

REVIEW OF ECONOMIC AND BUSINESS STUDIES

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Address:

14th Lăpuşneanu Street, 4th Floor, Room 412

Iaşi – Romania, Zip Code 700057

E-mail: rebs@feaa.uaic.ro

Web: www.rebs.ro

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RESEARCH ARTICLE



USING ZMET FOR INVESTIGATING THE ROLE OF SOCIAL MEDIA IN THE EMPLOYMENT PROCESS

MAGDALENA DANILEȚ^{*}, CLAUDIA STOIAN (BOBÂLCĂ)^{**}

Abstract: *The purpose of this paper is to explore the role of social media in the employment setting as it is perceived by the job seekers. The study is a qualitative investigation in which thirteen in-depth interviews based on Zaltman Metaphor Elicitation Technique (ZMET) were conducted in order to gain a deeper understanding of the link between social media and the process of employment. The 22 elicited bipolar constructs associated with the role of social media in the employment setting were framed into six deep metaphors: Connection, Resource, Journey, Control, Affective Distress and Transformation. The size of the sample and the deeply subjective nature of answers provided by the subject's limits the generalization of the results for a wider range of job seekers in the social media environment. This research provides an insight into deep-seated motivations, attitudes and behaviors involved in the use of social media by job seekers.*

Keywords: *ZMET interviews, social media, employment, mental map, in-depth interviews, consensus map*

JEL Classification: *M31*

1. INTRODUCTION

Social media is becoming more and more popular every day helping people to connect and communicate with each other, saving time and money. Statista (Statista, 2016) reports a spectacular growth of the Internet users in the last year from 2.21 billion in 2015 to 3.5 billion in 2016. Out of these, around 50% are active users of Facebook. According to Gemius Audience Report for Romania (Gemius, 2016) published in March 2016, out of 7,45 million users that connect to the Internet from a desktop computer, 80% access Facebook at least once a

^{*} Magdalena Danileț, Alexandru Ioan Cuza University, 11 Carol I Blvd, Iasi, Romania, e-mail: madalind@uaic.ro

^{**} Claudia Stoian (Bobâlcă), Alexandru Ioan Cuza University, 11 Carol I Blvd, Iasi, Romania, e-mail: iuliana.bobalca@uaic.ro

month. The large segment of Internet users aged 19 – 34 has the highest share of 45.2 % in total users.

Social media overview published in June 2016 by Zelist Monitor (Zelist, 2016) reports 8.4 million users of Facebook (desktop and mobile) and at least 2.5 million users of YouTube, Instagram, Twitter, Foursquare and LinkedIn without providing an assessment of multiple accounts users. Therefore, we are certain that we live in a world of multiplied communication though we have no certainty that the communication is deep and authentic.

Both the Internet and the Social Media have created a new, expanded world- a world in which space, time, customs and social norms are broader than in any other time in history. We are constantly invited and lured (and sometimes forced by the consequences) to live in this “digital world of mouth” (Nagendra, 2014) or “online world of mouse” (Rutter, et al., 2016) in which “personal social media usage has inevitably become intertwined with the workplace” (Drouin, et al., 2015: 123). Similarly to individuals, organizations cope with „a world where consumers can speak so freely with each other and businesses have increasingly less control over the information available about them in cyberspace” (Kaplan and Haenlein, 2010: 59).

How individuals and organizations manage the transformative effects of social media (Aral and Sinan, et al., 2013; Ollier-Malaterre and Rothbard, 2015) arises the interest of both researchers and practitioners. Researchers question how social media is understood (Kaplan and Haenlein, 2010), investigate the weaknesses of current literature and the critical challenges associated with the adoption of SM in the employment settings (Poba-Nzaou, et al., 2016; Lam, 2016; El Ouiridi, et al., 2016), discuss the unequal interest of researchers for investigating the perspective of recruiters and the recruited (Lam, 2016; El Ouiridi, et al., 2016) and suggest solutions for using social media by employers and job-seekers (Madia, 2011).

Our study joins research investigating how job seekers and employees view the role of social media in the employment setting (Eren and Vardarher, 2013; Nagendra, 2014; El Ouiridi, et al., 2015). This study explores the metaphors associated with the role of social media in the process of employment. By using ZMET methodology (Zaltman Metaphor Elicitation Technique), we could get access to thoughts and feelings that are difficult to discover by means of other

methods. We developed a consensus map reflecting the main concerns of study participants regarding the role of social media in the process of employment.

In studying the views of undergraduates on the use of SM for employment decisions, Drouin et al.(2015: 124) argue that “as social media is being used in employment decisions, but social media policies are still mostly non-existent or in flux, public opinions about these practices may help to shape future policy.” El Ouiridi et al.(2015: 9), studying the predictors of job seekers’ self-disclosure on SM, concludes that “results showed that high professional online image concerns predicted increased levels of career-oriented self-disclosure on social media”. This research provides an example of how resources and risks associated with social media may be questioned and clarified by job seekers and employers.

2. SOCIAL MEDIA IN THE EMPLOYMENT SETTING

Social media has been playing an increasingly important role in the relationship between the employee and the employer (Ladkin and Buhalis, 2016) and has been providing big opportunities for job seekers (Janta and Ladkin, 2013). Social media has enabled them to follow jobs available globally and at low cost, to collect information about hiring companies and also to use their personal web pages for promoting their own image and communicating the intentions to get a job to potential employers. Kwork (2011: 15) suggests a series of steps that job seekers may follow using social media: to understand expectations of a specific industry(in which they look for a job), to build a personal brand using social media matching industry expectations, to join professional organizations having accounts on social networks (for example, LinkedIn or Facebook) and to maintain the coherence of information on all social networks where the job seekers have accounts. Potential applicants may find out using social networks information about company culture, employment opportunities. Also, they may watch videos contain testimonials of employees or quickly interact with company representatives.

Similarly, social networks enable companies to get access to personal information of applicants, including their photographs. Companies may use them subjectively to select their potential employees (Smith and Kidder, 2010) before running face-to-face interviews. Cybervetting (or using social media for candidates’ selection) generates both positive and negatives effects. The research

of Donald et al. (2012) identifies a correlation between job performance and profile ratings analysis based on social networking websites but there is the risk of wrong profile matching due to incorrect or insufficient data. On social networks, there is an orientation towards self-promotion of individuals building and managing their profiles (Buffardi and Campbell, 2008) and presenting themselves in an exclusively positive light (Lee-Won, et al., 2014). Therefore, true matching between the expectations of employers and employees may be confirmed only by means of direct contact. So, it is not recommended that social media completely replaced other employment tools and rather be used as an extension of company's current strategy (Madia, 2011).

3. METHODOLOGY

In our research, we were inspired by the question of Kwok (2011: 13): "Seeking jobs on social media: are you ready?" and we were also motivated by the curiosity to discover the way in which our students see the link between social media and the employment process. Without getting a definite answer to the question *Are they ready?*, we investigated the metaphors associated with the role of social media in the employment setting.

3.1 Metaphor Elicitation

Studies in linguistics, philosophy and sociology (Lakoff, 1993; Gibbs Jr., 1993; Kövecses, 2010) confirmed that metaphors are fundamental to language, thought and experience. A metaphor represents "figurative language, referring to the representation of one thing in terms of another" (Lakoff and Johnson, 1980; Zaltman, 2003: 4) and it is an „appropriate tool for eliciting hidden knowledge” (Anghelcev, et al., 2015). The linguistic aspect of the metaphor is less important. The focus is placed on links among language, thought and action: „the metaphor is mainly a matter of thinking and action and less of language” (Lakoff and Johnson, 1980: 153). Moreover, Zaltman and Coulter (1995) argue for sensorality of metaphors and prevalence of visual metaphors. Images are considered more appropriate than words to reflect subjects' mental representations regarding the investigated research problem. While language is the expression of conscious thoughts, images reflect the unconscious beliefs and emotions (Anghelcev, et al., 2015). In other words, we may state that “images evoke deeper elements of

human consciousness than do the words” (Harper, 2002: 13). Zaltman Metaphor Elicitation Technique allows the identification of unconscious thoughts and feelings, (Zaltman, 2003) and it is a very powerful tool for mapping consumers’ minds (Ling, et al., 2009). Working both with words and images (Bagley, et al., 2006), „the ZMET technique can be used to understand deep-seated psychological factors that underlie behavior” (Khoo-Lattimore and Prideaux, 2013: 1042).

3.2 Method

To administer the ZMET in-depth interview, we followed the instructions provided in ZMET patent published on Google Patents (Zaltman, 1995), in other Zaltman’s studies (Zaltman, 1995; Zaltman and Coulter, 1995; Zaltman, 1996; Zaltman, 1997; Coulter, et al., 2001; Zaltman, 2003; Zaltman and Zaltman, 2008), as well as the arguments and demonstrations provided by Christensen and Olson (2002). We also found useful other studies using ZMET methodology. We looked into studies investigating decisions of tourists whether to adopt or not sustainable travel decisions (Khoo-Lattimore and Prideaux, 2013), perceptions over climate change (Anghelcev, et al., 2015), clicking-through thoughts of Internet users (Liu and Liu, 2013), adolescent mental model of MP3 (Ling, et al., 2009), consumer’s behavior in adopting the 3G mobile banking services (Lee, et al., 2003), consumer perceptions of the mobile internet (Sugai, 2005), sport event tourists’ behavior (Chen, 2010), brand meaning in higher education (Wilson and Elliot, 2016), consumers’ Internet perceptions (Joy, et al., 2009) and consumer trust in banking and banks (Andrei, et al., 2015).

3.3 Sample

In our study we interviewed 13 graduate students (10 women, 3 men), aged between 22 and 41, who have been using at least one social network for the past 2 years with at least 2-3 visits per week. Also, we made sure that all subjects involved in the research have accumulated at least 6 months work experience so that „participants knew the subject of research” (Christensen and Olson, 2002). Selected subjects in this research were graduate students in Business in their first year of study and they were recruited during mandatory classes. For their participation they received a bonus of one point for their final grade in the respective class. Studies showed that the number of constructs identified using

ZMET does not increase if the sample is bigger (Bagley et al, 2006) and 4-5 in-depth interviews provide approximately 90% of main information extracted from all interviews. (Zaltman, 1997). Generally, in-depth interviews in qualitative research are conducted until the information starts to repeat itself and there are no new elements. In our research, we reached this point after first seven interviews.

After expressing their consent to take part in the study, the subjects received, one week before the interview, a letter by email asking them to think about the role of using social networks in the process of employment and to select 8 images representing their thoughts and feelings on the topic. Students were free to choose these images from the Internet, newspapers and magazines or to take photos with their own camera. These pictures were brought to interviews, printed and scanned.

The in-depth interview lasted on the average 100 minutes and was video recorded with the explicit consent of each participant in the study. By Laddering procedure and probing questions, we have followed 11 steps of the ZMET interview.

4. ZMET PROCESS AND ANALYSIS

In what follows, we present each step undertaken in conducting the ZMET interview and the most suggestive and relevant examples.

Step 1 – Storytelling. The Participants were asked to explain how each image is related to the role of social networks in the process of employment. Using the laddering technique and the probing questions, we gained a deeper insight into the meaning of the chosen images for our subjects. For example, 5 participants chose images containing a magnifying glass. As we can see in Figure 1, the magnifying glass is shown in different usages, it zooms out an individual in a crowd, a detail of an individual, an object in a pile (a needle in a hay wagon), a detail on a map, a zoomed out detail.



Figure 1 Examples of magnifying glass images brought by participants

By means of questions, we learned that the same magnifying glass may very well refer to occasions for differentiation, invasive surveillance, an extremely difficult search, journey facilitated by social media or attention to details.

Step 2 – Triad Sort and Image Comparison. At this stage, we chose randomly three times three images out of eight. Then, we asked the subject to choose 2 images out of the 3 selected images that he or she thinks or feels have something in common and therefore are different from the third one. By repeating this process, we collected information to make up an extended list of constructs. For example, the comments made about the three images containing whether a telephone, a keyboard, a cutout of a man with a big “Me” on it have contributed to the eliciting of the 2 constructs kept in the final list: Accessibility and Social Media Profile/Self Branding.

Step 3 – Identifying and Recording Sensory Metaphors. After having removed the images from the subject’s sight, the subject was asked to link the role of social networks in the process of employment with a sound, taste, color, smell or a tactile sensation. For example, one study participant linked the role of social networks in the employment process with a tune of old traditional music remixed by means of modern technology, with the sweet taste of vanilla chocolate cake, with the light blue color of the sky, with the smell of mornings in the mountains and the silk-like touch of a piece of material ready to be shaped.

Step 4 – Metaphor elicitation/ Most representative image. At this stage, the subjects chose the most relevant image out of the 8 previously chosen images. Then, they zoomed out so much its view that it enabled them to introduce new elements and new meanings. For one of the participants, the initial image exemplifying the role of social networks in the process of employment, presents a young woman wearing a business suit with trousers and high heels, caught in a jump over a gap between two rocks. The zooming out of this image has made the subject see not an easy gap but an abyss and then a mountain. The abyss was correlated with the fear of danger and the unknown in the space of social media and the mountain with the need for additional effort and with the enthusiasm of mountain climbing as an initial setting for a future important decision in choosing a job. The view was completed with other people, imagined almost bipolarly: they may be very well waiting, helping or sharing their own experience in order to support her or they may very well be just boycotting or malicious individuals.

Stage 5 – Missed images. Participants were asked if there were other images they would have wanted to bring but failed to do so due to various reasons. They were asked to describe the images. The absent images may reflect significant elements of people's mindset related to the issue under investigation (Anghelcev, et al., 2015). For instance, the same subject declared that she would have liked to place her image on a bridge in the British city where she used to work during her vacation. The bridge was described as “the chance to link the two different worlds. By means of SN (social networks) you may link the pleasure to socialize with the need to search for a job. To be on a bridge meant that I took that step, that I made that link”. Beyond the universally known metaphor of the bridge, we noticed not only the simple distinction between pleasure to socialize and the job search but also their cataloguing as *different worlds* that *require* a bridge.

Stage 6 – Company perceptions about the role of social media in the employment process. At this stage, the subjects discussed what they think about the attitude of a potential employer towards the role of social media in the process of employment. This projective exercise allowed us to understand better the way in which the subjects view the relation they may develop with a potential employer by means of social media. Nuances, such as „Company promotional tool”, „Quick and free tool for getting to know potential employees”, „Waste of time, desired people are not searched on social media” or „Employers look up on social media just a list of skills, not people” allowed us to refine the list of constructs and the links among them. Moreover, the projection of subjects on the way in which a potential employer views the role of social media in the process of employment is linked to the way in which the subjects manage their personal accounts on social media.

Stage 7 – Critical message to the company. The subjects formulated just one message to a potential employer linked to the way in which this employer uses social networks to employ people. Messages such as „The profile on the social networks is just a small part of who I am”, „Indeed, you cannot get to know a person on social media” bring more light to the areas of their vulnerability and frustration associated with the relations built on social media. Messages such as „Handle with care”, „Specific, clear and concise job advertisements are better than lists requiring all the skills in the world” enabled

us to refine the constructs such as *Quality of data/information or Quality of data selection*.

Stage 8 – Surprise to the company. The subjects had the opportunity to describe their thoughts and feelings that they had believed employers were not ready to hear. Potential employers were „surprised” by the subjects through messages such as: „My social media account is blocked for the employers”, „Do not tag people just based on information from social media”, „You fail to use technology at its real potential”.

Stage 9 – The mental map. To produce a mental map, the interviewer checked together with the subject the list of constructs elicited during the interview. The participants were able to add or remove any constructs so that they could obtain the most „accurate representation” (Zaltman and Coulter, 1995, p. 42) of the role of SM in the employment process.

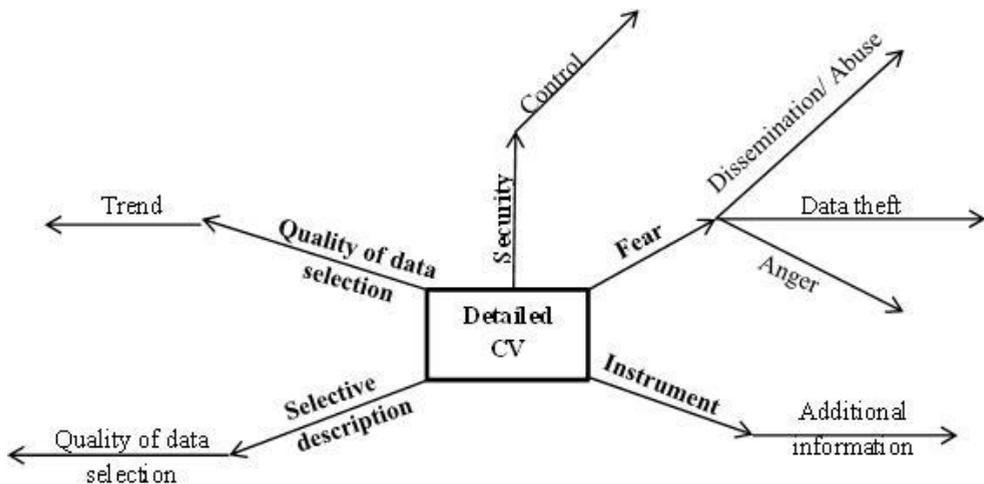


Figure 2 *The mental map of Participant no. 1*

As long as the mental maps of participants, such as the map shown in Figure 2, include the most significant elements for the representation of the role of SM in the process of employment, the key-words and their links mentioned in the mental map of each participant were the essential material for building and validating the consensus map.

Participant's observation is interesting: this substance is not the Social Media as technology as an immediate tool, but the social media spirit defined by the subject as the background support community, win-win relationships with the employer, the joy of meeting, mutual and continuous feed-back. For this subject, the role of social media does not end after the employment interview.

In Figure 4, we present the collage of a 23-year-old student working for a multinational IT company with an accumulated work experience of over 5 years. She underlines the benefits of technology supporting social media. By means of technology and social networks diversity „All is global, all is open.” Social networks allow students to access jobs anywhere in the world. The person, the applicant is the main focus. Global self-branding facilitated by the social media comes „in a package” with „being taken under the magnifying glass” but „the key is found in each person's hands using social media. Each person decides which social network to use, where to apply for jobs, to whom do you say Yes and to whom do you say No.”



Figure 4 *The summary image created by Participant no. 2*

This participant views technology and social media as an intermediary, a facilitator between the applicant and the potential employer. Self-branding is the recurrent topic and the aim is the direct, non-mediated contact with the potential employer chosen by the applicant. She states that in Social Media for an applicant „I chose weighs more than I was chosen”. This time the role of social

media ends immediately after the direct meeting, the face-to-face employment interview made part of the agenda of the protagonists, was scheduled.

Stage 11 – The Vignette or a mental video. In the last stage of the interview, the interviewer asked the subjects to imagine a five-minute long story having at least three characters (the subject being one of the characters, the second character is the social media and the other characters are freely chosen by the subject), with an intrigue and the epilogue showing the role of social media in the process of employment.

At the end of the five-minute story, the subjects were asked to imagine what a person would think or imagine about the role of SM in the employment process after having heard only the last sequence of the final interview, the five-minute story they have just recounted.

This time, it also has been reconfirmed that „people think differently when they think in motion than when they think in still images or pictures” (Zaltman and Coulter, 1995: 42) and „steps 12 (Summary Image) and 13 (Creation of a Vignette or Mental Video) typically provide different but complementary information” (Zaltman, 1995: 3). Attributed to characters from the imagined story, there appeared thoughts and feelings that have not been mentioned during the interview. Subject no. 4, a woman with a work experience of 19 years, who has been both the applicant and the employer during her work life, focused during the interview on the need to use professional social media platform for employment purposes such as Linkdin. The following statement was reiterated several times „Professional social networks allow the recruitment of professionals by professionals”. The story imagined at the end of the interview completed the representation of the role of social networks in the process of employment with the following story „*There was once a girl, isolated from the whole world but who instead had a long hair that she used to have access to the real world out there, the world where colors were colors, life was life, the birds sang, the butterflies flew... I am the girl, my hair is... my social network... that I use to make contact with the reality and with those who want to get to know me... . And... this girl would like to have a friend who would help her get rid of the prison she lives in and help her to socialize more with people around her. And she is not always successful in holding her hair and she throws it in different directions and clings it whether to trees, or animals and things that appear in her*

way and by pulling her hair she brings them near her.” The end of the story says that: „*The friend she is looking for finds the girl ... makes her go through unusual situations and makes her known to people. She arrives to a town where everybody knows her, children play with her hair and braid it... and the hair goes on streets... yes, where people can touch it and can see the girl ... so she makes friends. Yes ... my story is about relations, friendship and getting to know people*”. After this story of the reinvented Rapunzel, the story teller tells us that the meaning of this story for the listener may be the following „... *it is complicated to manage such a social network, such a beautiful and long hair, ...it is complicated to maintain it and make only some people touch you, the people you want.*”

It is an example of complementary information that helped us understand better how the subjects view the role of social media in the employment processing terms of opportunities and threats, personal power and vulnerability. In this case, the professional user of professional social networks seems to coexist with „*the girl isolated from the whole world but who instead had a long hair that she used to have access to the real world out there, the world where colors were colors, life was life, the birds sang, the butterflies flew... ...*”. For this subject having a long successful career, only this final sequence, the five-minute vignette, reveals her hidden thoughts and feelings related to her own vulnerability in using social media.

5 CONSTRUCTS ELICITATION

The material obtained during interviews (video recordings, transcripts, images produced by subjects, mental maps, the summary images) has been individually assessed by each researcher to extract preliminary key concepts and possible links among them. The unification of individual results from stage one of content analysis included the identification of synonyms and choosing a code or construct relevant for the general meaning of concepts extracted individually. We also had to return permanently to transcripts as to double check the meanings and to make sure that we included into the list all concepts mentioned by the subjects. The unification of individual results generated the first common list of 64 de key themes. The grouping of these key themes into bigger semantic fields led to the identification of 30 constructs. The next stage, data coding „in terms of

paired-construct relationships” (Zaltman and Coulter, 1995, p. 44) led to the final list of 22 constructs. The final list of constructs and links among them resulted after applying the rules recommended by ZMET methodology, according to which the consensus map includes constructs mentioned by at least 1/3 of participants and shows the links indicated by at least ¼ of the subjects (Zaltman and Coulter, 1995; Zaltman, 1995). Table 1 presents a selection of 9 constructs from the 22 included in the consensus map, explained by examples extracted from the statements of subjects. The 9 constructs kept in this table have been mentioned by 2/3 of the subjects.

Table 1 Selection of consensus map constructs

| Consensus Map Constructs | Illustrative statements |
|--|---|
| Online community | Young people community. Friends. Team. SM coagulates interest-based and professional communities. SM is the main character in our lives and in our conversations. Community support increases the probability of success. |
| Quality of SM communication | Direct and quick contact with people. Sharing ideas and experiences. SM as a megaphone. LinkedIn – a dialogue platform between professionals. Vague messages. Instant feedback. |
| Lookout | Data protection decreases the risk of data theft. The information is there even if you delete it. Be on guard, eyes open. Handle with care, SM can be dangerous. Pay attention: personal life is not the same as professional life. |
| Transgression in data use | The Big Brother is always there. Beware, you don't know where the employer collects his data from. Trap. SM is like a lure. The employer might monitor your activity on SM. You are under the magnifying glass. |
| Accomplishment | SM is like a key to the dream of my life. Success story of job searching on SM. SM is the starting point for professional growth. |
| Happy/ feel good | Happy like a child. Having fun while searching for a job. Relaxed attitude in searching for a job. Hope and curiosity. |
| Accessibility | Global access. Jobs all over the world. Sweet rivers. Multi-device accessibility. SM opens doors for you. Makes things easier for you. |
| Quality of data/ information | Incomplete information. Too many/few details. Quality of spelling and grammar. Relevant information. |
| Quality of Social Media Profile/ Self branding | False information is detectable. The same person can be different on three different platforms Self-branding. Be yourself, the profile must be representative for who you really are. Good management of the SM account. Be reliable on SM platforms. |

6. CONSENSUS MAP

Constructs associated with the role of social media in the employment setting, as well as the links among them are presented in the consensus map shown in Figure 5. In the ZMET methodology, the consensus map is one of the most important outcomes. “Direct and indirect connections between constructs (or themes) represent a reasoning chain or thinking process showing how one idea leads to another. These associations are important because addressing one construct will have a ripple or multiplier effect on those with which it is causally connected” (Zaltman and Coulter, 1995, p. 45). In the consensus map which we developed, we kept the methodological conventions and we drew the originator constructs by circles, the destination constructs by rectangles and the connector constructs by diamond shapes. The links among the constructs are visually represented by unidirectional and bi-directional arrows.

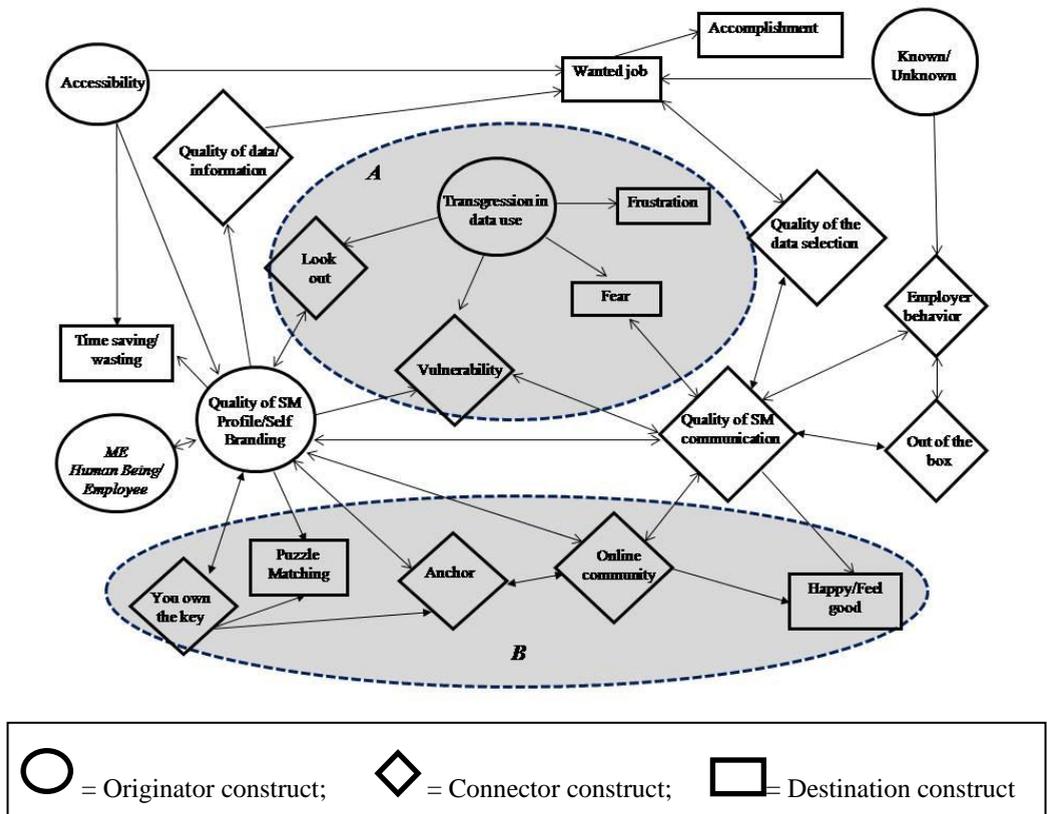


Figure 5 The consensus map showing the role of Social Media in the employment setting

Originator constructs. Based on interviews with study participants and data analysis, we extracted five constructs complying with the description of ZMET patent, according to which „the originating construct is the attribute which the subject felt was the cause of the second construct” (Zaltman, 1995, p. 10). *Quality of SM profile/ Self Branding, Me (as Human Being/ Employee), Accessibility, Known/ Unknown* and *Transgression in Data Use* seem to be the cause elements in the representation of the role of social media in the employment process. The construct *Quality of SM profile/ Self Branding* (that is a more or less true reflection of the construct *Me as Human Being/ Employee*) *has the most determining links as a cause element*. Most of these determining links have double arrows underlining the effects of feed-back on the way accounts are managed on social networks.

Connector Constructs. We identified ten constructs having the role of connectors: *Quality of SM communication, Online community, Quality of data/ information, Lookout, Out of the box, Quality of the data selection, Vulnerability, You own the key, Anchor, Employer behavior*. For example, the construct *Quality of SM communication* is most frequently mentioned ensuring multiple connections. The most important linking lines that were often mentioned in the final vignettes include two routes: *Quality of SM Profile – Quality of SM communication – Employer Behavior* and *Quality of SM profile – Online Community – Quality of SM communication – Quality of data selection – Wanted Job*.

Destination Constructs. For study participants, the two constructs *Wanted Job* and *Puzzle Matching (Job of my life, The job that fits me or To make only some people touch you, the ones you want* are just three examples of affirmations in this sense) were the most used aims for using social media in the process of employment. The construct *Wanted Job* is mentioned as the aim, but for most subjects, the generic question

“What does the job you search for on the SM mean for you?” provided responses gathered under the umbrella of the construct *Accomplishment*. Apart from the job as such, the subjects also reported that there was an intrinsic personal value of even higher importance to them than the *Wanted Job* in itself. This construct gathers statements such as *By finding the job I want, I become a winner* or *The Job I want is a step in my career journey*. The construct *Time saving/ wasting* is a bipolar result of the two originator constructs: *Accessibility (One-click away distance to social media)* and *Quality of SM profile (The way a personal account is managed and The activities run on social media account)*. What subjects feel about the use of social media in the employment process might have been gathered in a connector construct if we had considered the implications expressed by the subjects on the themes that built the construct *Quality of Social Media*

Communication. But, as in more than 80% of the transcribed interviews, the emotions included in the constructs *Fear*, *Frustration* and *Happy/Feel Good* appeared as the outcomes in mental maps and in the vignettes, we chose to mark them as destination constructs. For the subjects, the feelings they had or believed they would go through using social networks for employment are an end in themselves. What they felt or what they think they would feel the context of this research seems to be even more important than the technical descriptions of jobs they look for that have been included in the construct the Wanted Job.

After designing the consensus map and revising the transcripts for one last check-up in figure no. 5, we could distinguish two main concerning themes of our interlocutors regarding the use of SM in the employment process. The A and B grey areas from Figure no. 5 visually mark the two concerning themes. In the A area, we showed the Big Brother phenomenon associated with social media (Transgression in data use) which in the opinion of our subjects often generates Fear and Frustration, amplifies Vulnerability (towards a potential employer and towards other users of social media) and deepens the need to be „in constant alert” / „to be on guard”. The A area is the place of worry for our subjects. The B area is the place of security. The B area emphasizes that the subject has the power of control in the SM environment. The subject is not just a candidate for the Big Brother. The subject owns the key to what type, when and how SM resources one may use. The subject owns the matching key to find the right employer and other interesting people and is able to find the anchor needed to get support from the online communities. Also, searching for a job on social media may be relaxing and pleasant.

7. DISCUSSIONS

For a broader perspective on the role of social media in the process of employment we framed the constructs from the consensus map into six deep-metaphors: *Connection*, *Resource*, *Journey*, *Control*, *Affective distress*, *Transformation*. We used the model of seven deep metaphors suggested and argued by Zaltman and Zaltman (2008). As it can be observed in the table no. 2, links between the constructs and the deep metaphors were made with five out of seven metaphors of this model (*Balance*, *Transformation*, *Journey*, *Container*, *Connection*, *Resource* and *Control*). This framing into five deep metaphors came as a natural continuation after using the model developed by Zaltman and Zaltman (2008), according to which, the surface metaphors may be grouped into metaphor themes, which in turn are framed into deep metaphors. If in Table1 we kept some constructs from the consensus map (as metaphor themes) illustrated through

several statements of the subjects (as surface metaphors), the Table 2 shows the framing of all the 22 constructs of the consensus map into six deep metaphors.

For the constructs *Fear* and *Frustration*, as these have been described and explained by the subjects, we found the deep metaphor *Affective Distress*, suggested by Anghelcev et al. (2015) to be the most appropriate.

Table 2: *The connections between consensus map constructs and deep metaphors*

| Consensus Map Constructs | Deep metaphor |
|--|----------------------|
| Anchor | Connection |
| Employer behavior | |
| Me as Human Being/ Employee | |
| Online community | |
| Puzzle matching | |
| Quality of SM communication | |
| Lookout | Control |
| Transgression in data use | |
| Vulnerability | |
| You own the key | |
| Accomplishment | Journey |
| Happy/ feel good | |
| Known/ unknown | |
| Wanted job | |
| Accessibility | Resource |
| Quality of data/ information | |
| Quality of Social Media Profile/ Self branding | |
| Quality of the data selection | |
| Time saving/ wasting | |
| Out of the box | Transformation |
| Fear | Affective distress |
| Frustration | |

Even though the deep metaphor of *Connection* is found in the dictionary definition of the social media, the role of social media in the process of employment for our subjects is mainly defined by the existence of the online community as a third party in the relationship with the employer and by the nature of online communication. Discussing the nature of social media communication, the subjects most often mentioned instant feed-back and direct quick access to people and community from all over the world.

The deep metaphor *Resources* reflects the subjects' view on social media as a set of resources in the process of employment. The explicit statements of subjects

focused on four categories of resources provided by social media: the multitude of available data and information filters for selecting information, time and Self-Branding. Self-Branding is highly important for the interviewed subjects. On the one hand, it is presented as a resource implicitly delivered by social media. Signing into social media networks means that subjects have to create a personal account which is self-promotional in itself. On the other hand, the subjects view Self-branding as an outcome of the unique mix of shared personal information, features of online communities people belong to, quality of communication in which the individuals engage into and security measures taken for information shared in their accounts.

For our subjects, the wanted job is *journey* with multiple destinations. Each wanted job is just a stage that opens the way towards the next wanted job. According to the report of Jobvite (2016) on the American labor market, 74% of employees are open to a new job even if many of them are satisfied with their current job. For the generation subjects' parents, the wanted job still means a job for life, with a strong anchor on education received in Romania before the fall of the iron curtain. For the millennials, the journey metaphor in their job relations has become an implicit feature. The journey does not end with the wanted job but with the feeling of accomplishment and state of well-being. The Internet and the social media opened roads that were otherwise inaccessible and also underlined the risk of „unknown and unbeaten” road. One of the subjects expressed this idea by saying that „A job in another country, found on a social network, may be a great chance but also a big fraud”.

The deep metaphor *Control* is expressed bipolarly in our study. On the one hand, the subjects state that they own the key for using SM resources. On the other hand, the Big Brother theme emerges in all 13 interviews and is directly connected with the deep metaphor *Affective Distress* by means of the constructs *Fear and Frustration*. The construct *Look out* delivered by means of expressions, such as „Handle with care, it can be dangerous”, coexist with the construct *You own the key* in expressions such as „I am the only responsible for my choices on SM environment” and also with the construct *Vulnerability* seen in statements like „SM makes me vulnerable by lack of privacy”. Job search through social media means that our subjects have the ability to manage these challenges. The responses of our subjects match perfectly the conclusions of Ladkin and Buhalis, (2016, p. 338) stating that „there is a need to realize that their multiple identities are all at least partly visible, and the boundary between what is personal and what is private again is blurred. Maintaining both personal and professional spheres is an on-going challenge.” In our study, this on-going challenge is visible especially in the last sequence of the interview, in the vignette, in which the subjects stated that an

effective job search using social media may give you the feeling of accomplishment by getting the wanted job and by not feeling that you under the constant surveillance of the Big Brother.

8. CONCLUSIONS

The ZMET methodology enabled us to understand the thoughts and feelings of the subjects related to the role played by social media in the employment process. Job search by means of social media leaves behind a big part of traditional offline practices. It includes completely new ways of interaction that allow a better differentiation of job seekers and employers. This differentiation is gathered in the construct *Out of the Box* and it is exemplified by the subjects in expressions such as „Openness towards the new. Three steps ahead. Step out from the crowd.” For our subjects, the differentiation made in order to find the wanted job on social media is more than a simple growth of probability to obtain a specific job. It means *Transformation*. In fact, the entire experience of communication through social media to find a job is a transformative one. A reinvented Rapunzel presented earlier is one of the illustrations in this sense. If we agree that the use of social media in the process of employment has become a rule and not just an option, the research provides both to job seekers and to employers an example of how ZMET interview may clarify the way in which they manage resources and risks associated with employment in the social media environment.

Right after the end of the interview and when the camera was stopped, almost all subjects of the study reported that the interview experience made them become aware of specific features of communication and job search on social media they had not thought about before. Instead of a traditional good bye, on their own initiative, they told us that they were leaving the interview with a richer and deeper understanding of the role of SM in job search. Generally, the summary of feelings related to the topic researched and presented in this study for job seekers may be a resource for increasing their chances to get a suitable job by a better and more efficient use of social networks. On the other hand, the research provides to employers the opportunity to adjust their online recruitment policies taking into consideration the views of job seekers. A mental map such as the consensus map developed in this study does not provide definite or generally valid answers but invites to interrogations that go beyond ready-made recipes.

The reduced size of the sample and the high degree of subjectivity in data interpretation are limitations of this research, reducing the generalizations of its results for the target population. On the other hand, ZMET methodology involves the implementation of an exploratory qualitative research which allows small

samples. As future research direction, the study can be expanded on larger sample, both as a size and a structure. We intend to make ZMET interviews not only with employers but also with employees, users or non-users of social media in recruitment policy.

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FEMALE LABOR FORCE PARTICIPATION RATE AND ECONOMIC GROWTH IN THE FRAMEWORK OF KUZNETS CURVE: EVIDENCE FROM TURKEY

BUHARI DOĞAN*, MÜRSEL AKYÜZ**

Abstract: *In this study, the effect of economic growth in Turkey on the labor force participation rate of women was examined in the context of the Kuznets (1955) curve in the context of the data for the quarter years of 2000Q1-2013Q4. The co-integration test of the series was performed with the ARDL boundary test approach. As a result of the cointegration test, we find that the series move together in the long run. Findings show that economic growth increases women's labor force participation rate first but then it decreases women's labor force participation rate. Findings indicate that there is a reverse "U" relationship between economic growth and female labor force participation. As a result of the short-term analysis, it is found that error correction coefficient of the model is negative and statistically significant..*

Keywords: *Kuznets Curve, Economic Growth, Women's Labor Force Participation Rate, Turkey*

JEL Classification: *J21, O10, O15*

1. INTRODUCTION

One of the important indicators of economic growth and development is the participation rates in the labor force. Even though the efficient use of production factors takes place in the basis of economic development, the distribution of labour (labour force) factor which is a foremost of these factors is face to face with the gender inequality problem. Participation rates in the labor force, which have vital preventive measures for an economy, are scattered across women across the globe.

*Buhari Doğan, Süleyman Demirel University, Faculty of Economics and Administrative Sciences, Department of Economics, Isparta/Turkey, Email:doganbuhari@gmail.com

**Mürsel Akyüz, Munzur University, Faculty of Economics and Administrative Sciences, Department of Economics, Tunceli/Turkey

Even though the groups that constitute the majority of population in almost every countries in the world are women, their existence within the labour force market fell behind men from past to present. Along with the Industrial Revolution, women who are an effective component of production outside the labour market from 1750s to the present have begun to work for paid employment. However, since those years, women have always been seen as a cheap labour force. From the past to the present, even though women's participation to labour force market increased gradually within economic crisis periods, these increase might change between different countries, even between regions in the same country boundaries depending to the factors such as the traditions of the societies, religious beliefs, wealth level. When statistical data are examined, it is observed that women's labour force participation rate increased to 70% within the developed countries. When the labour force participation rate in Turkey is examined in terms of gender and age groups, men's labour force participation is higher when compared with women's (Kasa and Alptekin, 2015). The economic literature places particular emphasis on the role that women's participation in the labor force plays in the economic development of countries. Structural change of economies from agriculture to industry and services sector reduces the participation of women in the labor force in terms of developing countries. There are many factors that affect women's participation in the labor force. The most important factors affecting women's participation in the labor force are expressed as education level, family and community structure, number of children and economic development level of the country. Women's labor force activity is increasing in the developing universes of economic development with the increase of the dynamics of education and economic activity. As the economy grows, women have easier and better jobs and are therefore encouraged to be more economically active, which in turn increases women's participation in production activities. Women's participation in the labor force is desirable both in terms of equality and productivity. At the point of equality, women's participation in the labor force ultimately improves their economic situation and contributes to economic efficiency by increasing the development potential of the country (Mujahid and Zafar, 2012).

According to modernization theorists, economic growth is related to women's participation in the labor force, through changes in the professional structure and increases in educational opportunities as well as household

responsibilities. Modernization process is associated with increased labor demand, socially accepted education and employment of women and lower fertility rates Heckman (1978); Standing (1981); Bauer and Shin (1987). Some theoretical and empirical studies in the literature have found that female labor force participation has positive and strong links with economic growth (Tansel (2002); Fatima and Sultana (2009)). Worldwide trends indicate that women have a relatively more stable relationship between labor market participation and economic growth. A large majority of empirical research shows that women's participation in the labor force tends to decline in the first stages of economic growth, whereas after reaching a certain level of per capita positive relationship, women's participation in the labor market is increasing in the process (Lechman and Kaur, 2015). This implies that the relationship is a U-shaped statistical relationship between women's participation in work and economic growth.

Sinha (1965) suggests that the increase in the number of women in the labor force and the level of economic growth can be defined by a long-run U-shaped relationship. Since then, a significant portion of both theoretical and empirical findings have focused on the above relationship and have continuously updated information on this topic. Although the relationship between women's participation in labor and the level of economic growth is relatively stable and correlated with time, research findings still differ between different countries and groups of countries (Lechman and Kaur, 2015).

Understanding the relationship between economic development and women's participation in the labor force is important for many reasons. The U-shaped hypothesis states that there is some kind of trade-off between gender equality and economic growth in the development of an economy. Examination of this relationship is important for scholars and policy makers to know the trends in participation in the labor force and to design and implement policies from this point (Chapman, 2015).

The tendencies which are observed worldwide might be summarized that there is relatively a more stable relation with women's participation to labour force market and economic growth phase. As the clear majority of experimental (empirical) researches show that women's participation to labour force is in the downward tendency within the first phases of economic growth, on the other hand, a positive relationship occurs after per capita output reaches a certain level and

women's participation to the labour force market increases (Lechman and Kaur, 2015). This research provides extensive findings on re-examining the hypotheses and contributes to the current available information. In this context, the relationship between female labor force participation and economic growth is examined by the Boundary test approach for the Turkish sample in the context of the Kuznets (1955) curve. The study differs from the studies of the literature in terms of method used and sample.

It is expected that the period covered by the study in this context will contribute to the literature from the method and sample used. In the study, the theoretical background of the relationship between female labor force participation and economic growth will be discussed, and the development of women's labor force participation in Turkey will be informed and a literature review will be conducted. Then, the empirical application section will be passed, and the later findings will be evaluated.

2. THEORETICAL INFRASTRUCTURE

The participation rate of an economy in the labor force is expressed as one of the most important production factors that paves the way for economic growth and development. Participation rates in the labor force, which have vital preventive measures for an economy, are scattered across women throughout the world. Labor participation rates vary widely between men and women (Çatalbaş, 2015). In relation to this, Boserup (1970) argues that men's preferentially access education and new technologies can deprive women from work during their first years of growth. But as growth grows, women have access to education and technology. This situation indicates an increase in the form of female labor force participation rate. Another argument (see Boserup, 1970, 1990, Goldin, 1995) suggests that when the income situation is low, women work in productions on workshops in family farms or near homes. As the economy develops, the focus of production shifts from households to factories and from family companies to other companies, making it more difficult for women to work in a job to carry out reproductive and production activities together. Social norms show that manual work in factories is less useful for women. As the economy further develops, on the other hand, the manufacturing sector is becoming more of a retail production and office work. The work done in this way becomes less, cleaner and more pleasant in various forms.

Social stigma for women's employment decreases after marriage. As a result, women's participation in the labor force is increasing (Tam, 2011). Goldin (1995) and Tam (2008) think that income and substitution effect contributes to U-shaped pattern. When income is low and agriculture is dominant, the participation of women in the labor force is high. As the income increases, the demand for child ownership also increases. This kind of income effect leads to a decrease in the labor force participation rate of women. In addition, the increased use of machinery creates a substitution effect (such as men being physically capable) in women's participation in the labor force. Therefore, both income and substitution effects lead to a decline in the labor force participation rate of women and an increase in income (Tam, 2011).

Another important main stream idea on investigating the relation between women's participation to labour force and economic growth is that this relation is associated with long term structural changes and lapses. Lots of researchers think that as long as following certain development plans of the countries, renovated approaches experienced in structural changes affect women's active participation to labour force to a large extent. (Çağatay and Özler, 1995; Gaddis and Klasen, 2014). In the beginning phase of the economic development in which the large majority of society is low skilled and uneducated and economy itself remains weak in terms of labour force production, a major part of the labour force is employed in the agriculture sector. As countries proceed to the upper steps of development and as industrial sectors start to provide relatively more contribution than the agriculture sector, women's involvement to labour force decreases. Therefore, gradually increasing labour force demand within completely industrial sectors such as mining or construction makes less suitable conditions regarding women's participation to labour force. In this respect, it is observed that women's existence within the labour force decreases to a large extent in the dynamic industrialization process. In addition, when the national economy enters in the development process and as the service industries become progressively more dominant, the labour force market provides employment opportunity to women again (Cavalcanti and Tavares, 2011). These kinds of dynamics between women's participation to labour force and economic growth strengthen the appearance of U-shaped relation hypothesis. The nature of this relation shows diversity in different countries by members of different religions (such as Muslims and Christians) respecting to various norms,

behaviours, cultural and corporate values (Fernández, 2013). For example, women in Muslim countries lack their access to the labour force due to their religious constraints and for this reason, an U-shaped relation hypothesis with solid bases might not be valid in these countries (see. Doumato and Posusney, 2003; Nassar, 2003; Wolch and Dear, 2014).

Research shows that in the early stages of economic growth, women's labor force participation rates are falling, while women's labor force participation is increasing in later economic growth (Lechman and Kaur, 2015:246). Research in this regard has revealed that there is a U-shaped relationship between women's participation in labor and economic growth. Findings in the research indicate that there is a U-shaped relationship between labor force participation and economic growth in large proportion of women (Tam, 2011; Lechman and Okonowicz, 2013; Olivetti, 2013; Tsani et al., 2013; Kaur and Tao, 2014).

2.1. Women's Labor Force Participation in Turkey

When the distribution of the female labor force in Turkey is examined, it is seen that most of the women work in the rural areas with unpaid family worker status. This situation is less common in urban areas. For this reason, the participation rates of the female labor force in rural areas and the female labor force participation in urban areas differ. This suggests that women can take part in the labor market in the form of unpaid family workers, which is common in rural areas, but that they can not take part in the labor market with wage workers, which is widespread in urban areas (Özer and Biçerli, 2003; It is clear that the participation rates of women in the labor force between 1990 and 2013 are far behind when Turkey is compared to EU and OECD countries. Participation rates in the labor force in both EU countries and OECD countries, which showed large increases between these years, declined in Turkey. According to the World Bank data, the labor force participation rates in the EU and OECD countries, realized as 65% and 70% respectively in 2013, were only around 55% in Turkey. Although Turkey has grown economically in these years, Turkey has lagged behind the world in terms of participation in its labor force. This situation is expressed as one of the most fundamental problems of the Turkish economy (Catalbaş, 2015).

Looking at the participation rates of the female labor force, it seems more sad. Turkey is the lowest OECD country in the labor force participation rate.

Female labor force participation rates in the EU and OECD countries were 66.1% and 62.5% respectively in 2013 and 32% in Turkey (Çatalbaş, 2015). In Turkey, women's labor force, which has recently outgrown traditional roles, has become visible in business life, even at low levels. This is mostly true for the urban women labor force. Especially women with a higher rate of tertiary education seem to be determined to come to higher levels in career planning (Gurol, 2007).

On the other hand, it is also expressed as the conclusion of many academic researches that the participation rates of the female labor force are decreasing while the economy based on agriculture is moving to economics based on industry in the developing countries. While the economies are in the enlargement period, women's participation in the labor force is easier. In the early years of economic development, the amount of free labor, especially in the agricultural sector, is increasing. In the following periods, women can adapt to the labor force industry (Mujahid and Zafar, 2010).

3. LITERATURE SUMMARY

When studies on the labor force participation rates of women are examined in literature, factors affecting the entry of women into the labor market and their adaptation generally appear as the level of education, number of children, being urban or rural, perspective of family and community, and development level of the country. Women with higher education levels can find jobs easier and work at higher wages than women with lower education levels. Women with low levels of education usually work in rural areas as family workers and at low wages. The number of children is another factor that directly affects women's participation in the labor force. Many women with children can not access the labor market in terms of children due to domestic work. The fact that your husband is taking all the decisions in the family and the prohibition of the work of the woman is another factor that affects the participation in the female labor force. The level of development of the countries is the most discussed issue in the literature together with education. According to the majority of the studies done, the participation rates of the female labor force in underdeveloped and developing countries (see Boserup, 1970, Durand, 1975; Psacharopoulos, 1989; Kottis, 1990; Tam, 2011; Tsani et al. are very low compared to the developed countries (See Goldin, 1995, Tansel, 2002, Gaddis and Klasen, 2014). On the other hand, according to the

literature, the rates of female labor force participation are falling in the initial stages of economic development of countries. At later levels of economic development, female labor force participation rates are rising. This is explained by a U-shaped curve between economic development and female labor force participation rates. The following table has been presented with studies related to the subject.

Table 1 *Studies on Factors Affecting Labor Participation of Female*

| Writers | Sample | Methodos | Results |
|-----------------------------|--|---|---|
| Özer ve Biçerli (2003) | 12 Regions at the level of İBSS-1 (Turkey) | Panel, Ordinary Least Squares (OLS) | It has been determined that wages, inflation rates, growth rates and unemployment rates are not effective in women's participation in the labor force. It has been determined that wages, inflation rates, growth rates and unemployment rates are not effective in women's participation in the labor force. |
| Mujahid ve Zafar (2010) | Pakistan | ARDL | In the long run there is a U-shaped link between economic growth and female labor force participation rates. Increased levels of education and economic dynamics in relation to work increase women's labor participation rates in the later stages of economic growth. |
| Tam (2011) | World-wide 130 Countries | Ordinary Least Squares (OLS) Generalized Method of Moments (GMM) | There is no U-shaped relationship between the economic growth of the countries and the participation rates in the female labor force. |
| Yousefy and Baratali (2011) | Iran | ANOVA | In comparison, the level of education that women receive provides them to work in better positions. It also affects the chances of employment and promotion. |
| Kızılgöl Ayvaz (2012) | Turkey | Logit | The level of education, household income, |

| | | | |
|-------------------------------|--|------------------------------------|---|
| | | | dependency ratios, ownership of residence and age of women are the factors that affect the participation rate of women. |
| Günsoy ve Özsoy (2012) | Turkey | VAR | Participation in the labor force of vocational high school graduates has an important influence on economic growth |
| Bozkaya (2013) | Turkey | VAR | The most important factor determining the participation of women in the labor force in Turkey is the level of education. |
| Er (2013) | 26 Regions in the Level of İİBS-2 (Turkey) | Ordinary Least Squares (OLS) | Ordinary Least Squares (OLS) The level of education, male participation in the labor force, and the share of women in the agricultural sector affect the female labor force participation positively. |
| Tsani et al. (2013) | Southern Middle Eastern Countries | General Equilibrium Modeling (GEM) | The relationship between female labor force participation rates and economic growth supports the hypothesis. |
| Tan and Subramaniam (2013) | Malaysia | Ordinary Least Squares (OLS) | In Malaysia, women are not part of the labor force not because of their expectation from business life, they are not part of the labor force because of husbands' disapproval and family reasons, |
| Lahoti and Swaminathan (2013) | India | Ordinary Least Squares (OLS) | There is no significant relation between economic growth and female labor force participation rates. |
| William (2014) | USA | Ordinary Least Squares (OLS) | The wages that married women earn from household chores affect their participation in the labor force. The wages they earn from household chores reduce their participation in the labor force because they have a positive impact on their earnings. |

| | | | |
|--------------------------|---------------------------------|-------------------------------------|---|
| | | | |
| Chen et al. (2014) | China | Probit | Factors related to the family are more influential on female labor force participation rates than personal factors. |
| Çatalbaş Karpaz (2015) | 12 zones at the level of IBSS-1 | Panel, Ordinary Least Squares (OLS) | Fertility rate, divorce rates, informal employment, economic crisis and education are the factors that affect female labor force participation rates the most. |
| Ramirez and Ruben (2015) | Chile | Ordinary Least Squares (OLS) | Traditional gender awareness affects women's participation in the labor force. |
| Lechman and Kaur (2015) | World-wide 162 Countries | Generalized Method of Moments (GMM) | The relationship between economic growth and female labor force participation is supported by the U hypothesis for countries with high income levels, while it is not supported for low income countries. |
| Hare (2016) | China | Ordinary Least Squares (OLS) | Women's low education levels and flexibility in wages reduce women's participation in the labor force. It is stated that women with higher education levels can find jobs easier in the labor market. |
| Cubas (2016) | USA Mexico Brazil | Generalized Method of Moments (GMM) | Women's participation in the labor market is influenced by the fees paid for family work and informal economy entry. |

DATA SET AND MODEL

In the study, the effect of economic growth (*LNGDP*) on female labor force participation rate (*after this, it will be called as female labour participation rate (FLPR)*) (*FLPR*) was examined for the quarter years of 2000Q1-2013Q4 in the context of the Kuznets curriculum. Tam (2011); Sarcophagus and Swaminathan (2013); Lechman and Kaur (2015) have been taken into consideration. The

LNGDP series was obtained from the Electronic Data Distribution System (EVDS) and the FLPR series was obtained from the Turkish Statistical Institute (TUIK). The FLPR series used to represent the female labor force participation rate is the percentage of female labor force participation as a percentage of the total labor force. In this direction, the series have been tested primarily with unit root tests. The existence of cointegration between the series, Pesaran et al. (2001) was tested with the ARDL boundary test approach.

As an econometric method for revealing the relationship between variables, Pesaran et al. (2001). This method, called the boundary test (ARDL), is considered to be more flexible and useful when compared to Engle-Granger (1987), Johansen (1988) and Johansen and Juselius (1990) methods. Among the constraints of the mentioned methods, the series that are included in the model should not be stable at the level and they should become stable at the end of the difference operation. However, there is no such limitation in ARDL approach. That is, the series included in the model may be stationary at different levels (Tang, 2003). However, another advantage of the boundary test approach is that it allows estimation of a given model with low number of observations (Narayan and Narayan, 2004). In addition, while internalism is an important problem in other approaches, internalisability in the ARDL approach is a less important problem (Jalil, 2012). In short, ARDL can be defined as a method that indicates whether the dependent variable is I (1), and whether the independent variables are cointegration, even if they are I (1) or I (0) at different stationarity levels. The model to be used in operation is as follows.

$$FLPR_t = \alpha_0 + \alpha_1 LNGDP_t + \alpha_2 LNGDP2_t + \varepsilon_t \quad (1)$$

was expressed above. FLPR in the equation; Female labor force participation rate, LNGDP; LNGDP2; The wife of the grown up; Error term. The GDP series were included after the model logarithmic transformation was done. If it is > 0 and < 0 in the equation, it is concluded that there is an inverse relationship between economic growth and the labor force participation rate of women. If < 0 and > 0 , it is concluded that there is a relationship between economic growth and the labor force participation rate of women (Shahbaz et al., 2015).

Establishment of unconstrained error correction model (UECM) is required before the boundary test approach. Thereafter, a boundary test can be performed.

Pesaran et al. (2001) showed that the variance of variance, autocorrelation, and so on in the unrestricted error correction model, Stressing that there should be no problems. The model created in this direction is formulated below.

$$\Delta FLPR_t = \alpha_0 + \sum_{i=1}^m \alpha_{1i} \Delta FLPR_{t-i} + \sum_{i=0}^m \alpha_{2i} \Delta LNGDP_{t-i} + \sum_{i=0}^m \alpha_{3i} \Delta LNGDP2_{t-i} + \alpha_4 FLPR_{t-1} + \alpha_5 LNGDP_{t-1} + \alpha_6 LNGDP2_{t-1} + \varepsilon_{1t} \quad (2)$$

The expressions of the independent variables expressed in the equation are the same as those of the number 1 equation. Others are m; Optimum delay length; The difference processor. The delay length to be used in the ARDL model is important for both long-term and short-term analysis. In the study, it was tried not to determine the optimum delay length according to Schwarz Information Criteria (SIC). Considering that the series are quadrants, the delay limitation is set to a maximum of five.

The $H_0: \alpha_4 = \alpha_5 = \alpha_6 = 0$ hypothesis has been tested in the boundary test approach. The acceptance or rejection of this hypothesis is determined by the F test and Pesaran et al. (2001) are compared with the lower and upper critical values of the table. If the sample is small, the critical values of Narayan (2005) study can be taken into consideration. If the calculated value is above the upper critical value, it is determined that there is a cointegration relation between the series. If the calculated value is between two critical values, no comment on cointegration can be made. If the calculated value is smaller than the lower limit, it can not be decided that there is no cointegration between the series (Morley, 2006).

Cointegration analysis examines the long-run cohort. If the series are acting together in the long run, they are determined by the error correction model in which a sticker that may emerge is eliminated (Tari, 2011). In other words, the error correction model shows how long the series are converging after an aberration (Jalil, 2012). However, the error correction model may not always work (Tari, 2011). Short term analysis between variables was investigated with ARDL error correction model. The model is adapted to work as follows.

$$\Delta FLPR_t = \alpha_0 + \sum_{i=1}^m \alpha_{1i} \Delta FLPR_{t-i} + \sum_{i=0}^m \alpha_{2i} \Delta LNGDP_{t-i} + \sum_{i=0}^m \alpha_{3i} \Delta LNGDP2_{t-i} + ECT_{t-1} + \varepsilon_{1t} \quad (3)$$

The ECT in the equation is the term error correction. Error correction refers to a lagged value of error terms obtained in the long run. The error correction term gives information about how much of the difference between the series can be corrected after a certain period and it is also possible to calculate how many periods the deviation will end up after considering the relevant coefficient.

4. EMPIRICAL FINDINGS

Empirical analysis was carried out in the form of stationarity tests, cointegration tests, short and long term analyzes, respectively.

5.1. Unit Root Tests (Stability Tests)

The series were performed with Expanded Dickey Fuller (ADF) and Phillips Perron (PP) tests with and without unit root. The results obtained are presented below.

Table 2 ADF and PP Unit Root Test Results

| Variables | Augmented Dickey-Fuller (ADF) Test statistic | | Philips-Perron (PP Test statistic | | |
|---------------------------|--|-------------------------|-----------------------------------|-------------------------|--------|
| | <i>Level</i> | First Difference | <i>Level</i> | First Difference | |
| <i>FLPR</i> | 0.7021(4) | 0.0323(4)** | 0.0530(14)*** | 0.0000(14)* | |
| <i>LNGDP</i> | 0.0542(5)*** | - | 0.0924(15)*** | 0.0000(15)* | |
| <i>LNGDP2</i> | 0.0434(5)** | - | 0.0635(15)*** | 0.0000(16)* | |
| Significance Level | %1 | -4.198 | -3.605 | -4.198 | -3.605 |
| | %5 | -3.523 | -2.936 | -3.523 | -2.936 |
| | %10 | -3.192 | -2.606 | -3.192 | -2.606 |

Note: The values in brackets in the ADF test are the selected delay lengths using the Schwarz Information Criterion (SCI) and the maximum delay length is 9. In PP test, optimal delay length, Bartlett kernel (default) spectral estimation method and Newey-West Bandwidth (Automatic Selection) criteria were used. *: At the 1% level of significance, **: 5%, ***: It represents stability at the level of 10% significance.

Given the results in Table 2, the ADF and PP tests are at the level of the applied series or at the first difference. That is, it is possible to think of the series as any combination of I (0) and I (1) for all tests. There is no disadvantage in implementing the ARDL border test in this direction.

5.2. Cointegration Analysis

The Schwarz Information Criteria (SIC) for determining the delay length model for the boundary test is given in Table 3. It has been decided that the optimum delay length according to SIC is 1 when the maximum delay length is 5. Because 1 delay, the SIC takes the minimum value and there is no autocorrelation problem.

Table 3 Detection of Delay Length for Boundary Test

| Model | SIC | Definition |
|-------|-----------|---------------|
| 1 | 15.77986* | ARDL (1,3,4)* |
| 2 | 15.79004 | ARDL (1,4,3) |
| 3 | 15.81022 | ARDL (1,3,5) |
| 4 | 15.81486 | ARDL (1,5,3) |
| 5 | 15.82140 | ARDL (1,4,4) |

Note: The model is the delay length expressed in equation 2. * SIC (Schwarz Information Criteria) value is the minimum delay length.

For the realization of the cointegration test, the Unrestricted Error Correction Model (UECM), which is included in equation 2, is estimated. The F statistic of the model predicted in this direction is compared with the critical values of Peseran et al. (2001) and Narayan (2005). The findings were reported in Table 4.

Table 4 Bound Test Results

| k | F-statistic | Critical Values | Pesaran et. al (2001) Critical Values | | Narayan (2005) Critical Values | | Decision |
|---|-------------|-----------------|---------------------------------------|-------------|--------------------------------|-------------|------------------------|
| | | | Lower Level | Upper Level | Lower Level | Upper Level | |
| 2 | 5.43 | % 1 | 4.94 | 5.58 | 5.89 | 7.33 | There is cointegration |
| | | % 5 | 3.62 | 4.16 | 4.13 | 5.26 | |
| | | % 10 | 3.02 | 3.51 | 3.73 | 4.37 | |

Note:**5% shows meaningfulness. Critical values shows, Pesaran et al. (2001; 300), and Narayan (2005, 1988), the critical values for Case III, k = 2. The UECM has been taken as a maximum of "5" since the quadrant is being worked on. Estimation results are obtained according to Schwarz Information Criteria (SIC).

When the table 4 is examined, it is seen that the calculated F statistic is above the critical values at the level of significance of 1% according to Peseran et al. (2001) and 5% according to Narayan (2005). It is decided that there is

cointegration between the series with this movement. The co-integration indicates that the series of entities move together in the long run.

5.3.Long-term Analysis

In studying the maximum latency of 5, the best long-term model according to the SIC Schwarz information criteria is the non-autocorrelated ARDL (1,3,4) model expressed in equation (3). Figure 1 presents graphs of the statistics of the 20 most appropriate ARDL models for long-term analysis.

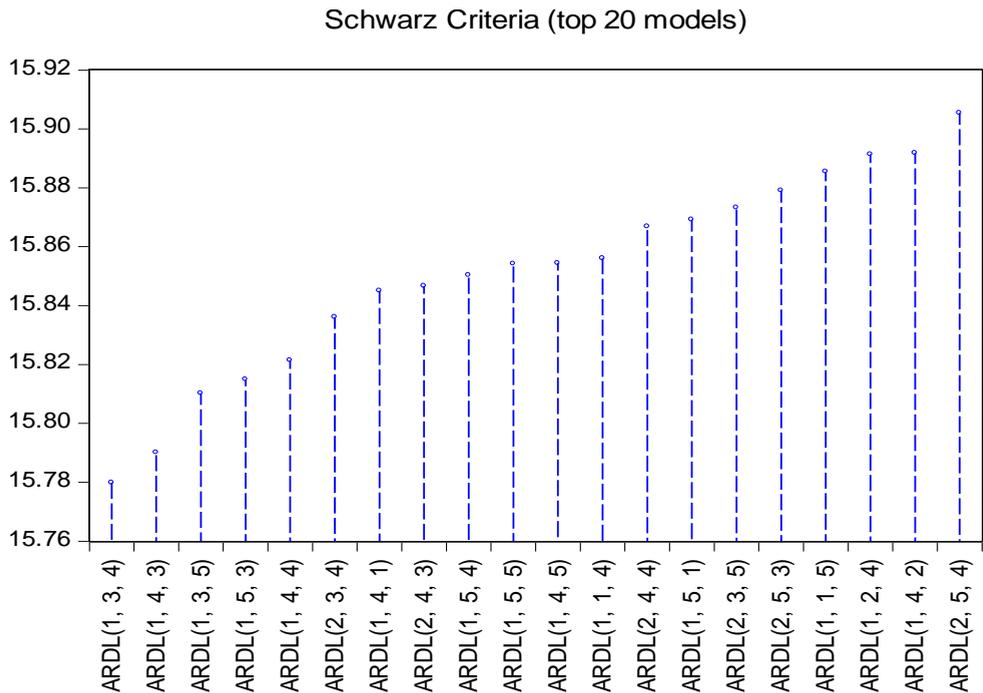


Figure 1 Top 20 Models for Long Term Analysis by SIC

After the findings, the long term relation was estimated by ARDL (Autoregressive Distributed Lag) model. The results obtained are the result of the optimal delayed long-term ARDL Model (1,3,4) and reported as follows.

Table 5 ARDL (1,3,4) Model Estimated Results and Long Term Coefficients

| Variable | Coefficient | t-statistic | Possibility |
|-----------------------|--------------------------|-------------------------------|--------------------------------|
| <i>FLPR</i> | 0.718 | 9.751 | 0.000 |
| <i>LNGDP</i> | -1.081 | -1.445 | 0.155 |
| <i>LNGDP2</i> | 2.155 | 1.525 | 0.134 |
| <i>C</i> | 9.293 | 1.891 | 0.065 |
| Long-term Coefficient | | | |
| <i>LNGDP</i> | 9.813 | 2.178 | 0.035** |
| <i>LNGDP2</i> | -17.468 | -2.010 | 0.050*** |
| <i>C</i> | 3.303 | 1.940 | 0.059 |
| Diagnostic Tests | | | |
| $R^2 = 0.93$ | F ist.= 55.422 (0.00) | $\chi^2_{BG} = [4.13] (0.25)$ | $F_{RR} = [0.16] (0.30)$ |
| $\bar{R}^2 = 0.91$ | DW= 1.98 | $\chi^2_{JB} = [1.17] (0.00)$ | $\chi^2_{BPG} = [2.24] (0.03)$ |

Note: DW, Durbin-Watson statistic in diagnostic tests; BG, Breusch-Godfrey autocorrelation test, RR; Ramsey model Failure to set up; JB, Jaque-Bera normality test; BPG is Breusch-Pagan-Godfrey varying variance statistics. The values in parentheses represent the probability values. *, At the 1% level of significance, **, 5%, ***, Represents a level of significance of 10%.

$$FLPR = 3.303 + 9.813 LNGDP + -17.468 LNGDP2 \quad (4)$$

(0.059) (0.035) (0.050)

Diagnostic tests performed at the end of the obtained results are given under Table 5. It shows that the model established in this direction is quite acceptable. The coefficients of the economic growth (LNGDP) series are positive and the coefficient of the economic growth (LNGDP2) ratio is negative. This suggests that economic growth reduces women's labor force participation rate first. Findings indicate that there is a reverse "U" relationship between economic growth and female labor force participation rate. Lechman and Kaur (2015) and Tsani et al. (2013) finds that there is an inverse "U" relationship between female labor force participation and economic growth. The model's Cusum test also shows that the regression coefficients are stable (Figure 2).

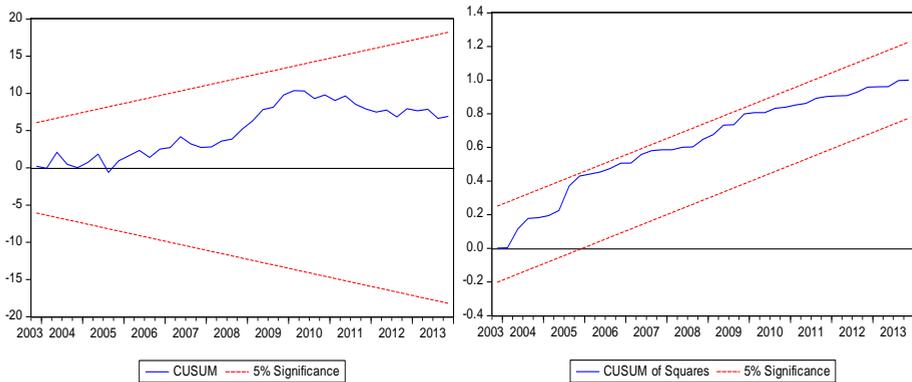


Figure 2 Boundary Test Parameter Stability Tests: Cusum and CusumQ

5.4.Short Term Analysis (Error Correction Model)

After deciding that the series were co-integrated in the long run, a short-term analysis was undertaken. The error correction model predicted result is the most suitable model (1,3,4) and the related results are reported in Table 6.

Table 6 ARDL (1,3,4) Model Estimation Results and Short Term Coefficients

| Variable | Coefficient | t-statistic | Possibility |
|------------------------|--------------------------|-------------------------------|--------------------------------|
| $\Delta LNGDP$ | -1.081 | -3.561 | 0.001 |
| $\Delta LNGDP_{t-1}$ | -2.130 | -0.845 | 0.402 |
| $\Delta LNGDP_{t-2}$ | 8.434 | -2.976 | 0.004 |
| $\Delta LNGDP^2$ | 2.155 | 3.771 | 0.000 |
| $\Delta LNGDP^2_{t-1}$ | 4.382 | 0.919 | 0.363 |
| $\Delta LNGDP^2_{t-2}$ | 1.525 | 2.875 | 0.006 |
| $\Delta LNGDP^2_{t-3}$ | 1.268 | 5.758 | 0.000 |
| ECT_{t-1} | -0.281 | -4.828 | 0.000 |
| Diagnostic Tests | | | |
| $R^2 = 0.13$ | F ist.= 3.373 (0.089) | $\chi^2_{BG} = [2.25] (0.43)$ | $F_{RR} = 2.26 [2] (0.09)$ |
| $\bar{R}^2 = 0.22$ | DW= 1.819 | $\chi^2_{JB} = 34.52(0.00)$ | $\chi^2_{BPG} = [2.18] (0.09)$ |

Note: DW, Durbin-Watson statistic in diagnostic tests; BG, Breusch-Godfrey autocorrelation test, RR; Ramsey model failure to set up; JB, Jaque-Bera normality test; BPG is Breusch-Pagan-Godfrey varying variance statistics. The values in parentheses represent the probability values.

Since the error correction term (ECT) is negatively and statistically significant, the error correction mechanism works. That is, short-term deviations are self-correcting after three and a half periods ($1 / 0,281$, ie about ten and a half months). That is, short-run deviations between the long-run series and the long-run series converge to the long term equilibrium value.

5. CONCLUSION

Participation ratio in labor is among the most important economic indicators of countries. This ratio, which is found by the ratio of the unemployed in the active population to the employed, is lower in Turkey than in other OECD countries. Woman labour force is one of the important factors for the countries' development. On the other hand, if women work, they feel themselves economically free. Therefore, the woman who feels economically free both believes herself better in economic life and also might raise clearly thinking individuals by being a better mother in social life. In addition, the woman who achieved her economic freedom might change the destiny of countries with her self-confidence and her unique ideas. For this reason, woman employment is a topic to lay weight on for the economic development of Turkey and other countries.

In this study, the effect of economic growth in Turkey on the labor force participation rate of women was examined in the context of Kuznet's curriculum in line with the data covering the quarter years of 2000Q1-2013Q4. It has been determined that there is a co-integration relationship between economic growth and the labor force participation rate of women, and based on this, a long and short term ARDL analysis has been conducted. Some studies in the literature have resulted in a "U" relationship between economic growth and female employment. This shows that the increase in education level of women, a reflection of the structural changes in the economy, is the shift in the effects of income and substitution effect. In our analysis, such a result is not obtained. Findings show that economic growth increases women's labor force participation rate first but then it decreases women's labor force participation rate. Findings indicate that there is a reverse "U" relationship between economic growth and female labor force participation. The results obtained are shown in Lechman and Kaur (2015) and Tsani et al. (2013). As a result of the short-term analysis, the error correcting

coefficient of the model was found to be negative and statistically significant. In this respect, short-term deviations are close to long-term equilibrium values.

Women who raise the generations should not be deprived of the rights men have within the society. Because the basis of the all-out development of the countries is based on being involved in production activities actively without separating woman or man. Otherwise, as mentioning a prosperous life becomes impossible, the country might even become obliged to get poor and vanish. For this reason, increasing woman employment is as important as the man employment for the development and improvement of economy. It is expected that women's participation in labor force and earning an economy will make an important contribution to the gain, development and acceleration of growth for any country. In this context, it is necessary to take necessary precautions to participate in the labor force of female.

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ENERGY CONSUMPTION AND GDP IN THE OECD COUNTRIES: A CAUSALITY ANALYSIS

MONDIU T. JAIYESIMI*, TOKUNBO S. OSINUBI**, LLOYD AMAGHIONYEODIWE***

Abstract: *This study investigated the nature or direction of causality between GDP, electricity consumption and total energy consumption in the OECD. Secondary data was used while both the ordinary least square (OLS) and generalized method of moments (GMM) estimators were employed to test for causality in our model. Our result found the presence of a bi-directional causality between energy consumption and GDP for the total energy demand model and between electricity consumption and GDP for the electricity demand model. By implication, the bi-directional causality in our estimated models suggest that both energy consumption and GDP are important factors in economic development in the OECD. Thus, if misguided policy measures are made to reduce energy consumption it could have a detrimental effect on GDP which will slow down economic growth. A recommendation is for policy makers to concentrate on encouraging energy efficiency as a way to reduce energy and electricity consumption.*

Keywords: *Energy consumption, Electricity consumption, GDP, Causality.*

1. INTRODUCTION

Electricity is vitally important for modern economies. It enables consumers to use appliances such as computers, medical devices, telecommunication appliances and transport vehicles; all of which increase the quality of life (Dilaver and Hunt, 2011). The generation and consumption of electricity by industries and households has also followed an increasing trend since the industrial revolution due to its underlying importance to different sectors of the economy. The electricity sector is regarded as one of the biggest contributors to the global emission of CO₂

* Mondiu T. Jaiyesimi, Department of Economics, University of Surrey, Guildford, Surrey, UK

** Tokunbo S. Osinubi, Department of Business Administration, College of Business, Montana State University – Billings, Billings, Montana, USA

*** Lloyd Amaghionyeodiwe, Department of Accounting and Finance, York College, City University of New York, Jamaica, USA

due to the use of fuels like crude oil and coal for power generation. Furthermore, the per capita electric power consumption for the OECD from 1978 to 2008 depicts an upward trend from 1978 with a 71.4% rise over the 31-year period. Marginal reductions in electricity consumption were however witnessed from 1991 to 1992 and 2007 to 2008 with 0.50% and 0.71% decline respectively. By 2010, the OECD still accounts for 51.1% of electricity generated globally (IEA, 2011). And with respect to per capita total energy consumption in the OECD, it reduced from 1980 to 1983 by approximately 10% following a 2.5% increase from 1978 to 1979. Per capita total energy consumption has however followed an increasing trend from 1984 to 2008 except for few periods of marginal reduction witnessed in 1989, 1998, 2001, 2006 and 2008. This trend notwithstanding, the total energy and electricity price in real terms showed significant structural breaks. This can be explained by the significant fluctuations in energy price that has characterised the energy industry since 1973. Electricity price rose sharply in 1980 by 7.6% following a 1.2% reduction in 1979. The increasing trend continued from 1980 to 1983. The periods from 1987 to 1989 and 1993 to 2000 witnessed a 5% and 13% fall in electricity price respectively. However, electricity price has been on a steady increase since 2000.

Available data indicates some volatility in total energy and electricity prices, OECD consumption and economic growth, which have followed an increasing trend. This by implication indicates that increased usage of energy can lead to more growth or that increased growth can lead to more energy consumption. Whichever way one looks at it, it presents the case of the much-discussed climate change. The emission of carbon dioxide (CO₂) and other greenhouse gas emissions are regarded as one of the salient issues affecting the global economy due to its damaging effect on the world atmosphere. This issue led to the move by the United Nations' Framework Convention on Climate Change through the much-publicised Kyoto Protocol, later amended by the Doha agreement in 2012, to address the rapid rise in carbon emission. Although the OECD accounts for 18% of world population, more than half of global consumption-based emission (1550 Million tonnes of CO₂) is still attributable to OECD consumption (Nakano et al. 2009). This however poses a challenge to climate security and set targets by policy makers concerning energy

conservation and emission reduction. According to the Kyoto¹ agreement, countries (mostly industrialized) agreed to reduce carbon emission relative to 1990 levels. For example, the United Kingdom agreed to reduce carbon emission by 20% of 1990 levels in 2010. However, some of the highest emitters like Australia and United States² refused to be signatories to the treaty due to their inability to guarantee reductions in carbon emission to meet set targets.

The issue of carbon emission and climate change has also led to a spectrum of empirical studies on the relationship between energy consumption and GDP in a bid to provide robust policy recommendations to tackle the unprecedented rise in the emission of CO₂ and other greenhouse gases. More so, the implementation of policies based on inconsistent empirical results and recommendations could be detrimental to the short and long term macroeconomic targets of any economy. In line with this, it is thus vital that policy makers are furnished with reliable and consistent estimates and recommendations on the relationship between energy consumption and GDP in the process of formulating and implementing energy reduction policies. Due to its position as the biggest consumer of energy globally and its mission to promote policies that will improve the economic and social well-being of people around the world, the importance of having a robust understanding of the OECD's energy causality estimates and position cannot be over emphasized. In addition, the investigation of causality between energy consumption and GDP has been known to give contradictory results in past research works due to differences in data sets and methodologies employed. This paper is unique as it contributes to the existing literature by employing newly developed panel data empirical techniques and an extended data set (when compared to Lee and Lee 2010) to estimate OECD demand models and determine the nature or direction of causality between GDP, electricity consumption and total energy consumption in the OECD. This research work also estimates both a fixed effect model using Ordinary Least Squares (OLS) method and the Generalized Method of Moments (GMM) estimator to compare and contrast estimated results of causality in the total

¹ Kyoto protocol is an international agreement linked to the United Nations Framework convention on climate change (UNFCCC)

² The United States alone is the largest generator of electricity in the world accounting for approximately one quarter of world's electricity (Narayan et al. 2007).

energy demand and electricity demand models. The rest of this study is organized as followed. The next section reviews the relevant literature in energy demand modelling, OECD energy demand and causality surveys. Section three explains the methodology, empirical results and the requisite economic interpretation while the final section concludes the study.

2. REVIEW OF RELATED STUDIES IN CAUSALITY BETWEEN ENERGY CONSUMPTION AND GDP

A number of studies that have investigated the relationship between energy consumption and GDP have cited the work of Kraft and Kraft (1978) as the pioneering study in this area of research. They employed a Bivariate Simms causality test to investigate the relationship between GNP and energy consumption in the United States from 1947 to 1974. However, according to Al-Iriani (2006), Sims (1972) and Granger (1969) causality techniques have been widely criticized as yielding inconsistent results. As a result, the use of cointegration and error correction models has gained more grounds in this area of research. More so, another limitation of the work of Kraft and Kraft (1978) is the short time span of the time-series data employed.

Due to the underlying differences in data sets, sample periods and methodologies, there has been a long-lasting argument on the most appropriate methodology for investigating causal relationships as a result of inconsistencies in results. More importantly, the disparities in the quality of estimated results between time series and panel based models have also been widely discussed. This study will look at a selected number of studies based on data set and methodologies (time series and panel based ones) as it relates to causal relationships in both OECD and non-OECD countries. After the findings of Kraft and Kraft (1978), Akarca and Long (1980), Erol and Yu (1987a), Yu and Choi (1985), and Yu and Hwang (1984) all discovered no causality between energy consumption and GDP using time series methodology. Soytas and Sari (2003) found causality to run from GDP to energy consumption in South Korea from 1953 to 1991 whereas, Oh and Lee (2004), using the Vector Error Correction Model (hereafter, VECM) and data set from 1981 to 2000 for the same country found no short run causality between energy consumption and GDP but their long run findings are similar to the results found by Soytas and Sari (2003). Magazzino, C., (2016) assessed the relationship among real GDP, CO₂

emissions and energy use in South Caucasus (Armenia, Azerbaijan and Georgia) and Turkey using a time series methodology. The study found energy use and CO₂ emissions drive real GDP in Armenia confirming a unidirectional causality from economic growth to energy consumption while the feedback hypothesis was established for Azerbaijan and Georgia. No causality link was found for Turkey between economic growth and energy consumption. Magazzino, C., (2016) also examined the relationship between CO₂ emissions, energy consumption and economic growth in Italy between 1970-2006 using the VAR methodology and found that the three estimated variables are not cointegrated.

Lee (2005) assessed the co-movement and the causal relationship between energy consumption and GDP in 18 developing countries employing tests of panel unit roots, heterogeneous panel cointegration and panel-based error correction models to determine the short and long run causality between energy consumption and GDP. The long run relationship of the variables was estimated using the FMOLS technique. Evidence from the study suggested that long-run and short-run causality run from energy consumption to GDP, but not vice versa. Mahadevan and Asafu-Adjaye (2000) investigated the relationship between energy consumption and economic growth using panel error correction model on 20 net energy importers and exporters from 1971 to 2002. Both panel and individual VECMs were estimated for appropriate comparison. They discovered that among the energy exporters, there is bi-directional causality between economic growth and energy consumption in the developed countries in the short-run and long-run, while in the developing countries, energy consumption stimulates growth only in the short-run. Having used consumer price index (CPI) as proxy for real energy price, Lee and Lee (2010) argue that CPI may very well not capture the real energy price and its use might lead to misleading results. Al-Iriani (2006) investigated the causal relationship between GDP and energy consumption in 6 countries of the Gulf Cooperation Council (GCC) using GMM to estimate a panel VECM. The findings suggest that uni-directional causality runs from GDP to energy consumption thereby suggesting a reasonable point for policy makers to implement energy conservation measures without affecting the economies negatively. Magazzino, C., (2017) also investigated the relationship among economic growth, carbon dioxide emissions and energy use for 19 Asia-Pacific Economic Cooperation (APEC) countries (1960-2013) using a panel Vector AutoRegression model (VAR) approach to estimate a three variable VAR. The

study, using a new panel cointegration technique, found no causal relationship between real GDP and energy use.

Hsiao's criterion was used by Altinay and Karagol (2004) to test for causality between GDP and energy consumption in Turkey from 1950 to 2000. The neutrality hypothesis was however established as they found no causality between the two variables. Huang et al (2008) employed the GMM estimator to estimate a Vector Autoregressive Model (hereafter, VAR) for 82 countries from 1972 to 2002. The countries were divided into four categories namely: low income group, lower middle income group, upper middle income group, and high income group. Neutrality hypothesis was established in the low-income group while in the middle-income group, GDP was found to cause energy consumption. However, in the high-income group, which is the area of concern of this research work, economic growth has a negative effect on energy consumption. Magazzino, C., (2016) however, using the same panel VAR methodology for 10 middle east countries (six Gulf Cooperation Council (GCC) and four non-GCC countries) over the period 1971-2006 found that for the four non-GCC countries investigated, energy use does not have an impact on growth. According to Oh and Lee (2004), one of the limitations of the VAR model is its inability to give information on long-run relationships in granger causality as the long run information is removed after first differencing. They however, stated that the VECM is more useful in providing long- and short-run information in granger causality testing. Narayan and Prasad (2008) employed the bootstrap simulation technique to investigate the nexus between electricity consumption and real GDP in 30 OECD countries. The approach, which was pioneered by Efron (1979), recycles information in the sample by simulations and the critical values of the bootstrap technique have been found to be robust when rejecting or failing to reject the null of no granger causality. In their findings, uni-directional causality was found from electricity consumption to GDP in Australia, Iceland, Italy, Slovak Republic, Czech Republic, Korea, Portugal and the United Kingdom. It suggests that electricity conservation policies will have a negative impact on economic growth. However, the results of the remaining 22 OECD countries suggest otherwise as electricity conservation policies will not have a negative effect on economic growth. In other time series approach, Magazzino, C., (2015) investigated the relationship between energy use and GDP in Israel between 1971 and 2007 and results confirmed that the direction

of causality is from aggregate income to energy use and while investigating the causal relationship between energy consumption and GDP in Italy, Magazzino, C., (2015) found during the period 1970-2009, the direction of causality is from energy use to GDP in the short run and there is a long run-bi-directional causality between the two variables.

Apergis and Payne (2010a) investigated the causal relationship between renewable energy consumption and economic growth in 25 OECD countries using panel heterogeneous cointegration tests, FMOLS and VECM to tests for long run relationship among the variables and the causal effects respectively. More so, due to the substantial contribution of coal to emission of CO₂ and other greenhouse gases, Apergis and Payne (2010b) examined the relationship between coal consumption and economic growth for 25 OECD countries using the same aforementioned panel estimation techniques. Fei li et al (2010) also used the panel unit roots, heterogeneous panel cointegration test and panel-based dynamic OLS to re-investigate the co-movement and relationship between energy consumption and economic growth for 30 provinces in mainland China from 1985 to 2007.

Constantini and Martini (2010) performed a comprehensive panel survey of 71 countries which included both 26 OECD and 45 non-OECD countries and on four end use sectors; industry, service, transport and residential. They used the FMOLS developed by Pedroni (2000) to test the long-run relationship of energy consumption and GDP before employing the VECM to test for causality. Given the limitations of estimating a bivariate model which does not give room for addition channels of causality (Lee and Chang 2008), both bivariate and trivariate models were estimated. The bivariate VECM was constructed to account for structural breaks with specific temporal dummy variables for each single country reflecting results from structural break tests. When the bivariate VECM was performed on the whole economy, they found short-run bi-directional causality and a uni-directional long-run relationship where economic output is a driver for energy consumption and not vice versa. However, when the trivariate VECM was estimated, the results differ due to the addition of energy price in the relationship. This cast some doubt on the ability of bivariate models to shape causal relationship between energy consumption and GDP especially when considering different sectors.

Chontanawat et. al (2008) tested for causality between energy consumption and GDP using a consistent data set for over 100 countries. The study, which

included 30 OECD countries and 78 non-OECD countries discovered that causality from energy to GDP is found to be more prevalent in the developed OECD countries compared to the developing non-OECD countries. This implies that energy conservation policies aimed at reducing emissions is likely to have greater impact on the GDP of the developed rather than the developing world. Lee and Lee (2010) also employed GMM in a panel context to estimate the short and long run causality for total energy and electricity demand model in the OECD. They found reciprocal causal relationships among GDP, energy price and energy consumption in the total energy model while uni-directional causality was found to run from income and electricity price to electricity consumption in the OECD. However, they used GDP per capita (constant 2000 US\$) which is not as widely used as GDP per capita using purchasing power parity (PPP) especially when dealing with a panel of different countries. Thus, this study will use GDP per capita (PPP) to account for economic activity in the total energy demand and electricity demand models.

Table 2.1 presents the overview of selected studies on the relationship between energy consumption and GDP.

Table 1 Summary of Selected Studies on the Nexus between Energy Consumption and GDP

| Authors | Data Type | Methodology | Subject | Period | Results |
|--------------------------|-------------|-------------------------------|---|--|---|
| Kraft and Kraft (1978) | Time-series | Bivariate Sims causality test | USA | 1947-1974 | Income → Energy consumption |
| Yu and Choi (1985) | Time-series | Bivariate granger test | South Korea Philippines Thailand and Philippines | 1954-1976 | Income → Energy consumption Energy consumption → Income Energy consumption ↔ Income |
| Mansih and Mansih (1998) | Time-series | VAR/ VECM | Sri Lanka and Thailand | 1955-1991 | Energy consumption ↔ Income |
| Asafu-Adjaye(2000) | Time-series | Engel and Granger | India Indonesia Philippines Thailand | 1971-1995 1971-1995 1973-1995 1973- | Energy consumption → Income Energy consumption → Income Energy |

| | | | | | |
|-----------------------------------|-------------|--------------------------|-----------------------|-----------|--|
| | | | | 1995 | consumption↔ Income Energy consumption↔ Income |
| Hondroyiannis et al (2002) | Time-series | Trivariate VECM | Greece | 1960-1996 | Energy consumption↔ Income |
| Soytas and Sari (2003) | Time-series | Bivariate VECM | Canada, USA and UK | 1950-1992 | Energy consumption~ Income |
| Lee (2005) | Panel | Trivariate Panel VECM | 18 non-OECD | 1975-2001 | Energy consumption →Income |
| Al-Iriani (2006) | Panel | Bivariate panel VECM/GMM | GCC countries | 1971-2002 | Income →Energy consumption |
| Mahadevan and Asafu-Adjaye (2007) | Panel | Trivariate Panel VECM | 20 OECD and non- OECD | 1971-2002 | SR: Energy consumption↔ Income LR: Income →Energy consumption |
| Lee and Lee (2010) | Panel | VECM/GMM | OECD | 1978-2004 | Income →Electricity consumption Energy consumption↔ Income |

Sources: Mahadevan and Asafu-Adjaye (2007) and updated by Authors

Notes: VAR: vector autoregressive model; GMM: generalized method of moments; VECM: vector error-correction model; LR: long run, SR: short run; →Signifies uni-directional causality; ↔ means bidirectional causality and ~ means no causality in any direction

3. METHODOLOGY AND DATA SOURCE

3.1 Model Specification

The study adapts the methodology of Al-Iriani (2006) in the panel VECM estimation as well as those of Lee and Lee (2010). This methodology follows the specification of two log-linear models of total energy and electricity demand:

Total Energy Demand Model:

$$TEC_{it} = \alpha_i + \beta_i GDP_{it} + \gamma_i TEP_{it} + \varepsilon_{it} \quad (1)$$

Electricity Demand Model:

$$EPC_{it} = \alpha_i + \phi_i GDP_{it} + \theta_i REP_{it} + \eta_{it} \quad (2)$$

- Where:
- TEC represents total energy consumption per capita,
- GDP represents gross domestic product per capita (PPP),
- TEP represents total energy price,
- EPC represents electricity consumption per capita,
- REP represents electricity price.
- β and γ both represent income and price elasticities in the total energy demand model
- ϕ and θ represent income and price elasticities in the electricity demand model.
- ε and η are stochastic error terms,
- i represents annual cross sectional observations of the OECD countries (1, 2, 3, ... N) and
- t is the time period of the individual cross sectional observations.

Note that all variables are in natural logarithms and the log-linear specification is to derive constant elasticities and reduce heteroscedasticity.

This study also aims to investigate the relationship between energy consumption and GDP in one relationship, and electricity consumption and GDP in another relationship respectively. The first step is to estimate a long-run relationship using the unit root test and the second step is to use the residuals from the long-run regression as an error correction term in a dynamic short-run equation. This is widely known as the two-step Engel and Granger procedure. Both OLS and the GMM estimators will be used to estimate the respective relationships specified as:

$$\Delta TEC_{it} = \theta_{1i} + \lambda_1 ECT_{it-1} + \sum_{k=1}^m \theta_{11k} \Delta TEC_{it-k} + \sum_{k=1}^m \theta_{12k} \Delta GDP_{it-k} + \sum_{k=1}^m \theta_{13k} \Delta TEP_{it-k} + \mu_{1it} \quad (3)$$

$$\Delta GDP_{it} = \theta_{2i} + \lambda_2 ECT_{it-1} + \sum_{k=1}^m \theta_{21k} \Delta GDP_{it-k} + \sum_{k=1}^m \theta_{22k} \Delta TEC_{it-k} + \sum_{k=1}^m \theta_{23k} \Delta TEP_{it-k} + \mu_{2it} \quad (4)$$

$$\Delta EPC_{it} = \phi_{1i} + \gamma_1 ECT_{it-1} + \sum_{k=1}^m \phi_{11k} \Delta EPC_{it-k} + \sum_{k=1}^m \phi_{12k} \Delta GDP_{it-k} + \sum_{k=1}^m \phi_{13k} \Delta REP_{it-k} + \mu_{1it} \quad (5)$$

$$\Delta GDP_{it} = \varphi_{2i} + \gamma_2 ECT_{it-1} + \sum_{k=1}^m \varphi_{21k} \Delta GDP_{it-k} + \sum_{k=1}^m \varphi_{22k} \Delta EPC_{it-k} + \sum_{k=1}^m \varphi_{23k} \Delta REP_{it-k} + \mu_{2it} \quad (6)$$

Where:

- Δ is the difference term
- θ and φ represent fixed country effects
- k ($k = 1, \dots, m$) is the optimal lag length determined by Schwarz Information Criterion
- **ECT** is the error correction term derived from the FMOLS estimation
- **λ and γ** are adjustment terms
- **μ** is the error term
- All variables remain as named in equations 1 and 2.

The aim of this section as explained above is to estimate VECMs for the two models using OLS and the one-step GMM technique introduced by Arellano and Bond (1991). The idea is to compare and contrast both techniques for appropriate analysis. In a dynamic panel model, panel data literature explains that introducing a lagged dependent variable causes problems in the model. This is because the error terms are correlated with the dependent variables and hence with the lagged dependent variables so the regressors will still be correlated with the error term. To correct this problem, the first step is to eliminate the country-specific effects by taking the first differences of the variables. However, this introduces serial correlation in the disturbances so instruments are introduced to the model. So long as the instruments are not correlated with the error term and the error terms are not serially correlated. This procedure will use $m=4$ as number of instruments as used by Lee and Lee (2010). To test for the direction of causality, the significance of all the coefficients of the independent variable in the over-parameterised models will be investigated. For short run causality, the following are tested:

$$H_0: \theta_{12k} = 0 \text{ for } \Delta GDP \text{ for all } k \text{ in equation} \quad (7)$$

$$H_0: \theta_{22k} = 0 \text{ for } \Delta TEC \text{ for all } k \text{ in equation} \quad (8)$$

$$H_0: \varphi_{12k} = 0 \text{ for } \Delta GDP \text{ for all } k \text{ in equation} \quad (9)$$

$$H_0: \varphi_{22k} = 0 \text{ for } \Delta EPC \text{ for all } k \text{ in equation} \quad (10)$$

Long run causality can be determined by employing the t-test on the estimates of the speed of adjustment terms (λ_i and γ_i) which represents the coefficients of the

error correction terms. $H_0: \lambda_i=0$ is tested for the respective speed of adjustment terms in equations 9 and 10 while $H_0: \gamma_i =0$ is tested for the respective speed of adjustment terms in equations 15 and 16. A joint test is then conducted to check for strong causality where the variables bear the burden of a short-run adjustment so as to re-establish a long run equilibrium following a shock in the system (Lee and Chang 2008). After testing for causality, the restricted short-run model will be presented after dropping all insignificant variables from the model to derive the short-run price and income elasticities of both models.

The unit root was done using the IPS, Fisher-ADF and Fisher PP tests. This was based on the following autoregressive model:

$$y_{it} = \rho_i y_{it-1} + \delta_i X_{it} + \mu_{it} \quad (11)$$

Where:

- y_{it} is a variable being examined, $i= 1, 2 \dots N$ is the number of cross-section units and $t=1, 2 \dots$
- T_i represents the observed time periods.
- X_{it} represents exogenous variables in the model including any fixed and individual trend,
- ρ_i represents the autoregressive coefficients and
- μ_{it} is a stochastic error term.

When the test is carried out and ρ_i is greater than 1 ($\rho_i > 1$), then y_{it} is said to be weakly trend stationary. However, if $\rho_i=1$, then there is presence of unit root in variable y_{it} .

These tests all assume that ρ_i may vary across countries following an individual unit roots process. The combination of the individual unit roots tests gives a panel-specific result. The IPS test is based on the group-mean approach and it specifies separate ADF estimation for each country.

3.2 Model Specification

This study utilized an annual data set that covered the period 1978 to 2008 for 24 OECD countries namely: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, South Korea, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States. The choice of these countries was based on data availability. Of the 34 OECD countries, the relevant data sets for this survey were unavailable for the remaining 10 countries. The data was sourced secondarily

from the International Energy Agency (IEA). These data include gross domestic product per capita in billion 2000 US\$ using Purchasing Power Parity (PPP); total energy consumption in kilo tonnes of oil equivalents per capita and electric power consumption in kilowatts/hour per capita. The indices of real electricity price and total energy price, was sourced from industry and households of the respective OECD countries using base year 2005 = 100.

4. EMPIRICAL ANALYSIS

4.1 Panel Unit Roots Test Results

Table 4.1.1 present results of the unit roots tests which follow an individual unit root process. The Im, Pesaran, and Shin (IPS) (2003), ADF fisher chi square and PP fisher chi square tests all suggest that the variables are integrated of order 1, I(1). All the series were found to be significant at 1% after taking the first difference. After investigating the stationarity properties of the variables, we can therefore conclude that the variables are stationary at first difference and integrated of the same order. We therefore proceed to test if there is a long run relationship among the variables.

Table 2: *Results of Tests with Individual Unit Root Processes*

| Test method | | GDP | EPC | REP | TEC | TEP |
|-----------------------|------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| IPS | Level | 3.49 (1.00) | 6.22 (1.00) | 2.01 (0.97) | 1.00 (0.84) | 6.32 (1.00) |
| | First difference | -6.16*** (0.00) | -9.65*** (0.00) | -8.79*** (0.00) | -10.32*** (0.00) | -9.32*** (0.00) |
| ADF Fisher Chi Square | Level | 20.96 (1.00) | 12.16 (1.00) | 40.21 (0.78) | 44.92 (0.60) | 13.62 (1.00) |
| | First difference | 125.74*** (0.00) | 203.47*** (0.00) | 194.16*** (0.00) | 206.82*** (0.00) | 166.06*** (0.00) |
| PP Fisher Chi Square | Level | 29.62 (0.98) | 17.43 (1.00) | 48.43 (0.46) | 43.99 (0.64) | 23.54 (1.00) |
| | First difference | 137.00*** (0.00) | 289.85*** (0.00) | 310.82*** (0.00) | 542.87*** (0.00) | 343.54*** (0.00) |

Notes: ***, ** and * denote significance at 1, 5 and 10% levels. P values are given in parenthesis and all tests assume presence of a unit root under the null hypothesis. The Fisher tests are computed using an asymptotic Chi-square distribution. The Modified Schwarz Information Criterion (MSIC) is used to select the optimal lag length.

4.2 Granger Causality Results

The OLS results for granger causality of the total energy and electricity demand models are presented in tables 4.6.1 and 4.6.2 respectively. Using a lag of up to two years³ as the optimal lag length, the joint significance of the coefficients of the lags of GDP and TEC in equations 9 and 10 respectively are determined using the standard F-test. Short run causality is estimated given that the dependent variable responds to short-term shocks to the stochastic environment (Asafu-Adjaye, 2000, Oh and Lee (2004), Mansih and Mansih 1996). Since we have estimated an ECM, the coefficient of the ECT⁴s provides estimates of long-run causality as their coefficients represent how fast deviations from the long run equilibrium are eliminated following changes in each variable (Oh and Lee, 2004). In the total energy model with energy consumption as the dependent variable, there exists a positive short-run relationship between energy consumption and GDP as the coefficients of the lagged GDP terms are significant. The t-statistic of the ECT is also significant suggesting that there is long-run causality running from GDP to energy consumption. This explains that GDP plays a critical role in the OECD considering its impact on energy consumption. Strong causality hypothesis⁵ is also established as the interaction between the error term and the regressors is significant.

With GDP as the dependent variable, the total energy relationship shows that energy consumption also drives GDP in the short-run. The coefficient of the ECT is not significant hence it suggests that there is no long-run relationship between them. In conclusion, the results of the causality test of the total energy demand model suggests that there is short-run bi-directional causality between energy consumption and GDP and long-run uni-directional causality between GDP and energy consumption. This means that in the short-run, high economic growth will lead to high energy consumption in the OECD and vice versa. GDP will also drive energy consumption in the long-run as suggested by the t-stat of the ECT. Strong causality was also established in both models to further engender the reason to suggest strong relationship between the variables.

³ Lee (2005) and Lee and Lee (2010) found lag of 2 years to be optimal.

⁴ The ECTs used for the OLS and GMM estimation are lagged by a year in which $ECT_{it-1} = TEC_{it-1} - \beta_i GDP_{it-1} - \gamma TEP_{it-1}$ for total energy demand model and $ECT_{it-1} = EPC_{it-1} - \varphi_i GDP_{it-1} - \theta_i TEP_{it-1}$ for electricity demand model.

⁵ The strong causality hypothesis holds when both the lagged values of the dependent variable and the ECT in the VECM estimation are significantly different from zero.

Table 3 Granger Causality Results for Total Energy Demand Model

| Dependent Variable | Short run | | Long Run | Direction of causality |
|--------------------|--------------------|--------------------|---------------------|------------------------|
| | Δ TEC | Δ GDP | ECT _{t-1} | |
| Δ TEC | ----- | 16.75*** (0.00) | -11.54*** [0.00] | GDP→TEC |
| Δ GDP | 21.41*** (0.00) | ----- | -1.52 [0.13] | TEC→GDP |

Strong Causality

| | Δ TEC | Δ GDP | Direction of causality |
|----------------------------------|--------------------|--------------------|------------------------|
| Δ GDP, ECT _{t-1} | 16.11*** (0.00) | | TEC→GDP |
| Δ TEC, ECT _{t-1} | | 59.59*** (0.00) | GDP→TEC |

Note: P values are in parentheses, t-statistics are reported in brackets.

The causality results of the electricity demand suggest that there is bi-directional short-run and long-run causality between electricity consumption and GDP with all the coefficients significant at 5% level. This result also shows the importance of electricity consumption on the GDP of OECD countries vice versa. By implication, any attempt by policy makers to implement strict energy reduction policies might have a negative effect on economic activity. For comparison and consistency, we proceed to estimate the specified VECMs using the one-step GMM estimator.

Table 4 Granger Causality Results for Electricity Demand Model

| Dependent Variable | Short run | | Long Run | Direction of causality |
|--------------------|--------------------|--------------------|--------------------|------------------------|
| | Δ EPC | Δ GDP | ECT _{t-1} | |
| Δ EPC | ----- | 31.39*** (0.00) | -7.56*** [0.00] | GDP →EPC |
| Δ GDP | 29.89*** (0.00) | ----- | -8.32*** [0.00] | EPC →GDP |

Strong Causality

| | Δ EPC | Δ GDP | Direction of causality |
|----------------------------------|--------------------|--------------------|------------------------|
| Δ EPC, ECT _{t-1} | | 34.91*** (0.00) | GDP →EPC |
| Δ GDP, ECT _{t-1} | 34.16*** (0.00) | | EPC →GDP |

Note: P-values are in parentheses, t-statistics are reported in brackets.

The one-step Arellano and Bond (1991) GMM estimator has been described by various studies to produce more efficient results relative to other procedures (See Lee and Lee, 2010, Constantini and Martini, 2010 and Liu, 2004). The GMM is a form of instrumental variable estimator that uses instruments to correct for serial correlation between the error terms and regressors which the standard OLS cannot do. After testing for causality with GMM using variables lagged up to four periods as instruments to correct for serial correlation (see, for example, Lee and Lee, 2010).

The results of the GMM estimation of causality in the total energy and electricity demand models are presented in tables 4.6.1 and 4.6.2. We find the results of the GMM estimation consistent with those of the OLS estimation except for the significance of the long run relationship between energy consumption and GDP. GMM finds that there is no long-run relationship between energy consumption and GDP with energy consumption as the dependent variable. This is contrary to the OLS result. More so, the absence of a long-run relationship found in the GDP model using OLS is not consistent with our GMM results, GMM suggests the presence of a long-term relationship between GDP and energy consumption. Albeit these few inconsistencies, the direction of short-run causality is the same using both GMM and OLS. It can also be concluded that there is long-run causality between energy consumption and GDP as at least one estimator has found causality in both model specifications. The strong causality hypothesis also holds for the two specified models.

Table 5 *GMM Granger Causality Results*

| Dependent Variable | Short run | | Long Run | Direction of causality |
|--------------------|-----------------|-------------------|--------------------|------------------------|
| | Δ TEC | Δ GDP | ECT_{t-1} | |
| Δ TEC | ----- | 5.62*** (0.00) | -1.13 [0.26] | GDP→TEC |
| Δ GDP | 3.26* (0.07) | ----- | -5.65*** [0.00] | TEC→GDP |

Notes: P values are in parentheses, t-statistics are reported in brackets.

Strong Causality

| | Δ TEC | Δ GDP | Direction of causality |
|---------------------------|-------------------|-------------------|------------------------|
| Δ GDP, ECT_{t-1} | 7.15*** (0.00) | | TEC→GDP |
| Δ TEC, ECT_{t-1} | | 7.02*** (0.00) | GDP→TEC |

TABLE 6 *GMM results for Electricity Demand Model*

| Dependent Variable | Short run | | Long Run | Direction of causality |
|--------------------|-------------------|-------------------|--------------------|------------------------|
| | Δ EPC | Δ GDP | ECT _{t-1} | |
| Δ EPC | ----- | 8.38*** (0.00) | -3.01*** [0.00] | GDP →EPC |
| Δ GDP | 7.73*** (0.06) | ----- | -4.56*** [0.00] | EPC →GDP |

Note: P values are in parentheses, t-statistics are reported in brackets.

Strong Causality

| | Δ EPC | Δ GDP | Direction of causality |
|----------------------------------|-------------------|--------------------|------------------------|
| Δ EPC, ECT _{t-1} | | 15.35*** (0.00) | GDP →EPC |
| Δ GDP, ECT _{t-1} | 6.71*** (0.00) | | EPC →GDP |

In the electricity demand models, the results show that short- and long-run bi-directional causality exists between electricity consumption and GDP. The strong hypothesis also holds here as the joint significance of the error term and regressors are significantly different from zero. It stresses the importance of electricity consumption in economic growth in the OECD and these results are also consistent with the OLS findings. We thereby proceed to derive short-run elasticities.

5. CONCLUSION

This study investigated the nature or direction of causality between GDP, electricity consumption and total energy consumption in the OECD. Both the OLS and GMM estimators were employed to test for causality in the two models. It was discovered that bi-directional causality exists between energy consumption and GDP for the total energy demand model and between electricity consumption and GDP for the electricity demand model. These results are consistent with the findings of Apergis and Payne (2010a, 2010b), Lee and Lee (2010), Asafu-Adjaye (2000) and Mahadevan and Asafu-Adjaye (2007) but contradict the findings of Al-Iriani (2005) and Lee and Chang (2008). According to literature, when energy consumption is found to cause GDP, the benefit of energy consumption far outweighs the externality cost of energy use. On the other hand, if GDP is found to cause energy consumption, the negative impact of energy consumption (e.g pollution) could hamper economic

growth and social welfare. In our case, however, the discovery of bi-directional causality in the estimated models suggest that both energy consumption and GDP are important factors in economic development in the OECD. If misguided policy measures are made to reduce energy consumption through, for example, the imposition of carbon tax or pricing policies, it could have a detrimental effect on GDP which will slow down economic growth. A recommendation is for policy makers to concentrate on encouraging energy efficiency as a way to reduce energy and electricity consumption. This can be done through many ways; manufacturers and other stake holders can be encouraged to invest in more new fuels efficient technologies (e.g. electric cars, gas powered appliances) and the switching of fuels to cleaner and more efficient alternatives (e.g switching from coal⁶ to gas in electricity generation) without it bearing much burden on cost. Consumers can also be sensitized on the importance of energy saving approaches to use of appliance stock to help reduce carbon emission and its negative impact on the environment.

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⁶ According to the IEA 2030 OECD outlook, generation of electricity from coal is expected to be the highest among a range of other energy sources as it approaches approximately 15000Twh by 2030. Given the amount of carbon that is emitted in coal-fired electricity generation in the OECD, stringent measures should be taken to allow for more use of the relatively cleaner gas or renewable energy for power generation.

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ELECTRICITY CONSUMPTION IN BOTSWANA: THE ROLE OF FINANCIAL DEVELOPMENT, INDUSTRIALISATION AND URBANIZATION

LIRA P. SEKANTSI*, SAYED TIMUNO**

Abstract: *Botswana's electricity supply is overwhelmed by the growing energy demands with the peak electric power deficits being met through imports. This study seeks to understand the key drivers of this increasing electricity demand. Using the Autoregressive Distributed Lag (ARDL) bounds testing and Error Correction Model (ECM), it examines the role played by financial development, industrialisation and urbanization in Botswana's energy (or more specifically electricity)-growth nexus between 1981 and 2011. The findings reveal that economic growth, financial development and industrialization positively affect electricity consumption in the short-run and long-run. However, urbanization increases electricity consumption only in the long-term. These finding not only support conservation hypothesis but also imply that policy-makers should take into account the increase in electricity demand arising from financial development, urbanization and industrialisation in energy (electricity) consumption planning in the economy to avoid energy crisis. In addition, policy-makers should search and invests in renewable energy sources such as solar to increase access to cheap energy source.*

Keywords: *Electricity Consumption, Financial Development, Industrialisation, Urbanization, Cointegration, Botswana.*

JEL Classification: *C22, Q43, Q48*

1. INTRODUCTION

Energy plays a central role in the economic growth and socio-economic development of countries around the world. This is because apart from improving

* Lira P. Sekantsi, National Payment System Division, Central Bank of Lesotho, P.O. Box 1184, Maseru 100, Lesotho. Email: skantsy@hotmail.co.uk

** Sayed Timuno, Macroeconomic Management Programme, Macroeconomic and Financial Management Institute of Eastern and Southern Africa, P.O. Box A1419, Harare, Zimbabwe, Email: sayeedjnr@gmail.com

socio-economic development, energy acts as a direct and indirect input in the production of goods and services in various sectors of the economy. In light of this, demand for energy continues to increase rapidly around the world. In line with this, most emerging economies and developing countries (including those in Africa) have experienced serious energy (or electricity) deficiency and have been struggling to meet the increasing demand for electricity (see Sekantsi and Motlokoa, 2015; Shahbaz and Lean, 2012; Zaman et al. 2012; Inglesi-Lotz, 2011). Botswana is not an exception to this dilemma.

Since gaining its independence, Botswana experienced rapid economic growth over the last four decades. In real terms, the economy recorded positive growth rate of 8% and 6% in 1981 and 2011, respectively. This robust growth was mainly driven by its energy-dependent mining (diamond) sector, which contributes significantly to government revenue in the country (Waves, 2014 and 2016; United Nations Economic Commission for Africa, 2016 and Kapunda and Moffat, 2016). Despite this remarkable performance, the country suffers from energy shortage due to its underdeveloped energy sector, which fails to generate enough power to meet increasing energy demand. Therefore, the peak power deficits have to be met by imports from Electricity Supply Commission (Eskom) in South Africa, Namibia Power Corporation (Nampower), Zambia Electricity Supply Corporation (ZESCO) and Southern African Power Pool (SAPP). However, the country still experiences load shedding (power black-outs) as a result of power supply shocks in exporting countries. Not only does this negatively affect socioeconomic wellbeing of the citizens and economic activities but also has a potential to undermine country's growth prospects and the ability to achieve the long term developmental objectives outlined in the country's Vision 2036. In addition, the country also experienced high rate of urbanisation; with two thirds of the country's population now living in urban areas and its industrial sector has grown significantly in recent years. The financial sector (especially the banking Sector) also underwent notable and exceptional growth due to financial reforms in recent years (Honde, 2016). These factors not only promote economic growth and improve standard of living but they can also increase pressure on energy demand in the country (Al-Mulali et al, 2012 and Liu, 2009, ab; Komal and Abbas, 2015 and Kahsai et al, 2012; Sadorsky, 2013).

The literature shows that aside from economic growth there are other factors (such as urbanization, industrialization, and financial development) that affect

energy demand in the economy (see Karanfil, 2009; Shahbaz and Lean, 2012). However, the studies that examined energy (or electricity) demand in Botswana namely; Adebola (2011), Amusa and Leshoro (2013), Essah and Efetotse (2014), Efetotse et al. (2015), have not considered how urbanization, industrialization and financial development affect energy (or electricity) demand in Botswana. This calls for more scholarly attention in identifying the factors influencing energy (or more specifically electricity) demand in Botswana in order to guide Government of Botswana, policy makers and other stakeholders in energy sector in the design of effective energy policy to address increasing energy demand in Botswana. Therefore, this paper seeks to understand the key determinants behind the growth of electricity consumption in Botswana by taking into account the role of financial development, industrialisation and urbanization in Botswana's energy-growth nexus. In this regard, it also contributes to the empirical literature on the drivers of energy consumption in Botswana (beyond what the aforementioned studies have done) and in developing countries in general. In order to investigate this relationship, the paper applies autoregressive distributed lag (ARDL) bounds testing approach to cointegration and estimates an error correction model (ECM) on Botswana's annual time series data ranging from 1981 to 2011.

The rest of the paper is structured as follows. The next section provides an overview of Botswana's energy sector. It is followed by a review of the literature on energy (or more specifically electricity) consumption determinants and the methodology. The empirical results are then presented and lastly, the concluding remarks together with recommendations are offered.

2. AN OVERVIEW OF ENERGY SECTOR IN BOTSWANA

Botswana is a small, landlocked country of about two million people with a total land area of approximately 582,000 square kilometers. At independence, Botswana was classified as one of the poorest countries globally (in terms of per capita GDP of approximately \$707). Post-independence, the country recorded robust economic growth⁸ due to discovery of diamonds, the effective and transparent use of mineral proceeds, good governance practices, political stability,

⁷ World Bank Database.

⁸ It recorded real GDP growth of approximately averaging 5% per year over the past ten years.

and prudent macroeconomic and fiscal management. As a result, it graduated to the ranks of upper-middle income countries. Notwithstanding this, the country still faces other socio-economic challenges of poverty; inequality and graduate unemployment (see UNECA, 2016).

The main energy sources in the country are electricity, fuel wood, liquefied petroleum gas, petrol, diesel, aviation gas and paraffin; with most of these imported largely from South Africa. Despite, possessing the huge natural resources endowment in the form of abundant coal (200 billion tonnes accounting for about 66% of the continent's coal resources) and sunshine (over 3200 hours at 21MJ per square metres), the country's energy sector remains underdeveloped and characterized by relatively low access and coverage by international standards. For example, fuel wood continues to be an important energy source with approximately 46% of the households nationally and 77% in rural areas relying on it for cooking. In addition, the electrification rate is reported to be at 49% and as of March 2015, the national access to electricity in the country stood at approximately 73% of the country's population; with rural access standing at approximately 67% of the population⁹. In terms of consumption, more electricity is consumed by the mining sector, followed by commercial sectors and the household sector. Electricity consumption by the government sector remains relatively low compared to that of the above-mentioned sectors (See UNDP and GoB, 2012; UNECA, 2016; Nachmany et al., 2015; Botswana Power Corporation (BPC), 2010, 2011, 2012, 2015).

In the recent past, members of the Southern African Power Pool (SAPP)¹⁰ including Botswana have experienced power supply deficit. In Botswana, this has led to persistent load shedding (rolling blackouts) which was aggravated by insufficient domestic power generation due to aging electricity infrastructure and underinvestment in energy infrastructure. In addition, the government's energy policy has over the years concentrated more on thermal power production due to the country's vast coal resources. This resulted in a partial neglect of other potential energy sources such as diesel and solar for power generation. Moreover, climate change impacts such as chronic droughts resulting from semi-arid climate

⁹ Note that this was based on initial parameters and the 2001 population census.

¹⁰ The SAPP is a cooperation of the national electricity companies in Southern Africa under the auspices of the Southern African Development Community (SADC). Therefore, members of SAPP are SADC countries.

conditions and erratic rainfalls have undermined hydropower generation, contributing to supply shortages. Furthermore, the monopoly of the electricity sector by the state-owned Botswana Power Corporation (BPC) has led to lack of competition in the market and inefficiencies in electricity generation, transmission and distribution in the country, which in turn constrained growth and the general development of the sector in the economy. In light of this, the country relies on imports from Eskom, NamPower, ZESCO and the SAPP (with more electricity imported from South Africa) to meet supply shortages (see Promethium Carbon, 2016a and 2016b; UNECA, 2016). On average, between 2005 and 2015, the ratio of imported electricity to total distribution was around 71% (see Table 1).

With electricity shortage recognized as a barrier to economic growth and socioeconomic development in the country, the Government of Botswana (GoB) has in the past few years embarked on an extensive power-sector reforms aimed at meeting the ever increasing demand, improving energy generation and distribution, energy efficiency and conservation to attain self-sufficiency in electricity supply. These reforms include the short term measures of constructing two emergency diesel powered plants; 90 MW at Orapa and 105 MW at Motshelagabedi. In addition, the medium to long term reforms include the refurbishment of Morupule A power plant and the construction of a four unit power station (Morupule B) which is expected to generate 600 MW of electricity. Other reforms include the policy shift from the importation of power to self-sufficiency in power generation and supply. This initiative led to the amendment of the Electricity Supply Act in 2007 to allow the participation of the private sector (i.e independent power producers (IPPs)) in the country's electricity industry to further augment electricity supply in the economy. To date, BPC and Electricity de France have formed a private renewable power company called BPC Lesedi, which provides renewable(solar) energy products and services to remote and rural areas of the country not connected to the national electricity grid (Promethium Carbon, 2016a and 2016b and Efetotse et al, 2015). In addition, the GoB has received positive responses from other IPPs to develop two additional units at Morupule B power plant.

Table 1 *Imported Electricity (MWH) as a Percentage of Distribution 2005 – 2015*

| Year\ Utility | Electricity Generation | Imported Electricity | Electricity Distribution | % Imported Electricity to Distribution |
|----------------------|-------------------------------|-----------------------------|---------------------------------|---|
| 2005 | 866,615 | 1,975,069 | 2,841,685 | 70% |
| 2006 | 794,271 | 2,206,951 | 3,001,223 | 74% |
| 2007 | 624,746 | 2,518,565 | 3,143,311 | 80% |
| 2008 | 587,286 | 2,727,938 | 3,315,223 | 82% |
| 2009 | 443,918 | 2,792,730 | 3,236,648 | 86% |
| 2010 | 456,972 | 3,088,080 | 3,545,052 | 87% |
| 2011 | 303,374 | 3,169,068 | 3,472,442 | 91% |
| 2012 | 703,213 | 2,999,797 | 3,703,010 | 81% |
| 2013 | 1,681,497 | 1,820,940 | 3,502,437 | 52% |
| 2014 | 2,361,954 | 1,627,925 | 3,989,879 | 41% |
| 2015 | 2,445,988 | 1,527,697 | 3,973,685 | 38% |

Source: Statistics Botswana, 2016

Furthermore, the GoB has launched the Rural Electrification Programme which seeks to connect various villages to the national grid and the Rural Electrification Collective Scheme, National Electricity Standard Connection cost and National Electrification Fund which are aimed at addressing issues of high connection costs and assisting households to connect to the national electricity grid at a national standard cost in electrified settlements, villages, towns and cities. The country has also embarked on the review of the National Energy Policy and Electricity Regulatory Framework for consideration by parliament during the 2016/17 financial year. Apart from that, the country is developing Renewable Energy Strategy and Energy Efficiency Strategy with the broad aim of addressing energy demand challenges and to position the country as an energy exporter. Institutionally, Botswana does not have an independent energy regulator. Therefore, the Department of Energy (under the auspices of the Ministry of Mineral Resources, Green Technology and Energy Security) currently acts as an interim energy regulator in the country with additional responsibility to develop energy policies in the country and supervision of BPC. However, as part of the energy sector reform project, the country plans to establish a Botswana Energy Regulatory Authority (BERWA) with

an aim to take-off all responsibilities of energy regulation from the Department of Energy (see Promethium Carbon, 2016a and 2016b).

3. LITERATURE REVIEW

The issue of the relationship between energy (or electricity) consumption and economic growth was initiated by Kraft and Kraft (1978), who concluded that economic growth resulted in increased energy demand in the United States (US) during the period 1947-1974. Following this empirical study, many empirical studies examined the nexus between these two variables and its policy implications in the context of two-way Granger causality. This led to four testable hypotheses, namely; the growth hypothesis, conservation hypothesis, feedback hypothesis and neutrality hypothesis. First, the growth hypothesis states that energy is an input in the production process and therefore energy consumption stimulates economic growth. Among others, the empirical works of Odhiambo (2009a), Narayan and Singh (2007), Altinay and Karagol (2005), Apergis and Payne (2009), Bowden and Payne (2009), Tsani (2010), Wang et al. (2011) found that energy (electricity) consumption increases economic growth. Second, the conservation hypothesis argues that economic growth influences energy consumption such that the more growth the economy experiences, the more energy will be demanded and consumed to support that kind of growth. Thus, energy conservation policies aimed at reducing energy use and waste can be implemented without negatively affecting economic performance (see Gosh, 2002). The empirical work of Kwakwa (2012), Narayan and Smyth (2005), Adom (2011), Mozumder and Marathe (2007), among others, found that economic growth affects energy consumption.

Third, the feedback (bidirectional) hypothesis asserts that energy consumption and economic growth are interrelated and may complement each other. In this case, efficient energy use and energy development policies geared towards increasing electricity generation can positively affect economic growth. Aslan (2014), Odhiambo (2009b), Tang (2008), and Masih and Masih (1997) are some of the empirical studies that provide support for this hypothesis. Finally, the neutrality hypothesis postulates that there is no causal relationship between energy consumption and economic growth. Thus, neither conservative nor expansive policies in relation to energy consumption have any impact on economic growth in the country. This hypothesis received

empirical support from the works of Payne (2009), Akarca and Long (1980), Cheng (1995), Yu and Hwang (1984), among others.

The empirical studies that examined energy-economic growth nexus failed to reach consensus on the relationship between these variables due to a number of factors including the employed model estimation techniques, problems associated with non-stationarity of data, different data sets, choice of variables, and different country characteristics(see Adom,2011; Sekantsi and Motlokoa,2015; Komal and Abbas,2015, among others). In addition, most studies that examine this relationship have also over-relied on a bivariate causality framework, which may suffer from the omission of variable bias by ignoring other important variables (such as financial development, industrialization and urbanization and specific country characteristics), which determine energy consumption in the economy.

The theoretical link between financial development and energy consumption is well established in the literature. At the household level, a well-developed financial system makes it easier for consumers to save, invest and borrow funds at cheaper costs to purchase energy consumable products such as automobiles, houses, refrigerators, air conditioners, and washing machines. These items normally consume a lot of energy with resultant potential to spur the overall demand for energy in the country. At the industrial level, a sophisticated financial system brings about improvements in financial markets infrastructures, which help entrepreneurs to not only to save and invest but also to access financial capital easily and at lower costs. Through this financial capital, entrepreneurs can either start new businesses or expand their existing businesses by buying and building more plants and factories as well as investing in more and /or advanced machinery and equipment, all of which increase demand for energy. For this purpose, a stock market development serves as a suitable avenue from which entrepreneurs may raise additional financing for businesses in the form of equity aside from debt financing. By availing more funds for investment projects as a result of increased risk diversification, stock markets lead to economic growth and property. This in turn boosts general consumer and business confidence in the economy with resultant increase in demand for energy intensive goods, which obviously increase energy consumption (see Mankiw and Scarth, 2008; Sadorsky, 2010; Islam et al, 2013; Komal and Abbas, 2015 and Chang, 2015).

Aside from increasing energy demand, the literature on the finance –energy nexus also argues that financial development lessens energy consumption through improving efficiency in the use of energy. In particular, investment in research and development (R&D), advancement in technology as well as innovation allow creation of energy efficient products like home appliances, which reduce energy consumption (Coban and Topcu, 2013). In connection with this, technology innovation by local firms emanating from foreign direct investment (FDI) inflows into the economy can reduce energy use in the economy (see Alfaro, et al, 2004, 2006; Bailliu, 2000). This is because some governments can provide financing support and encourage the licensing of sustainable energy technologies and services in an effort to ensure energy efficiency and sustainability in their jurisdictions (Mielnik and Goldemberg, 2002). Apart from financing energy intensive sectors, developed financial institutions can offer financing to renewable energy sector while capital markets can provide debt and equity financing to green renewable energy projects. In this way, financial development can lead to decrease in energy consumption in the economy. In addition; sophisticated financial markets do extend credit for environmentally friendly projects at low financing costs. While some of these projects may be aimed at reducing environmental costs associated with emission of carbon-dioxide into the air and water pollution, they decrease energy use. In light of this, it is obvious that financial development can increase energy consumption through lending capital to the energy industry on one hand. On the other hand, it can reduce energy consumption by acting as an incentive for increased energy substitution. In that respect, the effect of financial development on energy consumption is ambiguous (Dasgupta et al, 2006 and Chang, 2015).

The term industrialization refers to increase in industrial activities mainly emanating from economic growth in the economy. The economic literature has established a direct link between increase in industrial activity and energy demand due to growth in different sectors of the economy. According to this literature, increased industrial activity in the form of large-value manufacturing, which involves the use of heavy and advanced machinery and equipment, require more energy relative to traditional agriculture and basic manufacturing. For instance, industries specializing in petroleum refinement and production of some chemicals and paper usually consume more energy than those in agriculture. In light of this, industrialization is usually associated with increase in energy consumption in the

economy. Therefore, industrialized economies demand more energy than less industrialized economies (see Sadorsky, 2013 and 2014).

According Chace and Walsh (2006) and Wang (2014), urbanization relates to structural changes in the economy in the form of physical growth of urban areas resulting from rural migration and sub-urban concentration into cities or industrial areas. It is measured as the ratio of urban population to the total population. The literature has established several ways through which urbanization can impact upon demand for energy in the economy. First, urbanization can affect energy consumption in the economy through its impact on production process. By availing more labour that can participate in the production of goods and services, it increases economic activities in urban areas and brings about economies of scale in production. In this regard, production methods shifts from those that are less energy intensive to those that are more energy intensive with resultant increase in overall energy consumption. It also accelerates fuel switching from conventional energy sources such as biomass, paraffin and oil to centralized energy sources like electricity. In addition, the surge in production activities in urban areas may further increase demand for energy through growth in the informal economy and demand for more infrastructure such as road, buildings and so on. Second, urbanization increases energy consumption through increased mobility and motorized traffic in urban areas as well as transportation of raw materials and finished goods to and from the urban areas, all of which demand more energy. Lastly, apart from changing the production pattern of firms, which consequently increases energy demand, urbanization also transforms society's economic structure and lifestyle. By so doing, it affects energy consumption by changing the consumption pattern of urban dwellers to energy intensive products (such as refrigerators, air conditioners, automobiles, laptops) as they become richer (see Sadorsky, 2013 and 2014).

Empirically, there are several studies that explored the link between energy consumption and economic growth by also incorporating other variables such as financial development, industrialization and urbanization. Poumanyong and Kaneko (2010) used panel data techniques examine the effect of income, urbanization, industrialization and population on energy use in a sample of 99 countries during the period 1975- 2005. The findings suggested that the effect of urbanization on energy use varies across the stages of development of countries and urbanization decreases energy use in the low-income group, while it increases

energy use in the middle- and high-income groups. In addition, the results also suggested that industrialization impacts positively on energy consumption. However, its effect is only statistically significant in low and middle income groups. Shahbaz and Lean (2012) also assessed the relationship between energy consumption, economic growth financial development, industrialization and urbanization in Tunisia. Applying ARDL bounds testing and Granger causality tests on data for the period 1971 to 2008, the study confirmed the existence of cointegration among these variables in Tunisia and that in the long-run, *ceteris paribus*, a 1% increase in economic growth and financial development spur energy consumption by 0.5% and 0.14%, respectively, while 0.21% (and 0.9%) increase in energy consumption is found to be due to industrialization (and urbanization), respectively, holding other variables constant. In the short-term, the impact of financial development and industrialization on energy consumption was also found to be positive and statistically significant while urbanization had insignificant positive effect on energy demand in Tunisia.

Sardosky (2014) investigated the impact of income, urbanization and industrialisation on energy consumption in a sample of 18 emerging markets economies (including South Africa) during the period 1971 -2008. Applying different panel data approaches, the results revealed that income increases energy consumption in both the long-run and short-run in these countries. In addition, the results showed that urbanization decreases energy consumption in the long-term while industrialization increases it during the same time horizon. In another study, Islam et al (2013) applied ARDL bounds testing and vector error correction model (VECM) on data for period 1971-2009 to examine the link between energy consumption, financial development, economic growth and population in Malaysia. Their results provided evidence that, *ceteris paribus*, a 1% increase in economic growth and financial development, respectively, raise energy consumption by 0.86% and 0.07%, in the long-run on the one hand. On the other hand, a 1% rise in economic growth and financial development, respectively, increase energy consumption by 0.7% and 0.12% in the short term. However, the effect of population on energy consumption is only found to have positive in the long-run; with 1% increase in population size increasing energy consumption by 0.39%.

Salman and Atya (2014) employed Johansen cointegration test, error correction model and Granger causality to assess the causal relationship between

energy consumption, financial development and economic growth in North African countries (namely Algeria, Egypt and Tunisia) over the period 1980- 2010. The empirical results indicated positive relationship between financial development and energy consumption in Algeria and Egypt but negative relationship between these two variables in Tunisia. Komal and Abbas (2015) also explored the finance-growth-energy nexus in Pakistan during the period 1972-2012. By using the system Generalized Method of Moments (GMM) estimation technique, study captures the effect of financial development on energy consumption by using economic growth as an intermittent variable and includes energy prices and urbanization. The results revealed that financial development significantly increase energy consumption through economic growth channel whereas, the economic growth and urbanization significantly increase energy consumption in Pakistan. The other study by Abosedra et.al(2015) used ARDL bounds testing and VECM to examine the relationship between energy consumption, financial development, and economic growth in Lebanon for the period 2000M7 -2010M12. The results not only provide empirical evidence of cointegration between these variables but also establish that energy consumption and financial development significantly increase economic growth both in the long-run and short. On the other hand, financial development and economic growth also further increase energy consumption both in the long-run and short-run in Lebanon. In a recent study, Sekantsi et.al (2016) examined the role of financial development, industrialisation, and urbanisation in Lesotho's energy-growth nexus between 1973 and 2012. The findings from the cointegration analysis reveal that economic growth, financial development, and industrialisation are positively related to electricity consumption in the long-run. However, urbanization is found to have no significant effect on electricity consumption. Furthermore, regulation has also impacted positively on electricity demand in Lesotho.

In light of this literature review, it is obvious that there are other factors (such as financial development, industrialisation, and urbanization) in addition to economic growth that do impact upon energy (electricity consumption). However, in the context of Botswana, the few existing studies namely; Adebola(2011), Essah and Efetotse(2014), Efetotse et.al(2015) that examined energy(electricity)-growth nexus have not taken these other factors into account though they may have important implications for the underlying energy consumption given the level of economic development that Botswana has achieved so far. Therefore, this study

incorporates these variables to better understand the drivers of electricity consumption in Botswana.

4. ECONOMETRIC METHODOLOGY

This study adopts the basic framework for energy (or more specifically electricity) demand (consumption) used by Salman and Atya (2014) and Shahbaz and Lean (2012), specified as follows:

$$\ln(EC)_t = \beta_0 + \beta_1 \ln(GDP)_t + \beta_2 \ln(FD)_t + \beta_3 \ln(IND)_t + \beta_4 \ln(URB)_t + \varepsilon_t \quad (1)$$

where $\ln(EC)_t$, $\ln(GDP)_t$, $\ln(FD)_t$, $\ln(IND)_t$ and $\ln(URB)_t$ denote the natural logarithms of electric power consumption, economic growth, financial development, industrialization and urbanization, respectively. t is the time period, β 's are long-run parameters to be estimated, ε_t is the random error term. According to the reviewed literature on energy consumption, β_1 captures the effect of economic growth on energy(electricity) consumption, holding other variables constant, which is expected to either increase if the production process is energy intensive or decrease if it occurs in an efficient manner that conserves energy(see Islam et al,2013). The marginal propensity for financial development, β_2 , is expected to be either negative or positive while the marginal effects of industrialisation, β_3 , and that of urbanization, β_4 are both expected to be positive.

In building the model for electricity consumption in Botswana, this study employs ARDL bounds testing approach to cointegration and error correction model based on ARDL procedure developed by Pesaran and Shin (1999) and advanced by Pesaran et al. (2001). An ARDL bound testing is preferred to alternative techniques such as the maximum likelihood procedure (Johansen and Juselius, 1990) and the two-step procedure (Engle and Granger, 1987) on account of the following advantages. First, it is applicable irrespective of whether the level variables being tested are integrated of order zero or one, i.e they may be either $I(0)$ or $I(1)$. Second, it produces robust results even in small samples studies. Third, this procedure has finite-sample critical values as opposed to other cointegration approaches for which the distribution of the test statistic may be unknown in finite samples. Narayan (2005) develops a set of sample-specific critical value bounds for the sample sizes ranging from 30 to 80 using the same

approach and GAUSS code used by Pesaran et al. (2001) in generating the asymptotic values. Furthermore, it provides unbiased estimates of the long-run model and valid t -statistics even in the presence of endogenous regressors.

To implement the bounds test procedure, a conditional ARDL model is specified as follows:

$$\begin{aligned} \Delta \ln(EC)_t = & \alpha_0 + \sum_{i=1}^p \beta_i \Delta \ln(EC)_{t-i} + \sum_{i=0}^q \delta_i \Delta \ln(GDP)_{t-i} + \sum_{i=0}^q \varphi_i \Delta \ln(FD)_{t-i} \\ & + \sum_{i=0}^q \vartheta_i \Delta \ln(IND)_{t-i} + \sum_{i=0}^q \gamma_i \Delta \ln(URB)_{t-i} + \pi_1 \ln(GDP)_{t-1} \\ & + \pi_2 \ln(FD)_{t-1} + \pi_3 \ln(IND)_{t-1} + \pi_4 \ln(URB)_{t-1} + \varepsilon_t \quad (2) \end{aligned}$$

where all variables are as defined as previously, Δ is the first difference operator, p and q are the lag lengths, α_0 is the drift component and ε_t are random error terms. In the same manner, taking each of the other variables in equation (2) as dependent variables, other equations can be estimated.

In this framework, the long-run relationship between the concerned variables is assessed by testing the null hypothesis; $H_0: \pi_1 = \pi_2 = \pi_3 = \pi_4 = 0$ against the alternative hypothesis; $H_0: \pi_1 \neq \pi_2 \neq \pi_3 \neq \pi_4 = 0$. The computed F- statistic derived from this test is compared with two sets of critical values (lower and upper bound values) for a given level of significance reported in Pesaran et al. (2001) and Nayaran(2005) for large samples and small sample sizes, respectively. The lower bound values assume that all variables in ARDL model are $I(0)$ while the upper bound values assume that the variables are $I(1)$. Therefore, if the computed F-statistic is less than the lower bound value, the null hypothesis of no cointegration cannot be rejected. On the other, if the computed F-statistic exceeds the upper bound value, the null hypothesis of no cointegration is rejected and it is concluded that the variables are cointegrated. Nonetheless, if the computed F-statistic lies between the two critical bound values, test becomes inconclusive.

Having established cointegration between the variables of interest, the long-run and error correction models are estimated using ARDL framework as follows:

$$\ln(EC)_t = \alpha_0 + \sum_{i=1}^m \varphi_1 \ln(EC)_{t-i} + \sum_{i=0}^n \varphi_2 \ln(GDP)_{t-i} + \sum_{i=0}^z \varphi_3 \ln(FD)_{t-i} \\ + \sum_{i=0}^q \varphi_4 \ln(IND)_{t-i} + \sum_{i=0}^r \varphi_5 \ln(URB)_{t-i} + \mu_t \quad (3)$$

$$\Delta \ln(EC)_t = \alpha_0 + \sum_{i=1}^m \vartheta_1 \Delta \ln(EC)_{t-i} + \sum_{i=0}^n \vartheta_2 \Delta \ln(GDP)_{t-i} + \sum_{i=0}^z \vartheta_3 \Delta \ln(FD)_{t-i} \\ + \sum_{i=0}^q \vartheta_4 \Delta \ln(IND)_{t-i} + \sum_{i=0}^r \vartheta_5 \Delta \ln(URB)_{t-i} + \vartheta_6 ECT_{t-1} + \varepsilon_t \quad (4)$$

where all variables are as previously defined, μ_t and ε_t are random error terms and φ 's and ϑ 's are the parameters to be estimated, m , n , z , q and r are the maximum lag lengths¹¹ and ϑ_6 is the coefficient of the lagged error correction term (ECT_{t-1}), which measures the speed of adjustment to long-run equilibrium following a shock to the system.

5. DATA AND EMPIRICAL RESULTS

This paper employs annual time series data for Botswana covering the period 1981-2011. The choice of this sample was dictated by data availability. The data on electric power consumption (measured in kWh per capita), economic growth (measured by real gross domestic product (GDP) per capita), financial development (measured by domestic credit to private sector as a share of GDP), industrialization (measured as a ratio of industrial value-added to GDP) and urbanization (proxied as a share of urban population to total population) was obtained from the World World Bank Development Indicators (January 2015).

¹¹ The maximum lag lengths are normally selected by means of information criteria such as Akaike information criterion (AIC), Schwarz information criterion (SIC) and Hannan-Quinn information criterion (HQ).

Table 2 ADF and PP Unit Root Test Results

| Variable | ADF Test | | PP Test | |
|------------|---------------------|-----------------------|---------------------|------------------------|
| | Level | First Differences | Level | First Differences |
| $\ln(EC)$ | -0.7552 (0.8172) | -5.6599* (0.0001) | -0.7488 (0.8190) | -9.8186* (0.0000) |
| $\ln(GDP)$ | -2.3806 (0.1554) | -4.4311* (0.0015) | 0.0292 (0.9541) | -6.4000* (0.0000) |
| $\ln(FD)$ | -0.9955 (0.7414) | -3.3048** (0.0255) | -0.7145 (0.8281) | -3.7067* (0.0000) |
| $\ln(IND)$ | -1.8455 (0.3521) | -4.1188* (0.0035) | -1.2172 (0.6537) | -2.9293*** (0.0542) |
| $\ln(URB)$ | -2.3164 (0.4130) | -6.7293* (0.0000) | -2.2456 (0.4487) | -6.7812* (0.0000) |

Note: *,**,*** denote the level of statistical significance at 1%,5% and 10%, respectively. The values in parentheses are the probability values

As mentioned earlier, the bounds testing procedure can be applied regardless of whether the underlying regressors are $I(1)$, $I(0)$ or mutually cointegrated. However, it is still necessary to pretest the variables for unit roots in order to ensure that none of the variables is integrated of order 2 or greater, which would otherwise invalidate the procedure. Therefore, prior to application of this procedure, the paper undertakes unit root test by employing the standard Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Table 1 reports the results of the ADF and PP unit root tests both in levels and first differences. The ADF and PP tests results indicate that electricity consumption, economic growth, financial development, industrialization and urbanization are integrated of order one or $I(1)$. In light of this, ARDL bounds testing technique to cointegration can therefore be applied

Table 3 Bounds Testing to Cointegration Results

| F-statistic | Critical value bounds of the F-statistic: restricted intercept and no trend | | | | | | Evidence of Cointegration? |
|-------------|---|--------|--------|--------|--------|--------|----------------------------|
| | 99% | | 95% | | 90% | | |
| $k = 4$ | $I(0)$ | $I(1)$ | $I(0)$ | $I(1)$ | $I(0)$ | $I(1)$ | |
| 6.081* | 4.280 | 5.840 | 3.058 | 4.223 | 2.525 | 3.560 | Yes |

Note: 1) Critical values are extracted from Narayan (2005); k is the number of regressors and 2) * denotes the level of statistical significance at 1%.

Table 2 sets out the results of ARDL bounds testing procedure to cointegration between electricity consumption and its determinants. Using Schwarz information criterion (SIC) for selection of the optimal lag length¹², results indicate that the null hypothesis of no cointegration is rejected because the calculated F-statistic on the joint significance of the lagged levels of the variables, $F_{cal} = 6.081$, exceeds the upper bound critical value at either 1% or 5% levels of significance. Therefore, these results not only provide strong evidence of the existence of long-run steady state relationship between electricity consumption and its covariates but also that economic growth, financial development, industrialization and urbanization are long-run determinants of electricity consumption in Botswana.

Having established cointegration between the variables, the next step in the analysis involves the estimation of long-run elasticities for the existing relationship. Table 3 reports long-run elasticities of electricity consumption with respect to economic growth, financial development, industrialization and urbanization. The results indicate that all estimated long-run elasticities not only have the correct signs (positive) but they are also statistically significant either at 1% or 10% levels of significance. In this regard, their values are consistent with the predictions conceived by economic theory in relation to energy consumption. In particular, the elasticity of electricity consumption with respect to economic growth is positive and statistically significant at either 1% or 10% significance levels. This implies that, *ceteris paribus*, a 1% increase in economic growth raises electricity demand by 0.4%. This finding is consistent with that of Komal and Abbas (2015), Altinay and Karagol(2005), Shahbaz and Lean (2012), Aqeel and Butt(2001) as well as Adebola(2011) and Amusa and Leshoro(2013) for the case of Botswana. In the same manner, the coefficient of financial development, 0.1026, is also positive and statistically significant at 10% level of significance and it implies that, holding other things constant, a 1% increase in domestic credit to the private sector (financial development) spurs electricity demand directly or indirectly by about 0.1%. This is pertinent given that a well- developed financial sector in the economy provides cheap credit to households and businesses, which raises energy

¹² The optimal lag length was found to be 2.

demand through increased investment and business activities as well as use of energy-intensive equipment and machines by consumers. This result is in line with the findings of Sadorsky (2010, 2011), Islam et al (2013), Shahbaz and Lean (2012) and Komal and Abbas (2015), among others.

Table 4 *Estimated Long-run Coefficients*

| Variable | Coefficients | T-statistics |
|-----------------|---------------------|---------------------|
| <i>ln(GDP)</i> | 0.4016* | 2.9353(0.0085) |
| <i>ln(FD)</i> | 0.1026*** | 1.9786(0.0625) |
| <i>ln (IND)</i> | 0.5860* | 3.7689(0.0013) |
| <i>ln (URB)</i> | 0.2807* | 3.1166(0.0057) |

Note: Dependent variable = $\ln(EC)$. *, ** and *** denote the level of statistical significance at 1%, 5%, and 10%, respectively. The values in parentheses are the probability values.

In addition, the marginal effect of electricity consumption with respect to industrial value-added of 0.586 is also positive and statistically significant at either 1% or 5% significance levels. This suggests, holding other things constant, a 1% rise in industrial value-added increases electricity intensity by approximately 0.6% in the long-run. Aside from its consistency with the empirical findings of Shahbaz and Lean (2012) and Sadorsky(2013,2014), this result is pertinent for Botswana as the country has huge industrial sector (including mining sector and high-valued manufacturing),which demands and consumes more energy(electricity). Lastly, the urbanisation coefficient of 0.28 is positive and statistically significant at either 1% or 5% significance levels and it implies, *ceteris paribus*, a 1% increase in urbanization increases electricity intensity by approximately 0.3% in the long-run in Botswana. Again, this finding is also relevant for the case of Botswana because the country experienced tremendous urban migration over the past decades with two thirds of the country's population now living in urban areas. On one hand, this empirical evidence is in accordance with the findings of Shahbaz and Lean (2012), Liu (2009), Islam et.al (2013) Poumanyvong et.al (2012), among others. On the other hand, it contrasts with the finding of Sadorsky(2014) who found that urbanisation decreases energy consumption in a sample of 18 emerging markets economies (including South Africa).

Table 5 Short-run Results and the Diagnostic tests

| Part A: Error Correction Model | | |
|---------------------------------------|-----------------------|--------------------------|
| Explanatory Variable | Coefficients | T-statistics |
| $ECT(-1)$ | -0.9028* | -5.6379(0.0000) |
| $d(\ln(GDP))$ | 0.2750* | 3.1424(0.0054) |
| $d(\ln(FD))$ | 0.1245** | 2.3939(0.0271) |
| $d(\ln(IND))$ | 0.2725** | 2.2944(0.0333) |
| $d(\ln(IND(-1)))$ | 0.2269** | 2.1038(0.0489) |
| $d(\ln(URB))$ | 0.2015 | 1.0301(0.3159) |
| c | 5.0297* | 5.6597(0.0000) |
| Part B: Diagnostic Tests | | |
| Test | Test Statistic | Probability Value |
| R-squared | 0.9912 | - |
| Adjusted R^2 | 0.9871 | - |
| Jarque-Bera | 3.7597 | 0.1526 |
| Breusch-Godfrey- | 1.5972 | 0.2063 |
| LM test | | |
| BPG | 11.4112 | 0.2486 |
| Heteroskedasticity Test | | |
| Ramsey-RESET | 0.2425 | 0.6284 |
| Test | | |

Note: Note: Dependent variable = $d(\ln(EC))$. *, ** and *** denote the level of statistical significance at 1%, 5%, and 10%, respectively. The values in parentheses are the probability values.
The selected model is ARDL (1, 0, 0, 2, 0)

Table 4 reports the short-run dynamics of the relationship between electricity consumption and its determinants together with the associated diagnostic tests. Consistent with the long-run results, the estimates of all short-run elasticities, with an exception of that of urbanization, are not only positive but also highly significant. Specifically, the positive short-term elasticity of electricity consumption with respect to economic growth, 0.275, is statistically significant and close to its long-term value. It implies that a 1% increase in economic growth spurs electricity demand by approximately 0.3%. The same elasticity with respect to financial development, which is also statistically significant and almost the same as its long-run value, suggests that a 1% increase in financial development raises electricity demand increases by approximately 0.12% in the short-run. Despite remaining positive and statistically significant like other elasticities, the short-term elasticity of electricity consumption with respect to industrialisation (0.273) is smaller than its long-run value (0.586), which indicates that over time electricity demand becomes higher in

Botswana as the economy continues to industrialise. However, consistent with the finding of Islam et.al (2013) the elasticity of energy consumption with respect to urbanisation is positive but statistically insignificant perhaps due to longer time dynamic interaction of population with macroeconomic variables.

The coefficient of the lagged error correction term (ECT_{t-1}) not only has the correct sign (negative) but it is also statistically significant at 1% level of significance. This value confirms the integrity of the estimated long-run relationship (Bannerjee et al, 1998) and ensures the attainment of long-run equilibrium following a shock to the system. It implies that about 90% of the disequilibrium of electricity consumption adjusts back to equilibrium in the current year following a shock in the previous year in Botswana. The estimated model is also congruent with the data and passes all specification tests with respect to serial correlation, non-normality of residuals and heteroskedasticity. Specifically, the Jacque Bera(JB), BPG Heteroskedasticity and Breusch-Godfrey-LM tests not only fail to reject the null hypotheses of normality of errors, homoskedasticity and no serial correlation¹³, respectively. Therefore, the residuals are white noise and serially uncorrelated. In addition, Ramsey's reset test suggests that the model is well-specified. Furthermore, the short-run model stability, investigated by the CUSUM and CUSUMQ tests (reported in the appendices) on the recursive residuals, shows that the values fall within the 5% critical bands and this suggests that the parameters of the estimated model are stable over the sample period.

6. CONCLUSION AND POLICY IMPLICATIONS

Botswana's electricity supply is threatened by the growing energy (electricity) demands, with the peak electric power deficits being met by imports from neighbouring countries; largely South Africa. This paper seeks to understand the key drivers of electricity consumption in Botswana by examining the role played by financial development, industrialization and urbanization in Botswana's energy-growth nexus over the period 1981-2011. Using the ARDL bounds testing

¹³ In addition, the Q-statistics and correlogram of squared residuals are also found to be statistically insignificant, which provides more evidence that the residuals in the estimated model are not only serially uncorrected but also homoscedastic.

approach to cointegration and the associated error correction model (ECM), the results not only confirm cointegration among these series but also reveal that economic growth, financial development, industrialization increase electricity consumption both in the short-run and long-run in Botswana. However, urbanization positively affects electricity consumption in the only in the long-term.

The empirical finding that economic growth increases electricity consumption supports energy conservation policies. Therefore, various energy conservation measures aimed at reducing electricity consumption and waste in Botswana may not have a negative impact on economic growth. The empirical evidence that financial development spurs electricity consumption implies that a fairly developed financial sector in Botswana provides cheap credit to households, businesses and industrial sector, all of which increase demand for electricity due to increased investment and business activities as well as use of energy-intensive equipment and machines by households. In light of this, it is important for policy-makers in Botswana to take into account the increase in electricity consumption resulting from financial development at the time of electricity consumption planning to avoid energy crisis in the economy because failure to do so may result in underestimation of the country's energy demand at the detriment of sustainable economic growth. In addition, the GoB should consider the role that financial sector plays to finance entrepreneurial projects and research and development (R&D) geared towards innovating and promoting electricity (or more broadly energy) savings technologies and products. Not only will this reduce overall energy consumption but it will also accelerate economic growth through increases in business activities.

Furthermore, the empirical evidence that industrialization increases electricity consumption in Botswana implies that any industrial policy aimed at increasing industrialization spurs electricity demand. It further suggests that urbanization is likely to increase the country's electricity demand even more in the future. Therefore, it is necessary and prudent for the economy to ensure efficient use of available electricity resources and to upgrade the capacity of the existing electricity (or more broadly energy) facilities to keep electricity production in tandem with growing electricity demand. Moreover, the government should allow more private investments in renewable energy to increase access to cheap energy (or electricity).

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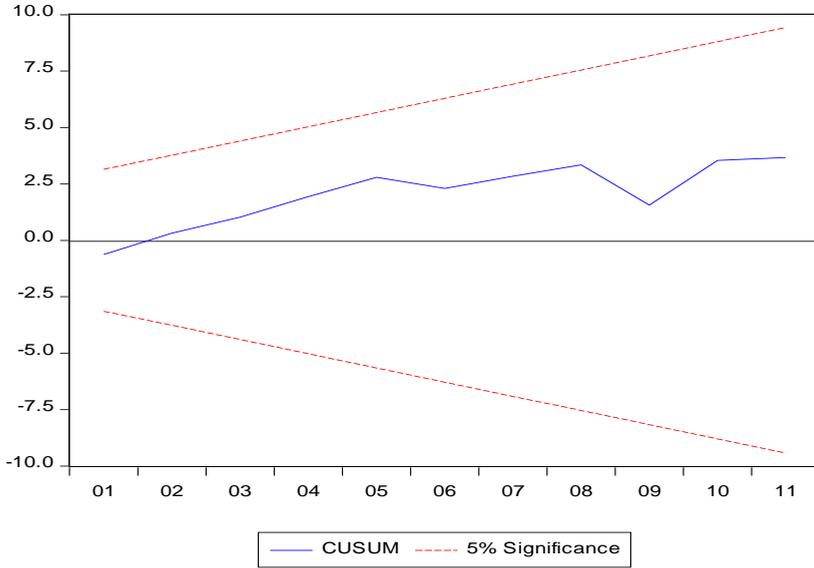
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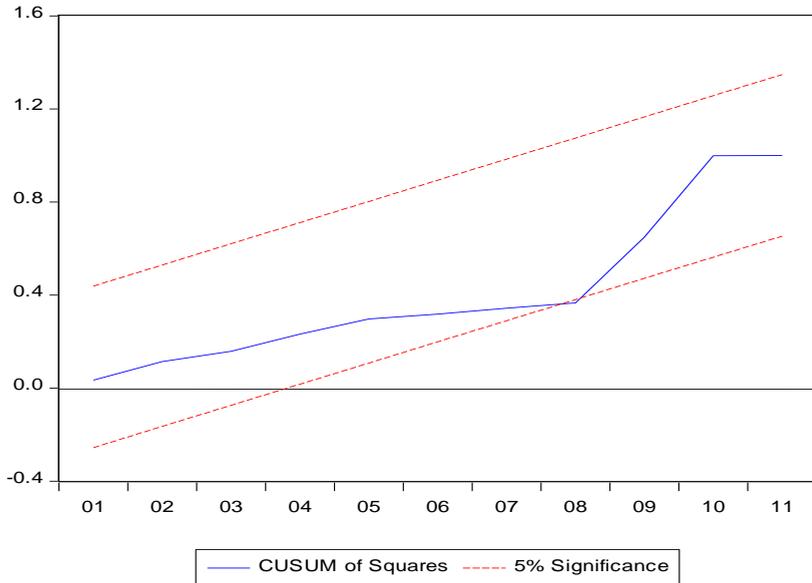
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Appendices

Appendix 1: The Plot of Cumulative Sum of Recursive Residuals (CUSUM)



Appendix 2: The Plot of CUSUM of Squares for Stability of the Model





FOREIGN EXCHANGE MARKET EFFICIENCY IN BOTSWANA

GOFAONE MATEBEJANA GAOTLHOBOGWE MOTLALENG **, JAMES JUANA

Abstract: *The random walk behaviour of exchange rates in Botswana's foreign exchange market is explored by employing unit root tests. The unit root tests employed include the ADF, PP and the KPSS. This paper uses monthly data for the period 2000:01 to 2015:12. The conclusive evidence based on the unit roots tests indicates that the behaviour of the Pula against the South African Rand, Japanese Yen and the American Dollar exchange rates is consistent with the random walk process and the weak form efficiency market hypothesis. However, the Pula against the British Pound is inconsistent with the weak form efficiency market hypothesis. These results compliment those from Namibia (Mabakeng and Sheefeni, 2014). Furthermore, there is no evidence of the semi-strong form level of efficiency as revealed by the cointegration results obtained. These results corroborates with those found by Wickremasinghe (2008) and Çiçek (2014) in which weak form was found to exist whilst the semi-strong form was found not to exist. This paper has filled an important gap as it is the first study to investigate the efficiency of the foreign exchange market in Botswana.*

Keywords: *Foreign exchange market, Efficiency market hypothesis, Botswana, Weak form efficiency*

JEL Classification: *F30; F31; G14*

1. INTRODUCTION

This paper examines weak form efficiency of foreign exchange market in Botswana. In addition to the weak form efficiency tests, the paper further tests for the semi-strong form of efficiency if and only if the weak form of efficiency holds for the Botswana foreign exchange market. The most critical issue is to establish whether or not economic resources based on the information available can be efficiently allocated in the foreign exchange market in Botswana. Although many studies on the efficiency of foreign exchange markets have been done in other

** **Corresponding Author:** Department of Economics, University of Botswana, P/Bag UB 705, Gaborone Botswana. Email: motlaleg@mopipi.ub.bw

countries (see for instance, Andika et al. 2016; Mabakeng and Sheefeni, 2014; Çiçek, 2014 and Wickremasinghe, 2008), there is literature gap in developing African countries. For instance, currently no study has been conducted on the efficiency of exchange market in Botswana. This paper attempts to fill this gap. The efficiency of the foreign exchange rate market in Botswana is tested for her currency the Pula against the US Dollar, British Pound, Japanese Yen and the South African Rand. Botswana is an open economy involved in international trade where the foreign exchange market is of paramount importance. Therefore, studies on the behaviour of exchange rates in Botswana have grave implications for overall market efficiency and economic policy making. However, in spite of many pieces of research (e.g., Motlaleng, (2009) concerning exchange rates in Botswana little is known about the foreign market's efficiency. The issue of foreign market efficiency might be attributable to failure or success of some policies and as such filling this gap can help in improving policies. It is therefore important to know whether the Botswana foreign exchange market is efficient or not so that proper measures are taken if the market is inefficient. An inefficient market implies that exchange rates are misaligned which results in arbitrage behaviour.

The efficiency of foreign exchange markets continues to play an imperative role in monetary policy making (Sarno and Taylor, 2001). The concept of market efficiency means that markets should fully and instantly reflect all available information to participants (Fama, 1970). This implies that it should be impossible for speculators to make excess profits. Also, past prices should not have the predictive ability of future prices. Efficiency in markets is distinguished based on the information that is used to form expectations about future prices. The first is the weak form efficiency in which prices reflect all historical information. Secondly, the semi-strong form of efficiency in which prices reflect all publicly available information. Lastly, is the strong form of efficiency in which prices reflect all private and public available information. There are two types of efficiency, the operational efficiency and allocational efficiency. Operational efficiency is focused on the presence of willing sellers and buyers supplying and demanding funds and can carry out transactions effectively. Thus, the efficiency here is in regard to how effective a market is in bringing buyers and sellers together. In this type of efficiency, an efficient market is one in which market buyers and sellers can make transactions cheaply. Allocational efficiency focuses on the ability of security

prices to equalise the risk-adjusted rate of return on all securities. When a market is allocationally efficient there is an optimal allocation of savings to investment with all participants in the market benefiting. However, of the two types of efficiency, Efficiency Market Hypothesis (EMH) is primarily concerned with allocational efficiency, (Pilbeam, 2010).

The efficient market hypothesis may fail if there are people who continuously make above normal profits from market anomalies. A market anomaly is a behaviour that is deemed to be inconsistent with the efficient market hypothesis and may be used for forecasting. Anomalies that have been documented include mean reversion, overreactions, the calendar effects and trading activities by insiders. A common anomaly in the foreign exchange market is the calendar effect, specifically the January effect (Mabakeng and Sheefeni, 2014). The January effect is a hypothesis that in the month of January there is a seasonal anomaly in the market. Here, securities' prices increase more than in any other month and creates opportunities for investors to buy stocks for lower prices before January and sell them after their value increases. This effect results in some investors getting above normal returns. Prices of assets in an efficient market are well described by a random walk (Bachelier, 1900). His argument gave birth to the Random Walk Hypothesis (RWH) in which asset prices do not portray any particular pattern. Consequently, tests for randomness in pricing are used to test for efficiency.

The efficiency or inefficiency of a foreign exchange market has important policy implications (Pilbeam, 2010). In a market where foreign exchange is inefficient a model that best predicts exchange can be modeled. As a result, an inefficient market makes opportunities available for arbitrageurs and speculators for profits in foreign exchange transactions. Moreover, for government authorities, market inefficiency allows for a way to determine the best way to influence exchange rates. For example, reducing exchange rates volatility and providing an opportunity to assess the consequences of different economic policies. Conversely, in an efficient foreign exchange market, there is minimal need for government intervention (Chiwira and Muyambiri, 2012)

The paper is structured as follows. Section II outlines a brief overview of the economy of Botswana's foreign exchange market. Section III provides a review of literature on foreign exchange markets efficiencies. Section IV focuses on the

methodology used in the paper. Finally, Sections V and VI focus on the empirical results and conclusions respectively.

2. BOTSWANA'S FOREIGN EXCHANGE MARKET

2.1 History of The Botswana Exchange Rate Policy

As a member of the RMA, (Rand Monetary Area) in 1966, Botswana used the Rand as its currency. South Africa had a chief role in the RMA, and was the largest economy compared to other members of the RMA and this made her benefit more from the union. Botswana withdrew from the RMA in August 1976 and introduced its own currency, the Pula. The Pula was then pegged to the US Dollar at $P1=US\$ 1.15$ and was at par value with the Rand. However, the Pula was revalued by five percent against the Rand in April 1977 which was aimed at reducing imported inflation from South Africa and demonstrating the new currency independence.

As a result of pegging the Pula to the US Dollar alongside the Rand, Botswana suffered imported inflation from South Africa. This was a result of a significant appreciation of the Rand against the US Dollar due to gold price increases. The appreciation against the US Dollar meant a depreciation of the Pula against the Rand, hence inflation. Consequently, to lessen the effects of the Rand movements in Botswana and to achieve a stable relationship of the Pula with the Rand, the Pula was pegged to a basket of currencies comprising of the Rand and the Special Drawing Rights (SDR) (Bank of Botswana, 2005). The choice of which currencies to peg with was mainly directed by the patterns of trade and main currencies used in international trade payments. In between 1981 and 1991 there was subsequent revaluation and devaluation of the Pula following different economic situations. Besides adjusting the value of the Pula, the relative weights were also changed many times to reflect relevant trade patterns.

Like many countries, Botswana's major exchange rate policy is to achieve a stable exchange rate. Furthermore, it is aimed at maintaining and enhancing the international competitiveness of domestic producers. A stable exchange rate is aimed at improvement of the balance of payments while enhancement of international competitiveness is aimed at macroeconomic stabilization, for instance, low inflation.

The Botswana exchange rate policy reflects the importance of the need to promote Botswana's competitiveness as in the economic diversification strategy.

As a way of attaining international competitiveness, Botswana saw the need to promote non-traditional exports and import substitution activities. The Botswana exchange rate therefore attempts to shift out the sector of non-tradable goods into the tradable goods sector thereby boosting output, employment and profits of the non-tradable goods.

Similar to many developing countries, Botswana adopted the intermediate exchange rate regime in an attempt to alleviate the vulnerability to volatility of an independent float as well as the straitjacket of the fixed exchange rate. The intermediate exchange rate regime enables Botswana to benefit from the two extreme exchange rate mechanisms. For instance, in a situation where revenues from diamonds are on the rise, a free float might lead to the exchange rate appreciation to levels that will be unfavourable to the non-diamond profitability. This is known as the Dutch disease and it would be inconsistent with the country's diversification objective. Therefore, an intermediate exchange rate regime comes to play in such scenarios to ensure development and diversification objectives are met (Masalila and Motshidisi, 2003; Motlaleng, 2009).

Another important goal of the Botswana exchange rate policy is to maintain a stable real exchange rate with Botswana's major trading partners. As a result of this objective, the authorities strongly monitor the relative inflation performance between Botswana, SDR countries and South Africa. If the inflation rate in Botswana is falling relative to its trading partners the equilibrium value of the Pula will be rising in relation to the basket. In contrast, the equilibrium value of the Pula will fall in relation to a basket of currencies if the Price level in Botswana is rising relative to that of its trading countries. In cases where the inflation differential is considered to be unfavorable to the attainment of the real exchange rate stability then the authorities put in place corrective interventions in an attempt to restore the given exchange rate objective (Bank of Botswana, 2005). However, the corrective measures are not only limited to the exchange rate mechanism but also consist of monetary policy action to an inflation objective. In most cases, the monetary policy is often preferred over the exchange rate mechanism. This explains why the discretionary revaluation or devaluation has not been used for quite some time now (Bank of Botswana, 2009). A substantial change in the exchange rate policy in Botswana was in 2005, when the crawling peg system was adopted. The rate of the

crawl was based on the differential between the bank of Botswana's inflation objective and the inflation forecast in trading partners (Bank of Botswana, 2005).

3. REVIEW OF PREVIOUS STUDIES

The theory of Efficient Market Hypothesis (EMH) is a common theory in stock markets or in investment. It holds that security prices contain all available information. According to Fama (1965), "an efficient market on the average, competition will cause the full effects of new information on intrinsic values to be reflected instantaneously in actual prices" as quoted by Ortiz et al.,(2005). That is, prices move in a random fashion, which is an indicator of a well-functioning, efficient market. The concept of market efficiency is viewed regarding the extent of information reflected in prices of commodities in the market and the speed at which new information is reflected in those prices. Ideally, in an efficient market, commodity prices adjust rapidly to the arrival of new information. Therefore, the current prices of all commodities reflect all information available (Pilbeam 2010). Using this concept in foreign exchange context, an efficient foreign exchange market is the one in which exchange rates contain all available information. The EMH therefore implies that changes of exchange rates in future should be unpredictable. By implication, it is not possible for one to make excess profits using any information since the returns are unpredictable and all the information is reflected in the exchange rates. Thus no speculation or arbitrage can take place. On the contrary, if the market is inefficient, traders can attempt to profit from their transactions through speculating and predicting the future exchange rates.

There are three forms of efficiencies according to Fama (1970): the weak form, semi-strong and the strong form. In weak form efficiency, prices incorporate all the information contained in the historical prices such that past prices cannot be used to predict current prices and hence one cannot use past prices to make above normal profits. This information includes the historical sequence of prices, rates of return, trading volume data and other market-generated information. The weak form is the lowest level of efficiency. On the other hand, the semi-strong form of efficiency states that all publicly available (market and non-market) information is reflected in prices. Publicly available information includes information from newspapers, public radio and television. The strong form of efficiency says that all possibly known information (public and private) is reflected in prices and hence

private information like insider information cannot aid in one making excess profits. The strong form of efficiency is an extreme form of efficiency that is hard to attain (Pilbeam, 2010).

The weak form of EMH can be tested using statistical tests of independence between stock prices or rates of return. Statistical tests of independence include autocorrelation tests, run tests and sign tests. Tests for a semi-strong form of EMH focus on testing the speed of price adjustment to publicly available information. For the strong form of efficiency performance of groups assumed to have access to true non-public information's performance is studied. If they consistently earn above average returns, the market will be inefficient (Pilbeam, 2010).

The main assumptions of this theory are:

- Investors value and analyse exchange rates for profit making
- New information arrives in the market in random fashion and independent from other news
- Quick adjustment of exchange rates to new information
- Exchange rates reflect all available information.

Theory stipulates that existence of the semi-strong form of efficiency implies the market is weak form efficient. In a market that is strong form efficient both semi-strong and weak form efficiency hold. This paper focuses on weak form efficiency and hence if it holds it is possible to have semi-strong and strong form efficiency. In further testing whether the Botswana foreign exchange market is efficient the semi-strong form of efficiency is tested since the weak form of efficiency holds in some instances.

Foreign exchange market efficiency can be divided into two aspects; (i) efficiency within the country, and (ii) the efficiency across countries. The market efficiency within the country is the one in which efficiency tests are conducted in its spot and forward exchange rates. If the forward exchange rate is an unbiased predictor of the spot exchange rates then the country is within-country efficient. On the other hand, the across-country efficiency is the one in which prices of at least two countries' exchange rates are tested for efficiency. Cross-country inefficiency implies that one country's spot exchange rate can be used to predict the spot exchange rate of another country it is tested against.

Ibrahim et al. (2011) used the unit root test to test for weak form efficiency in 30 OECD countries. The study adopted three unit root tests being the

Augmented Dickey-Fuller (ADF), Philip-Perron (PP) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS). They used monthly bilateral foreign exchange rates for different countries in the past seven years. Empirical results suggested that the markets in all the countries were efficient, consistent with the weak form of efficiency. Furthermore, their study tested whether excess returns could be realised using past information. The study found out that exchange rate movements could be easily predicted in hyperinflation periods. Dutt and Ghosh (1999) examined the European Economic Community major currencies using the Harris-Inder null of cointegration procedure. In their results, they found out that both the weak and semi-strong forms of efficiency did not exist in the major currencies of the European Economic Community. This implies that the foreign exchange market in those countries were inefficient in both weak and semi-strong forms.

Wickremasinghe (2004) examined weak and semi-strong form efficiency in the Sri Lanka exchange rate market using six bilateral exchange rates. In testing for weak form efficiency he used the ADF and the PP unit root tests. In further testing for the semi-strong form he used co-integration test, Granger causality and variance decomposition analysis. He found that the Sri-Lanka foreign exchange market was efficient in weak form but not in the semi-strong form. Furthermore, Andika et al. (2016) discovered that foreign exchange markets for the Asian-5 countries are efficient within countries, but inefficient across countries. They concluded that investors in the Asian-5 market cannot make abnormal returns by using information within countries foreign exchange markets.

In testing the relationship between the Pakistan spot and forward exchange rates with the aim of testing her foreign exchange market efficiency Bashir et al. (2014) found out that the forward rate does not fully reflect all the information available. This implies that the Pakistan foreign exchange market is inefficient.

Serbinnenko and Rachev (2009) investigated efficiency, risk and liquidity as seen by traders in Australia. In their study, they employed cointegration that involves two steps which include finding the order of cointegration using the Augmented Dickey-Fuller (ADF) test, which was confirmed with Phillips-Perron (PP) test. The results obtained showed that the spot foreign exchange market was proven to be efficient in the weak form and extremely liquid.

Noman and Minhaz (2008) used a battery unit root test, and variance ratio tests to inspect the weak form efficiency in 7 South Asian countries' foreign exchange

markets. The results showed that increments of the return series are not serially correlated. Therefore, the foreign exchange markets in South Asian countries are efficient in the weak form. Çiçek, (2014) tested both weak and semi-strong efficiency in the Turkish foreign exchange market. In testing for the weak form efficiency the study used unit root test and found out that the Turkish foreign exchange market is weak form efficient. However, the study found out that the Turkish foreign exchange market does not conform with the semi-strong form of efficiency.

In carrying out efficiency in foreign exchange markets on the transaction of the Japanese Yen, Euro and British Pound, Lee and Khatanbaatar, (2012) employed the filter rules tests. The findings revealed that the three currencies' transactions are efficient without considering transaction costs. Ortiz et al. (2005) tested efficiency for the 15 Latin American countries' exchange rates markets for the period 1970 to 2000. The objective was to investigate whether the efficient markets version of Purchasing Power Parity theory holds. The empirical results suggested that there is inefficiency in the foreign exchange markets in the region. This is explained by weak exchange rate policies as well as weak foreign exchange development.

Belkacem et al. (2005) to studied the efficiency of foreign exchange market in Tunisia. In their study, cointegration tests were conducted using spot exchange rates and one-month forward exchange daily rates of the Tunisian Dinar against the US Dollar, Euro and the Japanese Yen. The results indicated that the market is not efficient in the weak form.

Tweneboah et al. (2013) examined the efficiency of the Ghanaian foreign exchange market. They found out that the behaviour of the Cedi/US Dollar is inconsistent with the random walk process and the weak form of efficiency. The analysis was carried out using the parametric and non-parametric Variance Ratio (VR) tests based on ranks and signs. They argue that the VR technique is a better methodology to test for the random walk. Their results were not surprising as they are consistent with the fact that exchange rates are predictable.

Sifunjo et al. (2008) investigated the weak form of Efficiency Market Hypothesis of the Kenyan foreign exchange market. They employed the run tests and the Ljung-Box Q-statistic in addition to the unit root tests. The study used daily data of the Kenyan Shilling per US Dollar exchange rate for the period from January 1994 to June 2007. The findings of the study was that the Kenyan Foreign exchange rate market was not efficient or did not conform to the weak form of Efficiency Market

Hypothesis. According to the study, most rejections were due to significant patterns, trend stationarity and autocorrelation in foreign exchange returns as opposed to the random walk hypothesis in EMH. It was also found out that this was attributed to the exchange rate overshooting and undershooting phenomena. Mabakeng and Sheefeni (2014) tested the weak form of efficiency in the Namibian foreign exchange market using three bilateral exchange rates. Their study adopted the use of unit root tests, the Augmented Dickey-Fuller, Phillips-Perron and the Kwiatkowski-Phillips-Schmidt-Shin. Their study found out that past values cannot be used to predict current values hence it is efficient in the weak form.

In Botswana, a study on market efficiency was done on capital markets (Radikoko, 2014). It tested for the presence of Random Walk Behavior in the Domestic Companies Index (DCI) and Foreign Companies Index (FCI). It was found out that the capital market is not efficient in the weak form. The study was done for the period 1989-2013 for the DCI and for the period 2005-2013 for the FCI. Furthermore, Chiwira and Muyambiri(2012) also tested weak form efficiency in the Botswana stock market for the period 2004 to 2008. However, in their study the returns on All Company Index (ACI) on a weekly basis were investigated. In their study they used various methods including, the ADF, autocorrelation test, Kolmogorov-Smirnov test, Run tests and the unit root test. Similar results were obtained, i.e. the Botswana Stock market is not efficient in the weak form.

Efficiency of foreign exchange markets has been extensively tested using different econometric techniques and for different years. Most of these tests were however, in developed countries and it was concluded that the markets are efficient. Of the few studies carried out in developing countries there is mixed evidence on the weak form of efficiency. For instance, in Ghana (Tweneboah, et.al., 2013) and Kenya (Sifunjo et.al.,2008) the foreign markets have been found to be inconsistent with the weak form efficient market hypothesis whilst the Namibian (Mabakeng and Sheefeni) foreign exchange market has evidence of weak form efficiency. None of these studies on efficiency of foreign exchange market has been done in Botswana hence this paper contributes significantly to literature.

4. METHODOLOGY

4.1 Conceptual framework

In financial economics, the efficiency of markets is tested against holding the random walk hypothesis. A random walk means there is no particular pattern or trend in what is being tested. Thus, one cannot predict the direction of movement of the market. The empirical framework of this paper is based on the concept of Efficiency Market Hypothesis (EMH) as introduced by Fama (1965 and 1970). In this framework, efficiency as stated earlier is of three forms, weak, semi-strong and strong forms of market efficiency hypothesis.

Statistically, a series is purely random if it has zero mean, constant variance, and is serially uncorrelated, denoted as;

$$u_t \sim \text{IIDN}(0, \sigma^2) \quad (1)$$

i.e., u_t is independently and identically distributed as a normal distribution with zero mean and constant variance.

There are two types of random walk, random walk without drift and random walk with drift (Gujarati, 2003). The difference between the two is that the latter has no constant or intercept term while the former does. A series Y_t follows random walk without a drift if;

$$Y_t = Y_{t-1} + u_t \quad (2)$$

Where u_t is the white noise error term with mean zero and variance σ^2 . On the other hand, a series Y_t follows a random walk with drift if;

$$Y_t = \delta + Y_{t-1} + u_t \quad (3)$$

Where δ is the intercept and the series will go up if it is positive or go down if it is negative.

If random walk holds then, there will be evidence of efficiency in the foreign exchange market. This will imply that exchange rates follow a random walk i.e., there is no pattern and one cannot make above normal profits using past information as argued by Fama (1965).

4.2 Variable definition, measurement and expected signs

The paper adopts the use of nominal exchange rates as the dependent variable to test for dependence. Four bilateral exchange rates are used to test for efficiency in the Botswana foreign exchange market. These include, the Pula

against the American US Dollar (\$), the Rand (ZAR), Japanese Yen (JPY) and the British Pound (GBP) as they are major trading currencies with the Pula.

4.3 Data sources

Secondary data is employed by the paper using monthly foreign exchange rates for the mentioned four foreign exchange rates against the Pula. The data are obtained from various publications of Botswana Financial Statistics published by the Bank of Botswana. Furthermore, the data series used runs from 2000:01 to 2015:12.

4.4 Model specification

This paper adopts the methodology used by Ibrahim et al. (2011) and Wickremasinghe (2004). Unit root tests are employed to test for efficiency and they include the ADF, PP and KPSS analysis. The interest of this paper is to assess the efficiency of the foreign exchange rate market for the Pula against the US Dollar, British Pound, Japanese Yen and the Rand. The unit root tests provide confirmation on whether the exchange rates follow a random walk and eventually establish the weak form efficiency in Botswana foreign exchange market. Furthermore, if the weak form efficiency is found to hold, the cointegration test is used to test for semi-strong form of efficiency.

4.4.1 Augmented Dickey-Fuller (ADF) test

The Augmented Dickey-Fuller is a test for a unit root in a time series sample. It is an augmented version of the Dickey Fuller test for a large and more complicated set of time series models. The ADF statistic, used in the test, is a negative number. The ADF statistic is stronger, the more negative it is, the rejections of the hypothesis that there is a unit root at some level of confidence. The ADF assumes that the residual term is correlated. This test is carried out by augmenting the preceding equations by adding the lagged values of the dependent variable ΔY_t , (Gujarati, 2003). For example, if we had equation 4;

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + u_t \quad (4)$$

The estimated equation is equation 5 after adding lagged values

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^n \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (5)$$

Where ε_t denotes a pure white noise error term and where $\Delta Y_{t-1} = (\Delta Y_{t-1} - \Delta Y_{t-2})$, $\Delta Y_{t-2} = (\Delta Y_{t-2} - \Delta Y_{t-3})$. The number of lag terms to be included is

determined empirically such that after lagging the error term in equation 5 is serially uncorrelated. The ADF tests whether $\delta=0$, if δ equals to zero the series is non-stationary and if it is less than zero the series is stationary (Gujarati, 2003).

However, there are some drawbacks of the ADF test which require additional efforts to get reliable results. These include:

1. The Augmented Dickey Fuller test has low statistical power in differentiating between near unit root process thus, δ being close to zero and a true unit root process ($\delta=0$).
2. There is uncertainty about lags order, m , which is to be determined when applying the test.
3. Uncertainty about what test version to use, i.e. about including the intercept and time trend terms. Inappropriate exclusion or inclusion of these terms substantially affects test reliability.

4.4.2 The Phillips-Perron test

Phillips and Perron use non-parametric statistical methods to take care of serial correlation in the error terms without adding lagged difference terms unlike the ADF and DF tests. However, the asymptotic distribution of the PP t-statistic is the same as the ADF t-statistic critical values. The other advantage of the PP tests over the ADF tests is that the PP tests are robust to general forms of heteroskedasticity in the error term u_t . Another advantage is that the user does not have to specify a lag length for the test regression.

4.4.3 KPSS Unit Root Test

This is a complimentary test to unit root tests such as the DF and the ADF. The KPSS tests are used for testing a null hypothesis that an observable time series is stationary around a deterministic trend. Unlike, ADF and PP unit root tests the KPSS provide a test for the null hypothesis of trend stationarity against unit root alternative.

It considers the three-component representation of the observed time series $Y_1, Y_2, Y_3 \dots Y_n$ as the sum of a deterministic time trend, a random walk and a stationary residual:

$$Y_t = \beta t + (r_t + \alpha) + e_t \quad (6)$$

Where:

- $r_t = r_{t-1} + u_t$ is a random walk, the initial value $r_0 = \alpha$ serves as an intercept,
- t is the time index,
- u_t are independent identically distributed

The simplified version of the model without the time trend component is also used to test level stationarity.

The null and the alternative hypotheses are formulated as follows:

H0: Y_t is a trend (or level) stationary

H1: Y_t is a unit root process

If the series are non-stationary at either levels or first difference there is an existence of weak form efficiency, thus exchange rates behave as random walks.

4.4.4. Cointegration Test

This test establishes the long run relationship that exists between variables. Cointegration means that time series move together in the long run. In contrast, the absence of cointegration means that the variables have no long run link. Cointegration can only be carried out on variables that are integrated of order one. If the series are integrated of order zero they are said to be cointegrated (Gujarati, 2003). The Johansen cointegration test has been used to test for cointegration amongst the variables in this paper. It is seen as a robust and powerful technique for efficient market hypothesis testing in the foreign exchange. It has hence been adopted by several studies in testing for semi strong efficiency (See; Mabakeng & Sheefeni, (2014), Wickremasinghe,(2014) and Çiçek, (2014). The Johansen cointegration uses maximum likelihood and two statistics, the maximum eigen values and trace statistics. Furthermore, this test also allows for more than one cointegrating relationship, unlike the Engle–Granger method. However, it is subject to asymptotic properties. i.e., large samples. The results are most likely to be unreliable if the sample size is too small then.

5. EMPIRICAL FINDINGS

5.1 Unit Root Tests For Stationarity

To test whether a series has weak form efficiency a test for stationarity is carried out in the series. In this paper, three tests for stationarity have been employed on four bilateral exchange rates against the Pula. The primary reason for

carrying out three unit root tests is because of the limitations of low power and successive unit roots in the ADF and PP statistic respectively. As a result, their results tend to under-reject the null hypothesis of unit roots hence the KPSS is carried out to verify the PP and the ADF.

5.1.1 ADF Unit Root Test

Table 1 ADF Unit Root Tests at Levels and First difference

| AUGMENTED DICKEY-FULLER (ADF) | | | | | |
|-------------------------------|-----------------------|------------------------|------------------------|------------------------|-----------------------|
| Variables | With intercept | | Trend and intercept | | Order of Intergration |
| | Levels | First Difference | Levels | First Difference | |
| GBP | -3.2410** (0.0192) | -12.3564 * (0.0000) | -3.3646*** (0.0593) | -12.4455 * (0.0000) | I(0) |
| RSA | -1.0910 (0.7193) | -13.8325* (0.0000) | -0.7430 (0.9678) | -13.8400* (0.0000) | I(1) |
| USD | -0.90508 (0.7851) | -14.4091* (0.0000) | -2.0446 (0.5728) | -14.3779* (0.0000) | I(1) |
| JPY | -1.0207 (0.7457) | -14.3648* (0.0000) | -2.1501 (0.5142) | -4.3276* (0.0000) | I(1) |

Source: author's compilation and values obtained from Eviews
 *, **, *** are levels of significance at 1, 5, and 10%, respectively. *** means the rejection of the null hypothesis at 10% significant level. Values in the parenthesis are p-values.

Table 5.1.1 indicates that for all the variables except the British Pound are integrated of order one. Thus, they have unit roots and the null hypothesis cannot be rejected. The null hypothesis is that the series are non-stationary while the alternative hypothesis is that the series is stationary. Failure to reject the null hypothesis implies that the series are non-stationary for the Pula against the Rand, US Dollar and the Japanese Yen. These series are non-stationary at levels, both with intercept and trend and intercept. This indicates that there is a presence of unit root. Therefore, there is random walk in the Pula against the South African Rand, Japanese Yen and the US Dollar. All the series are stationary at first difference for both trend and intercept and intercept only at 1% level. According to the EMH theory, the presence of random walk in the exchange rates implies that they are

efficient in the weak form. In contrast, the British Pound is integrated of order zero and hence it has no unit roots. This implies that the British Pound is stationary. It is stationary at levels and first difference both for intercept and trend and intercept. It therefore follows that the British Pound does not follow a random walk. Therefore, it does not comply with the weak form efficiency according to EMH.

5.1.2 PP Unit Root Test

Table 2 PP Unit Root Test at levels and first difference

| PHILLIPS-PERRON (PP) | | | | | |
|----------------------|-----------------------|------------------------|------------------------|------------------------|-----------------------|
| Variables | With intercept | | Trend and intercept | | Order of Intergration |
| | Levels | First Difference | Levels | First Difference | |
| GBP | -3.2177** (0.0205) | -12.3564* (0.0000) | -3.4046*** (0.0538) | -12.4334* (0.0000) | I(0) |
| RSA | -1.1692 (0.6876) | -13.8626 * (0.0000) | -0.8998 (0.9529) | -13.8657 * (0.0000) | I(1) |
| USD | -0.9773 (0.7611) | -14.4017* (0.0000) | -2.2371 (0.4659) | -14.3721* (0.0000) | I(1) |
| JYN | -1.0207 (0.7457) | -14.3648* (0.0000) | -2.1790 (0.4981) | -14.3276* (0.0000) | I(1) |

Source: author's compilation and values obtained from Eviews
 *, **, *** are levels of significance at 1, 5, and 10%, respectively. *** means the rejection of the null hypothesis at 10% significant level. Values in the parenthesis are p-values.

In line with the ADF test, the PP test also confirms the presence of random walk in considered exchange rates with the exception of the British Pound as shown in Table 5.1.2. Similar to the results found using the ADF test, the Pula against the Rand, US Dollar and the Japanese Yen are integrated of order one. This means it still holds that they have unit roots and hence follow a random walk. The presence of a random walk implies that the series are efficient in the weak form in accordance to the EMH theory. However, they still become stationary after first differencing at 1% level of significance. Furthermore, the British Pound is also integrated of order one and hence stationary at both levels and first differencing as in the ADF test. Also, it does not go in line with the EMH theory since it does not

have unit roots therefore does not follow random walk. The PP test procedures are quite similar to those of the ADF test with non-stationarity at levels under both with intercept and with trend and intercept and stationarity after first differencing at 1% level. The PP test further confirms that the Botswana foreign exchange market is weak form efficient in all the considered exchange rates against the Pula except the British Pound.

5.1.3 KPSS Unit Root Test

Table 3 KPSS Unit Root Test at Levels

| Kwiatkowski-Phillips-Schmidt-Shin (KPSS) | | | | | |
|--|---------------------|-----------------------|-----------------------|----------------------|----------------------|
| Variables | With intercept | | Trend and intercept | | Order of integration |
| | Levels | First Difference | Levels | First Difference | |
| GBP | 1.2210* (0.0000) | 0.2526*** (0.1018) | 0.184715* (0.0000) | 0.0791** (0.0456) | I(0) |
| RSA | 1.0126* (0.0000) | 0.2365 (0.9638) | 0.2582* (0.0000) | 0.1678 (0.5043) | I(1) |
| USD | 1.3244* (0.0000) | 0.0638 (0.1422) | 0.1549* (0.0000) | 0.0519 (0.6294) | I(1) |
| JYN | 1.4849* (0.0000) | 0.0647 (0.2291) | 0.2030* (0.0000) | 0.0648 (0.5403) | I(1) |

Source: author's compilation and values obtained from Eviews
 *, **, *** are levels of significance at 1, 5, and 10%, respectively. *** means the rejection of the null hypothesis at 10% significant level. Values in the parenthesis are p-values.

The results obtained from the KPSS indicate that again, the weak form efficiency holds in the Botswana foreign exchange market in all the exchange rate series except the British Pound. In contrast to the ADF and the PP the Null hypothesis is that the series is stationary while the alternative hypothesis is that the series is non-stationary. However, similar results were found as in the ADF and the PP tests. The Pula against the Rand, US Dollar and the Japanese Yen are integrated of order one as in the ADF and PP tests. At levels the null hypothesis is not rejected at 1% level and hence concluded that at levels the series are stationary. However, after first differencing the null hypothesis is rejected which implies that the series has

unit roots and hence are random walks. However, in regard to the British Pound, both at levels and first differencing the null hypothesis is not rejected, thus the series have no unit roots hence stationary. This is against the random walk hypothesis and hence also against the weak form efficiency according to the EMH theory. These results are attuned with those of the ADF and PP and further affirming that the weak form of EMH is existent in the Botswana's foreign exchange market.

5.2 Cointegration Test

Cointegration test is used to test for semi-strong form of efficiency in this paper. Cointegration test is only carried out on non-stationary exchange rates. These tests have been carried out on the Pula against the South African Rand, Japanese Yen and the United States Dollar. The Johansen cointegration is employed to test the long run relationship between the exchange rates. Maximum Eigen value and trace statistics are both used to explore the number of cointegrating equations. If there is any series cointegrating then the market is not efficient in the semi-strong form. Therefore, one can predict the exchange rate movement from the other exchange rate that it is cointegrated with and make above normal profits. According to the EMH theory in the semi- strong form there should not be any relationship between the exchange rates. Any long run relationship violates the theory. This is so because for the semi-strong form of efficiency the existence of any long run relationship implies that there is no random walk in the series as they will be following the trend of another series.

5.2.1 Unrestricted Cointegration Rank Test (Trace)

Table 4 *Unrestricted Cointegration Rank Test (Trace)*

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value |
|------------------------------|------------|--------------------|------------------------|
| None * | 0.114464 | 69.57429 | 47.85613 |
| At most 1 | 0.041678 | 22.04328 | 29.79707 |
| At most 2 | 0.010433 | 5.397865 | 15.49471 |
| At most 3 | 0.003312 | 1.297274 | 3.841466 |

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

5.2.2. Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Table 5 *Unrestricted Cointegration Rank Test (Maximum Eigenvalue)*

| Hypothesized No. of CE(s) | Eigenvalue | Max-Eigen Statistic | 0.05 Critical Value | Prob.** |
|------------------------------|------------|------------------------|------------------------|---------|
| None * | 0.114464 | 47.53101 | 27.58434 | 0.0000 |
| At most 1 | 0.041678 | 16.64542 | 21.13162 | 0.1894 |
| At most 2 | 0.010433 | 4.100591 | 14.26460 | 0.8486 |
| At most 3 | 0.003312 | 1.297274 | 3.841466 | 0.2547 |

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

The results indicate that there is one cointegrating equations both in the trace test and the maximum eigenvalues at 0.05% level. The null hypothesis is that there is no cointegration while the alternative hypothesis is that there is cointegration. From the results the null hypothesis is rejected. Therefore, there is cointegration which is against the efficient market hypothesis in the semi-strong form. The existence of cointegration in the series implies that there is no random walk in the series hence there is a pattern that one can follow to predict a particular exchange rate. Since there is one cointegrating equation it suggests that from the non-stationary series, thus the Pula against the Rand, US Dollar and the Japanese Yen it is possible for one to predict the exchange rate movement of the cointegrating series from one another. The main problem with this test is that it does not reveal which of the considered exchange rates have long run relationship. It only make known that there is one pair of series that have a long run relationship as seen from the results. Moreover, with regard to the British Pound which was already found to be inefficient in the weak form it holds that it is also not semi- strong efficient. Any series intergrated of order zero naturally implies that it is cointegrated to other variables. According to the EMH theory, if the series is not weak form efficient it can never be semi- strong efficient. The series must first attain the lowest level of efficiency. These results provide evidence against the semi-strong form of efficiency holding in the Botswana foreign exchange market as far as the considered exchange rates are concerned.

6. CONCLUSIONS

This paper examined efficiency for the Botswana foreign exchange market for the period 2000:01 to 2015:12. Four exchange rates of the Pula against other currencies are considered. These are of the Pula against the South African Rand, the American Dollar, British Pound and the Japanese Yen. In assessing the weak form efficiency unit root tests approach was adopted to test for random walk behaviour in the exchange rates. Three types of unit root tests were conducted; the ADF, PP and the KPSS.

The ADF and the PP results revealed that the Botswana foreign exchange market is efficient in the weak form. Moreover, the KPSS test further confirmed the existence of this form of efficiency. The results showed that of the four considered exchange rates against the Pula, three exchange rates were non-stationary. These exchange rates included the Pula against the South African Rand, Japanese Yen and the United States Dollar. This implies that there is prevalence of random walk behaviour in the exchange rates which complies with the efficient market hypothesis in the weak form. Thus, it is not possible to predict exchange rates using past information. The results of the weak form of efficiency corroborates with the reviewed literature. For instance, they are in line with those in Sri Lanka (Wickremasinghe, 2004), and Namibia (Mabakeng and Sheefeni, 2014). As a result one cannot make excessive returns using past information on exchange rates. i.e., to say, the market participants cannot develop any statistical technique to gain from the foreign exchange market time and again.

However, unit root tests found that the British Pound was stationary at both levels and first difference. The British Pound was therefore found to be inconsistent with the random walk hypothesis. This implies that it is not aligned with the weak form of efficiency market hypothesis. This implies that the British Pound is not weak form efficient. The inconsistency of the British Pound to the weak form of efficiency may be attributable to significant patterns in the exchange rates of the pula against the British Pound. This implies that the participants in the foreign exchange market in Botswana can devise some rule or technique that can be used to predict movements of the Pula against the British Pound from its past values.

The semi-strong form of efficiency was tested to further interrogate the efficiency of the foreign exchange market in Botswana. In testing for semi-strong form of efficiency a cointegration test was conducted. Cointegration test was only

conducted in exchange rates that were found to be of order one as it is the condition for carrying out the test. Thus, those that were found to be non-stationary, which included the exchange rate of the Pula against the Rand, US Dollar and the Japanese Yen. From the cointegration results, one cointegrating relationship was found. i.e., there was one long run relationship between the currencies which imply that there is no random walk behaviour in the exchange rates as far as the semi-strong form of efficiency is concerned. These confirmed that the semi-strong form of efficiency in the Botswana foreign exchange market is non-existent. Moreover, the semi-strong form results are further supported by those found by Wickremasinghe (2004) who also examined both weak and semi-strong form of efficiencies. He also found that the weak form of efficiency does exist in the Sri-Lanka foreign exchange market but the semi-strong form does not as it is in this paper. The non-existence of the semi- strong form of efficiency means that it is possible for market participants to use public information to make excess profits.

Botswana's foreign exchange market is efficient at least in the weak form. Botswana's exchange rate policy must therefore be commended for attaining at least the weak form of efficiency. An efficient market implies that exchange rates are aligned and does not lead to arbitrage behaviour. This entails that it is not possible for market participants to make above normal profits using past information or following history of the exchange rates. As such, the Botswana exchange rate policy has been a success in terms of it bringing efficiency in the market as far as the weak form of efficiency is concerned.

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CASE STUDY



THE FINANCIAL CRISIS RESPONSE. COMPARATIVE ANALYSIS BETWEEN EUROPEAN UNION AND USA

FLORENTINA MELNIC*

Abstract: *This paper reviews the measures adopted by central banks from the most important economies during the crisis and assess their effectiveness. It is important for policy makers to identify which measures were effective in limiting the financial system distress in order to adopt the appropriate measure during future crisis. In case of US, TARP was the most important program for banking system and it was effective in reducing banks' contribution to systemic risk and banks' default probabilities. But TARP also conducted to a reduction in loans growth and create incentives for higher risk-taking behavior. The unconventional monetary policies adopted by ECB during the period 2008- 2016 reduced the impact of the crisis on the European economy and achieved their objectives: to support banks' funding and to increase lending to real economy (LTROs), to calm tensions from bond markets (CBPP, SMP, OMT), to support economic activity and to stabilize inflation rate (SMP, OMT, LTROs, APP).*

Keywords: *unconventional monetary policy, TARP, refinancing operations, financial crisis*

1. INTRODUCTION

In response to the global financial crisis central authorities around the world adopted, in the first phase, a series of traditional rescue measures directed at individual institutions. These measures consisted of liquidity support to failing institutions, that, subsequently, were sold or merged with stronger partners¹. The

* Florentina Melnic, PhD. Student Alexandru Ioan Cuza University of Iasi, email: florentina_iesanmuntean@yahoo.com

¹ We can mention here the case of Bear Stearns from the United States that was sold to JPMorgan Chase (March 2008), Northern Rock and Bradford and Bingley from UK nationalised in February 2008, respectively, September 2008 (and partly sold to Santander), SachsenLB from Germany sustained with liquidities (August 2007), and eventually merged with LBBW (April 2008).

takeover of Fannie Mae and Freddie Mac by the government and the collapse of Lehman Brothers worsen the financial conditions and send a sentiment of uncertainty among participants, that led to a drying up of funding markets (Stolz & Wedow, 2010). The shock generated by the Lehman Brothers' collapse and the liquidity pressures were felt rapidly by the European banking systems.

In this situation, the Federal Reserve and European Central Bank were forced to adopt non-standard measures designed to ease credit and liquidity constraints in order to restore financial stability and to maintain the lending to real economy (Carpenter, Demiralp, & Eisenschmidt, 2014). The measures implemented refer to expansion of the volume of lending facilities, longer-term financing, more frequent auctions or even changes in the auctioning process, a wide range of accepted collateral, direct asset purchases and liquidity facilities for intermediaries other than banks (Stolz & Wedow, 2010).

In general, the measures implemented in EU have been broadly similar to those adopted in the US. In both cases, the authorities have employed broadly the same tools (e.g. government guarantees, capital and liquidity injections, and asset protection) and have relied on a mix of ad hoc measures for individual institutions and schemes addressing the wider needs of the financial system. But, there are also some differences between the policies adopted in the US and the EU. The measures adopted by Federal Reserve System have been more expansive and have targeted also individual financial intermediaries, while the European Central Bank actions have been limited to liquidity extension. Another difference between the policies adopted in these two economies refer to the fact that capital injections were a requirement in the US, while in Europe capital support has typically been voluntary (Stolz & Wedow, 2010).

In this paper, we review the unconventional measures adopted by Federal Reserve System and European Central Bank and assess their effects. It is important for policy makers to establish which measures were effective in limiting the financial system distress in order to adopt the appropriate measure during future crisis. For US, TARP was the most important measure for banking system, US Treasury investing \$245 billion in financial institutions. TARP was effective in reducing banks' contribution to systemic risk, in reducing banks' default probabilities, but conducted to a reduction in loans growth and higher risk-taking. The unconventional monetary policies measures adopted by ECB during the period

2008- 2016 achieved their objectives: to support banks' funding and to increase lending to real economy (LTROs), to calm tensions from bond markets (CBPP, SMP, OMT), to support economic activity and to stabilize inflation rate (SMP, OMT, LTROs, APP).

2. US RESPONSE TO FINANCIAL CRISIS

2.1. Policy interventions during financial crisis

The US central authorities implemented during financial crisis a range of programs to sustain the affected sectors: small business, auto industry, financial markets, final consumers, pension funds and housing market. In this section we focus on the financial markets' measures, but mainly on bank based measures adopted by the American authorities. The authorities that have the power to intervene into American economy are Fed, FDIC and the Government.

Measures directed to financial markets

The measures adopted by the Fed had a direct or indirect impact on financial institutions or financial sectors. For example, the Recovery Act through the tax relief applied to the American taxpayers improved the financial conditions of banking clients. The supplementary amount could be used to obtain a larger amount of loans or to deposit it.²

The main programs adopted by central bank that meant to support financial markets were: Term Asset-Backed Securities Loan Facility (TALF), Commercial Paper Funding Facilities (CPFF), Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF), Primary Dealer Credit Facility (PDCF), and Term Securities Lending Facility (TSLF).³

² According to U.S. Department of the Treasury the tax relief appointed in The American Recovery and Reinvestment Act of 2009 (February 17th), will deliver an estimated \$150 billion of direct relief to Americans and their families. This program was designed to stimulate the US economy by investing in infrastructure, job creation, educational opportunities, improve health care – <https://www.treasury.gov/initiatives/recovery/Pages/recovery-act.aspx>

³ CPFF was created on October 2008 and closed in February 2010; AMLF was announced on September 2008 and closed on February 2010; PDCF was launched in March 2008 and closed on February 2010; the first auction of TSLF was on March 2008 and the program was closed on February 2010.

Table 1 US Government response to financial crisis

| Programs | Components | Sectors |
|--|--|--|
| Federal Reserve Financing programs | <ul style="list-style-type: none"> ➤ <i>Asset-backed commercial paper money-market mutual fund liquidity facility</i> ➤ <i>Commercial paper funding facility</i> ➤ <i>Currency swap lines with international central banks</i> ➤ <i>Money-market investor funding facility</i> ➤ <i>Primary dealer credit facility</i> ➤ <i>Term auction facility</i> ➤ <i>Term securities lending facility</i> | Small Business, Auto Industry, <i>Financial Markets</i> , Consumers, Retirement, Housing |
| Large bank stress tests | Small Business, Auto Industry, <i>Financial Markets</i> , Consumers, Retirement, Housing | |
| TARP bank investment programs | <ul style="list-style-type: none"> ➤ <i>Capital Assistance Program (CAP)</i> ➤ <i>Capital Purchase Program (CPP)</i> ➤ <i>Community Development Capital Initiative (CDCI)</i> ➤ <i>Asset Guarantee Program (AGP)</i> ➤ <i>Targeted Investment Program (TIP)</i> | Small Business, Auto Industry, <i>Financial Markets</i> , Consumers, Retirement, Housing |
| Recovery Act | Small Business, Auto Industry, <i>Financial Markets</i> , Consumers, Retirement, Housing | |
| TALF credit market program | Small Business, Auto Industry, <i>Financial Markets</i> , Consumers, Retirement | |
| FDIC bank debt insurance program | Small Business, Auto Industry, <i>Financial Markets</i> , Consumers, Housing | |
| TARP auto industry programs | <ul style="list-style-type: none"> ➤ <i>GM/Chrysler restructurings</i> ➤ <i>Auto supplier support program</i> ➤ <i>Auto warranty commitment program</i> | Small Business, Auto Industry, <i>Financial Markets</i> , Consumers, Retirement |
| FDIC insurance deposit limit increase | Small Business, <i>Financial Markets</i> , Consumers, Retirement | |
| Treasury market guarantee program | Small Business, <i>Financial Markets</i> , Consumers, Retirement | |
| AIG stabilization effort | <i>Financial Markets</i> , Consumers, Retirement | |
| Fannie Mae/Feddie | <i>Financial Markets</i> , Consumers, Retirement, Housing | |

| | | | |
|---|---|---|--|
| Mac stabilization effort | | | |
| Foreclosure-prevention and refinancing initiatives | ➤ | <i>Making Home Affordable (MHA)</i> | <i>Financial Markets, Consumers, Retirement, Housing</i> |
| | ➤ | <i>Home Affordable Modification Program (HAMP)</i> | |
| | ➤ | <i>Home Affordable Refinance Program (HARP)</i> | |
| | ➤ | <i>Other federal loan modification programs</i> | |
| | ➤ | <i>Hardest Hit Fund</i> | |
| | ➤ | <i>Neighborhood Stabilization Program</i> | |
| Legacy Securities Public-Private Investment Program | | <i>Financial Markets, Consumers, Housing</i> | |
| Small Business Administration lending program, Small Business Lending Fund, State Business Credit Initiative | | <i>Small Business, Financial Markets, Consumers</i> | |
| Treasure mortgage-backed securities purchase program | | <i>Financial Markets, Consumers, Housing</i> | |

Source: U.S. Department of the Treasury, 2013. *The Financial Crisis Five Years Later. Response, Reform, and Progress*, https://www.treasury.gov/connect/blog/Documents/-FinancialCrisis5Yr_vFINAL.pdf

TALF⁴ was created to support market participants to meet the credit needs of households and small businesses by supporting the issuance of asset-backed securities. In order to restore liquidity in short-term debt markets, Fed recourse to CPFF and AMLF. CPFF was designed to provide liquidity to US issuers of commercial paper by purchasing highly rated unsecured and asset-backed commercial papers. AMLF had the objective to facilitate the sale of assets by money-market mutual funds in the secondary market to increase their liquidity. Dealers were sustain through PDCF and TSLF. PDCF referred to an overnight loan

⁴ TALF was a joint Federal Reserve - Treasury program, launched in March 2009 and closed in June 2010. The final outstanding loan was repaid in October 2014.

facility that provided funding to primary dealers in exchange for a specified range of eligible collateral. TSLF provided liquidity to Treasury and other collateral markets by lending Treasury securities held by System Open Market Account to primary dealers against eligible collateral. Mortgage market was supported by Fed's actions of direct purchase of securities issued by Fannie Mae and Freddie Mac and of the mortgage-backed securities guaranteed by these institutions. Other individual institutions that were supported by Fed were Bear Stearns and AIG.

Measures directed to banking system

The main bank based measure adopted by Fed was Term Auction Facility. The objective of this facility was to provide liquidity to financial institutions in the early stages of the crisis when the bank funding markets confronted with severe pressure. This program was established in December 2007 based on the discount window. Through this program, Fed auctioned loans to a broader range of financially sound depository institutions against collateral. During the period 2003-2006, discount window and TAF usage averaged \$170 million per day, while during the financial crisis (August 2007 to December 2009) both facilities averaged \$221 billion per day (Berger, Black, Bouwman, & Dlugosz, 2017). Based on Federal Reserve data 416 different banks benefit from this program, that ended on March 2010.

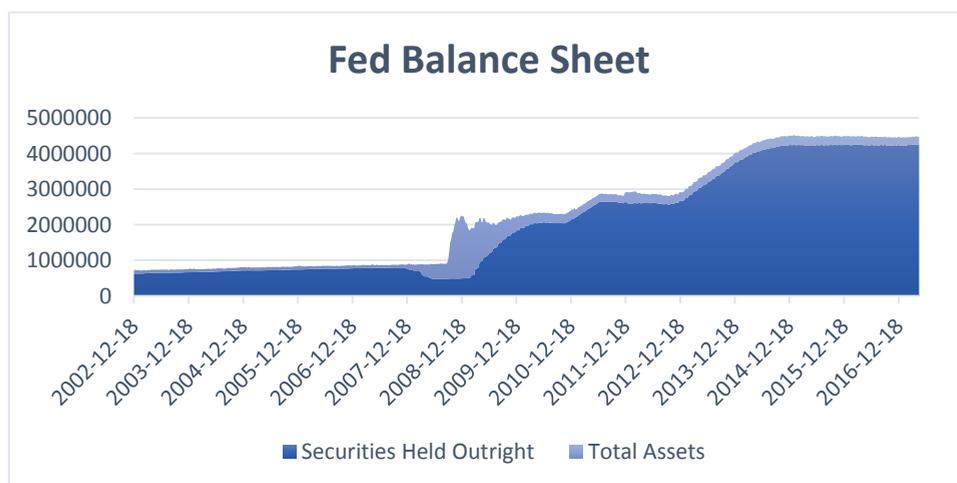
The American Government launched the Troubled Asset Relief Program (TARP⁵), one of the most important measure for banking system. The aim of this program was to ensure the stability of banking system by purchasing mortgage-related toxic assets and by injecting capital into banks. The intermediary objectives of TARP program were to restore liquidity to a market with frozen credit, promote economic growth, curb unemployment and to prevent foreclosures. This was followed through several sub-programs with different objectives: Asset Guarantee Program (AGP), Supervisory Capital Assessment Program (SCAP) and Capital Assistance Program (CAP), Capital Purchase Program (CPP), Community Development Capital Initiative (CDCI) and Targeted Investment Program (TIP). As of February 2017, the only programs that have outstanding investments are

⁵ Part of the United States' Emergency Economic Stabilization Act (EESA), signed into law by President Bush on October 3, 2008

Capital Purchase Program (0.19 billion dollars) and Community Development Capital Initiative (0.10 billion dollars) (US Department of the Treasury, 2017).

Through TARP bank investment program, Treasury invested \$245 billion in financial institutions, being considered the largest government bailout in the United States history (Montgomery & Takahashi, 2014). The impact of the adopted measures on the Fed's balance sheet can be observed in Graphic no 1.

Graphic 1 *The evolution of the FED's balance sheet during 2002-2017 (million US)*



Source: Federal Reserve Bank of Louis, Federal Reserve Economic Data – <https://fred.stlouisfed.org/series/WALCL> & <https://fred.stlouisfed.org/series/WSHOL>

The largest program within TARP was Capital Purchase Program (CPP) to which have been allocated approximately \$205 billion that were invested in 707 financial institutions from 48 states (Office of Financial Stability, 2013). Under this program banks could sell equity to the Treasury of maximum \$25 million or 3% of its risk-weighted assets with a dividend rate of 5% for the first five years and 9% thereafter. The first funds were disbursed on October 28, 2008 to the biggest US financial institutions including Goldman Sachs Group, Morgan Stanley, Bank of America, Citigroup, JPMorgan Chase and Wells Fargo & Co (Semaan & Peterson Drake, 2016). As of February 2017, there have been recovered from CPP program \$226.7 billions through repayments, auctions, dividends, interest and warrant income, meaning an additional return for the taxpayers.

2.2 The effectiveness of policy interventions in US

Discount window and TAF program were the first programs aimed to sustain the US financial system. Berger, Black, Bouwman, & Dlugosz (2017) studied the effects of these facilities on bank lending, concluding that the received funds were used to increase lending by both small and large banks. The positive effects of TAF program were confirmed by Frank & Hesse (2009) this program being effective in reducing the LIBOR-OIS spread, but the economic magnitude was not very large. In contrast, Taylor & Williams (2008) found that TAF had no significant effect on LIBOR-OIS spreads.

In their retrospective report, US Treasury sustain that TARP helped stop the widespread of financial panic, prevented what could have been a devastating collapse of the American financial system and helped many struggling homeowners to keep their homes (Office of Financial Stability, 2013).

However, literature offers divided opinions regarding the effectiveness of TARP program. There are studies that sustain the effectiveness of TARP program in reducing banks' contribution to systemic risk (Berger, Roman, & Sedunov, 2016), in reducing banks' default probabilities in the short term (Calabrese, Degl'Innocenti, & Osmetti, 2017), mitigating the propagation of housing market shocks across US (Jang, 2016), in reducing stock market volatility (Huerta, Perez-Liston, & Dave, 2011) and in creating real economic value through job creation (Berger & Roman, 2015). In contrast, the implementation of TARP conducted to a reduction in loan growth (Montgomery & Takahashi, 2014; Black & Hazelwood, 2013), higher-risk loans and risk-taking (Duchin & Sosyura, 2014; Black & Hazelwood, 2013), increase systemic risk (Farruggio, Michalak, & Uhde, 2013), declined operational efficiency (Harris, Huerta, & Ngo, 2013).

The immediate effect of TARP's announcement on financial markets was negative, deepening the uncertainty. The announcement was made in the second week after the decision not to intervene in Lehman Brothers by Federal Reserve Board Chairman Ben Bernake and Treasury Secretary Henry Paulson providing a 2½-page draft with no mention regarding the oversight and a few restrictions on the use. The uncertainty and the confusion about the procedures or criteria for future government intervention to prevent financial institutions from failing increased risk spreads in the interbank market. The original idea of TARP of buying troubled assets from financial institutions was changed as it was not clear how it will work.

The announcement that this program would simply inject capital into banks improved the financial conditions, removing the uncertainty. However, the longer-term effects on different variables are questionable.

Through TARP's capital injections, FED wanted to increase confidence in banks and to stimulate bank lending. Literature provides evidence regarding the failure of this program to achieve the latter goal (Montgomery & Takahashi, 2014; Black & Hazelwood, 2013; Duchin & Sosyura, 2014). Montgomery and Takahashi (2014) analyzed 9042 commercial banks for the period of 2001-2010 and found evidence that banks that received capital injections through TARP program reduced their loan growth. Taliaferro (2009) reports evidence that banks that received funds under CPP program used them to strengthen their capital position (about sixty cents of every dollar received) rather than support lending (thirteen cents of every dollar received). The evolution of bank lending during financial crisis has been documented by Ivashina and Scharfstein (2010), concluding that in the final quarter of 2008 there was a sharp drop in the new loans (credit lines) provided to large borrowers of 47% compared to the previous quarter of 2008. The lack of liquidity to finance larger businesses, determined banks to shift their loans to smaller and riskier businesses. Puddu and Walchli (2014) concluded that TARP banks provided higher new loans to small business of about 19% than no TARP banks in the years after receiving TARP equity (2008-2010). Li (2013) concluded that one-third of the TARP funds was directed to new loans while the rest was kept to strengthen their balance sheets.

Current research sustain the fact that banks shifted their portfolios toward riskier borrowers and the manifestation of moral hazard (Black & Hazelwood, 2013; Duchin & Sosyura, 2014). Black & Hazelwood (2013) concluded that, compared with non-TARP banks, large banks that received TARP capital increased the risk of the new granted loans, while small banks decreased it. The increased level of banks' risk-taking in the absence of increased lending may be the result of moral hazard, the offered bailout creating the perception for 'Too-big-to-fail' banks of implicit government support going forward. This result is confirmed by Duchin and Sosyura (2014) who found that an increase in banks' capital did not conducted to a credit expansion, but instead lead to riskier lending and investments, TARP banks offering favorable loan contract terms especially to high-risk borrowers (Berger, Makaew, & Roman, 2016). Wilson & Wu (2010) provide evidence

regarding the fact that banks that face insolvency and participate in a preferred stock recapitalization are tempted to reject good loans and accept the bad ones in order to shift risk to their creditors. This suggests that the size of the capital injection and the lack of any leverage-increasing limit may have led to inefficiency in the TARP program.

Farruggio, Michalak & Uhde (2013) revealed a light and a dark side of TARP program. They studied the impact of both announcements of TARP program (initial and revised), of capital injections and capital repayments on changes in bank shareholder value and risk exposure of 125 recipient banks. In their study, the dark side of this program refers to the fact that the announcements of TARP program as well as capital injections increased systemic risk. Capital injections are perceived by investors as a signal of higher expected default risk of supported banks. On the other hand, the announcements of TARP and capital repayments increased bank shareholder value. These results are confirmed by Ncube (2016) who concluded that the announcement of TARP program increased investors' confidence, but the receipt of TARP funds determined a negative market reaction with important stock price declines. Another negative effect of TARP capital injections was the reduction in operational efficiency for TARP recipients banks. Harris, Huerta, & Ngo (2013) argue this result through the moral hazard generated by bailouts, the political pressure to increase lending that reduced loans quality, the requirements imposed by TARP program and the government involvement in bank management decisions.

In contrast with the previous work, there are studies that prove the positive effects of TARP program on US banks (Berger, Roman, & Sedunov, 2016; Calabrese, Degl'Innocenti, & Osmetti, 2017; Jang, 2016). Berger, Roman, & Sedunov (2016) empirically demonstrated that TARP program reduced banks' contributions to systemic risk, but especially for larger and safer banks located in areas with better economic conditions. Furthermore, Calabrese, Degl'Innocenti, & Osmetti (2017) sustain that Capital Purchase Program, the largest bank bailout programme under TARP, helped banks to reduce their default probabilities in the short term, during the peak of financial crisis. This is confirmed by Croci, Hertig, & Nowak (2015) study, suggesting that bailing-out more banks would have

reduced the number of banks that were subject of FDIC resolution process⁶. Another positive effect of TARP program, highlighted by Liu, Kolari, Tippens, & Fraser, (2013) was the CPP banks' stock prices recovery and, furthermore, large and significant gains after the repayments of CPP funds.

To conclude, the literature does not offer a general accepted opinion regarding the overall effect of TARP program on US banking system. This effect is depending on the analyzed time-horizon (short vs. long term), the different stages of TARP program (announcements, capital injections or repayments), the computation of dependent variables (e.g. systemic risk vs. lending growth) and the independent financial variables used. Calabrese, Degl'Innocenti, & Osmetti (2017) concluded that TARP program reduced banks' default probabilities on the short term, while Semaan & Peterson Drake (2016) concluded that the idiosyncratic risk of CPP participants remained higher compared to those not participating in CPP four years following CPP. Regarding the impact of TARP equity on systemic risk Berger, Roman, & Sedunov (2016) estimated systemic risk through Normalized SRISK and Systemic Expected Shortfal, while Farruggio, Michalak, & Uhde (2013) defined systemic risk as the change in the correlation of bank stock returns with returns of the market portfolio. Both studies have obtained conflicting results.

3. EU RESPONSE TO FINANCIAL CRISIS

Traditionally, the ECB provides to central banks two standing facilities that can be used on their own initiative whenever they need liquidity or to deposit liquidity. These facilities refer to Marginal lending facility and Deposit facility but normally banks use them in the absence of other alternatives, as the interest rates are higher, respectively lower than money market rates.

3.1. Policy interventions during financial crisis

To manage the liquidity in the money market, ECB uses, through National Central Banks, open market operations. The most important operations are Main refinancing operations (MROs) and *Longer-term refinancing operations (LTROs)*. Another instrument used by ECB to manage liquidity is the *Minimum reserve*

⁶ From February 2007 to March 2017, 526 banks were resolved by the Federal Deposit Insurance Corporation - <https://www.fdic.gov/bank/individual/failed/banklist.html>

requirements, banks being bound to hold a specific value of their liabilities as deposits to central banks. The reserve ratio was reduced in December 2011 to 1% from 2% as a measure to improve banks liquidity conditions (ECB, 2016). During the financial crisis, ECB reacted by several interest rates rises and cuts both for refinancing operations and standing facilities. ECB had recourse to unconventional monetary policy as the conventional ones proved ineffective. The ECB's Governing Council decides the measures, but the Eurosystem as a whole implements them.

The European banking system faced significant losses since the fallout of the subprime mortgage crisis in the United States. Consequently, banks started to have doubts about the solvency of their counterparties from the interbank market, which conducted to important shortage of liquidity and the collapse of activity in many financial market segments (Boeckx, Dossche, & Peersman, 2017). To respond to the increased and unpredictable demand of liquidity, ECB started with several *Liquidity-providing operations* in July 2007. These operations continued until the collapse of Lehman Brothers and the intensification of the financial crisis in September 2008. Starting from that point, ECB implemented several monetary policies that were "unprecedented in nature, scope and magnitude". The aim of these policies was to achieve the primary objective of price stability (HICP inflation rates below, but close to 2%) and to ensure an appropriate monetary policy transmission mechanism to real economy. The adopted measures during the period 2007 – 2016 can be analyzed in Table 2.1.

On 15 October 2008, Governing Council decided that all ECB's operations to be carried out through *fixed rate tender procedures with full allotment*. This means that all refinancing operations in euro and US dollars to be conducted through tender procedures with fixed rate (equal to the ECB's policy rate in the case of operations denominated in euro) and full allotment (all bids were satisfied). On the same day, Governing Council announced the *extension of the collateral list and the foreign exchange swaps*. Traditionally, collateral refers to marketable financial securities, such as bonds⁷ and other types of assets, such as fixed term and

⁷ Central and regional government securities, covered and uncovered bank bonds, corporate bonds, asset-backed securities and other marketable assets

cash deposits and credit claims. In addition, ECB offered liquidities in US dollars and Swiss francs through foreign exchange swaps.

Table 2 *Unconventional monetary policies conducted by ECB during July 2007 – September 2016*

| Monetary operations | policy | Period | Details |
|--|---------------|---|--|
| Liquidity-providing operations | | July 2007 – September 2008 | |
| Fixed interest rate with allotment MROs and LTROs | | 15 October 2008 – January 2015 | |
| Extension of the list of collateral assets | | 15 October 2008 | <ul style="list-style-type: none"> • Marketable debt instruments denominated in other currencies than the euro, namely US dollars, the British pound and the Japanese yen, and issues in the euro area • Euro-denominated syndicated credit claims governed by UK law • Debt instruments issued by credit institutions which are traded on the accepted non-regular markets that are mentioned on the ECB website • Subordinated debt instruments when they are protected by an acceptable guarantee in section 6.3.2 of the General Documentation on Eurosystem monetary policy instruments and procedures. |
| | | 8 December 2011 | <ul style="list-style-type: none"> • Reduced the rating threshold for certain asset-backed securities • Allowed national central banks to accept as collateral additional performing credit claims (i.e. bank loans) that satisfy specific eligibility criteria |
| Swap lines with Fed and Swiss Central Bank | | Beginning with 15 October 2008 | |
| Extension of the maturity of LTROs | | February 2009 – July 2014 | <ol style="list-style-type: none"> 1. Three months (October 2008) 2. Six months (February 2009, August 2011) 3. Twelve months (June 2009, October 2011) 4. Thirteen months (October 2011) 5. Thirty-six months (December 2011, February 2012) |
| Covered Bond Purchase Programs (CBPP) | | 1. June 2009 – June 2010 2. November 2011 – October 2012 | Purchased in the primary and secondary markets of covered bonds eligible for use as collateral for Eurosystem credit operations |

| | | | |
|---|-----------------|--|--|
| Securities Programme (SMP) | Market | May 2010- March 2011 August 2011- February 2012 | The objective of these interventions was to address the malfunctioning of securities markets and to restore an appropriate monetary policy transmission mechanism |
| Outright Transactions (OMT) | Monetary | September 2012 | The differences between the two programs refer to: <ul style="list-style-type: none"> • OMTs are attached to a European Financial Stability Facility/European Stability Mechanism programme, ensuring that the Member States remain under considerable pressure to implement reforms and maintain fiscal discipline; • the maturity of OMT programme is between one and three years; • publication of relevant information on OMT interventions; • the size of the programme is unlimited; • Possibility to sell the bought government bonds under OMT with their valuation based on market prices rather than on final maturity. |
| Expanded Purchase Program (APP) | Asset | January 2015 – December 2017 | Third covered bond purchase programme (CBPP3) Asset-backed securities purchase programme (ABSPP) Public sector purchase programme (PSPP) Corporate sector purchase programme (CSPP) |
| Targeted longer-term refinancing operations (TLTROs) | | June 2014 March 2016 | Forty-eight months (July 2014) |

Source: Boeckx, J., Dossche M., Peersman G., (2017), Effectiveness and Transmission of the ECB's Balance Sheet Policies, International Journal of Central Banking, Vol. 13, issue 1, pg. 297-333; ECB, *Monthly Bulletins for January 2010, October 2012 and January 2014*, European Central Bank; ECB, *Measures to further expand the collateral framework and enhance the provision of liquidity*, Press Release, 15 October 2008; ECB, ECB announces measures to support bank lending and money market activity, Press Release, 8 December 2011.

In order to support bank lending and liquidity in the euro area money market, Governing Council announced during 2009 additional non-standard measures. ECB decided to extend the *maturity of longer-term refinancing operations* to six months in February 2009 and, after that, to twelve months in June 2009. The volume of outstanding open market operations reached a value of 663 billion EUR on 12 May 2009, declining from the historical high of 857 billion EUR at the end of 2008 (ECB, June 2009). Longer-term refinancing operations accounted for 64% of total outstanding refinancing operations in May 2009, while main refinancing operations only 36%.

During this year, Governing Council also announced the *Covered Bond Purchase Program*, through which ECB will purchase euro-denominated covered bond issued in the euro area. The objectives of this program were to reduce money

market term rates, to ease funding conditions for credit institutions and enterprises, to encourage credit institutions to maintain or to expand their lending to households and enterprises and to improve market liquidity in important segments of private debt securities markets (Gonzales-Paramo, 2011). This program ended in June 2010, when the announced nominal amount of 60 billion EUR was reached. Eurosystem purchased 422 different bonds, from the primary market (27%) and secondary market (73%) (ECB, 2010).

In order to reduce the severe tensions from securities markets in the first phase of sovereign debt crisis, Governing Council launched in May 2010 *Securities Market Programme*. Through this program, central authorities conducted interventions in the euro area public and private debt securities markets to ensure liquidity to dysfunctional market segments. The objective of the decision to purchase distressed European government bonds was to address the malfunctioning of securities markets and to restore an appropriate monetary policy transmission mechanism (ECB, May 2010). The injected liquidity under this program will be re-absorbed through specific operations. In 2012, the outstanding amount reached a nominal value of 218 billion EUR, Italy having a debt of 102.8 billion, followed by Spain (44.3 billion), Greece (33.9 billion), Portugal (22.8 billion) and Ireland (14.2 billion) (ECB, 2013). In 2016, the outstanding amount accounted for 105 billion EUR, of which Italy has 54.9 billion, Spain 20.1 billion, Greece 13.2 billion, Portugal 9.5 billion and Ireland 7.3 billion.

In 2011, given the renewed tensions in the financial markets related to the sustainability of public finances in both the US and the euro area and to the increased concerns regarding the global economic outlook, Governing Council decided to offer supplementary liquidity under LTROs with six-month (August 2011), twelve-month (October 2011) and, finally, three-year maturities (December 2011 and February 2012)⁸. Through these measures, ECB is ensuring that banks continue to have access to stable funding with longer maturities and thereby, supporting the ability of banks to maintain and expand lending to euro area households and non-financial corporations. This condition is necessary to

⁸ The 12-month LTRO announced in October 2011 was replaced by the three-year LTRO, giving the permission to shift all the outstanding amounts into the latter. In addition, under the three-year LTRO, banks have the option to repay the outstanding amounts received after one year, which gives them a high degree of flexibility.

safeguard price stability in the euro area, the final objective of monetary policy conducted by ECB (ECB, 2012). Under the first three-year LTRO, ECB provided liquidities to 523 counterparties of around 489.2 billion EUR, while under the second operation ECB financed 800 counterparties with 529.5 billion EUR (ECB, February 2013). Additionally, on 8 December 2011 the Governing Council decided to temporarily expand the list of collateral eligible for Eurosystem operations. The list of collateral contains a very wide range of assets – about 40,000 of around 14 trillion EUR or around 150% of GDP in 2012 (Cour-Thirrmann & Winkler, 2013).

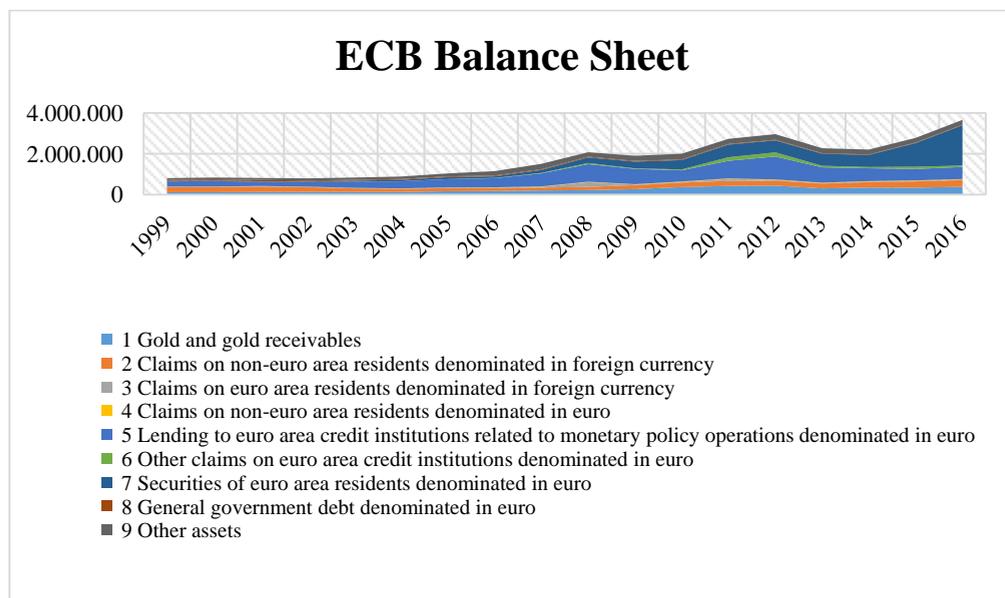
The increased fears among investors regarding the reversibility of the euro conducted to severe cases of malfunctioning in the price formation process in the government bond markets – the largest capital market in the euro area. In an economic environment characterized by high spreads between the yields on the government bonds of euro area countries, ECB introduced in September 2012 *Outright Monetary Transactions*. OMT programme was designed starting from SMP but made it more targeted. Under the OMT, ECB makes purchases of bonds from Eurozone countries in the secondary market to calm the market interest rates in countries subject to speculation.

Expanded Asset Purchase Program, implemented in January 2015, includes all purchase programmes under which private and public sector securities are purchased to address the risks of a too prolonged period of low inflation. Under this program, ECB creates new money to purchase euro-denominated, investment-grade securities issued by euro area governments and European institutions (quantitative easing). At the end of April 2017, Eurosystem holdings under this program amounted 1,834 billion EUR of which PSPP covers 1,511 billion.

The measures previously described are part of a package of measures that also includes *targeted longer-term refinancing operations* (TLTROs). Under the first series of TLTROs, Eurosystem provided financing to credit institutions for periods of up to four years, based on the amount of their loans to non-financial corporation and households (targeted operations). The second TLTRO provided even more attractive interest rates based on the loans issued to non-financial corporations and households.

The liquidity distributed to banking system through the above measures between October 2008 and December 2016 conducted to an important expansion of ECB's balance sheet.

Graphic 2 *The evolution of ECB's balance sheet between 1999 - 2016 (year-end, million EUR)*



Source: ECB - *Annual consolidated balance sheet of the Eurosystem* - <https://www.ecb.europa.eu/pub/annual/balance/html/index.en.html>

Starting from 2008, there is a significant increase in the variables with monetary policy purposes, namely lending to credit institutions from euro area and securities holdings of euro area residents. In 2008, the volume of lending to credit institutions (mainly through LTROs) increased by 220% compared with 2000, while the peak was achieved in 2012, increasing by 320% compared with 2000 and by 30% compared with the value from 2008. ECB started to hold securities in 2009 through CBPP, representing then only 1.5% from ECB's assets and reaching in 2016 a percent of 54% of ECB's assets.

3.2. The effectiveness of policy interventions in EU

The main aim of the adopted measures was to support the transmission of ECB's standard interest rates policy. As the economy financing is mostly bank-based in Europe, ECB's monetary policy focused primarily on banks, aiming at supporting their funding and liquidity conditions, to ensure that banks will continue to provide credit to the economy.

The overall impact of the unconventional monetary policies adopted during crisis has been studied by Falagiarda & Reitz (2015) and Gambacorta, Hofmann & Peersman (2014). The ECB monetary policies decreased the perceived sovereign risk of the stressed euro area countries⁹, with the exception of Greece (Falagiarda & Reitz, 2015) and determined a temporary increase in economic activity and consumer prices (Gambacorta, Hofmann, & Peersman, 2014). Falagiarda & Reitz (2015) studied the measures adopted during 2008-2012, while Gambacorta, Hofmann & Peersman (2014) studied the measures adopted by the eight advanced economies¹⁰ over the period 2008-2011.

The measure taken at the beginning of the financial crisis, in October 2008 and May 2009, have been crucial in stabilizing the financial system and the economy, in ensuring price stability (Cour-Thirmann & Winkler, 2013) and in avoiding a more disruptive collapse of the macro-economy (Fahr, Motto, Rostagno, Smets, & Tristani, 2011). Furthermore, Giannone, Lenza, Pill, & Reichlin (2012) found that ECB's interventions conducted to higher bank loans to households and non-financial corporations and also, to higher levels of industrial production and lower unemployment rates compared with the counterfactual situation when no non-standard monetary policy were implemented.

The extension of the longer-term refinancing operations' maturities contributed to the stabilization of the real economy. Cahn, Matheron & Sahuc (2014) confirmed that longer maturities result in larger macroeconomic effects. The authors compared the effects of the six-months LTROs with the twelve-months LTROs effects, concluding that the effects of the latter measure were even double than the previous ones.

The literature also provides evidence regarding the impact of the largest central bank liquidity injection – three-year LTROs. As pointed out by Darracq-Paries & De Santis (2015) this measure conducted to increases in GDP (by 0.8 percentage at the peak in mid-2013, compared with previous period), goods prices (by 0.30-0.35% at the peak in the beginning of 2014), loan volume to non-financial corporations (by 2.7-2.9% at the peak in the second half of 2014) and a reduction of lending rate spreads (by 19-20 basis points by mid-2014). The positive effects

⁹ Greece, Ireland, Italy, Portugal, Spain

¹⁰ Canada, the euro area, Japan, Norway, Sweden, Switzerland, UK and US

on bank credit supply to non-financial corporations are confirmed for the the largest users of LTROs - Italy (Carpinelli & Crosignani, 2017), Spain (Garcia-Posada & Marchetti, 2015) and France (Andrade, Cahn, Fraisse, & Mesonnier, 2015). The three-year LTRO increased the credit supply by 2% in the Italian case, while for Spain the increase was more moderate, of about 0.8-1%. Indeed, the cash holdings increased for corporations that used bank loans and credits as their main source of debt financing following the LTRO interventions. However, the effects on real economy were not visible, as the additional cash received was not employed in a productive manner, corporations even reducing their investments and the level of employment (Daetz, Subrahmanyam, Yongjun Tang, & Qian Wang, 2016). In contrast, Van der Kwaak (2017) found that banks did not expand credit to real economy, but they invested in government bonds that allow them to obtain more low-interest-rate central bank funding and thereby to increase their profits. Szczerbowicz (2012) confirmed that the three-year refinancing operations succeeded in reducing bank refinancing costs.

The first *Covered Bond Purchase Program* succeeded in achieving all its policy objectives during the implementation period (Beirne, et al., 2011) and to revitalise the primary market for these bonds (ECB, July 2009). Markmann & Zietz (2017) confirmed the results obtained by Beirne et al. (2011) finding a 10-11 basis points tightening of covered bond spreads that lasted for seven weeks. The authors also analysed the impact of following two CBPPs on secondary markets concluding that the effects of these programs were lower than the effect of the first CBPP. These results are explained by the fact the covered bond markets was in a rather healthy shape when the second CBPP was announced and did not show any signs of weakness at the time of the third CBPP (Markmann & Zietz, 2017). However, the programs were implemented in order to accomplish macroeconomic objectives.

Gibson, Hall & Tavlas (2016) studied the effects of the ECB's asset purchase programs, CBPP and SMP, on sovereign bond spreads and covered-bond prices for Greece, Ireland, Italy, Portugal and Spain. The results suggest that both programs reduced the sovereign spreads and raised the covered bond prices. The same results have been obtained by Szczerbowicz (2015), while Kilponen, Laakkonen & Vilmunen (2015) did not find lasting impact on government bond spreads. The impact of CBPP and SMP is also studied on commercial bank CDS

spreads by Gerlach-Kristen (2015), who finds that individual bank default risks decreased after the purchases under the two programs by the Eurosystem.

Kilponen, Laakkonen & Vilmunen (2015) analyzed the impact of a package of monetary policies¹¹ on sovereign bond spreads and concluded that SMP and OMT had the largest negative impact on bond spreads. This result is confirmed by Watfe (2015), Szczerbowicz (2015), Falagiarda & Reitz (2015). Moreover, Altavilla, Giannone & Lenza (2014) concluded that the reduction of government bond yields due to OMT is associated with a significant increase in real activity, credit and prices in Italy and Spain. The impact of SMP, OMT and of the three-year LTROs on the Italian economy has been studied by Casiraghi, Gaiotti, Rodano & Secchi (2016) confirming the fact that these measures induced a cumulative output growth response equal to 2.7 percentage points in 2012-13. Acharya, Eisert, Eufinger & Hirsch (2015) found that the OMT conducted to a reduction in the sovereign yields for the GIIPS countries that lead to an increase in the supply of loans to firms and to a decrease in bank credit risk, but with no impact on the employment level or investments.

The *Expended Asset Purchase Programme* or qualitative easing measure, is a more recent measure and its effects are still ongoing. However, there are a few studies that assess its effectiveness on sovereign yields (De Santis, 2016; Andrade et al., 2016) and on macroeconomy (Andrade et al., 2016). Andrade et al. (2016) found that APP contributes to the economy stabilization through asset price and inflation rate increases. On the other side, the *Public Sector Purchase Programme*, part of the APP, had no significant effects on sovereign bonds spreads (Watfe, 2015).

To sum up, the unconventional monetary policies adopted by ECB during the financial crisis succeeded in supporting the transmission of its standard interest rate policy. The monetary policy conducted by ECB stabilized the financial system and the economy by achieving their objectives: to support banks' funding and to increase lending to real economy (LTROs), to calm tensions from bond markets (CBPP, SMP, OMT), to support economic activity and to stabilize inflation rate (SMP, OMT, LTROs, APP).

¹¹ ECB collateral requirements relaxed and restricted, ECB liquidity support, CBPP, SMT, OMT, Draghi 'Whatever-It-Takes' Speech, Support Package Request/Decisions/Relaxed, Greece Debt Restructuring, Decisions on ESM, widening of the Mandate of EFSF/ESM, European Economic Recovery Plan, Other decisions related to European Economic Governance

4. US vs. EU APPROACH

Despite the US monetary approach, the adopted non-standard monetary policies from EU aimed at supporting the effective transmission of its standard policy. Therefore, the non-standard measures are a complement rather than a substitute for interest rate policy. Through this approach, ECB succeeded in improving the financial conditions and credit flows (Cour-Thirmann & Winkler, 2013).

Another difference between the two economies and their monetary policy decisions refers to the financial structure. Given that the economy is largely financed by banks in Europe, the ECB non-standard monetary policy focused mainly on banks, by lending to a large number of banks against collateral in order to improve their funding and liquidity conditions (Rodriguez & Carrasco, 2014). While monetary policy decisions are centralized at the level of the ECB's Governing Council, their implementation is decentralized and conducted by the Eurosystem, which comprises the 19 national central banks of the Euro area countries and the ECB. For US, the Federal Reserve Bank of New York implements monetary policy on behalf of the entire Federal Reserve System. The operations conducted by ECB mainly consist of refinancing operations to which a large number of counterparties have access, while in the US case the operations consist mainly of outright purchases and sales of assets in the open market with relatively small number of counterparties (Cour-Thirmann & Winkler, 2013).

The first stage of crisis (2007-2009) manifested similar in both economies and the policy responses were quite similar (Gros, Alcidi, & Gionvanni, 2012). When the global financial crisis started, in late August 2007, both central banks responded by cutting interest rates and by adopting several unconventional monetary policies. These policies included the extension of the maturities for the existing facilities – refinancing operations, lowering the standards for eligible collateral applied to banks and opening a series of swap facilities. The Lehman Brothers collapse generated a lack of confidence and liquidity in the interbank market. In order to facilitate the access to liquidities, central authorities intervened by expanding the availability of credit to financial institutions, reducing the main interest rates and by asset purchases. Fed purchased under TALF commercial papers, asset-backed securities and other private assets, while ECB implemented CBPP, fixed-rate tender procedure with full-allotment, extended the collateral list and the maturity of LTROs to six months and established swap lines with Fed.

In the second stage of the crisis (2010-2012), the problems were not the same in these two economies. While the euro area was confronting with high degree of financial distress, the main concern in the US was the fact the economy and the labour market were not recovering. Fed continues with asset purchases through open market operations and quantitative easing. In Europe, the crisis became a sovereign debt crisis with the epicenter in the Euro area. Starting from this point, the ECB's policies differed substantially from those of Fed, by implementing SMP, CBPP and three-year LTROs.

Gros, Alcidi & Gionvanni (2012) highlighted some more differences between the Fed's and ECB's policies. The Fed bought mostly risk-free assets like US government bonds and government-guaranteed bonds, while ECB invested in risky assets, the Fed lent very little to banks, while ECB lent huge amounts to banks and, consequently, Fed did quantitative easing, while ECB did credit easing. Hancock & Passmore (2011) concluded that the Fed's purchase of mortgage-backed securities as part of its first quantitative easing improved market functioning the primary and secondary markets for these instruments.

For Europe, the CBPP can be comparable with the QE1 conducted by Fed. As confirmed by Beirne et al., (2011) and Markmann & Zietz (2017) this program succeeded in tightening to reduce money market term rates, to ease funding conditions for credit institutions and enterprises, to encourage credit institutions to maintain or to expand their lending to households and enterprises and to improve market liquidity in important segments of private debt securities markets.

5. CONCLUSION

In response to the global financial crisis central authorities around the world adopted a series of non-standard measures designed to ease credit and liquidity constraints in order to restore financial stability and to maintain lending to real economy.

As affirmed by Farruggio, Michalak, & Uhde (2013), TARP had a light and a dark side. The light side refers to the positive effects had on financial system - reduced the contribution of banks to systemic risk, the default probabilities on the short-term, increased shareholder value. In contrast, there are studies that proved the program inefficiency - reduced banks' loan growth and increase their risk-

taking. However, TARP helped stop the widespread of financial panic and restored the investor's confidence.

The ECB's policies achieved their primary objective of supporting banks to continue lending to real economy. After reviewing the literature, we can conclude that banks increased their supply to households and non-financial corporations, but the impact on economy was limited. However, the adopted measures succeeded in calming the tensions from primary and secondary markets.

If we review the US and ECB approaches we can see that at the beginning of the financial crisis, central authorities acted broadly similar. The two important governments responded by cutting interest rates and by adopting several unconventional monetary policies - extension of the maturities for the existing facilities, lowering the standards for eligible collateral applied to banks and opening a series of swap facilities. If we refer to the differences between the central authorities' approaches we have to take into account that the US economy is market-based, while the ECB's economy is bank-based. The differences intervened after the collapse of Lehman Brothers and the manifestation of the sovereign debt crisis in Europe. The measures adopted by Federal Reserve System have been more expansive and have targeted also individual financial intermediaries, while the European Central Bank actions have been limited to liquidity extension. Another difference between the policies adopted by the two economies refer to the fact that capital injections were a requirement in the US, while in Europe capital support has typically been voluntary.

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