-oriented policies in the mid 1980s with a view to achieving high economic growth and reducing poverty (Ahmed, *et al.*, 2007: 9; Hoque and Yusop, 2010: 39; Hossain and Verbeke, 2010: 78; Islam and Habib, 2007: 3; Nahar and Siriwardana, 2009: 327; Rahman, 2008: 11; Salim and Hossain, 2006: 2567, 2569). Deregulation and agricultural trade liberalisation generated a momentum that began in the late 1980s and peaked in the early 1990s. Major reforms in agricultural policy included liberalisation of input markets, shrinking the role of government agencies in distribution of inputs, substantial reduction and rationalisation of tariffs, removal of quantitative restrictions, moving from multiple to a unified exchange rate, and from fixed to a flexible exchange rate system (Ahmed, *et al.*, 2007: 9; Ahmed and Sattar, 2004: 11, 12; Hoque and Yusop, 2010: 39; Hossain and Verbeke, 2010: 78; Islam and Habib, 2007: 4; Salim and Hossain, 2006: 2569).

Similarly, the government pursued a wide range of policy reforms to liberalise agricultural input markets including privatisation of the distribution system of key agricultural inputs, initiatives for deregulation measures to improve the investment climate for private enterprises, gradual elimination of subsidies on fertilisers and small irrigation equipment, and improving the maintenance of agricultural equipment through encouraging participation of the private sector (Ahmed, 2004: 11, 12; Ahmed, *et al.*, 2007: 9; Klytchnikova and Diop, 2006: 3; Salim and Hossain, 2006: 2569).

As a consequence of these reforms, the fertiliser trade was almost entirely handled by the private sector in 2005 (Ahmed, *et al.*, 2007: 19, 20; Ahmed and Sattar, 2004: 13, 19; Klytchnikova and Diop, 2006: 3; Salim and Hossain, 2006: 2569). Further policy reforms included rationalisation or elimination of import duties on agricultural inputs and spare parts; elimination of the government monopoly in fertiliser imports; and abolition of standardisation requirements (Ahmed, *et al.*, 2007: 19, 20; Ahmed and Sattar, 2004: 13, 19; Klytchnikova and Diop, 2006: 3; Salim and Hossain, 2006: 2569).

There were encouraging responses to these liberalisation and reform initiatives from market forces. Therefore, the private sector participation in the input market rose sharply. Irrigation equipment became cheaper and farmers had easy access to the equipment. Different types of high yielding variety (HYV) seeds were available to farmers, thereby promoting both extensive and intensive cultivation by increasing the irrigated area and use of fertilisers (Klytchnikova and Diop, 2006: 3; Salim and Hossain, 2006: 2569).

Consequently, agricultural trade liberalisation generated significant impacts on economic growth through productivity improvement in the agricultural sector. It contributed to technological innovation in agriculture, leading to productivity improvement of agricultural inputs (Ahmed and Sattar, 2004: 19; Islam and Habib, 2007: 4; Klytchnikova and Diop, 2006: 3). The reform measures – including liberalisation of the input markets for fertilisers, pesticides, and irrigation equipment and adoption of high yielding variety seeds for rice production – led to major structural reforms and technological transformation, resulting in a significant increase in productivity and growth in the agricultural sector. Technological changes in agricultural production enabled the country to achieve self-sufficiency in food-grain production in the early 1990s (Ahmed and Sattar, 2004: 19; Islam and Habib, 2007: 4; Klytchnikova and Diop, 2006: 3). The rising volume of rice production was accompanied by a decline in rice prices during 1990-2009. Moreover, because of significant structural transformation and technological changes, productivity of this sector was at its highest level (BBS, 2009: 3; Klytchnikova and Diop, 2006: 2; Ministry of Finance, 2010: 84).

These structural transformations reflected the government's efforts to open the economy, liberalise agricultural trade and reform domestic markets in the 1980s and 1990s (Ahmed and Sattar, 2004: 12; Klytchnikova and Diop, 2006: 2). They enabled the economy to achieve a significant growth in the 1990s – increase in real GDP by an average of 4.2 percent per year and significant increases in agricultural production (Klytchnikova and Diop, 2006: 2; Salim and Hossain, 2006: 2570).

3. LITERATURE REVIEW

Advocates of trade liberalisation argue that agricultural trade liberalisation will expand the small domestic market, provide access to foreign direct investment, create greater competition, facilitate technology transfer, generate marketing networks, and provide much-needed technical and managerial skills, resulting in higher economic growth (Annabi *et al.*, 2006: 4; Henry *et al.*, 2009: 237; McCulloch *et al.*, 2003: 15, 16; Stone and Shepherd, 2011: 5; Zhang, 2008: 175). They argue that agricultural trade liberalisation contributes to higher economic growth through technological transformation and productivity improvement and thereby reduces poverty. However, there has been a substantial debate on welfare gains and losses from economic growth resulting from technological transformation as a consequence of agricultural trade liberalisation. This debate is much more about distributional consequences and welfare implications than net gains and net losses (DFID, 2004: 10; Mendola, 2007: 373; Orden, 2006: 378; Pyakuryal *et al.*, 2010: 20, 31; San Vicente Portes, 2009: 945). The distributional impact of this growth can be mixed despite the extensive spread of technological transformation in agriculture. Even where agriculture retains comparative advantage, the liberalisation of trade raises questions about the pro-poor effects of agricultural productivity improvement due to issues related to income distribution (Acharya, 2011: 61; Acharya and Cohen, 2008: 1057; Gabre-Madhin *et al.*, 2002: 1; Gerard and Piketty, 2007: 2; Keleman, 2010: 13; Rakotoarisoa, 2011: 147). Therefore, the effect of agricultural trade liberalisation on welfare is highly contested in the development economics literature (Cassel and Patel, 2003: 6; Keleman, 2010: 13; Rakotoarisoa, 2011: 147; Sexton *et al.*, 2007: 253).

The first fundamental theorem of welfare economics argues that subject to certain exceptions – such as externalities, public goods, economies of scale and imperfect competition – every competitive-equilibrium is Pareto-optimal. Similarly, the second fundamental theorem states that every Pareto-optimal allocation of resources can be realised as the outcome of competitive equilibrium after a lump-sum transfer of claims on income (Blaug, 2007: 185; Bliss, 1987: 27; Greenwald and Stiglitz, 1986: 230; Krugman and Obstfeld, 2006: 225; Stiglitz and Charlton, 2007: 28, 29; Tribe *et al.*, 2010: 186). In fact, Pareto-optimality may not be achieved in the farm sector in the sense that agricultural trade liberalisation may affect some groups of rural households adversely despite the gains from this process by other groups. Moreover, perfect competition may not exist in the agriculture of developing countries due to market failure in the form of some externalities.

Although many studies indicated that agricultural trade liberalisation had made a significant contribution to economic growth through technological transformation in the agricultural sector, understanding the process of pro-poor economic growth and explaining the vast differences in economic performance across countries have been fundamental challenges for researchers as well as for policy makers (Chiquiar, 2008: 71; Gerard and Piketty, 2007: 2; Henry, *et al.*, 2009: 72; Kong, 2007: 1; Topalova, 2010: 3). One of the main reasons for the lack of empirical consensus on growth determinants relates to model specification, the choice of control variables and measurement shortcomings

(Acharya, 2011: 61; Achterbosch and Roza, 2007: 33, 34; Daniel and Perraud, 2009: 133; Durlauf et al., 2008: 2; Narayanan *et al.*, 2010: 755).

The impact of agricultural trade liberalisation on the welfare of rural households depends on not only how income is distributed to them but also what happens to average living standards of rural households. Even the same level of productivity growth may result in various levels of poverty reduction in different countries depending on their respective policies and income distribution (Chang *et al.*, 2009: 2; Duncan and Quang, 2003: 14; Ravallion, 2004: 12; Winters *et al.*, 2004: 107, 108). Ravallion (2004) argued that it should point to implications for policies that would be needed for rapid poverty reduction, in addition to promoting higher growth. He suggested that two sets of factors could be identified as the main proximate causes of the differing rates of poverty reduction at given rates of growth – the initial level of inequality, and how inequality changes over time. The higher the initial inequality in a country, the less is the gain from growth that tends to be shared (Orden, 2006: 379; Ravallion, 2004: 12; San Vicente Portes, 2009: 946; Susila and Bourgeois, 2008: 72, 76).

One of the key issues raised repeatedly in development economics is the mechanism through which an economy can grow fast and at the same time can lead to a more productive use of underutilised resources (Duncan and Quang, 2003: 6; Nissanke and Thorbecke, 2007: 2; Ruda, 2007: 711; Susila and Bourgeois, 2008: 75). This is another way of saying that development economics and good development strategies are about identifying technological transformations that lead to higher economic growth while simultaneously contributing to a decline in the numbers of underemployed and unemployed workers – ultimately accelerating poverty reduction (Duncan and Quang, 2003: 6; Nissanke and Thorbecke, 2007: 2; Ruda, 2007: 711; Susila and Bourgeois, 2008: 75).

Agricultural growth may reduce poverty through direct effects on farm productivity, incomes, and employment. It may also generate indirect impacts on the welfare of rural households through the growth linkage with the non-farm sector as well as through its impacts on food prices (Adeoti and Sinh, 2009: 6; Bezemer and Headey, 2008: 1343; Byerlee *et al.*, 2005: 4; Popli, 2010: 803; Thirtle *et al.*, 2001: 11; Valenzuela *et al.*, 2005: 1). There have been arguments that the poor typically spend a high share of their income on staple food; therefore, they benefit from a decline in the price of staple food induced by productivity improvement as a result of agricultural trade liberalisation. Benefits are greater for the urban poor and landless rural labourers since they are net food purchasers (Adeoti and Sinh, 2009: 6; Bezemer and Headey, 2008: 1343; Byerlee, *et al.*, 2005: 5).

Although agricultural trade liberalisation may improve productivity through technological innovation, this growth may not be pro-poor (Meijerink and Roza, 2007: 11; Popli, 2010: 803, 811; Ravallion, 2003: 15; 2009: 28, 29). However, some studies such as Byerlee, Diao and Jackson (2005), Winters, McCulloch and McKay (2004), and Bezemer and Headey (2008) argued that interaction of productivity growth, farm income, employment, and food prices could lead to a pro-poor outcome depending on two key condi-

tions. Firstly, agricultural productivity per unit of labour must increase to raise farm income, but agricultural productivity per unit of land must increase at a faster rate than that of labour in order to raise employment and rural wages. Secondly, increased total factor productivity (TFP) in agriculture must result in a decrease in real food prices, but the TFP must increase faster than food prices decrease for farm profitability to rise and for poor consumers to benefit from lower food prices.

Based on conventional wisdom, Anderson (2004) argued that higher economic growth would contribute to greater reduction in poverty; and aggregate economic growth differences were largely responsible for the differences in poverty alleviation across regions. He argued that initiatives to boost economic growth were, therefore, likely to be helpful in poverty reduction. Agricultural trade liberalisation is such an initiative that tends to boost economic growth through enhancing productivity of agricultural inputs. However, it may also alter relative product prices, which in turn may affect factor prices (Anderson, 2004: 1; Burstein and Vogel, 2011: 25; Topalova, 2010: 3; Xu, 2003: 417). Hence, the net effect of agricultural trade liberalisation on income distribution also depends on the directions of those domestic product price changes and, in turn, how they affect domestic factor prices. It is argued that if the price changes are pro-poor, then they will tend to reinforce any positive-growth effects of agricultural trade reform on the poor. Moreover, the outcome of this reform also depends on complementary pro-poor domestic policies (Anderson, 2004: 2; Meijerink and Roza, 2007: 12; Susila and Bourgeois, 2008: 75).

While trade liberalisation has facilitated agricultural growth through diffusion of modern technology and knowledge, the agro-pessimists argue that the contribution of agriculture to development is passive. Conversely, agro-pragmatists argue that agriculture has a significant role in growth as well as in poverty reduction. However, agricultural trade liberalisation may worsen the conditions of the poor in the form of higher prices due to the price of food in liberalised markets being determined more by world prices than by domestic productivity. This is because many governments of developing countries use control over external trade to hold domestic food prices below world prices (Anderson *et al.*, 2011: 1, 2; Byerlee, *et al.*, 2005: 8; Huylenbroeck *et al.*, 2007: 3; Keleman, 2010: 13, 26). Similarly, technological transformation as a result of agricultural trade liberalisation is sometimes seen as a source of impoverishment in the form of loss of employment leading to an increase in poverty because it is associated with a process of creative destruction. In this process, jobs and livelihoods are destroyed in some sectors whilst being created in others. Therefore, there may be some gainers as well as some losers resulting from agricultural trade liberalisation (Banerjee and Newman, 2004: 16; Gore, 2007: 31; OECD, 2011: 12; Susila and Bourgeois, 2008: 74, 75).

Kompas (2004) and Isik-Dikmelik (2006) found that agricultural trade liberalisation positively influenced the productivity of rice in Vietnam. However, the productivity slowed in the post-liberalisation period due to falls in the price of rice and slow increases in input prices. Large farmers exhibited more productivity and efficiency than

small farmers, suggesting the need for additional agricultural reforms to augment productivity. Yu and Nin-Pratt (2011) found that agricultural trade liberalisation positively influenced structural transformation in the input and output markets of agriculture in Sub-Saharan Africa, thereby contributing to productivity growth in the post-liberalisation era. They found that this growth was not sustainable due to the small contribution of technological change to productivity of agriculture. Yoo *et al* (2012) found that South Korean agriculture experienced a significant productivity growth resulting from trade liberalisation, and agricultural research and extension. They found that the elasticity of productivity growth with respect to trade openness was significantly larger in the post-reform period than that in the pre-reform period. They argued that Korean consumers also gained from trade reforms and productivity growth in the form of lower output prices.

Many studies have attempted to shed light on productivity of agriculture and income distribution in Bangladesh. Some of these major studies on this effect include: Rice Price Stabilization on Bangladesh· An Analysis of Policy Options (Dorosh and Shahabuddin, 2002); Trade Liberalisation and the Crop Sector in Bangladesh (Hossain and Deb, 2003); Poverty Alleviation Through Agriculture and Rural Development in Bangladesh (Hossain, 2004); Market Deregulation, Trade Liberalisation and Productive Efficiency in Bangladesh Agriculture: An Empirical Analysis (Salim and Hossain, 2006); Trade Reforms, Farm Productivity, and Poverty in Bangladesh (Klytchnikova and Diop, 2006); Impact of Shallow Tube-wells and Boro Rice on Food Security in Bangladesh (Hossain, 2009); Evaluation of Rice Markets Integration in Bangladesh (Hossain and Verbeke, 2010); and Welfare Impact of Policy Interventions in the Foodgrain Markets in Bangladesh (Alam *et al*., 2011). However, these studies did not attempt to analyse growth in real income of different groups of rural households (distributional consequences) in the post-liberalisation era, which is the main focus of this study.

3. METHODOLOGY AND RESEARCH DESIGN

3.1 Data and Post-liberalisation Period

The study used secondary data on household income mainly from two household surveys of the Bangladesh Bureau of Statistics (BBS) including *Household Income and Expenditure Survey(HHIES) 2005* (BBS, 2007b), and *Household Expenditure Surveys (HHES) 1985-86* (BBS, 1988). It has selected 1985-86 as a the base year because of availability of data as well as the substantial agricultural trade liberalisation in the late 1980s. Similarly, it has selected 2005 as the current year due to availability of the latest household survey data. Therefore, changes in household income is measured using data of *HHES 1985-86* as the base year and data of *HHIES 2005* as the current year.

The study encountered limitations in the use of secondary data due to a lack of disaggregation. The aggregate data approach uses summaries and thus cuts out much variation, resulting in higher correlations than with disaggregated data. In HHIES 2005, all

households were aggregated under 19 income or expenditure groups. For the purpose of regression and poverty analyses, this study overcame this limitation by disaggregating household data into 100 observations using respective household groups' weight (percentage share) as the basis for disaggregation. For instance, in HHIES 2005, households having income between TK3000 and TK3999 represented 14.87 percent of the total households (BBS, 2007b) and they were disaggregated into 15 observations (households) having similar distance of income between two observations. This disaggregation is based on the assumption that keeping the same average income-distance between two observations will not change the original characteristics of the data.

The study has also conducted a *Data Exploratory Analysis* to identify outliers. Two outliers were found in the data set of HHES 1985-86 and these outliers were dropped from this data set. However, no outlier was found with the data set of HHIES 2005.

The study also used primary data (Household Survey 2010, conducted by the authors) as complementary to secondary data. It applied a mixed method research design in primary data collection. Questionnaire and face-to-face interview techniques were used for collecting primary data. A structured survey questionnaire was designed with both closed-ended and open-ended questions. Therefore, the datasets included both quantitative (closed-ended) information through using a closed-ended checklist and qualitative (open-ended) information through interviews with participants. The choice of this method was warranted to achieve the objectives of the study.

The household head or a senior person of the household who had access to information of all household members answered this structured interview questionnaire. I conducted this structured interview through asking participants the questions and writing their answers. If a participant did not have information about all members of the household, the participant was not requested to participate in the survey.

The study used both probability and non-probability sampling methods for field survey to collect primary data. Using *convenience* and *judgment sampling*, non-probability sampling methods (Bartlett-II et al., 2008: 47), it selected Comilla amongst the sixty-four districts of Bangladesh for conducting the field survey. According to the Bangladesh Bureau of Statistics (BBS, 2007a), there are thirteen upazilas (sub-districts) in the Comilla district. They are: 1) Barura, 2) Brahmanpara, 3) Burichang, 4) Chandina, 5) Chauddagram, 6) Daudkandi, 7) Debidwar, 8) Homna, 9) Comilla Sadar, 10) Laksam, 11) Meghna, 12) Muradnagar, and 13) Nangalkot.

The study selected Comilla Sadar Upazila, then Chouara Union from that upazila and finally Shrimontapur village from that union for conducting the field survey. Based on cluster sampling, the households of the selected village were divided into three clusters (A, B and C) and then, using the random sampling technique, the cluster C was selected for the field survey. The study surveyed all 60 households from this cluster. Therefore, the sample size of this survey was 60 households of that village. The details of observations are presented in Table 1.

Table 1: *Distribution of observations by household types: HHS 2010*

Households	Observations
Total	**60**
Farm	52
Non-farm	8
Distribution of Farm- households	
1. Farmer	38
2. Agricultural labourer:	14
Distribution of Farmers	
1. Small farmer	30
2. Medium farmer	7
3. Large farmer	1

If a participant did not have information about all members of the household, the participant was not requested to participate in the survey. Therefore, all 60 observations for all questions were found correct/valid and no sample was dropped from the original data set. The study also conducted a *Data Exploratory Analysis* to identify outliers and no outlier was found in this data set.

3.2 Changes in Rice Prices and Household Income

The study considered rice as the representative of agriculture, thereby, considering changes in the rice price for analysing the impact of agricultural trade liberalisation on the real income of rural households for two main reasons. Firstly, agricultural trade liberalisation influenced rice production significantly: agricultural trade liberalisation directly impacted on new technology for rice production (such as irrigation, fertilisers, and high-yielding-varieties seeds). Secondly, rice is the major agricultural product in Bangladesh, capturing the largest share of the agricultural sector. It accounted for 75 percent of the total crop production value, 63 percent of total crop sales, and 75 percent of total cultivated area of the country in 2005 (Klytchnikova and Diop, 2006: 13). In addition, rice is the staple food in the economy. Therefore, any change in rice production and the price of rice impacts directly on the livelihoods and welfare of most households in the country.

The study focused on the impact of agricultural trade liberalisation on the changes in prices of agricultural products. Proponents of trade liberalisation argue that it is supposed to make the factors more competitive and efficient resulting in an outward or upward shift in rice production possibility frontier, leading to a downward (right) shift of supply function of rice. Given the demand function, a downward shift of the supply curve should push the domestic price down to settle at a new equilibrium point because rice is a non-exported good in Bangladesh as the government imposed restrictions on rice exports. Thus, the study explored the implications of the changes in price of rice by focusing on two types of prices, namely: producer price and consumer price.

The study deflated current year prices to base year prices by using the producer price index and the consumer price index from various statistical yearbooks of the Bangladesh Bureau of Statistics (BBS). It examined the effects of changes in producer and consumer prices of rice on the distribution of real income across different groups of rural households.

3.3 Analytical Techniques

The literature review showed that agricultural trade liberalisation could produce diverse welfare-impacts across rural households. Some households might have experienced benefits and others might have experienced losses. This is because agricultural trade liberalisation affects both goods and factor prices, which in turn affect household welfare in different ways, depending on their different characteristics (Nicita, 2009: 19).

All rural household groups were divided into five quintiles on the basis of income:
1. Bottom 20 percent (Quintile 1),
2. Lower middle 20 percent (Quintile 2),
3. Middle 20 percent (Quintile 3),
4. Upper middle 20 percent (Quintile 4), and
5. Top 20 percent (Quintile 5).

They were classified into two main groups on the basis of their involvement in farming activities, namely:
a. Farm households, and
b. Non-farm households.

Other classification included:
1. Farmers, who owned farm land, and
2. Agricultural labourers.

Farmers were further divided into three sub-groups based on their farm size (as used by the BBS during the Household Income and Expenditure Survey 2005, and Agricultural Sample Survey 2005):
a. Small Farmers (0.05-2.49 acres),
b. Medium farmers (2.50-7.49 acres), and
c. Large farmers (7.5 acres and above).

Finally, households were classified on the basis of their participation in the rice market either as
1. Net buyers or
2. Net sellers.

The study applied the Deaton methodology to identify net seller and net buyer households. Deaton (1989) formalised the concept of net benefit ratio (NBR), which is a proxy for the net-trading position of a household, to estimate the first-order impacts of price

changes on household welfare. The net benefit ratio for a commodity is the difference between the production ratio (PR) (value of production as a proportion of income, or expenditure) and consumption ratio (CR) (value of consumption as a proportion of income, or expenditure) of that commodity. It is the proportion of net sales to income or expenditure and is approximated by the difference between income share of the commodity and consumption share of the commodity.

Following the Deaton's (1989) methodology, Klytchnikova and Diop (2006), and Isik-Dikmelik (2006) expressed as follows:

$$NB = (PR - CR) = \frac{p_i^p q_i}{X} - \frac{p_i^c y_i}{X};$$

where q_i is the production and y_i is the consumption, X is the total income and p_i^p nd p_i^c are producer and consumer prices respectively. The *NB* is used to determine net seller and net buyer households.

3.4 Empirical Frameworks of the Study

3.4.1 Growth in Household Income

The study measured growth in real income by quintiles of the different groups of rural households. It measured the ordinary growth rate, pro-poor growth rate and growth rate in mean as defined and calculated by Ravallion and Chen (2003), and Ravallion (2004).

Ordinary Growth Rate ($g_t t$):

$$g_t = \left(\frac{y_t - y_0}{y_0}\right) \text{x } 100;$$

where y_t is the current year income and y_0 is the base year income.

Growth Rate at Quintile p:

$$g_t(p) = \left[\frac{y_t(p)}{y_{t-1}(p)}\right] - 1, \qquad \text{with p = 1, ..., 5;}$$

where p represents a quintile.

Growth Rate at Mean Income:

$$g_{t(avg)}(hh) = \left[\frac{y_{t(avg)}(hh)}{y_{t-1(avg)}(hh)}\right] - 1;$$

where (*hh*) represents a particular household group (such as small farmer, agricultural labourer, net seller etc.), $y_{t(avg)}(hh)$ is the average income of current period (t) for a par-

ticular group of household and $y_{t-1(avg)}(hh)$ is the average income of base period t–1 for a particular group of household.

Pro-poor Growth Rate:

$$g_t(pp) = \frac{1}{5}\sum_{i=1}^{5} g_t(p_i);$$

where $g_{\perp}t(p_{\downarrow}i)$ represents the quintile growth rate of *ith* quintile for a particular group of rural households. In fact pro-poor growth rate is the mean of quintile growth rates.

3.4.2 Decomposition of Income Growth

The study presented the actual changes in each income source for all rural households by decomposing the growth in real income by sources. The sum of these changes constitutes the total growth in real income. The study has decomposed the growth in real income by six sources of income such as agriculture, wage and salary, business and commerce, house rent, gift-remittance-assistance, and other sources as divided by the Bangladesh Bureau of Statistics in HHES 1985-86 and HHIES 2005.

The study first measured the actual growth of each of these sources. Then it summed up all individual growth rates from all sources. It divided each source's growth rate by the summed-value of their total growth for calculating the weight of each source's growth to the total growth. The study multiplied the calculated weight of each source by the actual growth in mean income experienced by all rural households as a group. The decomposition of income growth by sources provided insights into the components of the actual income-growth experienced by rural households.

4. RESULT DISCUSSION AND ANALYSIS

4.1 Change in Prices of Rice and Household Income

Agricultural trade liberalisation contributed to the increase in productivity of rice, resulting in higher volumes of rice production during 1985-86 to 2005. Since the government put a ban on rice exports, the increased volume of rice production also increased the supply of rice in the domestic market, leading to a decrease in rice prices. An estimate using data from HHES-1985-86 and HHIES-2005 indicates that both producer and consumer prices of rice decreased during this period. The producer price declined by a total of 22.78 percent with an average of 1.14 percent per year and the consumer price decreased by 13.95 percent with an average of 0.70 percent per year over the same period as shown in Table 2. A decrease in the producer price implies a decline in welfare (income) of rice farmers whereas a decrease in consumer price suggests an increase in the welfare (income) of rice consumers. The magnitude of decrease in producer price is much greater

than the decrease in the consumer price, indicating that rice traders or intermediaries between producers and consumers gained largely from this liberalisation process.

Table 2: *Change in producer and consumer prices of rice during 1985-86 to 2005*

Price type	Total change (percent)	Average change per year (percent)
Producer price	-22.78	-1.14
Consumer price	-13.95	-0.70

Source: Authors' calculation using data from BBS HHES 1985-86 and HHIES 2005

A disproportionate decrease in producer and consumer prices of rice affected the income distribution and welfare of rural households in accordance with their involvement with the rice market. The change in welfare of rural households was reflected in their income, which is analysed in the following sections.

4.2 Real Income Growth and Distribution

The descriptive statistics of household income is presented in Table 3. All household groups experienced an increase in mean income but standard deviations for all groups of rural household income increased significantly in 2005 compared to their levels in 1985-86, indicating that there was a significant dispersion of household incomes from their respective mean – suggesting a larger inequality in income distribution.

Table 3: *Descriptive statistics: household income by household types, 1985-86-2005*

Household type	1985-86		2005	
	Mean (taka)	Std. Deviation	Mean (taka)	Std. Deviation
All rural households	2168.61	1359.93	6043.61	7122.08
Farm household	2479.70	1465.11	6559.09	8091.20
Non-farm household	1406.96	571.30	4718.07	3361.88
Large farmer	5236.80	3013.95	34950.00	27625.24
Medium farmer	4070.27	589.59	10899.14	7637.13
Small farmer	2252.07	541.56	4786.45	2581.47
Agricultural labourer	1148.41	322.11	2343.92	1258.38

Source: Authors' calculation using data from HHES 1985-86 and HHIES 2005

An increase in productivity of rice and simultaneously a decrease in the price of rice jointly affected the welfare of rural households through distribution of income. Although other factors might also have affected the growth in real income of rural households, agricultural trade liberalisation is the most important policy reform because of households' critical dependence on rice in terms of both income and consumption.

Table 4 shows the growth in real income of different groups of rural households during 1985-86 to 2005. All rural households as a group experienced an increase in growth of real income by an average of 2.74 percent per year. The non-farm households experienced a

higher increase in real income growth with an average of 4.33 percent per year than that of farm households with an average of 1.90 percent during the same period. This is arguably because agricultural trade liberalisation significantly impacted on the growth of the rural non-farm sector such as markets, rice mills, agricultural equipment repair workshops and transportation logistics through the multiplier effects in the post-liberalisation era.

Amongst the farm households, medium and large farmers experienced the highest income growth with an average of 2.68 percent per year. The annual average growth rate of real income for small farmers and agricultural labourers were 1.58 and 2.08 percent respectively. In terms of household involvement with the rice market, net buyers gained a much higher average growth in real income with an average of 3.56 percent per year than that of net sellers with an average of only 1.24 percent. Amongst all groups of rural households, small farmers experienced the least growth in real income. This is because the majority of small farmers are both sellers and buyers of rice. They sell rice during harvest (peak) seasons at the lowest price to repay loans and meet essential household expenditure, and then buy rice during lean seasons at the highest price to meet household rice consumption. There were remarkable seasonal variations in producer and consumer prices of rice. In 2005, it is estimated that the producer and consumer prices of rice varied by 18.87 and 10.01 percent respectively over the peak and lean seasons. The Household Survey (HHS)-2010 (conducted by the authors) revealed that small farmers sold rice during peak seasons. Amongst small farmers, 57 percent sold rice during the peak season, 7 percent during the lean season, 33 percent in the both peak and lean seasons but mostly in the peak season, and 3 percent in both seasons but mostly in the lean season. On the contrary, 67 percent of them were rice buyers and they bought rice only during lean seasons. Therefore, small farmers experienced loss in both cases of rice selling and buying. Compared to this scenario, 25 percent of large and medium farmers sold rice during lean seasons and 75 percent in both peak and lean seasons but mostly in lean seasons.

Amongst the poor farm households, agricultural labourers experienced a higher income growth than that of small farmers, even higher than that of all farm households. This situation suggests that they received higher real income during that period because they were net buyers of rice and they bought rice at a lower price because 100 percent of agricultural labourers were net buyers. The HHS-2010 revealed that 93 percent of them bought rice during both peak and lean seasons equally and 7 percent bought during peak seasons. Similarly, agricultural labourers enjoyed higher wages with greater opportunities of employment during 1990-2010. Amongst the agricultural labourers, 86 percent of respondents confirmed an increase in nominal wages and 100 percent opined that there was a greater opportunity for employment during this period than pre-liberalisation era. This result suggests that agricultural labourers experienced higher growth in real income through higher wages with higher opportunity for employment and lower rice prices. This is an indication that agricultural trade liberalisation generated greater opportunities for employment and income for agricultural labourers.

Non-farm households experienced a higher growth in real income with a lower consumer price of rice. According to the HHS-2010, amongst the non-farm households, 57 percent bought rice

during peak seasons at the lowest price of the year and 43 percent bought during both peak and lean seasons equally. This finding suggests that non-farm households, being net buyers, gained the most from the lower rice price amongst all groups of rural households.

From the quintile analysis in Table 3, it is clear that rich households experienced higher average growth in real income than poor households, irrespective of all groups of rural households. The first quintile (Q-1) represents the bottom 20 percent income group (the poorest) and the fifth quintile (Q-5) represents the top 20 percent income group (the richest) for each group of rural households. The rate of pro-poor growth represents the mean growth rate of income for all quintiles of a particular group of households. This rate is less than the growth rate of real income in mean for all groups of rural households, suggesting that income growth during 1985-86 to 2005 was not pro-poor.

Table 4: *Annual average growth in real income by household types during 1985-86 to 2005*

	Quintile income growth rate (percent)					Average growth rate (percent)	
Household type	**Q-1**	**Q-2**	**Q-3**	**Q-4**	**Q-5**	**Rate of Pro-poor Growth (mean of quintile growth rates)**	**Growth rate in mean**
All rural households	1.11	1.70	2.02	2.60	3.04	2.10	2.74
Non-farm household	2.06	3.00	3.25	3.68	6.12	3.62	4.33
Farm household	0.60	1.19	1.57	2.10	2.21	1.53	1.90
Agricultural labourer	0.57	1.14	1.46	1.89	3.20	1.65	2.08
Small farmer	0.90	1.27	1.70	1.89	3.42	1.83	1.58
Medium and large farmer	0.79	1.67	2.06	2.89	4.41	2.36	2.68
Net seller	-0.54	0.24	0.71	1.43	2.28	0.82	1.24
Net buyer	1.52	1.89	2.46	3.28	6.28	3.09	3.56

Source: Authors' calculation using data from HHES 1985-86 and HHIES 2005

The growth in real income experienced by different groups of rural households can also be presented with growth incidence curves. The growth incidence curve demonstrates the growth in real income by quintile and presents the distribution of growth in income for different household groups as shown in Figure 1. Growth incidence curves revealed that all rural households experienced moderate to high-income growth during 1985-86 to 2005. The poor households for all groups of the rural communities experienced a lower growth in real income than the average growth rate of their own particular household groups, indicating that the poor benefited less than the rich from agricultural trade liberalisation. Similarly, income growth of the poorest farm households (lowest quintile) is much lower than the average income growth of the lowest quintile (the poorest) of non-farm households and a lower than the average income growth of all rural households as a group. This evidence suggests that agricultural trade liberalisation benefited non-farm households more than farm households. For the same reason, net-buyers gained more than net-sellers from these policy reforms. Small farmers experienced an even distribution of income growth more than any other groups of rural households because of their homogenous and non-diversified income from rice and a similar pattern of involvement

with the rice market – most of them sell rice during harvest seasons at lower producer prices and buy rice during lean seasons at higher consumer prices.

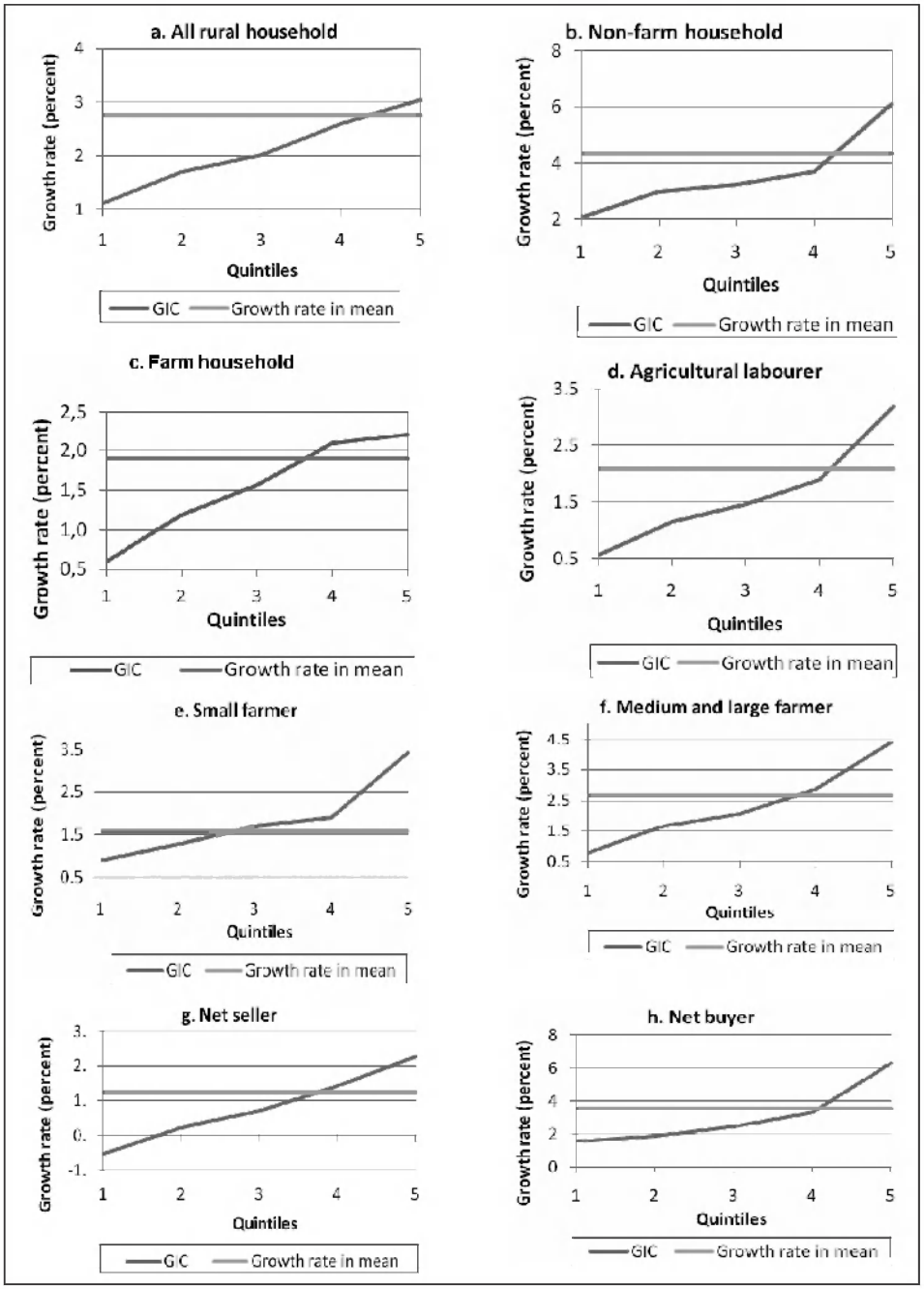

Figure 1: *Growth Incidence Curves (GIC) – real income growth rate: 1985-86 to 2005*

4.4 Decomposition of Income Growth

The above finding is reinforced by the results of a decomposition of growth in real income – an illustration of the importance of the growth links during 1985-86 to 2005. The decomposition of income growth for different groups of rural households is presented in Table 5. The contribution of each source of income is presented in such a way that their sum equals the total income growth experienced by different income groups of rural households by quintile income distributions. During 1985-86 to 2005, out of 2.74 percent of average real income growth in mean for all rural households, wage and salary contributed the highest by an average of 0.81 percent followed by business-commerce with a contribution of 0.76 percent to the real income growth in mean. Although agriculture is the largest income component of rural households, the contribution of agriculture to this income growth was only 0.62 percent, indicating that the income growth of rural households was mainly attributed to non-agricultural components. The share of income from gift-remittance-assistance was the largest contributor to income growth for poor households (Q-1, Q-2, and Q-3) whereas wage-salary and business-commerce played an important role in the income growth of rich households (Q-4 and Q-5). Considering agricultural contribution, rich households (Q-4 and Q-5) experienced higher income growth from agriculture than poor households (Q-1, Q-2, and Q-3). The contribution of agriculture to the growth in real income of rural households might be attributed to the improved productivity of rice resulting from agricultural trade liberalisation because the households' share of agricultural income in rural areas was dominated by income from rice.

Table 5: *Decomposition of annual average growth in real income by sources: 1985-86 to 2005*

Sources	Growth rate in mean (%)	Growth rate in quintiles (%)				
		Q-1	*Q-2*	*Q-3*	*Q-4*	*Q-5*
All rural households	2.74	1.11	1.70	2.02	2.60	3.04
Agriculture	0.62	0.02	0.19	0.27	0.53	0.73
Wage and salary	0.81	0.13	0.51	0.61	0.92	1.09
Business and commerce	0.76	0.01	0.17	0.45	0.75	0.81
House rent	0.05	-0.01	0.01	-0.02	0.01	0.10
Gift, remittance and assistance	0.34	0.95	0.63	0.65	0.14	0.16
Other sources	0.17	0.01	0.19	0.06	0.25	0.17

Source: Authors' calculation using data from BBS HHES 1985-86 and HHIES 2005

5. A COMPARISON BETWEEN BANGLADESH, THAILAND AND TANZANIA

This study has found that increased productivity and the subsequent reduction in both producer and consumer prices of rice generated differences in changes in real income of different groups of rural households in Bangladesh in the post-liberalisation era. Similar evidence was found in the case of agricultural trade liberalisation in Thailand and Tanzania.

In general, agricultural trade liberalisation significantly increased domestic production and the flow of both exports and imports in Thailand (Pupongsak, 2009; Warr, 2008). In particular, the government agricultural trade policies could not contribute to raising the productivity of rural people or to assisting them to find better economic opportunities outside agriculture (Warr, 2008: 268). Trade liberalisation made them worse-off as they did not have enough access to the markets or to the government policy-making process (Jitsanguan, 2008: 3; Zamroni, 2006: 65). Trade liberalisation increased inequality because of the increase in real income of skilled labour and the decrease in real income of unskilled labour. Farmers experienced losses from higher input prices and lower output prices. Therefore, farm households experienced an increase in the incidence of poverty. Although the government increased programmes for rural development through cash transfer to village organisations, subsidised loans and infrastructure development, these programmes were not directly linked to increasing agricultural production (Akapaiboon, 2010; Boossabong and Taylor, 2009; Pupongsak, 2009; Warr, 2008).

As in the case of Thailand, evidence from various studies suggests that the impact of agricultural trade liberalisation on the Tanzanian economy is also mixed. Although some studies found positive impacts on the economy (Kazungu, 2009; World Bank, 2000), these studies were highly criticised due to the model specification and measurement shortcomings (Kilma *et al.*, 2008). Agricultural trade liberalisation could not influence technological transformation and productivity of agriculture. Although the total maize production increased due to expansion of cultivable land, the average yield decreased – suggesting a decreasing return to scale in the post-liberalisation period (Kilma, *et al.*, 2008; Tuwa, 2007). Agricultural trade had an insignificant impact on poverty reduction. The poor became more vulnerable due to volatility of maize (staple) prices and farmers shifting production from staple to other cash crops, thus reducing food security. Large farmers gained more from crop diversification than small farmers. Small farmers faced multiple constraints related to access to agricultural inputs and extension services (Leyaro and Morrissey, 2010; Pan and Christiaensen, 2011; Urassa, 2010).
The empirical evidence from the above economies provides a useful basis for understanding the impact of agricultural trade liberalisation on the welfare of rural households in Bangladesh. Agricultural trade liberalisation could not improve distribution of income among rural households due to the lack of government policies related to productivity stimulation and income distribution, suggesting that mere 'price is right' or trade liberalisation would not automatically promote welfare of rural communities. Besides trade reform measures, there is the need for complementary policies to enhance productivity as well as to reduce inequality between the poor and the rich.

6. CONCLUSION

The above findings and analyses suggest that increased productivity and the subsequent reduction in both producer and consumer prices of rice generated differences in changes in real income of different groups of rural households. Findings of this study indicated that non-farm households gained more than farm households from the large reduction

in consumer price. Farm households gained from the increase in productivity but experienced losses from producer price reduction. The two opposite forces – increase in productivity and reduction in producer price – offset the effects of each other, thereby affecting income of farm households.

Although rural households experienced a moderate to high increase in real income, non-farm households experienced a larger increase than farm households. Amongst the farm households, large and medium farmers gained the most and small farmers gained the least from the growth in real income, indicating that rich households experienced a much higher increase in real income than poor households – thereby adversely affecting the distribution of income and widening the income gap between rich and poor households. These findings demonstrated that while agricultural trade liberalisation benefited rural households generally, the benefits were not distributed equally and in fact, inequality increased amongst rural households. The above findings suggest that the growth in household income was not pro-poor during 1985-86 to 2005. Although all rural households experienced moderate to high growth in real income and consumption, rich households gained more from agricultural trade liberalisation through higher real income than poor households. This suggests that agricultural trade liberalisation contributed to higher growth in the rural economy but it contributed to greater inequality in income distribution amongst the rich and poor income groups (quintiles). Therefore, the government should formulate policies such as a progressive income tax to impose higher tax on higher income and income transfer to the poor to reduce inequality amongst different groups of rural households. The government should also formulate other complementary policies which could improve the situation of the poor in the form of institutional changes [as seen in the case of Vietnam (Abbott *et al.*, 2009) and China (Huang *et al.*, 2007)] including higher investment in education and infrastructure and development of markets, finance, input services for agro-products, organisation of agro-food chains and cooperatives.

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