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Research

Full Length Research Paper

Team briefing and workers' commitment in Nigerian banking industry

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The association of team briefing and workers' commitment was examined in this study. Respondents were drawn from a sample of 357 bankers in the South-south zone of Nigeria. Cross sectional survey design was utilized. With the use of Spearman Rank Order Correlation, we obtained the following results: team briefing had a significant positive relationship with affective, continuance and normative commitment. This suggests that workers remain with their organization because they are emotionally tied to the organization and feel morally obliged to remain as well as not wanting to lose their investment in the organization.

Key words: Team briefing, affective commitment, normative commitment, continuance commitment, two-way communication, employees' voice.

INTRODUCTION

Workers' commitment is a widely researched construct in the management literature (Meyer and Allen, 1991; Mowday et al., 1982; Swailes, 2002; Argyle, 1989; Etzioni; 1975). It is widely believed that a committed worker would be more motivated and loyal to the firm (Meyer and Allen, 1991; Ahiauzu and Asawo, 2012) and organizations will have low employee turnover (Guest and Conway, 1998). Thus employers strive to improve their employees' commitment in order to improve productivity and reduce staff turnover (Oladejo et al., 2011). Researchers (Zabid et al., 2003; Oladejo et al., 2011; Omolayo and Owolabi, 2007; Salami, 2008; Ardrey et al., 2001; Carmeli and Gefen, 2005; Akintayo, 2010)

have studied how other constructs like monetary rewards, psychological and demographic factors, structure, work family role, human resource management practice, communication climate and job satisfaction could improve commitment in organizations. This is as a result of the importance attached to gaining and maintaining the commitment of workers.

Irrespective of these researchers, workers' commitment continues to be a major problem in Nigerian organizations (Ahiauzu and Asawo, 2012; Okpara, 2004; Aina et al., 2012; Ahiauzu and Asawo, 2009). Owing to this problem, we investigated the effect of team briefing on workers' commitment in a bid to bring about

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improvement in employees' level of commitment. We found there is a dearth of literature on the effect of team briefing on workers' commitment in Nigeria.

In this study therefore, we examined the nature of 'team briefing' as a form of employees' voice and its effect on workers' commitment in the banking industry in Nigeria.

REVIEW OF LITERATURE

Team briefing

In order for an organisation to achieve its goals, there must be effective communication between managers and employees. Two-way communication is simply defined as "meetings between managers and their staff", or can be referred to as Team briefing (Armstrong, 2003:808). Team briefing is a regular and systematic process that ensures communication takes place between management and employees. It was introduced by the Industrial Society in the United Kingdom. Since inception there have been fewer incidences of industrial disputes owing to increased understanding and acceptance of change (Dudai and Cacioppe, 1991).

The objective of team briefing is to make sure that every employee knows and understands what he and others are doing in the organisation and why. Team briefing involves managers and their team getting together for about half an hour, in a formal setting, on a weekly basis to discuss issues relevant to their work and to provide them with information about the wider organisation. Everyone has the opportunity to discuss specific job related matters with members of their team.

Team briefing (Dudai and Cacioppe, 1991) is a systematic, yet flexible system that ensures that information is passed regularly to all staff through interlinked team meetings. It allows information, ideas and questions to be fed back to other managers within the structure. Team briefing entails face to face discussion which encourages people to feel like part of a team and reinforces the message that it is the team leader and not the grapevine that provides accurate, credible information.

Effective communication through team briefing has a strong impact on employees' sense of wellbeing, job satisfaction and commitment (Rogers et al., 1994; Oliver and Tonks, 1998; Johlke and Duham, 2000). Communication acts as the primary means for organizational members to process information, reduce ambiguity, and coordinate their actions (Johnson, 2009). Managers in organizations can personally influence employees; therefore they need to ensure that employees are given adequate information on their job roles. Employees are the face of the organisation and have a powerful influence in organisation success (White et al., 2010).

The importance of team briefing has been highlighted in several studies: Jo and Shim (2005) found a strong relationship between management's interpersonal communication and employees forming trusting attitudes. Personal relationships can help draw people into an organization and motivate them to stay in the organization. Team briefing as a form of communication allows subordinates to ask questions and seek clarification, therefore promoting shared understanding in the organisation. It also improves employee's performance, teambuilding, commitment and employee relations (Oliver and Tonks, 1998; Gamble and Kelliher, 1999).

Augustine (2011) posits that at times of major changes or crisis in an organisation team briefing is a useful channel for passing urgent messages throughout the organisation at short notice. For it to be successful, team briefing should be based on a regular briefing or bulletin from the top of the organisation so that all employees have access to a message which everyone can hear/read before team briefings take place. This may be through email, the intranet or a printed copy. The message from the top remains consistent to all audiences and has not been watered down or become garbled.

In their research of an electronic retail chain in the United Kingdom, Gamble and Kelliher (1999) reported that managers were not trained, appraised or given feedback on the way to conducting team briefings. The organisation did not create a formal mechanism to monitor team briefings nor to make them successful. Therefore, team briefing had little impact on employee's motivation or behaviour. They attributed this failure to the organization's culture of promoting from within the ranks and national culture of conservatism.

In light of the above, Dudai and Cacioppe (1991) are of the view that team briefing fails in some organisation because managers do not feel responsible for communicating the corporate vision, goals, changes or policies initiated by senior management. Some managers lack the confidence in communication, since they do not have presentation, listening, asserting and meeting skills. Managers withhold sensitive information from employees believing the information will be misused or distorted. Also some employees' are unable to read, speak or understand English which worsens the communication problems in organisations.

Dudai and Cacioppe (1991) maintained that team briefing is not successful in some organizations because of lack of commitment by senior management, lack of proper training, misunderstanding as to what it is, information not being relevant of lacking enough detail, mostly one way (Top-down), Accuracy – what is filtered out? Relevancy, the manager is boring.

To overcome the shortcomings of team briefing, top management according to Oliver and Tonks (1998) should ensure that their organizational culture is one that supports team briefing. Such an organizational culture according to them will have the following characteristics:

Freedom to express opinions without retribution, Effective communication systems, Positive reinforcement is a recognized factor in helping to motivate employees, Creativity and innovation are encouraged, "risk" taking is encouraged (a "blame free" culture exists); Team working and networking are visibly practiced; Learning and development are seen as important for individuals and the organisation as a whole.

When organisations are able to tailor their culture to the above then they can accrue the benefits of using team briefing which Augustine (2011) listed as follows: Organisations can rapidly develop a shared vision, Management can gauge the progress towards achieving the vision, It helps strengthen new teams, Organisations can gather and exchange information on a timely basis, Organisation members are able to share best practice through examples of success in other areas of the organisation, People are able to receive immediate feedback, Regular alignment of actions to the culture and vision, Clarifying accountabilities and agreeing actions, Fast problem-solving, Meetings result in clear actions, responsibilities and deadlines, it enables and improves downward, upward and lateral (sideways) communications throughout the organization, prevents rumour and 'the grapevine' from gaining credibility, enables clarity of direction and information from the top, enables questions and suggestions to be fed back from all staff to the top, develops greater awareness and involvement at all levels, averts tendency towards 'mushroom management' (keeping people in the dark and covering them with manure), creates a culture of open communication, clears blockages and misunderstandings, explains financial, commercial and strategic issues, develops a shared sense of mission, vision, collective aims and reasons why, cease reliance or dependence on assumptions.

Oliver and Tonks believe that feedback, hard work, commitment and perseverance are essential to successfully implement team briefing. Senior management commitment is very important. In a compatible culture, team briefing promotes consultation and a more open climate thereby serving as an effective employee voice mechanism.

Workers' commitment

Several definitions abound in the literature of workers' commitment and its measures (Etzioni 1975; Mowday et al., 1982; Argyle, 1989; Swailes, 2002). In this study, we adopted the definition of commitment as proffered by Meyer and Allen (1991) because it is the most influential current model of measuring workers' commitment to their organizations. Several studies (Herscovitch and Meyer, 2002; Irving et al., 1997; Meyer et al., 2012) have been carried out to test the applicability of the Three Component Model of Commitment. These studies provide strong evidence for the generalizability of Meyer and Allen's model of commitment.

Meyer and Allen (1991) define workers' commitment as "a psychological state that characterizes the employees' relationship with the organization which has implications for the decision to continue or discontinue membership in the organization." Organisational commitment, they suggest, comprises three components: Affective, normative and continuance. Meyer et al. (2012:1) reiterated that "workers' commitment can take multiple forms, each characterized by a different psychological state or mindset. Affective commitment (AC) reflects an emotional attachment and desire to remain with the organization, normative commitment (NC) is experienced as a sense of obligation to remain, and continuance commitment (CC) reflects an awareness of the costs associated with leaving. All three forms of commitment tie an individual to the organization and decrease the likelihood of leaving, but their implications for on-the-job behavior can differ."

Muthuvelo and Rose (2005) have argued that employees with low affective commitment will leave an organization while those with high affective commitment will stay for longer periods because they are more loyal and believe in the goals and mission of the organization. Affective commitment brings about overall job satisfaction (Meyer et al., 2002).

Meyer et al., (2012)'s research revealed that employees that are affectively and normatively committed want to stay with their organizations because they feel it is the right thing to do, they are happier, more satisfied, more self-directed, healthier, more engaged and more willing to go the extra mile for their organization.

Meyer and Herscovitch (2001) report that employees with continuance commitment are less willing than those with affective and normative commitment to exert extra discretionary behaviour. Meyer et al. (2012) however found that workers with strong affective, normative, and continuance commitment are satisfied, self-directed and loyal to their organization. The absence of affective and normative commitment in such workers is what leads to the negative behaviour exhibited. In support Meyer and Parfyonova (2010) believe that the combination of affective and normative commitment leads to more positive outcomes such as organizational citizenship behaviour, employee wellbeing and intention to stay. Organizations benefit more when employees display affective and normative commitments than when they have only affective commitment. Organizations need to be more concerned with identifying the combination of different commitment profiles than mere looking at independent components of commitment alone (Meyer et al., 2012).

Team briefing and workers' commitment

Dudai and Cacioppe (1991) described team briefing as a systematic, yet flexible system that ensures that

information is passed regularly to all staff through interlinked team meetings. It allows information, ideas and questions to be fed back to other managers within the structure. Team briefing entails face to face discussion which encourages people to feel like part of a team and reinforces the message that it is the team leader and not the grapevine that provides accurate, credible information. Team briefing promotes under-standing and encourages commitment (Oliver and Tonks, 1998). When employees are given relevant and timely information by management they become more committed to the organisation. Employees feel valued in the organisation and hence will have a positive attitude towards their organisation. Several studies have shown that giving employees information (which team briefing does) will increase their commitment to the organisation (Addae, 2006; Saks, 1994; Ganzach et al., 2002; Trombetta and Rogers, 1988). Addae (2006)'s study demonstrated that giving employees information leads to affective commitment and job satisfaction of employees. Also, Ganzach et al. (2002) found that information given to employees made them to develop more positive attitudes towards their organisation. Trombetta and Rogers (1988) are of the view that information adequacy is related to organizational commitment. Team briefing and organizational commitment has found strong support in the literature; we therefore hypothesized that:

Ho_1: there is no significant relationship between team briefing and employees' affective commitment.
Ho_2: there is no significant relationship between team briefing and employees' continuance commitment
Ho_3: there is no significant relationship between team briefing and employees' normative commitment

METHOD

Cross sectional survey design was utilized for this study; however we adopted a triangulation of methodology (using both questionnaire and interviews as our research instruments). The population was 5000 employees obtained from the listed banks in the Nigeria Stock Exchange. The accessible population was all the employees in the bank's headquarters in the six state capital of the South-south zone of Nigeria. The sample size for this study was 357. It was obtained from Krejcie and Morgan's (1970) table on sample size determination, where the appropriate sample size for a population of 5000 was 357. However, the completed and usable copies of questionnaire for the analysis were 315, representing 88.24% of respondents who genuinely participated in the study.

The questionnaire and in-depth interview were the instruments used for data collection. The questionnaire comprised two sections. Section A was demographic information such as age, gender, length of stay in the organization and educational qualifications. Section B elicited respondent's views concerning the study variables. The 5-point Likert Scale type of questionnaire was adopted with responses ranging from strongly agree to strongly disagree. The scale used for measuring team briefing was adapted from the work of Cacioppe and Mock (1984) and Dudai and Cacioppe (1991). Workers' commitment was measured using Allen and Meyer's (1990) Organizational Commitment Questionnaire

(OCQ) which we adapted for our study. The OCQ measured affective commitment, continuance commitment and normative commitment. Affective commitment had 9 items, while continuance and normative commitment had 8 items each. From the foregoing, it is clear that the variables that were employed for this study have construct validity because they were sourced from existing literature and had been pre-tested and validated in previous studies (Cacioppe and Mock, 1984; Dudai and Cacioppe, 1991; Allen and Meyer, 1990, 1991; Herscovitch and Meyer, 2002; Pittorino, 2008).

RESULTS AND ANALYSIS

Cronbach Alpha was used to test for reliability in our study. Researchers, (Bryman and Bell, 2007; Nunally and Berstein, 1994; Sekaran, 2003) consider an alpha level of 0.7 efficient. The following Cronbach Alpha Coefficient was obtained for our scales: Team Briefing (0.740), Affective Commitment (0.771), Continuance Commitment (0.724), and Normative Commitment (0.708). All the variables had internal reliability.

The results obtained from frequencies and percentages used in classifying the demographic data from section A of the questionnaire were as follows: Majority of the workers had been working for the bank between 1-3 years, which represents 47.94% of respondents; 24.8% of workers had been working between 4-5 years, while employees who had worked between 4-8 years represented 3.2% of respondents and those with over 8 years represented 7.6% of respondents. Males working in the banking industry were 168, representing 53.3% of respondents, while females made up the remaining 46.7% and were 147 in number. 47.3% of respondents were between the ages of 20-29, 45.7% were between the ages of 30-39, 6.7% were between the ages of 40-49 and only one person was 50 and above. Respondents with Bachelor's degree were 157 in number representing 49.8%, Diploma/Certificate 85 (27%), Post Graduate Degree 66 (21%) and West African Examination Certifi-cate or its equivalent were 7 in number representing 2.2% of respondents. This indicates that most workers were highly educated in the banking industry in Nigeria (Okpu and Jaja, 2014a; 2014b; Jaja and Okpu, 2013a; 2013b).

The following mean scores (x) were obtained for the variables using univariate analysis. Tables 1, 2, 3 and 4 give the mean scores for each variable. Team Briefing (TB) had 8 items on the scale, affective commitment (ACS) had 9 items, continuance (CCS) and normative (NCS) had 8 items each.

The Spearman Rank Correlation Coefficient using SPSS was used in the bivariate analysis to establish the association between Team Briefing and Workers' Commitment (Table 5). The following guidelines were used to accept or reject the null hypotheses: when the statistical test of significance (P-value) is less than 0.05 i.e., $P<0.05$, the null hypothesis was rejected, when $P>0.05$, the null hypothesis was accepted. This is in line

Table 1. Statistics on team briefing.

		TBS1	TBS2	TBS3	TBS4	TBS5	TBS6	TBS7	TBS8
N	Valid	315	315	315	315	315	315	315	315
	Missing	0	0	0	0	0	0	0	0
Mean		3.3873	2.7556	3.1841	2.7302	2.7968	3.1492	2.6000	2.4952
Std. Deviation		.87562	1.37792	1.00844	1.40071	1.00476	.82552	1.31333	1.41054
Skewness		-1.900	-1.060	-2.026	-1.190	-1.479	-1.788	-1.132	-.932
Std. Error of Skewness		.137	.137	.137	.137	.137	.137	.137	.137
Minimum		.00	.00	.00	.00	.00	.00	.00	.00
Maximum		4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

Source: SPSS computation.

Table 2. Statistics on affective commitment.

		ACS1	ACS2	ACS3	ACS4	ACS5	ACS6	ACS7	ACS8	ACS9
N	Valid	315	315	315	315	315	315	315	315	315
	Missing	0	0	0	0	0	0	0	0	0
Mean		1.8825	2.7841	2.5175	2.1048	1.6063	1.5810	2.3778	1.4921	1.6317
Std. Deviation		1.39683	1.04260	1.30732	1.27137	1.08726	1.10972	1.29679	1.09534	1.36760
Skewness		.049	-1.374	-.852	-.320	.278	.364	-.809	.364	.214
Std. Error of Skewness		.137	.137	.137	.137	.137	.137	.137	.137	.137
Minimum		.00	.00	.00	.00	.00	.00	.00	.00	.00
Maximum		4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

Source: SPSS Computation.

Table 3. Statistics on continuance commitment.

		CCS1	CCS2	CCS3	CCS4	CCS5	CCS6	CCS7	CCS8
N	Valid	315	315	315	315	315	315	315	315
	Missing	0	0	0	0	0	0	0	0
Mean		2.1238	1.8571	2.3079	2.2349	2.1651	2.0857	2.1714	2.1937
Std. Deviation		1.26965	1.18989	1.26079	1.36682	1.32036	1.29512	1.31472	1.25833
Skewness		-.103	.062	-.674	-.567	-.407	-.178	-.201	-.206
Std. Error of Skewness		.137	.137	.137	.137	.137	.137	.137	.137
Minimum		.00	.00	.00	.00	.00	.00	.00	.00
Maximum		4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

Source: SPSS computation.

Table 4. Statistics on normative commitment.

		NCS1	NCS2	NCS3	NCS4	NCS5	NCS6	NCS7	NCS8
N	Valid	315	315	315	315	315	315	315	315
	Missing	0	0	0	0	0	0	0	0
Mean		2.2730	1.8190	2.3175	2.3111	1.8825	2.0952	1.9778	1.6476
Std. Deviation		1.37136	1.20599	1.28719	1.43157	1.22689	1.17178	1.31484	1.35426
Skewness		-.398	.352	-.591	.470	.496	.077	.024	.079
Std. Error of Skewness		.137	.137	.137	.137	.137	.137	.137	.137
Minimum		.00	.00	.00	.00	.00	.00	.00	.00
Maximum		4.00	4.00	4.00	12.00	4.00	4.00	4.00	4.00

Source: SPSS computation.

Table 5. Statistics of variables.

	N	Mean	Std. deviation	Skewness	
	Statistics	Statistics	Statistic	Statistic	Std. error
TBS	315	2.8873	.69946	-.457	.137
ACS	315	1.9975	.64236	.364	.137
CCS	315	2.1425	.75092	.028	.137
NCS	315	2.0405	.74410	.591	.137
Valid N (List wise)	315				

The overall mean score (x) for Team Briefing (TBS) = 2.8873, Affective Commitment (ACS) = 1.9975, Continuance Commitment (CCS) = 2.1425, Normative Commitment (NCS) = 2.0405.

Table 6. Correlation matrix for team briefing and workers' commitment.

			TBS	ACS	CCS	NCS
Spearman's rho	TBS	Correlation Coefficient	1.000	.368(**)	.186(**)	.329(**)
		Sig. (2-tailed)	.	.000	.001	.000
		N	315	315	315	315
	ACS	Correlation Coefficient	.368(**)	1.000	.290(**)	.247(**)
		Sig. (2-tailed)	.000	.	.000	.000
		N	315	315	315	315
	CCS	Correlation Coefficient	.186(**)	.290(**)	1.000	.525(**)
		Sig. (2-tailed)	.001	.000	.	.000
		N	315	315	315	315
	NCS	Correlation Coefficient	.329(**)	.247(**)	.525(**)	1.000
		Sig. (2-tailed)	.000	.000	.000	.
		N	315	315	315	315

** Correlation is significant at the 0.01 level (2-tailed).

with Kathari's (2006) decision rule. The confidence interval was set at the 0.05 (two tailed). Table 6 presents the result of the association between Team Briefing (TBS) and Workers Commitment – Affective Commitment (ACS), Continuance Commitment (CCS), and Normative Commitment (NCS).

Table 6 shows that for our first hypothesis, r = 0.368** p = 0.000, therefore our first null hypothesis is rejected. There is a significant positive relationship between team briefing and affective commitment at the 0.01 level of significance.

Table 6 shows that for our second hypothesis, r = 0.186** p = 0.001, therefore our second null hypothesis is rejected. There is a significant positive relationship between Team Briefing and Continuance Commitment at the 0.01 level of significance.

From Table 6, for our third hypothesis r = 0.329** p = 0.000, therefore our third null hypothesis is rejected. There is a significant positive relationship between Team Briefing and Normative Commitment at the 0.01 level of significance.

Therefore, we can state our hypothesis thus:

H_1: there is a significant positive relationship between Team   Briefing and affective commitment
H_2: there is a significant positive relationship between Team Briefing and continuance commitment
H_3: there is a significant positive relationship between Team Briefing and normative commitment

This result is consistent with the in-depth interview conducted. Notes were taken in recording participant's responses. The questions were based on the survey instrument and elicited information about bankers' views of the use of Team Briefing and how it affects their commitment to their organization. Two participants from the six states were selected and a total of twelve banking personnel were interviewed.

There is usually a team briefing whereby the manager exchanges information with his subordinates. Some Interviewees assert that this takes place once a week usually on Mondays, while others are of the view that it takes place twice weekly, Mondays or Wednesdays, depending on issues on ground. The manager passes on information to his/her subordinates especially new changes that top management is proposing. Employees

are at liberty to contribute or voice their feelings concerning such changes. Sometimes their views are taken into consideration, but at other times, management just listens and nothing is done about their suggestions. As one participant reports: "my manager just calls us into his office and tells us what top management has decided. When we point out how this will affect us, he tells us that we should comply or else we will be seen as rule breakers". To an extent there is a bit of intimidation in some banks as what is being practiced is a form of autocratic leadership style by management, whereby employees have little or no input into decisions affecting them. This was a minority view, as most bankers interviewed hold contrary view and assert that they hold interesting discourse with their managers and pass their views through him/her to top management. Sometimes their decisions are implemented and this makes them feel good about the bank. When asked how this affects their commitment to the bank, they said the bank cares about their views; therefore, they are ready to work passionately to help the bank achieve their objectives. This translates to affective commitment whereby workers are emotionally attached to their organization.

DISCUSSION

The results from Table 6 indicate that there is a significant positive relationship between team briefing and workers' affective commitment. Since team briefing entails face to face discussions, it encourages people to feel like part of a team and increases their sense of belonging to the team and hence to the organization. This makes employees' feel like part of a family in the organization and makes them to be emotionally attached to the firm. They remain with their organization because they want to. Team briefing allows workers to make input into decisions taken at the bank and this makes them feel as if the organization's problems are their own. Therefore the organization has a great deal of personal meaning to them.

Table 6 also indicates that there is a significant positive relationship between team briefing and workers' continuance commitment. Workers remain with the organization because they are scared of quitting their jobs without having another one lined up. They also do not want to let go of the benefits they presently receive with their organizations. They are quite calculative in their thinking and feel they would lose a lot personally if they were to leave to the organization. Therefore they stay with the organization because of perceived lack of another choice.

The result from Table 6 shows that there is also a significant positive relationship between team briefing and workers' normative commitment. Team briefing enhances employee's loyalty to the firm since they have

the ears of their manager and they believe information that is required is being relayed to them in a timely fashion. They feel appreciated because their opinion concerning changes is considered by management. This makes them morally obliged to remain with the bank and strengthens their belief in the value of remaining loyal to one organization.

We found in our study that:

1.   Team briefing as a form of employee voice in the banking Industry in Nigeria has a significant positive effect on workers' affective commitment.
2.   Team Briefing as a form of employee voice in the banking Industry in Nigeria has a significant positive effect on workers' continuance commitment.
3.   Team briefing as a form of employee voice in the banking Industry in Nigeria has a significant positive effect on workers' normative commitment.

From our study we found that the use of Team Briefing as a form of Employee Voice in the Banking Industry in Nigeria has a significant positive relationship with workers' affective, continuance and normative commitment. This is not surprising because according to Meyer and Allen (1991) employees can experience all three forms of commitment to varying degrees and the strength of each is influenced by different factors. Our findings also support Meyer et al. (2012)'s contention that employees' who have a strong affective, continuance and normative commitment will exhibit extra discretionary behaviour than those that portray only affective, normative or continuance commitment.

Drawing from this, our study suggests that workers in the Nigeria Banking Sector are affectively committed to their organizations. By the use of team briefing employees are of the view that their needs and expectations about the organization are matched by their actual experience in the organization. Therefore workers exhibit emotional attachment and identification with the organization. This may be as a result of team briefing allowing employees and managers to have a face to face discussion, which encourages employees to feel like part of a team, thereby improving employee's performance, teambuilding, commitment and employee relations (Oliver and Tonks, 1998; Gamble and Kelliher, 1999). As information is passed regularly to all employees through interlinked team meetings, workers are able to pass on their suggestions to top management and made to feel that they are important in the organization and they contribute to the decision making mechanism in their firms. This symbiotic relationship sharpens their sense of belonging and hence they become more affectively committed to the bank. This finding is supported by Jo and Shim (2005)'s assertions in the literature that there exists strong relationship between management's interpersonal communication and employee's forming

trusting attitudes, which motivates workers to want to stay in the organization.

Our findings also show that the use of team briefing as a form of employee voice has a significant positive effect on workers' continuance commitment. This supports Oliver and Tonks (1998)'s findings that team briefing promotes understanding and encourages commitment. This means employees are aware of the cost associated with leaving the organization and they stay because they need to. According to Coetzee (2005), the cost employees associate to leaving an organization include the fear of wasting time and effort spent acquiring nontransferable skills, losing attractive benefits, giving up seniority-based privileges or having to uproot family and disrupt personal relationship. When employees are given relevant and timely information by management they become more committed to the organisation. This has found support from other empirical researches (Addae 2006; Saks, 1994; Trombetta and Rogers, 1988). Employees want their performance to be appreciated and by offering them appropriate rewards and benefit packages, they will continue to be desirous of remaining in the organization.

We also found in our study that the use of team briefing as a form of employee voice in the Banking Industry in Nigeria has a significant positive effect on worker's normative commitment. Team briefing allows workers to make input into decisions taken in the bank. This makes them to feel that their opinion concerning changes is considered by their manager. Hence they are loyal to the company since the bank has supported their ideas and recognized their input in the decision making mechanism of the bank. Weiner (1982) describes normative commitment as a generalized value of loyalty and duty employees have towards their organization. Hence they feel morally obliged to remain with the organization. According to Jha (2011:56), "this feeling of moral obligation is measured by the extent to which a person feels that he or she should be loyal to his or her organization, make personal sacrifice to help it out and not criticize it".

Since workers believe they are given opportunity to make input to decision making in the bank by the use of team briefing, they are thus committed to the goals and vision of the organization. This commitment is reflected in their desire, need and obligation to remain with the organization.

CONCLUSION AND IMPLICATIONS

When managers have face to face interaction with their subordinates, with exchange of information, ideas and feedback, employees are made to feel that their opinion is important to management and they contribute in decision making in the organization. This finding from our study clearly shows that team briefing is an important form of employee voice and it helps to increase workers'

affective, continuance and normative commitment in the organization. This finding supports other research works (Rogers et al., 1998; Gamble and Kelliher, 1999).

Team briefing as a form of employee voice is most favoured by workers and this increased their affective, continuance and normative commitment. Therefore managers should be concerned with ways of capturing and retaining the commitment of workers. Guest and Conway (1998) believe that positive organizational commitment is associated with higher motivation, higher performance and less likelihood of employees leaving the organization. Therefore when managers use team briefing in their organizations, employees would be more committed to their organizations. According to Coetzee (2005) committed employees do better than uncommitted ones and organizations with committed employees perform better financially than organizations with uncommitted workers. In the same vein, Boxall and Purcell (2011) assert that employees' perceptions of the extent to which they are provided with information by their manager, the degree to which the manager provides a chance to comment and responds to suggestions, are associated with higher levels of job satisfaction and job engagement.

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Full Length Research Paper

Monetary policy in Cape Verde and macroeconomic changes: Empirical evidences

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The main objective of this study was to analyze Cape Verdean monetary policy, the rules chosen by the decision makers, its changes and its transmission to the economy. Primarily, we analyzed the dynamics of the most important Cape Verdean macroeconomic time series. By using the *Vector Autoregression* (VAR) and the *Markov Switching Vector Autoregression* (MS-VAR) models, we also analyzed and compared how those dynamics were connected to the monetary policy regime adopted during the period of 1991 to 2011. We tried two models, in the second of which was included the effective exchange rate index in order to capture transmissions of the exchange rate channel.. Through the MS-VAR, we also estimated two regimes which were statistically identified. The second regime seems to be more persistent and characterized the entire period from 1993 to 2006, which matches with important changes in Cape Verde's economy. We compare the impulse-response functions estimated by using the VAR model and the impulse-response regime-dependent functions estimated by MS-VAR models. The latter indicated that only in the second regime does a positive shock in the residuals of interest rate have the expected effects, decreasing the output level and the price index.

Key words: Monetary policy transmission channels, Cape Verde, MS-VAR.

INTRODUCTION

Monetary policy rules are the main components of economic policy decisions nowadays. Their appropriate use can, at the same time, be a source of stability of expectations and can also be used to stimulate the economy in times of recession and crisis, mainly through the credit channels. In terms of the economy's stability, it has been observed generally among countries, and also

in the case of Cape Verde, that central banks try to merge the monetary policy instruments, for instance, those within Foreign-Exchange Reserves, also named forex reserves, to control the markets' liquidity conditions in the economy. The contribution of this study is to estimate the parameters of stability used to govern monetary policy in Cape Verde, by understanding how

they respond to the transmissions of shocks between the estimated regimes, simulated here using the residues of the interest rate (IR).

In general, the monetary policy is ruled by central banks. They try to affect the economy by controlling some key monetary variables. The main objectives of central banks are: price index stability, long-run economic growth with low levels of unemployment and favorable results in the Balance of Payment (BoP). Due to the importance of this subject, relevant discussions within the economic literature correspond to the accurate management of such instruments, under nominal and real-side economic contexts.

Some of the pioneering studies on effects of monetary policy shocks on macroeconomic variables, in terms of the current research, are Bernanke and Blinder (1992) and Sims (1992). Since then, several other studies such as Bernanke and Gertler (1995), Ganley and Salmon (1997), Eyzaguirre (1998), Martines et al. (2001), Barth and Ramey (2001) have widely used Vector Auto-regressive (VAR) methods, developed by Sims (1980), which are recognized to provide more precise parameter estimates than the structural regression models.

Some recent studies[1] embrace the concept that monetary policy affects the direction of the output, here represented by the GDP, in the short term. Thus, they focus their efforts on measuring that effect. Such studies look to answer the following questions: does monetary policy have real effects on the economy? If so, which mechanisms must be transmitted to the real side? Which proportion? And when does the economy start to see the consequences of these effects? Moreover, such studies aim to identify some structural changes in economic series in a similar way to that which will be estimated here. We remember that this issue is quite relevant, which motivated, for example, Chow (1960) to introduce a test based on F statistics, in order to check the stability of the estimated parameters for different regression models.

Hamilton (1989), on the other hand, investigates time series samples by introducing Markov Switching in autoregressive models, with the purpose of modeling changes in the regimes. With this new technique, dealing with the structural changes in economic time series as random variables, it was possible not only to identify the changing point between regimes, but also the probability of time series remaining in a particular regime, or else changing to another one (Silva et al., 2006).

In this sense, Krolzig (1997) developed the Markov Switching Vector Autoregression (MS-VAR), as a combination of the VAR and the Markov Switching modeling. Thus, if the system is subject to changes in regimes, the parameters of the VAR are time-varying. Since then, several studies have been conducted by adopting the use

of the MS-VAR, such as Gonzalez-Garcia (2006), Sims and Zha (2006), and Tomazzia and Meurer (2010).

Tomazzia and Meurer (2010) pointed out that the consideration of the effects of monetary policy, as well as the changes occurring in their mechanisms, are important to understand how the economy works. This issue has been addressed in several countries, serving as an aid for making decisions by monetary authorities. The case of Cape Verde demonstrates the need for more studies that intend to provide more information about the appropriate management of monetary instruments.

This study aims to investigate the changes in the dynamics of the main macroeconomic variables in Cape Verde and their dynamics, to understand which of those variables are more important for the management of monetary policy in the country, during the period between 1991 and 2011. For both of them, MS-VAR models were estimated. Regimes were also estimated, as well as a matrix of probabilities of transitions from one regime to another. The impulse-response functions were estimated, simulating shocks in terms of residuals of the IR. Thus, the present study attempts to contribute to the existing literature on monetary policy in Cape Verde, by presenting new evidence from parameter estimations of the MS-VAR model.

This research is organized in six more sections, in addition to this brief introduction. In the second section, we present the mechanisms of monetary policy transmission, while the third one provides an analysis of the economy of Cape Verde, focused on its relationship with the management of monetary policy. Regarding the fourth section, it has a description of the methodology that will be used in empirical strategy. In the fifth section the obtained results are laid out. Finally, in the sixth section the final considerations are presented.

Monetary policy transmission

In this section, we discuss the theory of monetary policy transmission channels and offer a survey of important empirical works on the measurement of the monetary policy effects and its changes over time.

Monetary policy transmission mechanism

There is not an agreement or majority of empirical results about the effects of monetary policy on the price index (CPI) or the GDP, a fact that has led to the expansion of modeling with a variety of approaches trying to understand the role of monetary policy. As already emphasized, many of the studies on this subject assume the idea of currency neutrality only in the long term. Since in the short term, due to some degree of nominal rigidity in prices and salaries, there may be real effects on the macroeconomic variables. The main contributions in this

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[1] See for example, Ireland (2005), Dabla-Norris and Floerkemeier (2006), Sims and Zha (2006), Al–Mashat and Bilmeier (2007), Demchuk *et al*. (2012).
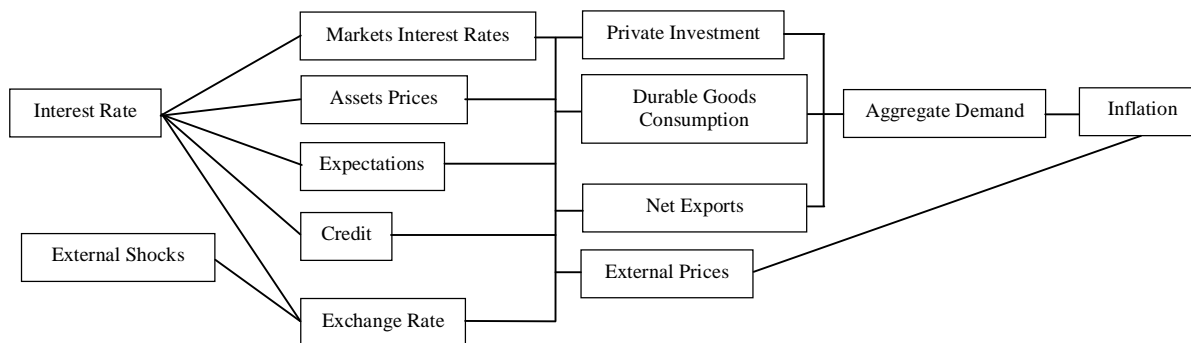
Figure 1. Monetary Policy Transmission Mechanism. **Source:** Adapted from Modenesi (2005).

sense come from works such as Fisher (1977), Sheshinski and Weiss (1977), Taylor (1979; 1980), Calvo (1982; 1983) and McCallum (1986). With the adoption of the Inflation Targeting Regime (ITR)[2] by various countries, the main objective of the monetary policy, which consists of obtaining and maintaining the stability of prices, was viewed as a global concern. Therefore, it is necessary to know the mechanisms of shocks transmission, including its channels.

According to Ramaswamy and Sloek (1997), the existence and efficiency of monetary policy transmission depends on the existence of an appropriate mechanism of shock interactions. An inadequate understanding of the transmission mechanisms can unnecessarily raise the monetary stabilization costs, reducing the GDP and increasing unemployment, as well as generating inefficiency in controlling inflation, here named as CPI. According to Taylor (1995) the monetary transmission mechanism is defined as the process through which monetary policy decisions are transmitted to the real output level and inflation.

Rocha (2008) tries to evaluate the monetary policy mechanisms in Cape Verde by using data from the period of 1991 to 2003. The author estimated a VAR model using quarterly data of GDP, CPI, IR, total domestic credit, M2, exchange rate (ER), private credit and public credit. The results point to a low elasticity of variables adopted as target, in the 'caused by Granger[3]' sense, if compared to those used as instruments, mainly, the IR and ER. So, there was observed a weak, but persistent, mechanism of transmission. The credit channel also did not work as expected by the theory. The author justifies this result with the fact that the imposition of credit limits in the country may cause the same shock effect in the residuals of the IR. The channel of the ER, as our results, had no significant effect for the period under analysis in either study. Finally, it was noted that there is a lag in the

GDP and of the (CPI) responses, due to a shock in terms of residuals of the IR.

Figure 1 elaborated from Modenesi (2005) illustrates the relationship of the macroeconomic variables, allowing us to carry out some intuitive exercises, concerning the effects of shocks in the monetary policy transmission channels.

Concerning the transmission channels, Kuttner and Mosser (2002) identified the following[4]: IR, ER, credit and asset prices. When these variables are affected, monetary policy decisions will influence the levels of savings and investment, and families and firms' expenditures. Thus, the aggregate demand changes and consequently there will not be any changes in the CPI.

Interest rate channel

The IR is the usual transmission channel in monetary policy. There are propagation mechanisms in the economy which associate variations in the basic IR with other interest rates practiced in the money market. It also affects the long-term IRs, which are relevant to decisions regarding consumption and long-term investments. By supposing that families maintain consumption habits and the demand for money is stable or fixed[5], a contractionary monetary policy will reduce the level of monetary liquidity in the economy, which would cause an increase of nominal IR in the market. Therefore, there will be an elevation, at least temporarily, of real IR, due to the fact that in the short term, as described by Christiano et al. (2005), there is some degree of rigidity of nominal prices of goods, and of some inputs such as labor. The logic is that this rise in the real cost of capital will reduce investments, as well as expenditures with the consumption of durable goods. Thus, there may be a reduction in aggregate demand and consequently the GDP.

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[2] Also known as Inflation Targeting (IT), the Inflation Targeting Regime is the one in which the central bank commits to control the price index using a pre-established target (level) and forecasts to manage it.
[3] Refer to Granger (1969).

[4] In this work, the IR channels and the ER will be studied. For theoretical understanding of other transmission, refer to Bernanke and Blinder (1988), Bernanke and Gertler (1995), Modenesi, 2005.
[5] See for instance Christiano, Eichenbaum and Evans (2005).

Exchange rate channel

Another important channel of monetary policy transmission, especially in economies with a major dependence on external sector, is through the ER. According to Rocha (2008), it would be one of the most important in Cape Verde, due to the great weight of imports on the country's GDP composition. This channel has been gaining importance due to the increase in the globalization and the adoption of flexible ER in almost all countries in the world.

As already mentioned, in case of a contractionary monetary policy an increase in the IR can happen, which would cause a flow of international capital into the economy, causing pressure on the ER to appreciate. Due to some degree of price rigidity in the short term, the effective ER also could decline, making the Cape Verdeans products less competitive (through prices), thus causing a reduction in the level of net exports and, consequently, in the GDP.

In addition to this direct effect on the CPI, the ER could have indirect effects in two ways, also indicated in Figure 1. The first one is through the goods produced domestically in the country, which make use of imported inputs. With the appreciation of the ER, the costs of these goods decrease, causing the collapse of their prices. The second effect is through the aggregate demand, because when the ER increases, the imported goods would become cheaper. This would encourage the replacement of domestic goods with similar imported goods, a fact that would result in a decrease in aggregate demand and force the CPI.

CAPE VERDE, ECONOMIC DEVELOPMENT AND MONETARY POLICY

Cape Verde, since colonial times (XV to XX century), was marked by severe conditions with regard to absence of resources, with low productive structure, which is basically supported by the subsistence agricultural sector, and virtually non-existent industry. These facts have caused difficulties in the economic development of the country, as Rocha (2008) points out. Since its independence, Cape Verde has gone through a period of strong centralization of main economic activities. In fact, from 1975 to 1991, it was up to the State, with a left wing government, to develop almost all business activity, important industries and services. The decisions about the role of complementary activities were left to the timid private sector.

And during the period from 1991 to 2000 the government actions had as their main objective the transformation of the nationalized economy to a market economy. The democratization of the institutions, the private sector's changing role in the development of the country, and the growth of foreign direct investment were

the main goals. In the second half of this decade, in agreement with The Major Plan Options 1997-2000, other targets of the government were ensuring the forex reserves, maintain the GDP always higher than 5%, the maintenance of the public deficit below 5%, as well as policies to reduce unemployment, improvement of domestic production and food security, and other themes with respect to the characteristics of the country.

Rocha (2008) also highlights three distinct periods that have influenced the conduct of monetary policy in the country. The first one relates to the period up to 1993, when there was a separation of the functions of the central and commercial bank and the creation of two independent institutions. The monetary policy was exercised mainly by establishment of limits to credit expansion. The IRs were fixed administratively and used as an instrument of credit distribution. The performance of the monetary policy was intended to protect the Balance of Payments and to ensure stability in the CPI, in addition to controlling the internal liquidity to ensure the forex reserves growth.

The second period is from 1993 to 1999, in which some tax and exchange reforms had the purpose of inserting the country into the world economy, by means of economic stabilization, in order to increase productivity, reduce unit costs per output unit produced by households, and maintain the stability of prices. It was also marked by a change in the ER regime in 1998 and the adoption of mechanisms of indirect control of the monetary policy management in 1999. In March, 1998, Cape Verde and Portugal have signed the Exchange Rate Cooperation Agreement (ACC). It aimed to connect the Cape Verdean currency to the Portuguese currency, by means of an ER regime of fixed parity, the creation of conditions that would guarantee the convertibility of the Cape Verdean Escudo (CVE), the stability of the CPI, protecting the value of the national currency, and serving as credible nominal anchor for monetary policy. Since 1999, the Portuguese currency was replaced by the Euro, which has allowed Cape Verde to have, through the Portuguese currency, access to the entire Euro area.

According to the Bank of Cape Verde (BCV) (2008), the objectives of the ACC were reflections of the macroeconomic scenario prevailing then. This period was characterized by unsustainable imbalances, having as great restriction the large ER instability, putting at risk the country's external reserves. Furthermore, as already emphasized, Cape Verde has a wide open and vulnerable economy, seriously dependent on cash inflows, resulting from current transfers, leaving the fluctuations for the ER.

This fact has allowed the country as a small open economy to improve its economic relations with Portugal and Europe. This has ensured some favorable conditions for the deployment of structural reforms, with a view to adjust and transform the economy (BCV, 2012). The country has committed itself to adopting the criteria of convergence of EU countries, as a reference for the

conduct of their economic policy. On the other hand, Cape Verde gained larger credit facility for the con-solidation of foreign-exchange reserves.

After the creation of the ER regime of fixed parity, inflation took a clearly descending trajectory, with levels comparable to those of Portugal, a country with a preponderant weight in imports from Cape Verde. This suggests that the ER has worked to some degree, such as an effective nominal anchor, in the sense of promoting the stability of prices (DELGADO and SANTOS, 2006).

And finally, after 1999, the third period, pointed out by Rocha (2008), comprises the period in which adjustment of monetary policy was obtained, currently through open market operations, changes in coefficients of reserves and adjustments in the discount rate of the BCV (WORLD TRADE ORGANIZATION, 2007). In the period from 2001 to 2011 the government's efforts have been concentrated on repairing the imbalances of public accounts to lay the foundations for sustained growth through structural reforms and poverty assistance, development of basic infrastructure, and promotion of spatial planning. The stability of prices and the consolidation of forex reserves were the monetary policy priorities.

Cape Verde in 2004 was contemplated in the North-American aid development program, the Millennium Challenge Corporation[6] (MCA), with an aid of 117.8 million dollars, for a period of five years. At the end of 2007, the country began to benefit from a special partner-ship with European Union (EU) settled on the Maastricht[7] criteria, aiming at providing the country with economic governance addressed to the balance of public finances and stability in prices.

In 2008 the country joined the World Trade Organization (WTO), as recognition for its ability to follow the rules of international trade. In that year, there was a change in status from Cape Verde's status, moving to the group of Medium Development Countries. This requires the country to make structural changes in order to make it more competitive and create its own resources to finance the development process. On the other hand, there is also a process of a gradual reduction of aid, which it has been receiving since the independence, a fact that represents one of the greatest challenges to the country.

The BCV, as the main regulatory body and executive of the country in relation to the management of monetary policy, performs the functions of the central bank, according to the Law N° 10/VI/2002, of July 15th, 2002, and works together with the government, in the definition and implementation of monetary and ER policies, and as supervisor of financial and foreign currency markets. The

monetary policy of the BCV has as its main objective the maintenance of CPI stability, i.e., to maintain the currency purchasing power, in order to promote economic growth and jobs creation (BCV, 2012). The operational frame-work of monetary policy assumes the IR as the operating target, the ER stability as the short-term goal and the preservation of CPI stability, as the final objective.

It is not always possible taking the monetary policy as the main instrument of economic policy, to be able to change the conditions of the markets of Cape Verde (ROCHA, 2008). This is due to the presence of a too restricted financial system, composed only of a bank that developed, at the same time, the functions of the central bank, commercial bank, and a small mailbox.

According to Marta (2006) is possible to identify a stable trajectory of the ER over the past few years, since the period after 1998, with some gains for the domestic economy, with emphasis on CPI stability. Other gains that were expected with the PEG[8], such as the conver-gence of domestic IR in the direction of the rate of the Euro Zone, and a strategic access of the country to the international capital market, have not yet reached the desired extent.

The BCV itself recognizes that the adoption of this ER regime assumes a theoretical loss of local control of monetary policy, since the entire economic policy and, particularly, monetary and fiscal policy, become subordinate to the goal of preserving ER stability, i.e., the currency parity defense. Even so, one of the most important contemporary issues is the option for euroization[9] of the economy, as one of the ways to be successful in those objectives.

Cape Verde is a country where the productive structure is fragile, which makes it more dependent on imports of goods and goods with emphasis on food and fuels, which represent 2/3 of domestic needs. According to Tavares (2012) the structural external deficit has risen in recent years. Few products are made and exported in the country, which keeps the coverage rate very low.

According to the data from the World Bank, during the period from 1990 to 2011, imports and exports had an average growth rate of 7.6 and 7.8%, respectively. Imports had an average weight in GDP of 66.4%, while exports registered an average weight of 26.5%. Since the imports have a greater weight in the GDP than the exports, it is clear that the trade balance does not sustain the needs of external financing. Cape Verde is known as a country that depends on income flows from tourism services, migrant transfers, foreign direct investment and foreign aid. Thus far, during the period from 1987 to 2011, a positive trend of the capital flows to the country was observed, with an average rate of growth of 40.9%, which was reflected in the inflow of foreign capital, in

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[6] Aim the economy sustainable development, turning the country into the least dependent from abroad. Due to good performance and results, the MCA was renewed at the end of 2009.

[7] Criteria which Member States of the European Union must possess for achieving the Economic and Monetary Union (EMU) and then they can adopt the Euro. Cooperation at the political level, public security, regional integration and the fight against poverty are the priorities.

[8] Fixed exchange rate.

[9] Decision by which a country officially abandons its own currency and adopts the Euro, for being more stable and advantageous.

particular, foreign direct investment, as described by Semedo (2007).

Despite the long term goals, monetary policy depends on the ER regime. In the short term, the country offers some degrees of freedom, which can be quite useful in stabilizing situations resulting from the so-called asymmetric shocks. Those degrees of freedom, in the short term, largely depend on the robustness of the country's forex reserves (MARTA, 2006).

METHODOLOGY

Regimes and parameters stability

Before the 1970s, the macroeconomic instruments were based on simultaneous equations, that is, linear systems with endogenous and exogenous variables which use classifications to specify structural restrictions and identify the matrix of parameters estimated (Hoover, 2006). Some studies, such as Christ (1994), for example, evaluate the background of monetary policy offered by Cowles Commission and its contributions to econometrics. This interaction allows us choose an approach that solves the problem of structural restrictions and for instance, innovates in the sense of estimating a nonlinear system with time varying parameters.

Sims (1980) argued that the problem of structural restrictions, named on some occasions as 'incredible restrictions', is one of the main problems of monetary policy. Used to estimate large econometric models, they reduce the veracity of the parameters' estimations. To increase the confidence of monetary policy recommendations based on stochastic models, Sims (1980) proposed Vector Autoregression (VAR) as an alternative modeling strategy. This model is an extension of the methodology of univariate autoregressive models developed by Box and Jenkins (1976) and in the macroeconomic literature of empirical studies. Among the ways in which VAR modeling aids the study of aspects of variables' relationships are possible estimate causalities among variables, impulse-response functions and the forecast error variance decomposition of variables.

The introduction of nonlinearity in a context of regimes and time varying parameters put forward by the Markov Switching Vector Autoregression (MS-VAR) was developed by Krolzig (1997). It was the combination of the VAR introduced by Sims (1980), and models with the possibility of estimating regime changes, governed by Markov Switching. The MS-VAR enlarged its importance in studies of monetary policy due to the frequent criticism that the VAR model found over the last decades, related to the parameters' stability and linearity (GONZALEZ and GONZALEZ-GARCIA, 2006).

For this study, the use of the VAR model assumes, at least, in an indirect way, only one monetary policy regime, since the matrix of parameters obtained through the equation system is static for the period of the sample. In agreement with Tomazzia and Meurer (2010) if there is a change in the monetary policy, the formation of expectation changes; thus, its necessary time-varying parameters. The authors also emphasize other sources of changes that would reflect changes in parameters over time, i.e., the structural changes in the financial system, changes in the preferences of policy makers and of economic agents, which can be misestimated through a VAR model, due to the complexity of acquisition of knowledge *a priori* to specify those changes in an appropriate way.

The models MS-VAR can be formally described as processes of vector autoregressions of the time series observed y_{1t}, $Y_t = y_{2t}, y_{3t}, \ldots y_{kt}$, whose parameters are unconditionally variant in time,

but constant when conditioned to some discrete variable and non-observable of a regime $s_t \in \{1,2, \ldots m\}$ (KROLZIG, 1997):

$$Y_t - \mu(s_t) = A_1(s_t)(Y_{t-1} - \mu(s_{t-1})) + A_p(s_t)\left(Y_{t-p} - \mu(s_{t-p})\right) + B(s_t)u_t \tag{1}$$

where u_t is the term of error conditioning to the regime, i.e., $\mathrm{u}_t \mid \mathrm{s}_t \sim \mathrm{NID}(0, \Sigma(\mathrm{s}_t))$. Here *p* corresponds to the number of autoregressive lags, *m* is the number of non-observed regimes and *k* is the dimension of the vector of variables.

This model can be denoted by MS(*m*)-VAR(*p*), i. e., a MS-VAR of *p* order with *m* regimes. The terms $\mu(s_t), A_p(s_t)$, e $\Sigma(s_t)$ represent the functions of change in the matrix of parameters of intercept, autoregressive parameters and variance, respectively, conditional upon the regime. In other words, as the parameters of the VAR depend on the variable regime s_t.

One of the peculiar characteristics of a model with Markovian changes is due to the fact that the non-observed realizations of the regime $s_t \in \{1,2, \ldots m\}$ are generated by a discreet "time", constituting a stochastic process governed by Markov Switching, with discrete states. The probability of transition between the regimes is given by:

$$P_{ij} = Pr(s_{t+1} = j|s_t = i), \sum_{j=1}^{m} p_{ij} = 1 \forall i, j \in \{1,2, \ldots m\} \tag{2}$$

where the probability p_{ij} represents the probability that at time *t+1* the chain changes to the regime *j*, given that it is located in *i* at time *t*.

By means of an algorithm for filtering and smoothing for obtaining the probabilities, it is possible to statistically identify regimes in a system, enabling the inference about the probability distribution of the non-observed variable regime $s_t \in \{1,2, \ldots m\}$, given the set of observed variables Y_t. Regularly, the filtering method used is the Hamilton's algorithm (1989), but other filters such as Filter (1960) can also be used.

The conventional procedure to estimate the parameters of the model is to maximize the log-likelihood function, and then use the parameters to estimate the probabilities filtered and smoothed for the regimes. However, this method is not recommended in small samples, since the number of parameters to be estimated is considerably high. We used the Expectation-Maximization (EM) algorithm, originally described by Dempster et al. (1977). This technique begins with the initial estimations of the non-observed regimes, and the parameters of the model are estimated from the probabilities smoothed to the last stage of expectation. These two steps are referred to as steps of expectation and maximization[10].

Table 1 shows the different specifications of the MS-VAR model.

Model specification for Cape Verde

Based on the empirical study performed by Rocha (2008), we estimated relations and structural changes in major macroeconomic time series in Cape Verde. As well, we analyzed which of these changes are related to the management of monetary policy during the period from 1991 to 2011. These improvements try to go in the direction of the arguments of the author about the limitations of his work, with emphasis on the fact that the monetary policy demonstrated changes in the 1990s, as already presented in section 3.4.

For this study we used as variables the Output Level (Gross

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[10] See Hamilton (1990) for more details.

Table 1. Types of MS-VAR Models.

Notation	μ	v	Σ	A_i
MSM(*M*)-VAR(*p*)	varying	-	invariant	invariant
MSMH(*M*)-VAR(*p*)	varying	-	varying	invariant
MSIA(M)-VAR(p)	-	varying	invariant	varying
MSI(*M*)-VAR(*p*)	-	varying	invariant	invariant
MSIH(*M*)-VAR(*p*)	-	varying	varying	invariant
MSIAH(*M*)-VAR(*p*)	-	varying	varying	varying

μ : mean, v : intercept Σ : variance A_i : matrix of autoregressive parameters.
Source: Krolzig, 1997.

Table 2. List of the variables used.

Variable	Code	description
Interest Rate	IR	Active rate for 91-day operation
Economic Activity Level	GDP	Gross Domestic Product in natural logarithm
Internal Price Level	CPI	CPI - overall - index (2011=100) in %
Exchange Rate	ER	Effective exchange rate index (2001 = 100), in natural logarithm

Source: Bank of Cape Verde and World Bank.

Domestic Product - GDP), the Consumer Price Index (CPI), the Exchange Rate (ER), and the Interest Rate (IR). As in Rocha (2008), the active rate for 91-day operations was used as a variable representative of monetary policy. The reason for this choice lies in the fact that the IR determined on the market responds more quickly to changes in the monetary policy management. The ER used was the nominal effective ER of the BCV, with base year in 2011.

The data sample used for the analysis was obtained from the BCV, between 1991 and 2011, with quarterly frequency. The times series behaviors can be checked in Figure 1 of the Appendix. Only the GDP variable was collected from the World Bank, with annual frequency. With the purpose of obtaining a greater number of observations, by using the method proposed by Lisman and Sandee (1964), the data sample of observations of GDP was converted to quarterly frequency and seasonal adjustments patterns, removed. The summary of abbreviations of variables used is shown in Table 2.

Model 1: Simple model

The initial model is parsimonious and formed by the variables CPI, GDP and IR. This model is intended to draw basic lessons between targets and monetary policy instrument in Cape Verde. Here, the IR is interpreted as being the reaction function of the BCV, insofar as it is influenced by changes in the GDP and on the CPI in the economy. It is described by the relationship (3):

$$Y_t = [GDP_t, CPI_t, IR_t]^T \tag{3}$$

Model 2: Exchange Rate Model

As previously argued, since 1990, the Cape Verdean economy entered a gradual process of economic openness, inserting,

therefore, the country in the world scenario, with an objective of raising its productivity, foreign direct investments, and CPI stability. Thus, from the first model to the variable ER was introduced in order to obtain alternative results.

$$Y_t = [GDP_t, CPI_t, ER_t, IR_t]^T \tag{4}$$

Both models MS-VAR follow the nomenclature developed by Krolzig (1997) and as estimated in the form MSIA(*m*)-VAR(*p*), i.e., the intercepts and parameters are time-varying. Both are composed of two regimes (*m*= 2), for a number of lags equal to one (*p*= 1). It is worth pointing out that such choices are derived from the criterion of parsimony, considering a limited number of observations. Soon, given the fact that the data are quarterly and the period was from 1991 to 2011, 32 parameters were estimated and this number represents 38% of the sample. Besides, if we increase the numbers of regimes, lags, or both, the model could not be estimated for any algorithm.

RESULTS

As already presented in section 3, the results of Rocha (2008) did not perform very well in the monetary policy transmission channels in Cape Verde. In this sense, we characterized the Cape Verdean economy by using the MS-VAR model. In order to compare the progress of MS-VAR model we also estimated a VAR model. To proceed with the estimations, we tested if the time series used were stationary. We used Augmented Dickey-Fuller (ADF) proposed by Dickey and Fuller (1979), the Phillips-Perron (PP) test, proposed by Phillips and Perron (1988) and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test

Orthogonal Impulse Response from dTxjur

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95 % Bootstrap CI, 1000 runs

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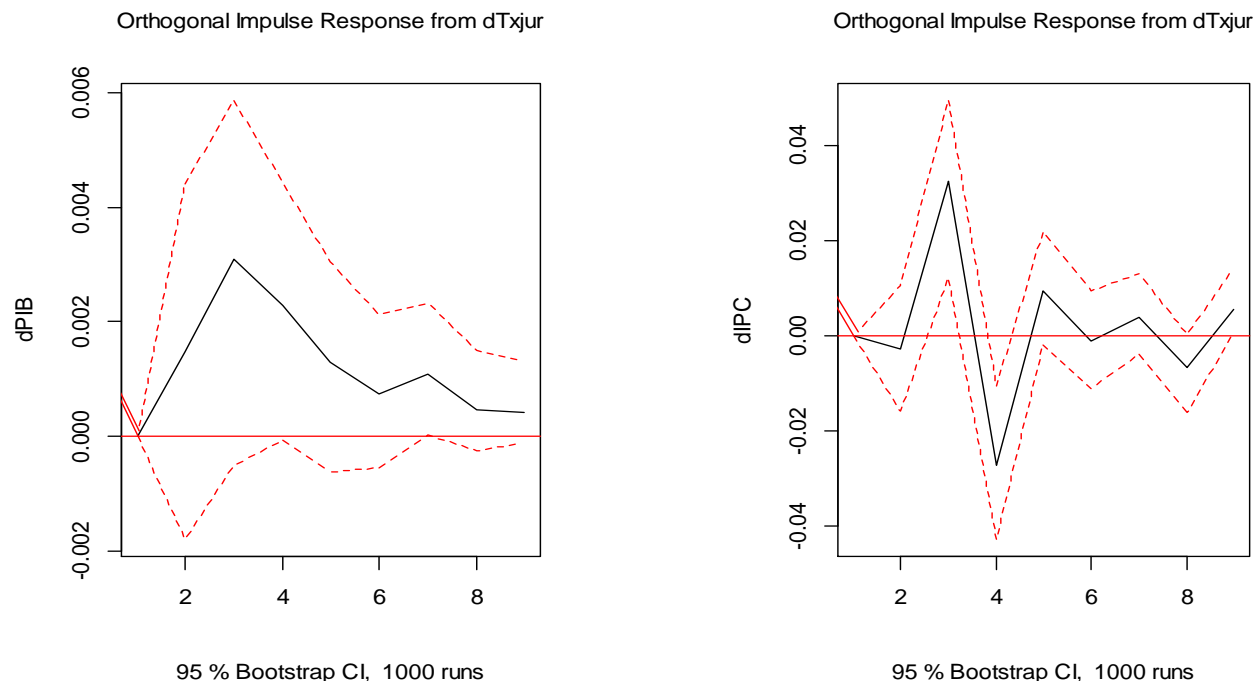
Figure 2. Model 1 impulse-response functions by using the VAR. **Source:** Elaborated by the authors.

Table 3. Tests of stationary (p-values).

Variables	ADF	PP	KPSS
GDP	0.01	0.8256	0.01
PCI	0.01	0.01	0.1
ER	0.7167	0.9685	0.01
IR	0.6088	0.665	0.01
DGDP	0.01	0.01	0.01
DPCI	0.01	0.01	0.1
DER	0.01	0.01	0.01918
DIR	0.03907	0.01	0.1

Source: Bank of Cape Verde and World Bank.

proposed by Kwiatkowski et al. (1992). The results are in Table 3.

Model 1

To analyze the monetary policy rule and its channels we estimate impulse-response functions by using the VAR model. The results of the estimations can be found in Table 1 of the Appendix. In addition, we also estimated the Variance Decomposition. Figure 2 illustrates the impulse-response functions of IR on GDP and CPI:

Through Figure 2 we can check that the impulse-response of IR on GDP is quite low and its sign is the opposite of the register in the literature. The results

obtained by using the simple VAR model shows that a shock on residues of the IR leads to GDP growth. For the CPI we can verify that the magnitudes of the effects are near zero. In Table 4 it is possible to see the Forecast Error Variance Decomposition (FEVD) of GDP and CPI by Cholesky factorization.

The results obtained are important if we think in terms of impulse-response functions estimated. Most of the deviations caused by GDP variations are explained by variations in the same variable (91.1%), during the period of 8 quarters. On average CPI and IR respond with 2.1 and 6.4%, respectively, through variations in GDP. On the other hand, on average CPI is explained 23.5% by variations in IR. This indicates that IPC could be more affected by the IR channel than the GDP.

Anyway, the results provided by the VAR model also assume that the relations among variables are all linear. This can be rejected if we pay attention to the dynamics of the period of the data used, and the historical charac-teristics of Cape Verdean Economy during the same period.

The linearity LR test, denoted in Table 5, was perform-ed and indicates that the relations among variables are non-linear and that the parameters change significantly during the regimes. This fact is one of several that justify the MS-VAR model due to VAR.

After we performed the test with the results described in Table 5, the model was estimated. Due to the parsi-mony criterion, we tried a model with two regimes, one lag and varying intercepts and parameters. As mentioned,

Table 4. Forecast error variance decomposition of GDP and CPI of Model 1.

	GDP			CPI		
Period	GDP	CPI	IR	GDP	CPI	IR
1	1.00000	0.00000	0.00000	0.00316	0.99684	0.00000
2	0.96900	0.02199	0.00901	0.01677	0.98186	0.00137
3	0.93734	0.01989	0.04277	0.01738	0.82676	0.15586
4	0.92197	0.01904	0.05899	0.02408	0.74274	0.23318
5	0.91560	0.02128	0.06312	0.03676	0.72475	0.23849
6	0.91455	0.02123	0.06422	0.04181	0.72346	0.23473
7	0.91145	0.02104	0.06751	0.04308	0.72239	0.23453
8	0.91093	0.02108	0.06799	0.04346	0.71804	0.23850

Source: Elaborated by the authors.

Table 5. Model 1 linearity test.

H0= model is linear			
LR Test: 113.4055	χ^2 (12) =[0.0000]	χ^2 (14)=[0.0000]	DAVIES=[0.0000]

Source: Elaborated by the authors.

for this model, 32 parameters were estimated. Mainly due to this reason, we preferred a simple system characterized by the MSIA(2)-VAR(1)[11].

The results of the estimations are in Table 2, and the residues of the presented model are shown in Figure 2, both in the Appendix. As the transition probabilities, the results are represented in the following transition matrix:

$$P = \begin{bmatrix} 0.4674 & 0.5326 \\ 0.0748 & 0.9252 \end{bmatrix}$$

When analyzing the results it is clear that regime 2 is more persistent than regime 1. That is, once the economy is ruled by regime 1, the probability of its continuing in the current regime is 46.74%. As a consequence, it has 53.26% probability of changing to regime 2. While for regime 2, the probability of persistence is 92.52%, and 7.48% probability of switching regime. Figure 3 illustrates the estimated probabilities for both regimes:

With this instrument it was possible to determine the classification of regimes throughout the sample period, as shown in Table 6.

The predominance of regime 2 is clearly observed, as already emphasized. The period from 1993:1 to 2006:2 was exclusively marked by regime 2. It occurred during the period of separation of the functions of the central and commercial banks and the creation of two independent institutions. It is worth remembering that prior to 1993 the monetary policy was exercised primarily

[11] See Krolzig (1997) for more details.

Table 6. Regimes estimated ranking.

Regime 1	Regime 2
1991:2 - 1991:4	1992:1 - 1992:2
1992:3 - 1992:4	1993:1 - 2006:2
2006:3 - 2006:3	2006:4 - 2006:4
2007:1 - 2007:3	2007:4 - 2010:4
2011:1 - 2011:1	2011:2 - 2011:2
2011:3 - 2011:3	2011:4 - 2011:4

Source: Elaborated by the authors.

through the establishment of limits to the expansion of credit, IRs were fixed administratively and used as an instrument in credit distribution. In addition to this change, in 1998, some others occurred in the forex reserves system.

Regime 1 was observed during the period from 1991 to 1992. It is worth remembering that the high inflation registered in the late 1980s, linked to strong macroeconomic imbalances, pushed the government at that time. In this direction, through a budget plan, the fiscal and ER system required reforms that could deal with the inflationary process.

By analyzing Figure 1 in the Appendix, we can see that the classification of regimes, in some ways, follows the changes in the structure of the series of IRs. Regime 1 is more often observed in periods of lower IRs, whereas regime 2 remains in the periods associated with higher rates. This shows, therefore, that the classification of

Figure 3. Predicted, filtered and smoothed probabilities of Model 1. **Source:** Elaborated by the authors.

regimes has a higher elasticity to changes up to some value of IR. This result is combined with the fact that, due to the structure of the domestic financial market and the low domestic savings, the interest rates practiced in Cape Verde are relatively high.

In Figure 4, the impulse-response functions depend on each regime estimated through the MS-VAR model. Notice that a shock in residues of the IR causes different effects on variables, if we compare two regimes. The impact of residues of the IR on the GDP causes its reduction on both regimes, as conventional literature highlighted in section 2 registered. For regime 1, this reduction in the GDP extends until the end of the fourth quarter. While for the second regime, the effect is more persistent, considering that the GDP presents a negative signal, even after ten quarters. Another difference lies on the shock magnitude, because in regime 2, the impact is higher.

Analyzing the CPI case, it is noticed that the results of the impact on residues of the IR in regimes estimated were totally different, i.e., they are the opposite in terms of magnitude and in their sign.

The shock effect on both regimes remains until the tenth quarter. The effect of this shock is more intense in the first regime.

However, in this regime the results estimated are not in the same direction as the traditional literature in terms of the decline in the CPI. What is observed is that this shock causes a rise of 3% in the CPI, which lasts until the end of the second quarter. This result is known as price

puzzle effect and was described by Sims (1992). In a general way, the result found signs that regime 1 is classified as the one in which the monetary policy is less effective. This is different from regime 2, when the monetary policy was more effective.

Model 2

Since the 1990s, the ER policy has become more important to policy makers due to the countries' need to elevate their share of the international trade system. Cape Verde, as well as other small economies, demands conditions to balance its relations with developed countries. Another fact is that many young countries with fragile external accounting passed through reforms in that period. In many cases with the objective of stabilizing those economies' outputs, controlling the CPI and creating some protection against international crisis.

In this sense, we estimated the VAR and MS-VAR models, including the ER as well. The results of the VAR model are in Table 7 of the Appendix. Figure 7 illustrates the impulse-response functions of shocks in residues of the IR on the GDP, PCI and ER. In general, they were similar to the model 1, i.e., magnitudes and directions. The difference is that a positive shock leads to a rise in the IR, as well an injection of international capital in the country and a decrease in the ER.

If we observe Figure 5, we can see that the response of shocks in residues of the IR on the ER is statistically

Regime 1   Regime 2
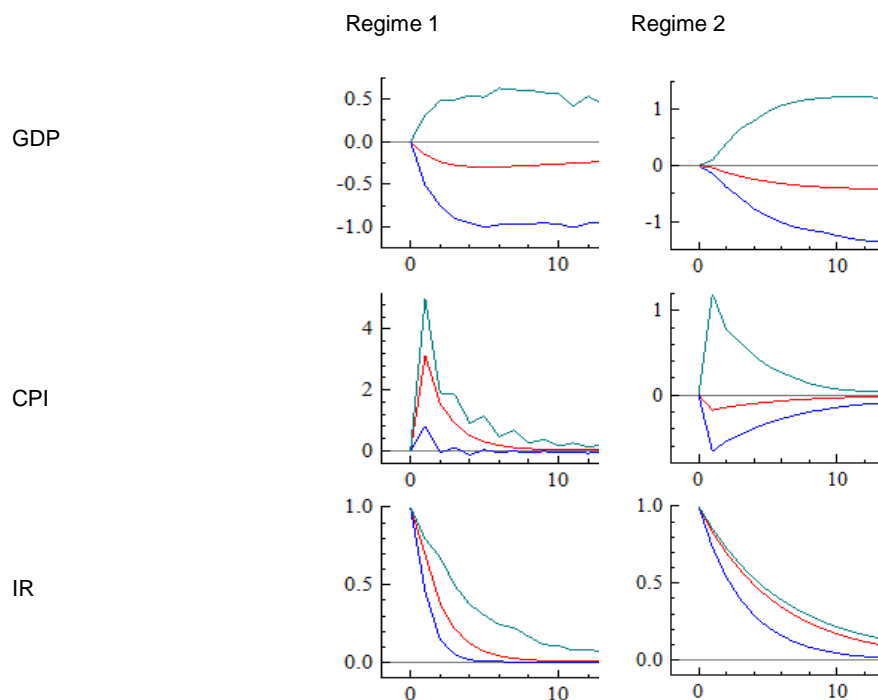
Figure 4. Model 1 impulse-response functions by using the MS-VAR. **Source:** Elaborated by the authors.

Table 7. Forecast Error Variance Decomposition of GDP, CPI and ER of Model 2.

	GDP				CPI			
Period	GDP	CPI	ER	IR	GDP	CPI	ER	IR
1	1.00000	0.00000	0.00000	0.00000	0.00331	0.99669	0.00000	0.00000
2	0.96924	0.01882	0.00462	0.00733	0.01544	0.97721	0.00586	0.00149
3	0.90866	0.01644	0.03425	0.04065	0.01459	0.82402	0.00540	0.15599
4	0.89134	0.01569	0.03938	0.05359	0.01783	0.74046	0.00636	0.23535
5	0.88664	0.01682	0.03988	0.05667	0.02868	0.72144	0.00873	0.24115
6	0.88576	0.01676	0.03997	0.05752	0.03361	0.71940	0.00978	0.23721
7	0.88240	0.01656	0.04037	0.06067	0.03495	0.71768	0.01004	0.23733
8	0.88146	0.01654	0.04063	0.06137	0.03529	0.71313	0.01006	0.24152

Source: Elaborated by the authors.

insignificant. We could find the same result in Eyzaguirre (1998) for the Chilean economy. A possible explanation is that countries with characteristics of Cape Verde have a need for amounts of foreign-exchange reserves to protect themselves from international crisis.

The results provided for Variance Decomposition, displayed in Table 7, are in line with the impulse-response functions estimated in model 1. The average of deviations caused by IR on GDP variations is 5.8% and

has a null effect of ER. The deviations of ER in general explain 4.0% of deviations in GDP. In case of the CPI the results are different from the rest of the variables of the linear system. Since the third quarter, the variable CPI is affected by the IR and its percentage of explanation of CPI is approximately 23.8%. The contribution of ER to explain the deviations in the CPI is on average 1%. Comparing both models we can verify that impacts of shocks are pretty similar.

Orthogonal Impulse Response from dTxjur

Orthogonal Impulse Response from dTxjur

95 % Bootstrap CI, 1000 runs

95 % Bootstrap CI, 1000 runs

Orthogonal Impulse Response from dTxjur

95 % Bootstrap CI, 1000 runs
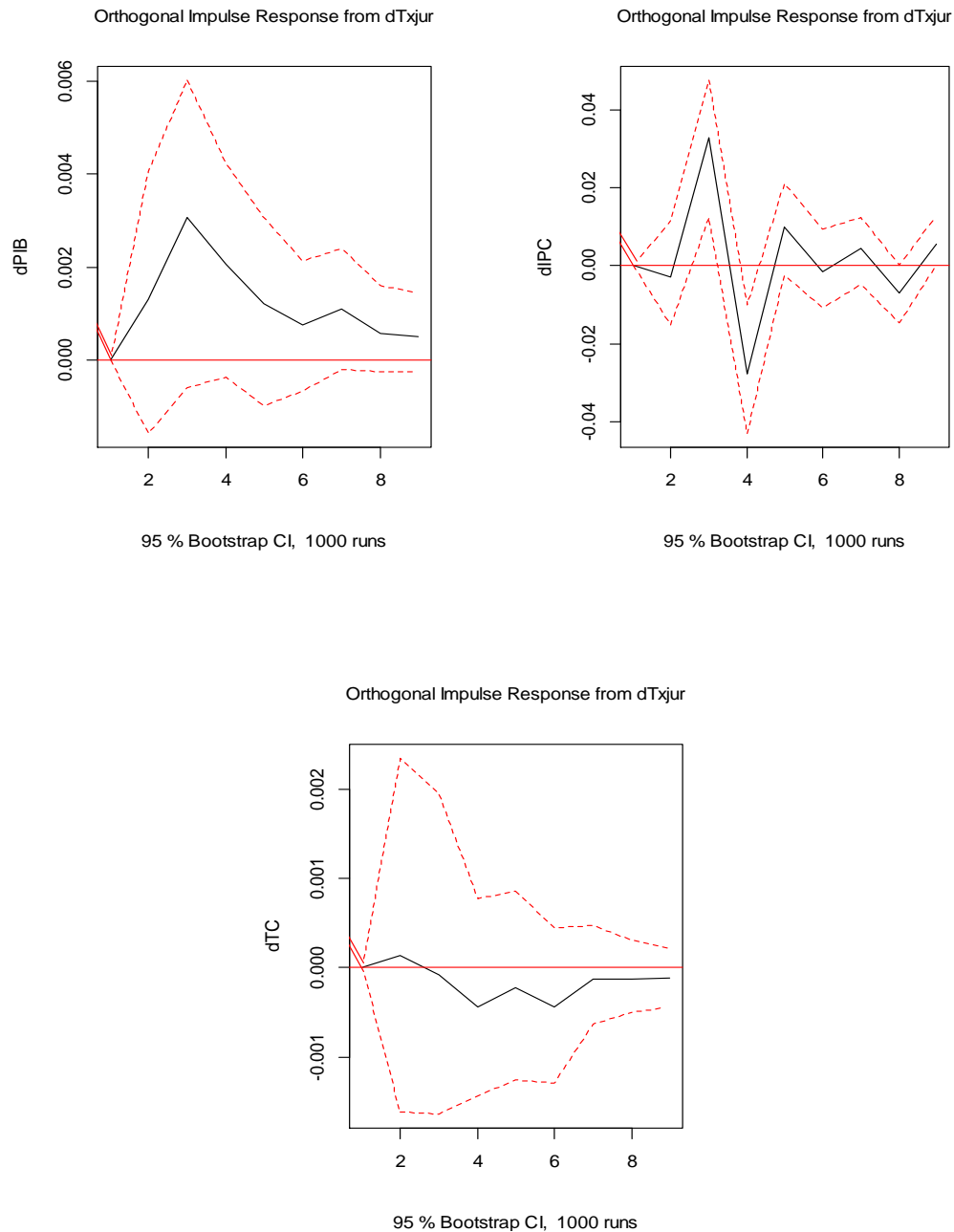
Figure 5. Model 2 impulse-response functions by using the VAR Source**:** Elaborated by the authors.

The model MSIA(2)-VAR(1) presenting the ER is an attempt to capture the effects of international trade on the rule of monetary policy in Cape Verde. The linearity test denoted by LR test (Table 8), was performed and indicates that model 2 is also non-linear and that the parameters change significantly between regimes 1 and 2.

$$P = \begin{bmatrix} 0.4754 & 0.5246 \\ 0.0719 & 0.9281 \end{bmatrix}$$

As in model 1, the results found in this model indicate that regime 2 is more persistent than regime 1. With the introduction of the ER, once at regime 1, the probability of permanence in the current regime is 47.54% with 52.46% of probability to change to regime 2. But, if the current regime is the second one, the probability to remain in this regime is 92.81% and the probability of change to regime 1 is 7.19%.

In Figure 6 we have the estimated probabilities for both regimes. The results are near values of the parameters to

Table 8. Model 2 linearity test.

H0= model is linear			
LR test: 125,8876	χ^2 (20) =[0.0000]	χ^2 (22)=[0.0000]	DAVIES=[0.0000]

Source: Elaborated by the authors.
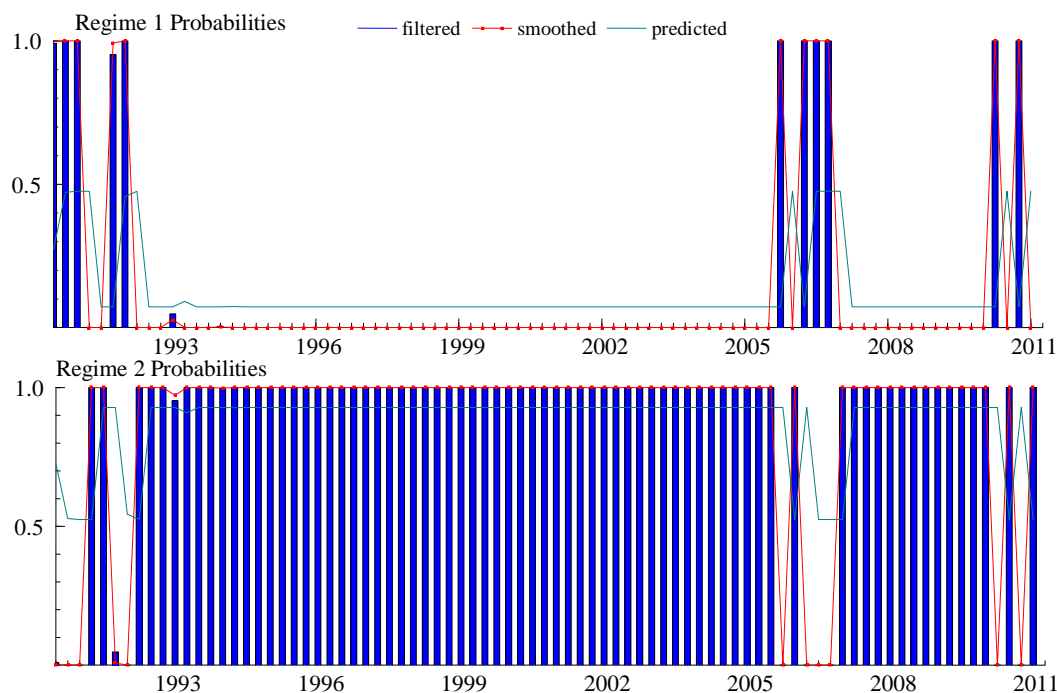
Figure 6. Predicted, filtered and smoothed probabilities of Model 2. **Source:** Elaborated by the authors.

those obtained in model 1. It is realized as before the predominance of regime 2. We also observed that the period 2 occurs from 1993:1 to 2006:2. Again, the distribution of regimes shows a robust relationship with the IR level in Cape Verde, as found in model 1.

In Figure 7 the impulse-response functions depends on each regime estimated by using the MS-VAR model. The parameters estimated in this model emphasize those who had already been estimated in model 1. In both regimes, the more the negative shock effects in residues of the IR on the GDP, the more the increase in the CPI in the first regime. In the second one, the monetary policy seems to be more effective, by reducing the CPI. For the ER case it is detected that the response to a shock in residues of the IR in regime 1 is small. Either, for regime 2 the results show that after the shock, the ER reduces, indicating an appreciation that lasts until the fourth quarter.

The introduction of the ER in the model has presented some changes in the results of the impulse-response functions, when compared with those obtained in model 1. For regime 1 this reduction in the GDP is until the second quarter, while in regime 2, the negative effects

persist until the eighth quarter. Therefore, it is seen that in both cases, the decrease was less persistent, if we compare with the results of model 1.

With the addition of the ER in model 2, the estimated impact of the IR on the CPI is from 3 to 2.5% in relation to the model 1. For the second regime, even with the ER appreciation, there were not observed any changes in the CPI. Indirect effects were expected, such as, for example, the reduction in CPI, due to the fact that Cape Verde imports the majority of its goods, which in the presence of the ER appreciation, would lead imported products to become relatively cheaper.

Conclusion

Depending on the approach to be adopted, the various objectives of economic policy of a country can be analyzed. For this, is necessary that the State has a set of instruments, which are usually employed to achieve such objectives. Highlights go to fiscal, monetary and ER policy. In this work we have chosen to study the monetary

Regime 1   Regime 2
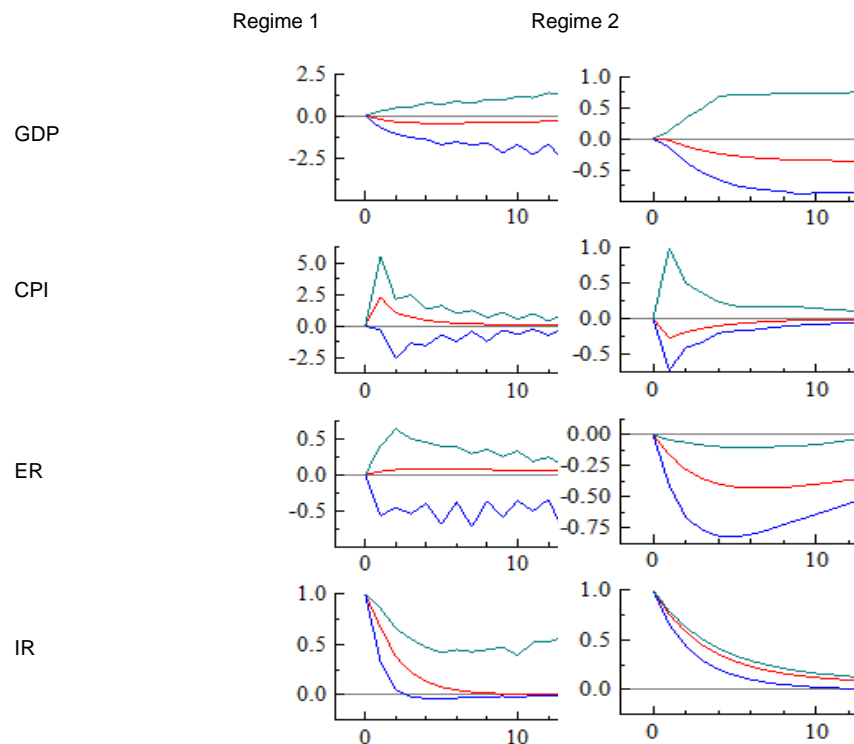
Figure 7. Model 2 impulse-response functions by using the MS-VAR.
Source: Elaborated by the authors.

policy in Cape Verde. It was observed that the monetary policy produces some degree of effects on the economy of Cape Verde. However, this occurs under certain circumstances, indicated mainly by the estimated regimes of the MS-VAR model.

It is usual in the literature to find empirical works that deal with this issue, but applied to the industrialized countries. For emerging countries in the process of development, such studies are quite scarce. Among the reasons for this, some lie in the issue of access to information, linked to economic instability that such countries experienced in last decades of the 20th century. In Cape Verde's case, the access to information is a major obstacle to academic advancement in practically all knowledge areas. Due to this, research related to the subject proposed has not yet been explored with the same intensity as in other countries. This is the main reason that in this study we used as data a relatively a short period sample, which goes from 1991 to 2011. The model assumes the GDP and the CPI as targeting variables, active rates for 91-day operations as an instrument of the monetary policy, and, finally, the ER asthe intermediate objective of monetary policy.

The VAR and MS-VAR models estimations allowed us to investigate the changes observed in the main macroeconomic variables of Cape Verde during the period mentioned. As well, they also allowed us to understand what relations these changes preserved, important for management of monetary policy. The MS-VAR modeling has an important contribution in this sense, due to its capability of statistically identifying regimes in the time series used. The time-varying parameters help us to understand changes in the formation of expectations, due to the structural changes in the financial system, changes in the preferences of policy makers and of economic agents, which can be misestimated through a VAR model. It cannot describe the complexity of acquisition of knowledge *a priori* to specify those changes, as emphasized in section 4.

As the main result, the estimation of the MSIA(2)-VAR(1) model produced some information about the probabilities of transition from both models. We saw that regime 2 is the most persistent and prevails during the entire period from January 1993 to February 2006. This period matches with the one in which there was a separation in the central bank functions of central bank and commercial bank, and the creation of two independent institutions. In the period that preceded 1993, the monetary policy was ruled primarily by the creation of limits for credit expansion; also, the IRs were fixed administratively, and used as an instrument of credit distribution. In addition to this change, in 1993, still during the period, there was a change in the forex reserves system, which happened in 1998.

Taking a look at the results of the Cape Verdean economy, we highlight, as we did in section 2, small economies with external sector dependence, especially the role of foreign direct investments as a key for the country's development process. Thus the increasing of the IR works as an attractor for foreign capital and consequently increasing the GDP. Taking for instance the null initial effect of a shock of the IR on the CPI and afterwards followed by a rise in the latter, we can find a possible explanation through the presence of the price puzzle, described by Sims (1992).

Another question is due to the presence of price rigidity in the very short term and the menu costs, as argued by the new Keynesian literature, such as Calvo (1983) and Christiano, Eichenbaum and Evans (2005), for example. The rise in the CPI can also be explained by the costs channel, in the sense that when the IR elevates due to the shock, the contracts that were signed may not have been adjusted; nevertheless futures contracts were targeted with those adjustments, incorporating the growth in the capital cost, and being transmitted to the CPI.

An econometric examination lies in the fact that the classification of regimes is elastic to changes up to a certain value of the IR. It was observed that this value is relatively high in Cape Verde, and this is due to the domestic structure of the national financial system and weak internal savings, as mentioned earlier. Impulse-response regime-dependent functions were useful tools in the analysis of the changes in the patterns of monetary policy. The results indicate that in regime 2 the BCV failed to practice an effective monetary policy, by completing the objectives according to the literature. On the other hand, we also observed that in regime 1 a rise occurs in the CPI, due to a positive shock in residues of the IR. By introducing the ER in the model, in regime 1, the impact of former on the CPI reduces from 3 to 2.5%. Another change in the results was the duration of the negative effect of the positive shock in residues of the IR on the GDP, which was small in both regimes.

Conflict of Interests

The author(s) have not declared any conflict of interests.

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APPENDIX

Table 1. Results of VAR for Model 1.

	DPIB	DIPC	DTXJUR
	0.874535	-0.58132	-0.099674
DGDP(-1)	(0.11664)	(0.58741)	(0.0486)
	[7.49774]*	[-0.98964]	[-2.05086]**
	0.094006	0.542543	0.095033
DGDP (-2)	(0.11334)	(0.5708)	(0.04723)
	[0.82940]	[0.95049]	[2.01223]**
	0.028145	-0.071255	-0.006483
DPCI(-1)	(0.02252)	(0.11339)	(0.00938)
	[1.25000]	[-0.62838]	[-0.69101]
	-0.010949	-0.057126	0.024885
DPCI(-2)	(0.02272)	(0.11443)	(0.00947)
	[-0.48186]	[-0.49921]	[2.62833]**
	-0.250441	-1.998303	0.724111
DIR(-1)	(0.2572)	(1.29528)	(0.10717)
	[-0.97372]	[-1.54276]	[6.75669]*
	-0.043529	2.936582	0.162716
DIR(-2)	(0.26859)	(1.35263)	(0.11191)
	[-0.16207]	[2.17102]**	[1.45393]
Const.	0.365014	0.277196	0.060449
	(0.0489)	(0.24627)	(0.02038)
	[7.46445]*	[1.12560]	[2.96670]**

Source: Elaborated by the authors. *1% significance.
**5% significance. ***10% significance. Standard
deviation in brackets.

Table 2. Results of MSIA-VAR for Model 1.

Regime 1				Regime 2		
	DGDP	DPCI	DIR	DGDP	DPCI	DIR
	0.95942	-0,056821	-0.009031	0.981886	-0.007954	-0.000968
GDP_1	(0.0028913)	(0.019489)	(0.001331)	(0.0021193)	(0.014053)	(0.00095392)
	[331.8281]*	[-0.98964]	[-2.05086]**	[463.3017]*	[-0.566]	[-1.0144]
	0.004778	-0.198357	-0.032395	0.285631	-0.031121	-0.01172
CPI_1	(0.016395)	(0.11151)	(0.007563)	(0.050367)	(0.33712)	(0.022827)
	[0.2914]	[-1.7788]***	[-4.2833]**	[5.671]*	[-0.0923]	[-0.5134]
	-0.151747	3135919	0.691321	-0.039259	-0.178207	0.834332
IR_1	(0.29009)	(1.9751)	(0.14384)	(0.083277)	(0.56153)	(0.038078)
	[-0.5231]	[-2.0000]***	[4.8063]**	[-0.4714]	[-0.3174]	[21.9112]*
Const.	0.441166	0.148309	0.111419	0.199362	0.107302	0.030178
	(0.04368)	(0.29335)	(0.020197)	(0.025157)	(0.16632)	(0.011304)
	[10.1001]*	[0.5056]	[-5.5167]*	[7.9247]*	[0.6451]	[2.6698]**

Source: Elaborated by the authors. *1% significance. **5% significance. ***10% significance. Standard
deviation in brackets.

Table 3. Results of VAR for Model 2.

	DGDP	DPCI	DER	DIR
DGDP(-1)	0.828756	-0.597101	-0.031632	-0.094509
	(0.11505)	(0.59445)	(0.09785)	(0.04849)
	[7.20374]*	[-1.00446]	[-0.32329]	[-1.94894]***
DGDP(-2)	0.139291	0.600586	0.026152	0.085012
	(0.11235)	(0.5805)	(0.09555)	(0.04735)
	[1.23985]	[1.03461]	[0.27370]	[1.79523]***
DPCI(-1)	0.028022	-0.079131	0.000272	-0.00556
	(0.02191)	(0.11319)	(0.01863)	(0.00923)
	[1.27923]	[-0.69911]	[0.01460]	[-0.60244]
DPCI(-2)	-0.00889	-0.060173	0.00241	0.025088
	(0.0221)	(0.11418)	(0.01879)	(0.00931)
	[-0.40231]	[-0.52700]	[0.12823]	[2.69346]**
DER(-1)	0.348007	-0.225652	1.015342	0.000732
	(0.13913)	(0.71888)	(0.11833)	(0.05864)
	[2.50136]**	[-0.31389]	[8.58078]*	[0.01249]
DER(-2)	-0.326003	0.626829	-0.10755	-0.04877
	(0.13683)	(0.70701)	(0.11637)	(0.05767)
	[-2.38255]**	[0.88659]	[-0.92418]	[-0.84558]
DIR(-1)	-0.23528	-1.484008	-0.122287	0.663482
	(0.25918)	(1.33923)	(0.22044)	(0.10925)
	[-0.90777]	[-1.10811]	[-0.55475]	[6.07318]*
DIR(-2)	-0.004233	3.384348	-0.147419	0.108027
	(0.26885)	(1.38919)	(0.22866)	(0.11332)
	[-0.01575]	[2.43621]**	[-0.64471]	[0.95326]
Const.	0.262205	-2.119666	0.514876	0.345354
	(0.32821)	(1.69587)	(0.27914)	(0.13834)
	[0.79890]	[-1.24990]	[1.84451]*	[2.49639]**

Source: Elaborated by the authors. *1% significance. **5% significance.
***10% significance. Standard deviation in brackets.

Table 4 . Results of MSIA-VAR for Model 2.

Regime 1					Regime 2			
	GDP	CPI	ER	IR	GDP	CPI	ER	IR
GDP_1	0.979474	0.189117	-0.014083	-0.008652	0.982433	-0.012046	-0.002887	-0.004662
	(0.014)	(0.0849)	(0.0163)	(0.004)	(0.0045)	(0.0298)	(0.0052)	(0.0021)
	[70.1755]*	[2.227]**	[-0.863]	[-2.1814]**	[219.5404]*	[-0.4045]	[-0.557]	[-2.1897]**
CPI_1	0.000394	-0.251322	-0.001421	-0.03266	0.288199	-0.038126	0.012144	-0.01224
	(0.0165)	(0.1084)	(0.0193)	(0.0074)	(0.0491)	(0.3215)	(0.057)	(0.0221)
	[0.0238]	[-2.3177]**	[-0.0737]	[-4.4195]*	[5.8662]*	[-0.1186]	[0.2129]	[-0.555]
ER_1	0.20506	2.520064	0.846884	0.003271	0.006189	-0.041244	0.910791	-0.035482
	(0.14)	(0.8506)	(0.1637)	(0.0397)	(0.0384)	(0.2537)	(0.0442)	(0.0182)
	[1.4643]	[2.9626]**	[5.174]*	[0.0825]	[0.161]	[-0.1626]	[20.585]*	[-1.9472]***
IR_1	-0.223808	2.267515	0.043816	0.672602	-0.025789	-0.268521	-0.166075	0.755568
	(0.2939)	(1.9264)	(0.3425)	(0.1321)	0.1182	0.7795	0.1369	0.0549
	[-0.7616]	[1.1771]	[0.1279]	[5.0901]*	[-0.2182]	[-0.3445]	[-1.2132]	[21.9112]*
Const.	-0.708536	-13.97748	0.850837	0.094322	0.163581	0.350171	0.461863	0.240935
	(0.7859)	(4.7728)	(0.9187)	(0.2225)	(0.2293)	(1.5169)	(0.2643)	(0.109)
	[-0.9016]	[-2.9286]**	[0.4239]	[0.4239]	[-0.2182]	[-0.3445]	[-1.2132]	[13.7657]*

Source: Elaborated by the authors. *1% significance. **5% significance. ***10% significance. Standard deviation in brackets.
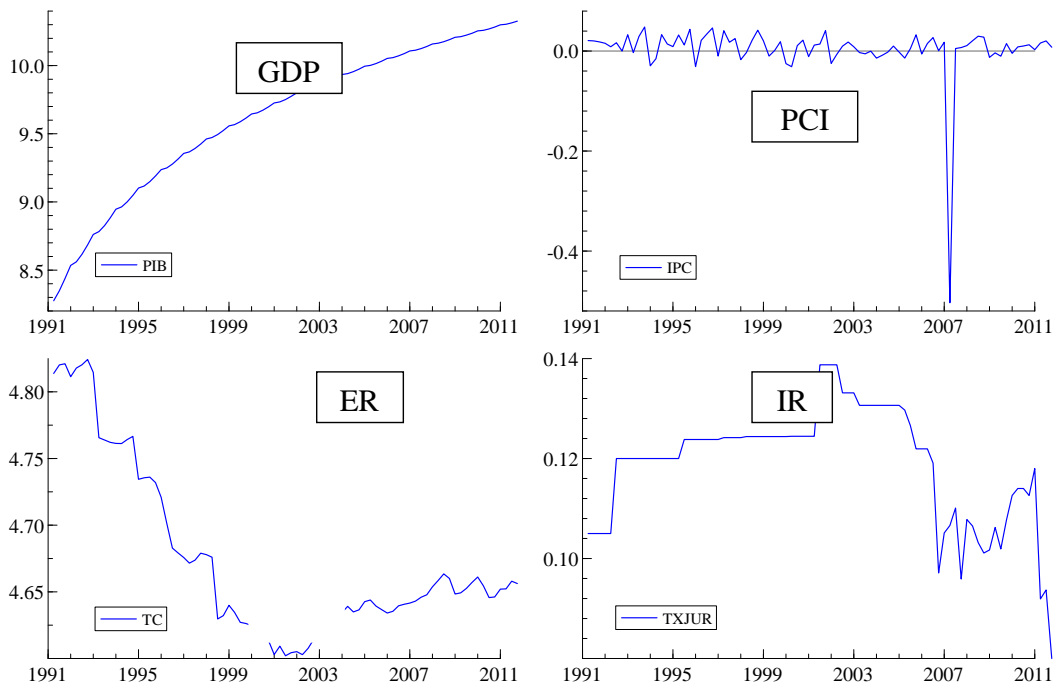
Figure 1. Times series used. Source**:** Elaborated by the authors.
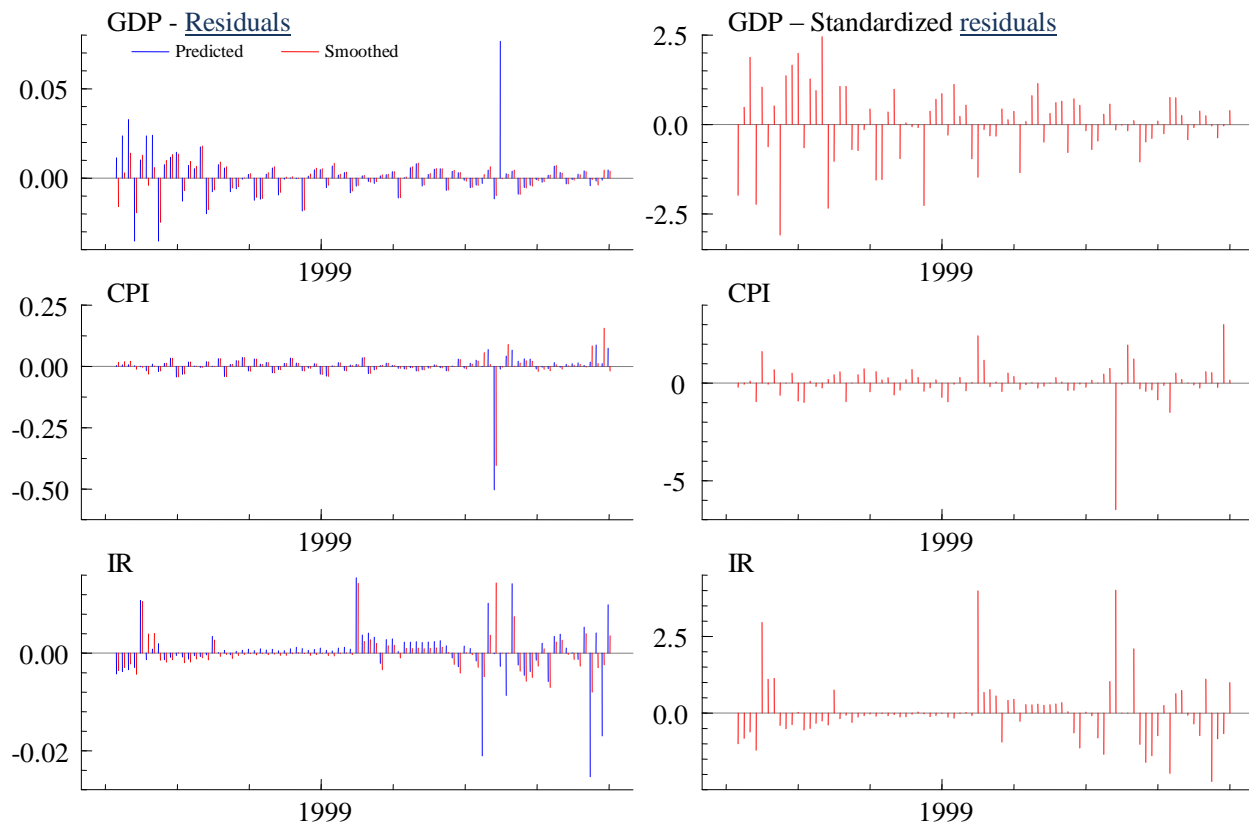

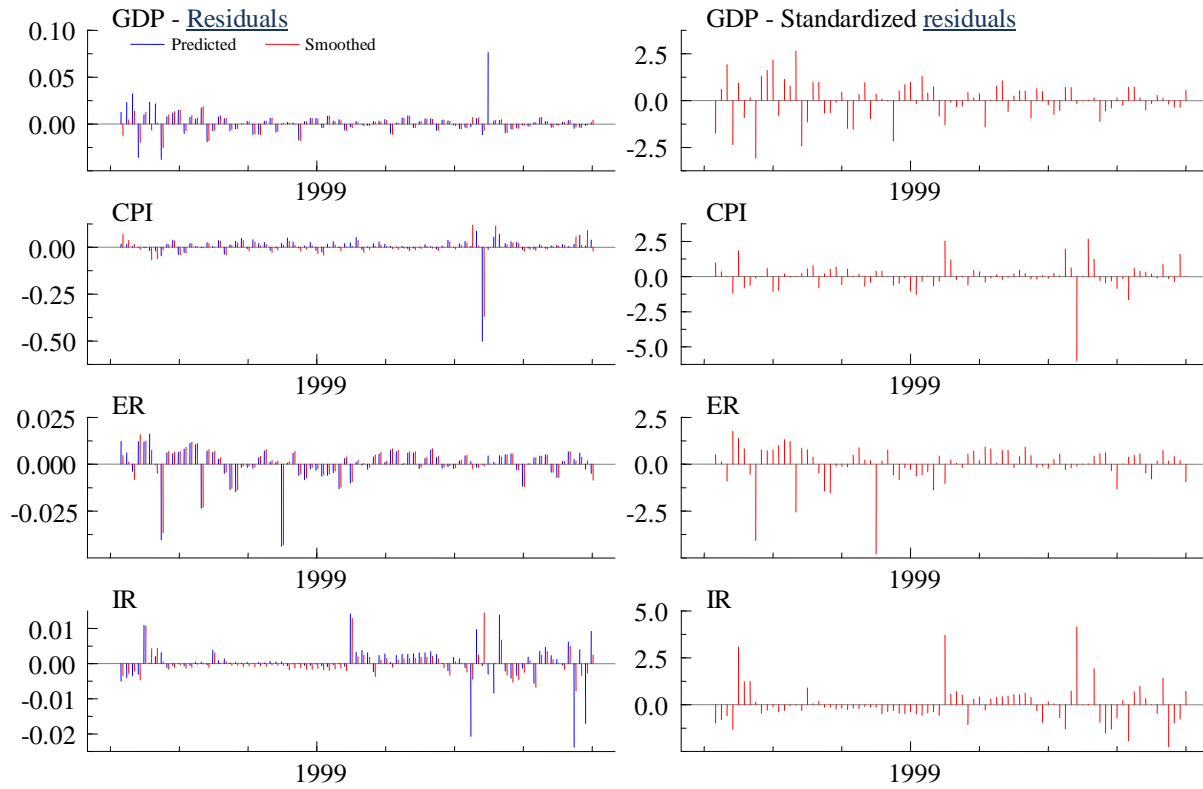**Figure 2.** Residuals of the MSIA(2)-VAR(1) for Model 1.Source: Elaborated by the authors.

Figure 3. Residuals of the MSIA(2)-VAR(1) for Model 2. Source**:** Elaborated by the authors.

Full Length Research Paper

An empirical study of consumers' willingness to pay for traceable food in Beijing, Shanghai and Jinan of China

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There have been more and more food safety incidents since 1990s in China. Implementation of traceability system is an important way to improve food safety in China. The food traceability system is still in an initial stage and implemented only in limited products and companies in China. Contingent valuation method (CVM) was used to investigate the Chinese consumers' willingness to pay for traceable vegetables and beef. The research was based on 600 face-to-face survey conducted in Beijing, Shanghai and Jinan in China. It shows that: (1) Price of traceable bean sprouts, leccute and beef (*BBS*), place of purchase (*PLACE*), consumer perception of food risk (RISK), gender (*GENDER*), consumer health (*HEALTH*) and per capita monthly income (*LANINCOME*) have significant effects on consumers' *WTP* for traceable food. (2) The respondents' willingness to pay for traceable bean sprouts, leccute and beef are 91.7, 99.2 and 18.4% higher than normal bean sprouts, leccute and beef respectively. (3) Consumers show greater willingness to pay for the traceable food with other quality certification.

Key words: Food traceability system, consumers' willingness to pay, contingent valuation method.

INTRODUCTION

There have been more and more food safety incidents since 1990s in China. In 2008, melamine was found in infant milk powder produced by Sanlu Group in Hebei province at first, then it was found in several other famous milk powder producers. These incidents have caused widely public concern over the food safety and significant effects on the food market in China. Meanwhile, food safety is seriously concerned worldwide nowadays. If the food produced in China cannot be traced, some of them would not be permitted to export to many developed countries, such as USA, Japan and European Union. Therefore, it is necessary to establish food traceability system in China.

In order to improve food safety regulation efficiency in domestic market and overcome trade barrier in international trade, the Chinese government began to construct the traceability system since 2000. In 2004, 8 cities were selected as pilot cities to establish food safety monitoring system by the Ministry of Agriculture of China. Since then food tracing system was established in Beijing, Shanghai, Shouguang, Nanjing etc. The Ministry of Commerce of China began to establish food tracing system in 2010, and 35 cities were ratified as pilot cities for food tracing system until 2013. Despite the Chinese government and producers have made a lot of efforts to establish the food traceability system, the food tracea-

bility system is still in an initial stage and has been used only in limited products and companies.It is important to have a good sense of consumers' willingness to pay (WTP) for certified traceable food and its affecting factors. The aim of the research was to investigate consumers' willingness to pay (WTP) for certified traceable food and its affecting factors.

Contingent valuation method (CVM) was used to investigate the Chinese consumers' willingness to pay for traceable vegetables and beef. The research was based on 600 face-to-face survey conducted in Beijing, Shanghai and Jinan in China.

The outline of the paper is as follows. The next section is a literature review. The third section is data, sample characteristics and method. The last section is empirical results and discussion.

LITERATURE REVIEW

Traceability system

Traceability is defined as the ability to trace the history, application or location of an entity by means of recorded information (ISO8402, 1994). European Union (EU) defined traceability as the ability to trace or track the information of production, processing and selling (EU, 2002). Traceability system can be divided into four levels: they are product, data, standard, information technology and planning respectively. There are internal company traceability and inter-business traceability (Moe,1998).

Traceability system was first evaluated according to the depth; width and accuracy in American's agricultural survey report .The report took three industries as the example and evaluated the traceability efficiency in different industries(Carla et al., 2010). It further pointed out that it was very difficult to draft the same standard in different industries (Golan et al., 2003).

By implementing the traceability system, the defected product can be called back through checking recorded information. The scholars showed that food traceability system not only promotes food security supervision but also improves the management decision and reduces the negative effects on public health (Hobbs et al., 2005; Golan et al., 2003; Souza-Monteiro and Casewell, 2004; Linhai et al., 2010). It can also reduce the transaction cost arising from the monitoring of product quality including the production methods of suppliers (Hobbs et al., 2005).

Consumers' willingness to pay

There have been many studies on consumers' willing-ness to pay for traceable food in the developed countries and regions, such as USA (Dickinson, 2002), Canada (Hobbs et al., 2005), Spain (Angulo et al., 2005), the United Kingdom, Japan (Dickinson and Bailey, 2005).

The research on consumers' willingness to pay for traceability in USA, Canada and Japan showed that consumers' willingness to pay for traceable produce was different. However, it is common that consumers in the three countries were willing to pay a higher price for traceable produce with both information about food safety and animal welfare (Dickinson and Bailey, 2003).

Willingness to pay for traceable produce is a concern to Chinese scholars in recent years. Linhai (2010) showed that most respondents were willing to pay no more than 30% price premium for traceable produce.

There are various methods employed to elicit consumers' willingness to pay premium for traceable food, such as contingent valuation method, cost of illness, experimental markets, conjoint analysis, prices paid in market, liability costs, trade analysis and so on. Contingent valuation method is widely adopted in research of consumers' willingness to pay (ZhiGang and Yanna, 2006; Huimin et al., 2012; Zhigang et al., 2013; Yong et al., 2014; Zengjin et al., 2014).The categories of traceable food focused by scholars were milk products (Zhigang and Yanna 2006), vegetables (Yong et al., 2014), beef (Zengjin et al., 2014), pork (Huimin et al., 2012; Zhigang et al., 2013) and so on. The results showed that respondents were not certain that the traceable pork were safe food, and their ability to pay was low (Huimin et al., 2012); consumers were willing to pay 22.5% higher price for trace able pork than common pork in Beijing (Zhigang et al., 2013); the attention of consumers for vegetable quality was very high, but the cognition of the traceability of vegetables was very low (Zhigang et al., 2013).

Yong et al. (2014) found that in terms of willingness to pay, most respondents said they were willing to pay more for traceability agricultural products, but the willingness to pay was low; consumers' willingness to pay was driven by gender, age, family population, traceability label trust and paying ability and other factors.Zengjin et al. (2014) analyzed consumers' willingness to pay for traceable beef with 400 questionnaires. The study found that consumers' cognitive level of traceable beef was low, but 95.25% of the respondents were likely to buy traceable food after they were told the benefit of traceability; and the respondents were willing to pay a price premium of 20% for traceable beef.

In conclusion, scholars have researched consumers' willingness to pay for traceable food in various countries and regions, but such researches are still in an initial stage in China. It can be found from previous studies that contingent valuation method is a feasible and popular method to investigate consumers' willingness to pay for traceable food. Chinese scholars mainly focused on several primary traceable foods. Most of the previous studies were only investigating one city and one product in China.

METHOD

Theoretical analysis

The theory of this research is rooted in consumer utility function.

YingHeng (2006) specified the economic principles in estimating consumers' willingness to pay as follows:Assuming all other conditions are constant, food security levels will increase from a lower Q_0 to a higher level Q_1 due to the implementation of traceability system, while consumers will get a greater utility, that is,

$$U_1(Q_1, I, X, \varepsilon_1) > U_0(Q_0, I, X, \varepsilon_0) \tag{1}$$

Where $U(.)$ stands for the consumers utility function, I is consumers income level, X are other factors affecting consumers utility, ε is an error term.

In order to obtain willingness to pay(WTP), let

$$U_1(Q_1, I - WTP, X, \varepsilon_1) = U_0(Q_0, I, X, \varepsilon_0) \tag{2}$$

Then consumers' *WTP* can be arrived at by statistical method. Derivations are as follows,

Y means consumers' option for traceable food. If consumer chooses traceable food, $Y=1$, if no, $Y=0$.

Bid is the price consumers are willing to pay for traceable food. P is the price for normal food,Z includes food safety level (Q), income (I)and other factors that affect consumers' utility. ε_0 and ε_1 are random error terms. Consumers' utility function for traceable food is $U_{Y=1}(Z, BID, \varepsilon_1)$, while consumers' utility function for normal food is $U_{Y=0}(Z, P, \varepsilon_0)$.

Assuming that consumers' utility function is liner function, and random error ε follows Weibull distribution. When consumers choose traceable food, the utility function takes the form of

$$U_{Y=1} = \alpha_1 + \beta_1'Z + \lambda_1 BID + \varepsilon_1 \tag{3}$$

If consumers choose normal food, the utility function is

$$U_{Y=0} = \alpha_0 + \beta_0'Z + \lambda_0 P + \varepsilon_0 \tag{4}$$

P is the average market price for normal food in formula (4);it means P is the constant in this formula, so formula (4) can be rewritten to

$$U_{Y=0} = \alpha_0' + \beta_0'Z + \varepsilon_0 \tag{5}$$

where $\alpha_0' = \alpha_0 + \lambda_0 P$.

Consumers' utilities in formula (3) and (5) are unobservable, but their options for traceable food or normal food are observable. If $U_{Y=1} \geq U_{Y=0}$, consumers choose to buy traceable food. If $U_{Y=1} < U_{Y=0}$, choose to buy normal food.

Let formula (3) minuses formula (5), get

$$U_{Y=1} - U_{Y=0} = (\alpha_1 - \alpha_0')) + (\beta_1 - \beta_0)'Z + \lambda BID + (\varepsilon_1 - \varepsilon_0) \tag{6}$$

Then it can be rewritten as

$$U^* = \alpha^* + \beta^{*'}Z + \lambda^* BID + \mu^* \tag{7}$$

We can arrive at the probability equation when consumers choose to buy traceable food ($Y=1$), which takes the form of,

$$P(Y=1) = P(U^* > 0) = P[\mu^* > -(\alpha^* + \beta^{*'}Z + \lambda^* BID)] \tag{8}$$

Formula (8) is a logit linear model. Y is the dependent variable; Z and BID are independent variables, α^*, $\beta^{*'}$, λ^* are parameters to be estimated, μ^* is stochastic error.

Formula (8) can be rewritten as,

$$P(Y=1) = \Lambda(U^*) = [1 + \exp(-U^*)]^{-1} \tag{9}$$

Take formula (7) into formula (9), the following linear logit model is obtained

$$\ln\left[\frac{P(Y=1)}{1 - P(Y=1)}\right] = \alpha^* + \beta^{*'}Z + \lambda^* BID \tag{10}$$

Consumers' willingness to pay for traceable produce $\mathrm{E}(BID)$ can also be got when utility for traceable food(formula (3)) and normal food (formula (4)) are equal.

$$\alpha_0' + \beta_0'Z + \varepsilon_0 = \alpha_1 + \beta_1'Z + \lambda_1 BID + \varepsilon_1 \tag{11}$$

For $\mathrm{E}(\varepsilon_0) = \mathrm{E}(\varepsilon_1) = 0$, take the mean on both sides of the formula and get

$$\mathrm{E}(BID) = -\frac{\alpha^* + \beta^{*'}\mathrm{E}(Z)}{\lambda^*} \tag{12}$$

Take the coefficient got from formula (10) and the mean of *Z* into formula (12), $\mathrm{E}(BID)$ is obtained.

Then $\mathrm{E}(WTP)$ can be got by the following formula

$$\mathrm{E}(WTP) = \mathrm{E}(BID) - P_0 \tag{13}$$

Data collection and sample characteristics

Data collection

Questionnaire survey with face-to-face talk was used to collect data in the survey. We delivered 600 questionnaires and 576 of them were valid. The effective response rate was 96%. The interviewers brought some traceable vegetables to scan in the POS machine to make respondents understand the questions in the questionnaire better. Moreover, they were trained survey skills before visiting respondents. The contingent valuation method with two-bounded dichotomous choice method is used in the design of the questionnaire to obtain more objective information in the survey. The two-bounded dichotomous choice is a questioning approach derived from dichotomous choice method. The specific question is to ask consumers whether they would like to pay for traceable produce at the price of (B_0); if the consumer answers "yes", then continue to ask his willingness to pay at a higher price of (B_1). If

Table 1. Socio-demographic statistics-gender.

		Frequency	Percent	Valid percent	Cumulative percent
Valid	Male	284	49.3	49.3	49.3
	Female	292	50.7	50.7	100.0
	Total	576	100	100	

Table 2. Socio-demographic statistics-marital status.

		Frequency	Percent	Valid percent	Cumulative percent
	Unmarried	223	38.7	39.2	39.2
Valid	Married	346	60.1	60.8	100.0
	Total	569	98.8	100.0	
Missing		7	1.2		
Total		576	100		

Table 3. Socio-demographic statistics-Education level.

		Frequency	Percent	Valid percent	Cumulative percent
	Primary school	11	1.9	1.9	1.9
	Middle school	67	11.6	11.8	13.7
	High school	169	29.3	29.8	43.5
Valid	Junior College	124	21.5	21.8	65.3
	College	173	30.0	30.5	95.8
	Master and above	24	4.2	4.2	100.0
	Total	568	98.6	100.0	
Missing		8	1.4		
Total		576	100		

the consumer answers "no", then continue to ask at a lower price to test his willingness to pay.

As for the survey locations, some supermarkets and shopping centers in Beijing, Shanghai and Jinan were selected. These three metropolises are located in the central, south and middle of China respectively. The traceability system is in the initial stage in China, so its implementation requires certain conditions. The reliability of the survey will be affected if the consumers' income level and cognitive level are too low. So we selected the above 3 metropolises as the survey locations.

The research focused on consumers' willingness to pay for traceable vegetables and beef. Bean sprouts and lettuce were selected for the representative vegetables, because the two vegetables are normal vegetables that people consume in their daily life in China. Beef was selected, because its traceability system was implemented early in both developed countries and China.

Sample characteristics

The survey showed that almost half of respondents (49.3%) were males. Married respondents accounted for 60.8%. Approximately half of the respondents (48%) were under 30 years old, 22% respondents were 30-40 years old, 14.4% respondents were 41-50 years old, 22% respondents were 30-40 years old, 8.3% respon-

dents were 50--60 years old, 5.7% respondents were above 60 years old. Most of the family's average (60.4%) monthly income was less than RMB 4500 yuan (Tables 1-4).

Most respondents (65.3%) who buy food were mainly family members. More than half (51.2%) of respondents expressed willingness to buy vegetables in the open market. 72% of the respondents were willing to purchase beef in the supermarket or specialty stores.

As for respondents' perspective of who to play the major role in food safety, 54.9, 53.4, 51.2, 38.7 and 5.7% respondents answered that the government , the retailers, producers, raw material suppliers, consumers should take the major responsibility in food safety respectively.

Most respondents (89.8%) considered pesticide residues as the most important factor affecting human health, followed by human food additives and preservatives (65.6%), excessive fertilizer (57.5%), animal food additives (56.3%), animal diseases (54.7%), heavy metals contamination (49%), microbial contamination (35.9%), genetically modified food (31.8%) and so on.

The survey showed that 76.2% of the respondents did not have knowledge of traceability system.

Information channels for those who have knowledge of the traceability system were TV (68.2%), newspaper (35.4%), internet (31.3%), radio (21.8%), leaflets (15%) and friends (13.6%) respectively.

When respondents were asked about the reasons why they did

Table 4. Socio-demographic statistics-Monthly family income (unit: RMB yuan).

		Frequency	Percent	Valid percent	Cumulative percent
Valid	<1000	18	3.1	3.2	3.2
	1000-1500	63	10.9	11.1	14.2
	1500-2500	100	17.4	17.5	31.8
	2500-3500	76	13.2	13.3	45.1
	3500-4500	87	15.1	15.3	60.4
	4500-5500	56	9.7	9.8	70.2
	5500-6500	42	7.3	7.4	77.5
	6500-7500	39	6.8	6.8	84.4
	≥7500	89	15.5	15.6	100.0
	Total	570	99.0	100.0	
Missing		6	1.0		
Total		576	100		

not know about the traceability system, 56.9% of the respondents said that the government's information service was not enough, 43.1% of the respondents thought that the supermarkets' information service were not enough, 37.3% of the respondents believed that producers' information service was not enough. 28.7% of the respondents thought that the food in open market was safe.When the respondents were asked why they did not want to pay a price premium for traceable vegetables, the respondents' answers were as follows:

First, Majority of the respondents (68.5%) thought that prices of traceable vegetables were too high. Second, 36% of the respondents thought that the food traceability system was the responsibility of the government and producers. Third, 26.8% of the respondents thought traceability system was unreliable due to the limited government regulation. Fourth, 19% of consumers thought information delivered in the food traceability system was unbelievable. At last, a small number of respondents (8.7%) said that they trust the security of normal vegetables and the food traceability system was not necessary.

EMPIRICAL ANALYSIS AND RESULTS

Variable Selection

Table 5 shows definitions of variables, descriptive statistics and expected directions.

Empirical analysis

Table 6 shows that price of traceable bean sprouts, leccute and beef (*BBS*), place of purchase (*PLACE*), consumer perception of food risk (RISK), gender (*GENDER*), consumer health (*HEALTH*) and per capita monthly income (*LANINCOME*) have significant effects on consumers' *WTP* for traceable food.

Price of traceable food has a negative effect on consumers' willingness to pay; the higher the price, the lower likelihood for consumers to buy traceable food. *Place of purchase* has a positive effect on consumers' willingness to pay; it indicates that consumers who

usually go shopping in supermarkets rather than open markets are more likely to buy traceable food.

Risk perception has a positive effect on consumers' willingness to pay. Consumers who think that the situation of food safety is serious and it is important in people's health are willing to pay a higher price for traceable vegetables or beef.

Consumer health status (*HEALTH*) has a positive effect on consumers' willingness to pay; the worse the consumers' physical conditions, the higher likelihood for them to pay for traceable food.

Average per capita monthly income (*LAINCOME*) has a positive impact on consumers' willingness to pay; the higher the consumers' average monthly income, the more likely for them to pay a price premium for traceable food. The price premium of the consumers' willingness to pay for traceable bean sprouts, leccute, and beef can be got according to formula (13). The price of normal bean sprouts, leccute and beef is RMB 4 yuan per kg, RMB 4 yuan per kg and RMB 40 yuan per kg respectively. The results show that the respondents' willingness to pay for traceable bean sprouts, leccute and beef are 91.7, 99.2, and 18.4% higher than normal bean sprouts, leccute and beef respectively. It indicates that consumers' willingness to pay for traceable bean sprouts is RMB 7.666 yuan per kg, traceable lecctue is RMB 7.971 yuan per kg, and traceable beef is RMB 47.452 yuan per kg. The prices that respondents would like to pay for these three traceable foods were much lower than their sales price in the surveyed supermarket. The sales prices in the surveyed supermarket were RMB 11.98 yuan per kg, RMB 12.986 yuan per kg and RMB 96 yuan per kg, respectively.

DISCUSSION

This research investigated consumers' willingness to pay for traceable vegetables and beef and its influencing

Table 5. Definitions of variables, descriptive statistics and expected directions.

Variable	Definition	Mean	Standard deviation	Expected directions
BBS1	Maximum price that the consumer is willing to pay for traceable bean sprouts	3.68	0.94	-
BBS2	Maximum price that the consumer is willing to pay for traceable lettuce	7.103	2.276	-
BBS3	Maximum price that the consumer is willing to pay for traceable beef	29.547	4.441	-
PURCHASE	Whether the consumer is the main buyer,1="yes", 0="not"	0.66	0.47	-
PLACEV	The place to buy vegetables, 1="market", 0="farmers market"	0.48	0.50	+
PLACEB	The place to buy beef,1="market",0="farmers market"			+
RISK	Risk perception			+
GENDER	Gender,1="female"，0="male"	0.51	0.50	+
EDU	Education,1="high school and above", 0="under high school"	0.86	0.34	+
MAR	Marital status,1="married", 0="unmarried"	0.62	0.49	+
AGE	Age,1="less than 30", 2="30-40", 3="40-50", 4="50-60", 5="more than 60"	2.05	1.26	+
HEALTHE	Health, 5="very healthy", 4="healthy", 3="general", 2="not good", 1="very bad"	4.09	0.66	+
CHILDREN	Number of children under 13 years old	0.37	0.57	-
ELDER	Number of people over 60 years old	0.63	0.87	+
AINCOME	Per capita family income (RMB yuan)	1389.90	910.89	+

factors. The survey places were Beijing, Shanghai and Jinan in China. It showed that most consumers had never heard of traceability system in China. The major information channels for those who had knowledge of traceable food were TV, newspaper and Internet. The higher the consumers' risk perception, the more likely they were willing to buy traceable food. The reason that consumers were reluctant to buy traceable food at a higher price can be explained as follows: First, the price of traceable food was too high. Second, majority of consumers thought that food safety was not consumers' responsibility but the government's, retailers' and producers' responsibility Third, unreliable information still existed in the food traceability system.When the prices of traceable food are relatively modest, many consumers prefer to pay for them. The higher the traceable food price, the less likely consumers are willing to pay for them. But, their willingness to pay still declines when the price of traceable food is too high.

Implications

The research provides insights into the marketing strategies of the traceable food producers, retailers. The research also provides insights into the food traceability system construction of the Chinese government.

The traceable food producers and retailers should consider seriously the consumers' willingness to pay for traceable food to improve their marketing strategies.

Firstly, as the prices of traceable food in China are too high to accept for most consumers, the traceable food producers and retailers should take more measures to reduce the costs and lower the market prices of traceable food.

Secondly, the traceable food producers and retailers should consider to provide more information about the food traceability system to enhance the consumers' understanding of the procedure of traceable food production.

Thirdly, the traceable food producers and retailers should make certain that the tracing food is safety, and it is worth to pay a price premium.

The findings also suggest that the government should take more efforts to improve the food traceability system in China, such as expanding pilots of the food traceability system in more cities, providing more conveniently installation for consumers' information inquiry of traceable food, offering more knowledge of the food traceability

Table 6. Logit regression results for traceable produce.

Explanatory variables	Bean sprouts Coefficients	Lettuce Coefficients	Beef Coefficients
BBS	-12.449***	-12.85***	-4.97***
PURCHASE	-0.155	0.738**	-0.155
PLACEB/V	0.667**	0.766***	0.792***
RISK	2.215***	3.88***	2.399***
GENDER	1.002***	0.459	0.252
EDU	-0.413	0.377	0.356
MAR	-0.151	-0.626	-0.03
AGE	0.087	0.369***	0.002
HEALTHE	0.778***	1.069***	0.676***
CHILDREN	0.408	0.912***	0.371
ELDER	0.322	0.295	0.262**
AINCOME	1.874***	2.111***	1.684***
Number of samples	556	572	560
-2 Log likelihood	228.48	228.93	445.84
Hosmer-Lemeshow Chi-square(Sig.)	13.145(0.107)	10.742(0.217)	7.329(0.502)

Note: ***significance at 1%, **significance at 5%.

system and the relationship between traceability and food safety, supporting the producers and retailers to reduce costs of implementing the food traceability system.

LIMITATIONS

Consumers' willingness to pay is estimated in the simulated situation. The estimation for consumers' willingness to pay cannot stand for the real situation completely. Contingent Valuation Method adopted in the research may engender biases. However, it is widely used and it is suitable for the research. Future studies may select more traceable foods; adopt more advanced research method to make the estimated results more reliable.

Conflict of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

An analysis of the impact of oil price shocks on the growth of the Nigerian economy: 1970-2011

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This paper examines the impact of oil price shocks on Nigerian economic growth while controlling the effects of unrest in the international oil market, exchange rate and agriculture output using quarterly time series data from 1970:q1-20011:q4.The broad objective of the study is to evaluate the long run relationship among the variables namely; oil price, exchange rate, agriculture output, unrest and economic growth. The research applied ADF unit root tests to ascertain the stationary of the series and also employed Johansen and Juselius (1990) trace and maximal eigenvalue tests to ensure long-run relationship among the variables under the study. In addition, structural Vector Autoregression (SVAR) is also applied in examining the link between the shocks emanating from oil price, unrest and their impacts on economic growth. The finding from ADF revealed that all the series at level are not stationary but stationary at first difference with constant. Moreover, the findings from SVAR using the Impulse response functions (IRFs) and variance decompositions (VDCs) indicated that the response of oil price shocks and unrest to (rGDP) economic growth depicts both positive and negative impact, i.e. long-run impact on economic growth exists. The study concludes that oil price, exchange rate, agriculture output and unrest contained some useful information in predicting the future path of economic growth in Nigeria. It, therefore, recommends that government should diversified the economy from oil to non oil sectors base and to improving the security situation in the Niger Delta with a view to boosting oil output, hence leading to increased revenue and by implication growth of the economy.

Key words: GDP, Exchange rate, agriculture output, oil prices, unrest, VAR, SVAR.

INTRODUCTION

Oil price shocks are predominantly defined with respect to price fluctuations resulting from changes in either the demand or supply side of the international oil market (Wakeford, 2006). These changes have been traditionally traced to supply side disruptions such as OPEC supply quotas, political upheavals in the oil rich Middle East and

activities of militant groups in the Niger Delta Region of Nigeria. The shocks could be positive (a rise) or negative (a fall).

In Nigeria, oil plays a critical role in the conduct of fiscal and monetary policies because it accounts for an average of 80 percent of government revenue, 90-95

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percent of foreign exchange earnings and 12 percent of the real gross domestic product (Anyanwu, 1997).

Historically, the price of oil had been fairly stable until 1973. Since then, the impact of oil price shocks on the world economy has been larger (Hamilton, 2003). In the past three decades, the price of oil has been volatile and given the role of oil in the Nigerian economy, the effects of oil price shocks have been very significant and dis-stabilizing.

Nigeria has been the major oil producer in African continent together with Libya. Indeed, attacks on the oil refineries and the kidnapping of foreign engineers by the movement for the emancipation of the Niger Delta in the Niger Delta region was reported to have been one of the causes of international oil price increase from 2006-2007. This notwithstanding, in general, Nigeria's production can be considered to be not enough to affect the international oil price, thus this assumption is appropriate (CBN, 2008).

As an oil exporter and importer of refined petroleum products, any volatility or fluctuations in oil prices will adversely affect the Nigerian economy either positively or negatively. Several empirical studies have been undertaken to investigate the effect of oil price volatility on macroeconomic variables in different economies. Although the literatures are mixed on the causality between the oil price volatility and the macroeconomic variables, most empirical studies show that oil price directly impacts on macroeconomic variables (Joseph, 2013; Aliyu, 2009).

As a mono-product economy, Nigeria remains suscep-tible to the movements in international crude oil prices. During periods of favorable oil price shocks triggered by conflicts in oil-producing areas of the world, the surge in the demand for the commodity by consuming nations, seasonality factors, trading positions, etc; the country experiences favorable terms-of-trade quantified in terms of a robust current account surplus and exchange rate appreciation. On the converse, when crude oil prices are low, occasioned by factors such as low demand, seasonality factors, excess supply and exchange rate appreciation, the Nigerian economy experiences signifi-cant drop in the level of foreign exchange inflows that often result in budget deficit and or slower growth. A recent example was the dramatic drop in the price of crude oil in the wake of the global financial and economic crises. The price of oil fell by about two thirds from its peak of $147.0 per barrel in July 2008 to $41.4 at end-December 2008.

However, various episodes of oil shock have been observed in Nigeria. Each of the shocks had connections with some movements in key macroeconomic variables in Nigeria. For instance, the 1973-74, 1979-80, 1990, 1999-2000, 2003-2006, 2007-2008 and 2011 periods were associated with price increases while the oil market collapse of 1986, the Iranian revolution of 1991-1992, the

East Asian Crisis of 1997-1998, Energy Crisis and tension from Middle East of 2000-2001were an episode of price decrease.

Theoretically, oil price increases translate to higher production costs, leading to commodity price increases at which firms sell their products in the market. Higher com-modity prices then translate to lower demand for goods and services, therefore shrinking aggregate output and employment level. Furthermore, higher oil prices affect aggregate demand and consumption in the economy.

The transfer of income and resources from an oil-importing to oil-exporting economies is projected to reduce worldwide demand as demand in the former is likely to decline more than it will rise in the latter [Hunt et al., 2001]. The resulting lower purchasing power of the oil-importing economy translates to a lower demand. Also, oil price shocks pose economic uncertainty on future performance of the Macroeconomy. People may postpone consumption and investment decisions until they see an improvement in the economic situation.

It is against this background, the study finds a gap to fill. i.e. by considering the effects of unrest asa variable that potentially affects oil output which in turn leads to revenueleakages which is assumed to have implications on the economic growth of both oil exporting and importing countries (especially Nigeria). Therefore, given the above scenario, the research paper seeks to address the following questions: Do all the variables under study have a long run relationship? What are the impacts of these different shocks to the growth of Nigerian econo-my? The broad objective of this paper is to examine the impact of oil price shocks on the growth of Nigerian economy. It thereby adds to the scanty existing empirical literatures on the impact of oil price shocks on macro-economic variables in both oil exporting and importing developing countries (more specifically Nigeria).

Following the introductory section of the paper, the study focuses on the review of related literatures on the oil prices-macroeconomic variables relationship in section 2. Data Descriptions and econometric model specifica-tions used in section 3. Section 4 would be the data presentation and interpretations of estimation results. While conclusions and recommendations and policy implications of the findings are presented in section 5.

LITERATURE REVIEW

In this section of the study we shall consider the research work which was carried out by various researchers. Bjornland (2004), Berument and Ceylan (2005), Huang and Guo (2007) did a study on the impact of oil prices on economic growth of the following countries which include; Venezuela, China, Algeria, Iran, Iraq, Jordan, Kuwait, Oman, Qatar, Syria, Tunisia, UAE, Norway, Philippine and G7 countries by using a structural vector auto-

regressive (SVAR) framework. Their findings show that an oil price shock stimulates the economy while for countries as Bahrain, Egypt, Lebanon, Morocco and Yemen did not find any significant impact on oil price shocks on their economy.

Furthermore, studies on Nigerian economy like that of Aliyu (2009), Olomola and Adejumo (2006), Ayadi (2005), Gunu (2010), Agbede (2013) used VAR frame work to examine the effect of real exchange rate, oil price shocks, oil production shocks, money supply, net foreign assets, interest rate, inflation, and output. Empirically, the response of the real exchange rate is generally positive after a positive oil production shock, indicating a real depreciation of the naira. The impulse response of the real exchange rate is negligible relative to that of oil production, but the response of the real exchange rate after a year is about two times larger than that of oil production.

Rautava (2004) develops a small VAR model to examine these dynamics in the Russian economy and shows that oil has played a significant role in movements of Russian GDP. Higher oil price leads to higher GDP, in both the short and long run. On the other hand, in the model, a higher oil price does not lead to a stronger real exchange rate, although the author conjectures that this may be because of the estimation strategy.

Anshasy et al. (2005) examine the effects of oil price shocks on Venezuela's economic performance over 1950-2001. They investigate the relationship between oil prices, governmental revenues, government consumption spending, GDP and investment by employing a general to specific modeling (VAR and VECM). They found two long run relations consistent with economic growth and fiscal balance and that this relationship is important not only for the long run performance but also for short term fluctuations.

Jimenez-Rodriguez and Sanchez (2012) studied the role of oil price shocks in Japanese macroeconomic developments using quarterly data from Japan over the period 1976- 2008. They also use VAR framework to find the evidence of non-linear effects of oil price on both industrial output and inflation. The theory predicts that, in an oil importing economy like Japan, unexpected hikes in oil prices should lead to lower economic activity and higher inflation. The empirical findings concerning the effects of oil shocks on industrial output growth and inflation confirm the expected pattern.

Englama et al. (2010) examined the effects of oil price volatility, demand for foreign exchange, and external reserves on exchange rate volatility in Nigeria using monthly data for the period 1999:1 to 2009:12.The authors utilized cointegration technique and vector error correction model (VECM) for the long-run and the short-run analysis, respectively. The results showed that a 1.0 per cent permanent increase in oil price at the international market increases exchange rate volatility by 0.54 per cent in the long-run, while in the short-run by 0.02 per cent. Also a permanent 1.0 per cent increase in demand for foreign exchange increases exchange rate volatility by 14.8 per cent in the long-run. The study reaffirms the direct link of demand for foreign exchange and oil price volatility with exchange rate movements and, therefore, recommends that demand for foreign exchange should be closely monitored and exchange rate should move in tandem with the volatility in crude oil prices bearing in mind that Nigeria remains an oil-dependent economy.

Ayoola (2013) examines the effects of crude oil price changes on economic activity in an oil dependent economy-Nigeria. A small open economy structural vector autoregressive (SVAR) technique is employed to study the macroeconomic dynamics of domestic price level, economic output, money supply and oil price in Nigeria. The study covers the period between 1985:q1 to 2010:q4. The results of the Impulse Response Functions (IRFs) and the Forecast Error Variance Decompositions (FEVDs) suggest that domestic policies, instead of oil-boom should be blamed for inflation. Also, oil price variations are driven mostly by oil shocks; however, domestic shocks are responsible for a reasonable portion of oil price variations. The study concludes that oil still has very important indirect impact on the Nigerian economy and the monetary policy is the channel through which this indirect impact transmits.

However, from the above strand of literature we will come to observe more especially most of the study frequencies were too scanty. To this end, studying 'shocks' and 'relationships' using these frequencies the clustering effect is gone- some vital information will be lost. The study finds this interesting to re-estimate these shocks using structural VAR framework on Nigerian data from 1970q1 to 2011q4 so as to filter through.

Datadescriptions and econometric model specifications

This study relies heavily on secondary data; variables including real GDP, exchange rate, agriculture output are sourced from Central Bank of Nigeria (CBN) statistical bulletin, average world oil price from Energy Intelligence Agency (EIA) and unrest(dummy) is sourced from both International Crisis Group (ICG) and Nigerian National Petroleum Corporation (NNPC statistical Bulletin). The trend of the data would be analyzed by the use of unit root test (Augmented Dickey Fuller ADF) test for stationary, for the accessing of the long run relationship among the variables Johansen Cointegration test is to be employed while for examining the long run impact of the shocks Structural VAR (Blanchard and Quah, 1989) Long run restriction pattern on the basis of impulse response functions and forecast error variance decomposition

would be employed. Finally quarterly data will be used for the period between 1970-2011 (i.e. 168 observations), which is the period that represents occurrence of the oil shocks in international oil market.

Econometricsmodel specification

The general econometric specificationof the model to be estimated is as follows:

$$GDP = f(OP, EX, UN, OA)$$

$$GDP_t = \beta_0 + \beta_1 OILP_t + \beta_2 EXR_t + \beta_3 UNRST_t + \beta_4 AGR_t + \varepsilon_t$$

Where:
GDP =Gross Domestic Product
OILP = Crude oil prices
EXR = Nominal foreign exchange rate
UNRST=Unrest (oil shocks)
AGR= Output of Agriculture

Stationarity test and study variables

The variables of interest (i.e. endogenous variables) are seasonally adjusted real GDP and nominal foreign exchange rate, agriculture output, oil price and unrest (dummy variable). The choice of variables is mainly driven by similar studies, in particular Aliyu (2009) and is used as a benchmark, which is been conducted in Nigeria and is in accord with economic theory. Since it is a time series data, the regressions involving unit root processes may give spurious results and the naive application of regression analysis may yield nonsense results.

Therefore, distinction between whether the levels or differences of a series is stationary leads to substantially different conclusions and hence test of non-stationarity, that is, unit roots are the usual practice today.

Therefore, the study applies the commonly used augmented Dickey-Fuller (ADF) unit root tests to determine the variables' stationarity properties or integration order. Before estimating the VAR model, we would use the most recommended Akaike information criterion (AIC) test to determine the lag length of the VAR system to make sure the model is well specified.

The test estimation procedure takes the following forms;

$$(\text{ADF-test}): \quad \Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha_i \sum_{t-1}^{m} \Delta Y_{t-i} + \varepsilon_t$$

Where Δy_t denotes lag difference of the variable under consideration. m is the number of lags and εt is the error term. The stationarity of the variables is tested using the hypothesis;

For ADF:
Ho: $\delta 1 = 0$ (Null hypothesis), [where $\delta 1 = \rho -1 = 0$]
Ho: $\delta 1 < 0$ (Alternative Hypothesis)

Based on the critical values of respective statistics, if null hypothesis cannot be rejected, then the time series are non-stationary at the level and need to go through first or higher order differencing process to achieve stationarity and to find the order of integration. The test is applied to each variable used in the model.

Johansen and Juselius 1990 Test for Cointegration

The VAR model is specified as follows;

$$Y_t = A_O + \alpha_i \sum_{k-1}^{p} A_k + y_{t-k} + \varepsilon_t \quad \text{......................} (\text{I})$$

Where y_t is a (n× 1) vector of non-stationary *I (* I *)* variables, n is the number of variables in the system, in this study four in each case. A_0Is (n× 1) vector of constant terms, A_k is a (n×n) matrix of coefficients, e_t is a (n × 1) vector of error terms, which is independent and identically distributed, and p is the order of auto regression or number of lags. In this study weuse quarterly frequency data for all analysis.

$$Y_t = B + \sum_{k-O}^{\infty} B_k \ell_{t-k} \quad \text{......................................} (\text{II})$$

Thus, $y_t$is expressed as a linear combination of current and past innovations. Based on (2), impulse response functions are simulated for assessing dynamic effects of oil price shocks on output rGDP, exchange rate, output of agric and oil price. To test for cointegration, we employ a VAR-based approach of Johansen and Juselius (1990). In particular, the Johansen and Juselius (JJ) test for cointegration is based on evaluating the rank of coefficient matrix of level variables in the regression of changes in a vector of variables on its own lags and lagged level variables. The rank of the matrix, which depends on the number of its characteristic roots (eigenvalues) that differ from zero, indicates the number of cointegrating vectors governing the relationships among variables.

Johansen and Juselius (1990) develop two test statistics to determine the number of cointegrating vectors –the Trace and the Maximal Eigenvalues (M.E) statistics;

$$\lambda Trace: \quad (\text{r}) = -T \sum_{i=r+1}^{k} log(1-\lambda)$$
$$\lambda Maxeigenvalues: \quad (r, r+1) = -T log(1-\lambda_{r+1})$$
$$\text{..} (\text{III})$$

Where T is the number of effective observations and λs are estimated eigenvalues. For our analysis although our sample size is 168, in case of handling sample size of less than 100, we adjust the trace and M.E statistics by a factor (T=np)/T, where Tis the effective number of observations, nis the number of variables and p is the lag order. This is to correct bias towards finding evidence for cointegration in finite or small sample. The adjusted Trace statistic tests the null hypothesis that, the number of distinct cointegrating relationships is less than or equal to r against the alternative hypothesis of more than rcointegrating relationships. Meanwhile, the adjusted M.E test statistic tests the null hypothesis that the number of cointegrating relationships is less than or equal to ragainst the alternative of r+ 1 cointegrating relationships.

Structural VAR model

The advantage of the SVAR approach is that the system dynamics can be easily investigated via impulse response analysis, and the statistical significance of the various shocks can be evaluated with confidence intervals. Moreover, the relative importance of stochastic shocks can be examined by forecast error variance decomposition. The different structural shocks are identified by means of long-run restrictions, whereby certain shocks are allowed to have long-run impacts on all or some of the system variables.

However, after we might ascertain the relationship among the variables using VAR, then we follow the discussion on the SVAR approach. The starting point is a reduced form *K*-dimensional VAR model

$$y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + \varepsilon_t, \ldots\ldots\ldots\ldots\ldots\ldots (I)$$

In (I) above, is a vector of (K× 1) endogenous variables, five system variables among them are real GDP(y_t), oil price (oil price) and unrest(un_t). They are fixed (k× k) coefficient matrices which means bivariate model (2 × 2) using SVAR to examine the impact of oil price shocks and unrest on economic growth following Blanchard and Quah (1989), and we assume that follows a -dimensional white noise process with:

$$E(\varepsilon_t) = 0, \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(II)$$

Therefore, reformulate (I)

$$\Delta y_t = A_1 \Delta y_{t-p} + \ldots A_p \Delta y_{t-p} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots (III)$$

Theequation III and following the Blanchard and Quah (1989), the model is expressed as an infinite moving average representation of the variables such that:

$$\Delta yt = A_1\varepsilon_t + A_1\varepsilon_t + \ldots + \sum_{i=0}^{\infty} A\varepsilon_{t-1} = A(L)\varepsilon_t \ldots\ldots\ldots\ldots (IV)$$

$$\Delta yt = \begin{pmatrix} \Delta LrGDP \\ \Delta oilprice \end{pmatrix} \quad \Delta\varepsilon_t = \begin{pmatrix} \varepsilon 1t \\ \varepsilon 2t \end{pmatrix}$$

$$\text{and} \quad \begin{pmatrix} \Delta LrGDP \\ \Delta un \end{pmatrix} \quad \Delta\varepsilon_t = \begin{pmatrix} \varepsilon 1t \\ \varepsilon 2t \end{pmatrix}$$

Where;

Changes in (ΔLrGDP, Δoilprice) and (ΔLrGDP, Δunrest) are all assumed to be stationary while permanent and transitory errors ε, are uncorrelated white noise disturbances. The ε_{1t} and ε_{2t} are the demand shocks and supply shocks respectively. It is assumed that demand shocks have temporary effect on the level of GDP. The identity matrix is obtained by normalizing the variance of the structural shocks such that: $E(\varepsilon_1\varepsilon_2) = I$ that is, these shocks are orthogonal and serially uncorrelated.

The reduced form of the model in the moving average representation is:

$$\Delta_{xt} = e_t + C_1 e_{t-1} + \ldots + \sum_{i-0}^{\infty} C1e\, t-1 = C(L)e_t \ldots\ldots\ldots (V)$$

This can be represented as follows:

$$\begin{pmatrix} \Delta LrGDP \\ \Delta Loilprice \end{pmatrix} = \begin{pmatrix} C_{11}(L) & C_{12}(L) \\ C_{21}(L) & C_{22}(L) \end{pmatrix} \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{pmatrix} \quad \text{and}$$

$$\begin{pmatrix} \Delta LrGDP \\ \Delta un \end{pmatrix} = \begin{pmatrix} C_{11}(L) & C_{12}(L) \\ C_{21}(L) & C_{22}(L) \end{pmatrix} \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{pmatrix} \ldots\ldots\ldots\ldots (VI)$$

Where e_t is a vector of estimated reduced-form residuals with variance $E(e_t\, e_t) = \Omega$ and matrices C_i represent the impulse response function of shocks to ΔLrGDP, ΔLoilprice and Δun (dummy) respectively and C(L) is an infinite polynomial in the lag operator $A(L) = C(L)^{-1}$.

From equations (IV) and (V), It can be shown that the

reduced form residuals are related to the structural residuals as; $e_t = A(0) \varepsilon_t$......... (Ⅶ)

Where A(0) is a matrix of the contemporaneous effect of the structural innovations, it follows that: $E(e_t\, e_t) = A(0)$ $E(e_t\, e_t)A(0)$ ...... (Ⅷ)

Since $E(e_t\, e_t) = $ Ⅰ then $A(0)A(0)' = \Omega$

DATA PRESENTATION AND ESTIMATION OF RESULTS

Introduction

This section of the paper deals with the presentation and analysis of the estimated results arrived at, i.e. it shows the estimated results which include; unit root tests of the variables on the time series, cointegration results and impulse response analysis with forecast error variance decomposition results are presented here.

Unit root test

The study conducts unit root tests on the variables with Augmented Dickey Fuller (ADF). Outcomes of the tests are presented in Table 1. According to ADF test statistics at level, there is enough evidence to infer that the null hypothesis is true and the alternative hypothesis is false. On the other hand, at first difference with constant, there is enough evidence to infer that the null hypothesis is false and the alternative hypothesis is true. The study therefore, rejects the null hypothesis of unit root at first difference and not rejects the alternative hypothesis. However, the paper adopts ADF Test as the statistic that produces first difference stationary of all the series at 1% level of significance. In conclusion, there is enough empirical evidence to infer that, all series at first difference appears to be I (1) processes. Therefore, this allows us to conduct co-integration tests among the variables.

VAR based on Johansen and Juselius 1990 Cointegration test

To achieve objective one, the study accessed long run relationship among the variables using VAR based Johansen and Juselius (1990). Since oil price, exchange rate, agriculture output, and real GDP contain unit root at level test but stationary at first difference, the study would now conduct cointegration test as suggested through by Johansen and Juselius to see whether if either (1) GDP and Oil Price have common relationship or (2) GDP and Unrest have common relationship or (3) the above mentioned Five (5) macroeconomic variables (GDP, Oil

Table 1a. Unit root test at level with constant.

Variables	ADF	Integration
RGDP	2.07	-
OIL PRICE	-2.55	-
EXC RATE	0.39	-
AGR	3.26	-

Source: researchers' computations, E-views, 7.1, 2015. *, ** and *** indicate statistical significance at the 1%, 5% and 10% level, respectively. With constants only: Mckinnon (1996) critical values are; -3.470(1%), -2.879(5%) and -2.576(10%).

Table 1b. Unit root test at 1st difference with constant.

Variables	ADF	Integration
RGDP	-17.87*	I (1)
OIL PRICE	-10.25*	I (1)
EXC RATE	-15.56*	I (1)
AGR	-14.08*	I (1)

price, Agr output, Exchange rate and Unrest) have a common long run relationship in Nigerian economy. The results of cointegration tests are shown in Tables 2(a and b) to 3(a and b).

From Tables 2(a and b) and 3(a and b), the normal criterion to find the result of trace test, is to compare the trace value with the critical value. If the trace value is higher than the critical value it means there is cointegration. This method of analysis suggests that there is the existence of long run relationship between GDP, as dependent variable and OILP and UNRST as independent variables. This shows thatboth the trace and maximum eigenvalue tests indicate that there are two cointegrating equations at the 5% significance level among the volatility of oil price, unrest and GDP.

From Table 4(a and b), this method of analysis suggests that there is the existence of long run relationship between GDP, as dependent variable and OILP, EXR, AGR, and UNRST as independent variables. This suggests that there are only two cointegrating equation at 5% level of significance i.e. the above table indicates two cointegrating equations at 5% level of significance. Therefore, Table 4(a and b) test statistics indicates that the null hypothesis stated that all variables under study do not have long run relationship can be safely rejected at all levels of significance and not reject the alternative hypothesis by concluding that there is enough empirical evidence to infer that the alternative hypothesis is true. Therefore, these series do have common long run relationship in Nigeria considering the period under review.

Table 2a. Unrestricted cointegration test (trace statistics) between GDP and oil price.

Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	0.05 critical value	Prob.**
None *	0.1559	38.063	15.495	0.000
At most 1 *	0.0607	10.263	3.8415	0.001

Source: Researchers computation, E-views 7.1, 2015.

Table 2b. Unrestricted cointegration test (Maximum Eigen Value Statistics) between GDP and oil price.

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen statistic	0.05 critical value	Prob.**
None *	0.1559	27.800	14.265	0.000
At most 1 *	0.0607	10.263	3.8415	0.001

Source: Researchers computation, E-views 7.1, 2015.

Table 3a. Unrestricted cointegration test (trace statistics) between GDP and unrest.

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 critical value	Prob.**
None *	0.1445	44.324	15.495	0.000
At most 1 *	0.1079	18.719	3.8415	0.000

Source: Researchers computation, E-views 7.1, 2015

Table 3b. Unrestricted cointegration test maximum Eigen value statistics between GDP and unrest.

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 critical value	Prob.**
None *	0.1446	25.605	14.265	0.000
At most 1 *	0.1079	18.719	3.8415	0.000

Source: Researchers computation, E-views 7.1, 2015

Blanchard and Quah (1989) Long run Pattern (SVAR Model)

To achieve the second objective, the study has detailed discussion on Structural vector autoregressive framework by which restrictions are based and supported by economic theory. As already explained for just-identified restrictions to be achieved, we need at least one restriction i.e. $n(n+1)/2$ restrictions and following Blanchard and Quah (1989) framework, to test the null hypothesis that oil price shocks and unrest both do have long-run impact on economic growth.

The unrest is regarded to have temporary effect being the research gap; therefore, all the temporary effects are restricted to zero. After estimating the just identified restrictions, the results generated from impulse responses are reported in Figure 1 (a and b). The estimation of SVAR is carried out in a multivariate VAR model. The results of the unit root tests indicate that all the series are I(1) and lag 3 is used which suggests absence of serial correlation.

Figure (1a) presents the impulse responses from an oil

Table 4a. Unrestricted cointegration test (trace statistics).

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 critical value	Prob.**
None *	0.6044	222.50	69.819	0.000
At most 1 *	0.2272	70.413	47.856	0.000
At most 2	0.1353	28.145	29.798	0.077
At most 3	0.0257	4.3108	15.495	0.877
At most 4	0.0003	0.0486	3.8415	0.826

Source: Researchers computation, E-views 7.1, 2015

Table 4b. Unrestricted cointegration test maximum eigen value statistics.

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 critical value	Prob.**
None *	0.6044	152.09	33.877	0.000
At most 1 *	0.2272	42.268	27.584	0.000
At most 2 *	0.1353	23.834	21.132	0.020
At most 3	0.0257	4.2623	14.265	0.840
At most 4	0.0003	0.0486	3.8415	0.826

Source: Researchers computation, E-views 7.1, 2015

Accumulated Response of GDP to Cholesky
One S.D. Innovations

Accumulated Response of OILP to Cholesky
One S.D. Innovations

Figure 1a. Impulse responses.

**Accumulated Response of GDP to Cholesky
One S.D. Innovations**

**Accumulated Response of UNRST to Cholesky
One S.D. Innovations**
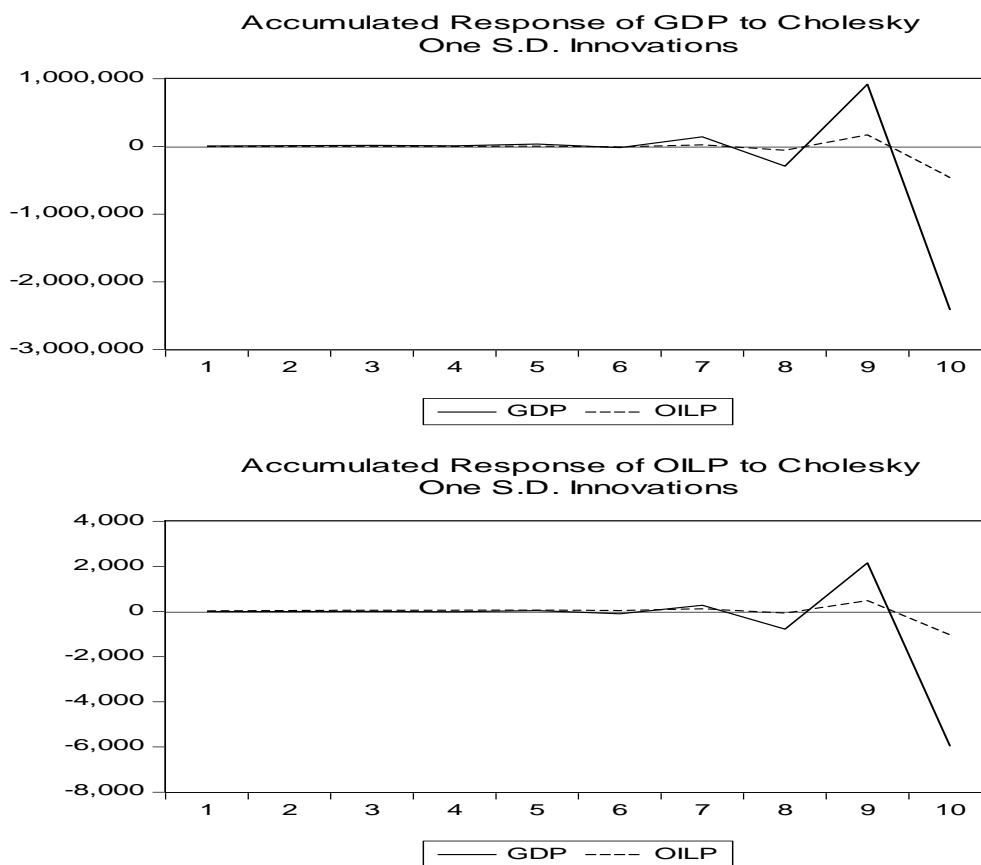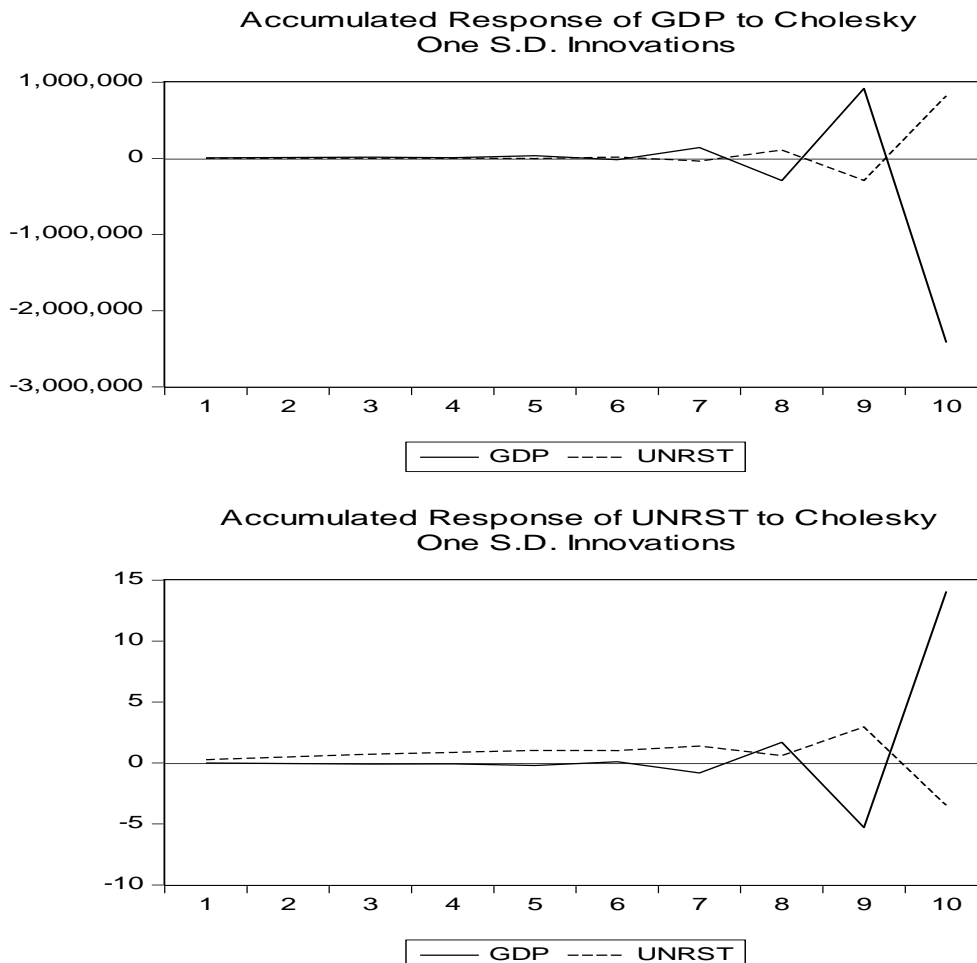

Figure 1b. The bivariate model for *rgdp* and *unrest*.

price to *rgdp* in the bivariate model for *rgdp* and *oil price* variable. It shows that the level of *rgdp* increases to about 0.2% from 1st quarter up to 7th quarters, i.e. the resultant shocks due to *oil price* positively responses which lead to appreciation in the rGDP innovation. Meanwhile, in Figure (1b) shows the bivariate model for *rgdp* and *unrest*. It indicates a negative response of *unrest* to *rgdp* innovations from 1st to 7th quarters but from that quarter it dwindles up to last quarter of the innovations. The results indicate that oil price shocks and unrest in international oil market do have impacts on the economic growth in Nigeria considering the period under review.

More so, the study rejects the null hypothesis that states oil price shocks and unrest do not have long run impact on the economic growth considering the period under review by stating that, there is enough evidence to infer that the null hypothesis is false and that the alternative hypothesis is true. The study concludes that there are enough empirical evidences to infer that the alternative hypothesis is true and these variables have impacts on the economic growth in the long-run.

However, both impulse responses analysis for oil price and unrest depict positive and inverse implications with the level of real GDP respectively. This is consistent with prior expectation of the theory. And also consistent with the VAR results in Aliyu (2009), that positive relationship for both an oil importing and exporting country like Nigeria. In similar findings, there is a need for policy-makers to consider unrest as another source of shocks before oil price shocks being a major source of shocks or fluctuations for many variables in the Nigerian economy as similar prescriptions for New Zealand in the study by Grounder and Bartleet (2007). Looking critically at Figures (1a) impulse responses, we can now have an overwhelming feature of Dutch Disease (resource curse) hypothesis in Nigeria and the same as in Olomola and Adejumo (2006).

Forecast error variance decomposition

Under this fragment, the forecast error variance decom-

Table 5a. Variance decomposition of AGR.

VAR. DECOMP	S.E	AGR	EXR	OILP	UNRST	GDP
1	4626	100.0*	0.000	0.000	0.000	0.000
2	7545	94.98*	1.129	0.405	0.743	2.743
3	2219	96.96*	0.323	0.047	0.180	2.489
4	5888	97.14*	0.321	0.132	0.253	2.155
5	1666	97.38*	0.292	0.069	0.231	2.028
6	4572	97.25*	0.312	0.082	0.239	2.122
7	1.27E	97.28*	0.305	0.073	0.234	2.120
8	3.51E	97.27*	0.307	0.076	0.236	2.110
9	9.74E	97.28*	0.306	0.075	0.235	2.107
10	2.70E	97.27*	0.308	0.076	0.235	2.109

Source: study 2015. Asterisks indicate presentations of a variable shocks in relation to other innovations in the system.

Table 5b. Variance decomposition of EXR.

VAR. DECOMP	S.E	AGR	EXR	OILP	UNRST	GDP
1	21.96	3.590	96.42*	0.000	0.000	0.000
2	41.44	55.01	44.09*	0.800	0.003	0.099
3	68.45	75.66	20.68*	1.086	0.510	2.067
4	179.35	92.27	5.338*	0.169	0.136	2.096
5	4770.0	96.62	0.769*	0.162	0.298	2.149
6	1340.0	97.14	0.519*	0.071	0.214	2.060
7	3668	97.27	0.289*	0.090	0.246	2.115
8	10168	97.27	0.321*	0.075	0.232	2.110
9	28160	97.28	0.302*	0.076	0.237	2.109
10	78018	97.27	0.308*	0.075	0.235	2.108

Source: study 2015. Asterisks indicate presentations of a variable shocks in relation to other innovations in the system.

position tells us exactly how much of the unanticipated changes of the variables are explained by different shocks. The variance decomposition generally suggests that oil price shocks are considerable source of volatility for most of macroeconomic variables. Tables 5(a to e) present the results of the forecast error variance decomposition of rgdp, exchange rate, oil price, agriculture output and unrest at various periods.

Table 5a shows that the variance decomposition of agriculture output accounts for a relative proportion of forecast error due to its own innovation throughout the periods. From the table, oilp, unrst and EXR contributions to agriculture output fluctuations are less than that of rGDP in the given period. I.e. exchange rate, oil price and unrest explain about 0.308, 0.076 and 0.235%, while gross domestic product explains about 2.109% fluctuations in agriculture at 10th periods respectively. Contemporaneously and over the time horizon, agriculture output drives its own variance by over 100%

at 1st period.

Table 5b shows that the variance decomposition of exchange rate accounts for the highest proportion of forecast error due to its own innovation in the first period. Exchange rate accounts for 96.42% in the 1st period. Its proportion in the 2nd period decreases continually until it reaches 0.308% in the 10th period. While the innovations of rgdp, agriculture output, oil price, and unrest explain about less than one percent in the 1th period. AGR increases from 2nd to 10th periods. But the contributions of rGDP, OILP and UNREST to EXR are very small because they dwindle throughout the periods.

Table 5c shows that the variance decomposition of oil price accounts for the highest proportion of forecast error due to its own innovation while the innovations of agriculture output, exchange rate, unrest and rgdp explain about 97.28, 0.306%, 0.235% and 2.109% at 10th period respectively. Contemporaneously and over the time horizon, oil price drives its own variance by over

Table 5c. Variance decomposition of OILP.

VAR. DECOMP	S.E	AGR	EXR	OILP	UNRST	GDP
1	25.39	1.286	1.250	97.47*	0.000	0.000
2	35.86	19.81	5.948	72.68*	0.242	1.319
3	51.83	54.45	3.073	39.30*	0.140	3.137
4	150.3	93.25	0.635	4.661*	0.286	1.169
5	361.0	96.16	0.448	0.929*	0.277	2.183
6	1027.	97.16	0.302	0.159*	0.224	2.159
7	2812.	97.23	0.314	0.096*	0.239	2.118
8	7830.	97.29	0.303	0.075*	0.234	2.097
9	2165	97.27	0.308	0.077*	0.237	2.200
10	6000	97.28	0.306	0.075*	0.235	2.109

Source: study 2015. Asterisks indicate presentations of a variable shocks in relation to other innovations in the system.

Table 5d. Variance decomposition of UNRST.

VAR DECOMP	S.E	AGR	EXR	OILP	UNRST	GDP
1	0.264	0.022	0.628	0.217	99.13*	0.000
2	0.356	0.235	0.354	2.373	95.79*	1.249
3	0.455	10.37	0.228	5.396	81.93*	2.076
4	0.542	27.06	0.445	5.133	65.72*	1.642
5	1.035	75.48	0.169	1.427	20.81*	2.200
6	2.444	93.55	0.400	0.350	3.713*	2.000
7	6.746	96.70	0.279	0.109	0.790*	2.129
8	18.55	97.30	0.318	0.080	0.286*	2.107
9	51.45	97.26	0.303	0.076	0.248*	2.200
10	142.5	97.27	0.307	0.076	0.236*	2.108

Source: study 2015. Asterisks indicate presentations of a variable shocks in relation to other innovations in the system.

Table 5e. Variance Decomposition of GDP.

VAR. DECOMP	S.E	AGR	EXR	OILP	UNRST	GDP
1	7286	36.09	0.147	0.724	0.327	62.72*
2	1478	74.00	0.239	0.336	0.097	26.33*
3	2375	84.88	0.219	0.534	0.530	13.83*
4	5712	95.63	0.521	0.105	0.329	3.419*
5	1467	95.93	0.355	0.066	0.205	3.444*
6	4208	97.48	0.279	0.078	0.236	1.932*
7	1156.	97.24	0.309	0.080	0.236	2.140*
8	3206.	97.29	0.306	0.075	0.237	2.095*
9	8880	97.26	0.307	0.076	0.235	2.130*
10	2459	97.28	0.306	0.075	0.236	2.105*

Source: study 2015. Asterisks indicate presentations of a variable shocks in relation to other innovations in the system.

97.47% at 1st period.

Table 5d shows that the variance decomposition of unrest accounts for the highest proportion of forecast error due to its own innovation while the innovations of rgdp, exchange rate, agriculture output and oil price explain about 2.108, 0.307% 97.27 and 0.076% at 10th period respectively. Contemporaneously and over the time horizon, unrest drives its own variance by over 99.13% at 1st period. After the 1st and 2nd periods, UNRST deceases drastically to 0.236% in 10th period which is less than the proportions of rGDP, EXR, and AGR in the 10th periods (i.e. 2.108, 0.307 and 97.27%).

Table 5e shows that the variance decomposition of rGDP accounts for the highest proportion of forecast error due to its own innovation. This means that the fluctuations of GDP are explained mainly by GDP shocks and other variables shocks, in the long run. Gross Domestic Product (GDP) accounts for 63.72% in the 1st period. Its proportion decreases continually until it reaches 4.04 % in the 10th period. EXR, OILP, AGR and OILP shock account for less that 1% in the 1st period. But AGR proportion increases over time and reaches 94.56% in the 10th period. While, the proportion of EXR, OILP and UNRST dwindles over time from the $2^{nd} – 10^{th}$ periods. The result shows that in the long run Agriculture output shocks account for the major variation in gross domestic product.

DISCUSSIONS/POLICY IMPLICATIONS

The policy implications of the results from VAR and Structural VAR have striking issues in the forecasting performance of an estimate; estimation using Structural VAR has error band while using unrestricted VAR has no error band. The findings from this study indicated usefulness of these variables through their contributions in predicting future path of Nigerian economic growth. Jimenez-Rodreguez and Sanchez (2012), Olomola and Adejumo (2006) reported similar result with respect to oil price shocks both in the Nigerian economy and Japan economy. In the analysis, agriculture output has the highest long run contribution, followed by exchange rate then oil price. It is widely accepted that agricultural output contributes to economic growth.

Nevertheless, the result from the estimated regression output is in line with a priory expectation. In other words, it mirrors the fact that unrest has ripple effect on the economy. However, considering the research scope, unrest has inverse ripple effect on the Nigerian macroeconomic variables with its coefficient correctively signs. This suggests that, to achieve meaningful macroeconomic targets as far as Nigerian economy is concerned, emphasis should be geared towards addressing unrest.

In addition to the above, the number of cointegrating relationship has also played a key role in this line of exercise. So, to impose restrictions to recover the shocks in oil price and unrest, the study will now have to refer back to the number of cointegrating vectors. As for the broad objective, the study normalizes the coefficients of the regression, with one cointegrating equation; the theory needs only one restriction, that is, the just identified restriction.

To this end, this study examines the impact of oil price shocks on rGDP, exchange rate, agriculture output and unrest on the Nigeria's economic growth. Since Nigeria is an oil producing country, naira real exchange rate appreciates with higher oil prices leading to higher inflow of foreign exchange into the economy. Although this may sound good to the economy, unrest has ripple effect on real economic activities as it reduces the volume of oil output and this translates into less optimum revenues.

CONCLUSION AND RECOMMENDATIONS

In conclusion therefore, unrestricted VAR has been extensively used in recent empirical research to assess the evidence in support of central proposition of macroeconomics, such as the impact of oil price shocks and aggregate variables. Estimated impulse response and forecast error variance decomposition have also played a key role in these exercises. The approach has been vigorously pursued following the research of Blanchard and Quah (1989).

The study raises some important issues about what is expected to be learning from this line of empirical research. The asymptotic analysis shows that in studying shocks or volatility on frequencies of annual data the clustering effect is gone.

Some previous research as e.g. Olomola and Adejumo (2006) has shown that estimated impulse response can be very sensitive to changes in VAR model specification, such as the inclusion of trends and additional variables; and there has been debate about the robustness of the empirical findings in this line of research. This result corroborates with earlier findings on unrestricted VAR impulse response, given a clear analytical reasons why impulse responses from unrestricted VARs are unreliable even in very large samples and show that different models in the VAR class produce impulse response with very different behavior. Model like unrestricted VAR has no theory supporting it and then produces inconsistent impulse responses. It is particularly important that the cointegrating relations in a system (hence the number of unit roots) be estimated consistently.

In general, the results upon being a pioneer study for controlling the effect of unrest (systemic risk) to the study impact of oil price shocks with an approach that follows structural econometric model, while there are certainly differences in forecasting performance in time series

models, the most serious disagreements between time series model arise in policy analysis. The main conclusion is that, differing treatment of cointegration in the models plays a big role in affecting the outcomes of policy analysis. Although this issue was not investigated in the previous empirical assessment, it seems likely (by analogy to the result for structural – just identifying restriction approach) that similar effect to those had discovered come into play in structural econometric models when unit roots or near unit roots are estimated.

Therefore, the study recommends that government shoulddiversify the economic base from oil to non-oil as a necessary condition for sustainability and growth.Also government should improve the security in the Niger Delta area with a view to boosting oil output, hence leading to increase oil revenue and by implication growth of the economy.

Finally, in analyzing economic shocks we have to be careful in the choices of variables; the study recommends carrying out misspecification tests of no-serial correlation, normality and heteroscedasticity tests for the model. In this case the study recommends diagnostics test.

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