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EDITORIAL

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EDITORIAL

La Revue Economique de l'Afrique de l'Ouest fournit une tribune pour la participation de tous les acteurs clés au processus d'intégration monétaire de la région de la CEDEAO, en matière de recommandations de politiques économiques. La revue est une publication bilingue (en Français et en Anglais) bi-annuelle (Juin et Décembre) de l'Agence Monétaire de l'Afrique de l'Ouest (AMAO), dont le mandat comprend, entre autres, le renforcement de la Coopération Monétaire, la Consultation entre Etats membres de la CEDEAO, la facilitation de l'harmonisation et la coordination des politiques monétaires et budgétaires.

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La problématique du choix du régime de change dans les pays de la CEDEAO

Mouhamadou Bamba DIOP* and Alsim FALL**

Résumé

Dans la perspective de la création de la future monnaie unique par les pays membres de la CEDEAO, il est intéressant de s'interroger sur la pertinence du régime de change à adopter. Ce papier traite cette question en adoptant une analyse basée sur l'expérience des pays en développement et sur les résultats d'un modèle d'équilibre général dynamique stochastique en présence de rigidités nominales. L'analyse montre que les régimes de change fixe et intermédiaire devraient être privilégiés par les pays de la CEDEAO. Le régime de change fixe offre plusieurs avantages, car il permet de stabiliser l'économie sans détériorer les performances de croissance. Cependant, sous ce régime, l'économie serait davantage exposée aux crises de change. Sous ce rapport un régime de change intermédiaire semble être plus approprié.

Classification JEL: E12, E58, F31, F41, F47

Mots Clés : Régime de change, performances économiques, CEDEAO, modèle DSGE en économie ouverte

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1. Introduction

La question relative au choix du régime de change est d'une importance majeure pour le développement économique d'un pays. Les débats autour de ce sujet sont d'ailleurs vieux de deux cent ans. Seulement, ils se sont posés avec plus d'acuité depuis les travaux de Friedman et de Mundell qui ont replacé cette problématique au centre de la macroéconomie internationale. Par ailleurs, à la suite de l'effondrement du système de Bretton Woods les pays ont désormais eu le libre choix d'adopter le régime de change (fixe, flottant ou intermédiaire) le mieux adapté à leurs besoins sur la base de critères qui leur sont propres. Les investigations aussi bien théoriques qu'empiriques ont essayé d'identifier le régime de change le plus approprié pour une économie en examinant ses effets sur les variables macroéconomiques. De nos jours, aucun consensus n'émerge de façon claire, d'où le traitement très galvaudé du « cas par cas », surtout dans les pays en développement.

Pourtant, au cours des années 90 et au début des années 2000, il se dégageait un consensus selon lequel les régimes de change intermédiaires seraient intrinsèquement fragiles et ne pouvaient constituer une politique crédible. Ce consensus est né de la succession de crises de change qui ont frappé les pays émergents (Mexique, 1994 ; Thaïlande, Indonésie et Corée du Sud, 1997 ; Russie et Brésil, 1998 ; Argentine et Turquie, 2000 ; Turquie, 2001 ; Argentine, 2002). Pour rappel, tous ces pays ont choisi des stratégies d'ancrage nominal assimilables à un régime de change intermédiaire. Dans le même temps, des pays émergents comme l'Afrique du Sud et le Mexique en 1998, ont pu échapper à la crise grâce à l'adoption d'un régime de change plus flexible. Ainsi, il a été reconnu que seules les solutions en coin – les caisses d'émission (*currency board*) et le flottement pur – étaient soutenables dans un environnement monétaire international marqué par la mobilité des capitaux. Récemment, le FMI a nuancé les positions extrêmes de ses anciennes études grâce aux investigations de Ghosh et Ostry et Tsangarides (2010), qui à travers les classifications *de jure* et *de facto* des régimes de change, ont évalué les effets des régimes sur un ensemble de variables relatives aux politiques monétaire et budgétaire, à l'inflation, à la croissance, aux crises économiques, au commerce et aux flux de capitaux. Il en ressort un message plus nuancé quant aux performances des divers régimes de change. En substance, les régimes plus rigides (fixe ou intermédiaire) permettent d'ancrer les anticipations inflationnistes, soutiennent la croissance de la production et favorisent l'intégration économique. Toutefois, ils limitent le recours aux politiques macroéconomiques, accroissent la vulnérabilité aux crises et freinent l'ajustement extérieur.

L'objet de cette étude est de contribuer à la réflexion sur les répercussions économiques éventuelles de l'adoption d'un régime de change commun par les pays de la CEDEAO, dans la perspective de la création de la future monnaie unique. Plus spécifiquement, l'étude cherche à mesurer les impacts liés au choix d'un régime de change sur les résultats macroéconomiques de l'espace communautaire (inflation, croissance, vulnérabilité aux crises, bien-être, etc.). Il faut préciser que, par rapport aux autres régions de l'Afrique, la CEDEAO est bien avancée dans la mise en place d'une intégration monétaire. Déjà, un sous ensemble de pays, qui constitue l'Union Economique et Monétaire Ouest Africaine (UEMOA), partage une monnaie unique depuis près de 60 années. Les autres pays de la CEDEAO se sont engagés à harmoniser leur politique monétaire et de change durant une période dite de transition. Pour cette raison, ils se sont regroupés au sein d'une même entité appelée la Zone Monétaire de l'Afrique de

l'Ouest (ZMAO). A terme, les deux entités devraient s'unir pour ne former qu'une seule zone monétaire. Il est dès lors naturel de s'interroger sur l'existence d'un régime de change qui puisse à la fois répondre aux besoins des pays membres de la CEDEAO. Par exemple, quelles garanties pourrait-on donner aux pays de l'UEMOA pour qu'ils changent de régime étant donné qu'ils ont, depuis 60 années, opté pour un régime de change fixe ?

Naturellement, il existe une littérature riche consacrée à l'étude de la future monnaie unique dans la zone CEDEAO. Les études se sont intéressées notamment :

- aux bénéfices tirés de la monnaie unique au regard des critères d'une zone monétaire optimale (Bangaké, 2008 ; Dupasquier et al. 2005) ; au commerce et à l'intégration financière (Gbetnkom, 2006 ; Goretti et Weisfeld, 2008 ; Masson, 2008 ; Sy, 2008) ;

- à la nature des chocs (régionaux ou idiosyncratiques) qui frappent les pays membres (Bénassy-Quéré et Coupet, 2005 ; Tsangarides et Sureshi, 2008 ; Xiaodan et Yoonbai, 2009 ; Dufrenot, 2009a) ;

- à la coordination des politiques macroéconomiques au regard d'éventuels comportements individualistes (passager clandestin, aléa moral) de certains Etats membres (Debrun et al. 2005 ; Masson et Patillo, 2001, 2002) ; et

- à la convergence nominale (Alagidede et al. 2008, Dufrenot, 2009b).

La présente étude est alors une contribution supplémentaire à cette littérature déjà existante. Mais, elle se veut à la fois exhaustive et rigoureuse en cherchant à analyser les politiques macroéconomiques (budgétaires et monétaires) mises en œuvre par les pays membres, en rapport avec leur politique de change. Les conséquences de ces politiques en termes de stabilité et de croissance devraient éclairer la réflexion quant au choix d'un régime de change optimal ou consensuel. Au-delà de cette analyse factuelle et empirique, l'étude aura à exploiter d'autres méthodes de simulations dynamiques et stochastiques pour étayer ses résultats.

Le reste de l'article s'article comme suit. La section 2 se consacre à une revue de la littérature essentiellement théorique sur les principaux facteurs devant présider au choix du régime de change approprié. La section 3 présente les faits stylisés. Il est question, dans cette section, d'étudier les relations entre le choix du régime de change, les politiques macroéconomiques et les performances macroéconomiques des pays membres de la CEDEAO. L'analyse est menée au regard des résultats empiriques les plus récents dans les pays en développement. La section 4. se propose d'établir un modèle d'équilibre général dynamique stochastique (DSGE), pour renforcer l'analyse à travers des simulations d'impacts. Les résultats du modèle DSGE sont présentés à la section 5. et la dernière section est réservée à la conclusion et aux recommandations.

2. Survol de la littérature

Pour de nombreux pays, le choix du régime de change représente la décision de politique économique la plus importante du fait que le taux de change est une variable clé dans la

détermination des flux des échanges des biens et services et des capitaux. A cet égard, il exerce une pression importante sur la balance des paiements, les prix ainsi que d'autres variables macroéconomiques. La problématique du choix du régime de change remonte de plus de deux siècles. Mais elle a pris un grand intérêt depuis la mise en place du système de Bretton Woods. Friedman (1953) s'est insurgé contre ce système arguant que les taux de change fixes étaient générateurs de crises spéculatives et d'instabilité. Les travaux de Mundell (1960) sont allés au-delà de la conclusion de Friedman en soulignant le caractère important de la mobilité du capital. Ceux-ci ont souligné qu'en cas de mobilité du capital, le système idéal est celui du taux de change fixe car le taux d'intérêt influe directement sur la balance des paiements. Par contre, si le capital est immobile, il est préférable d'opter pour un régime de change flexible.

D'une manière générale, on distingue deux types d'objectifs relatifs aux choix du régime de change ; un objectif de stabilité illustré par une minimisation de la variance de l'output et des prix et un objectif de bien-être illustré par la maximisation d'une fonction d'utilité. L'objectif de stabilité, qui consiste à une minimisation d'une fonction de perte, est une approche retenue par bon nombre d'auteurs tels que Friedman (1953), Mundell (1960, 1961, 1963), Aizenman et Frenkel (1985), Aizenman et Hausmann (2001) et Allegret, Ayadi et Haouani Khouni (2006). L'objectif de bien être associé à une maximisation d'une fonction d'utilité est mis en évidence dans les travaux de Lapan et Enders (1980), Helpman (1981), Eaton (1985), Chinn et Miller (1998), Neumeyer (1998) et Obstfeld et Rogoff (1998). La question du choix du régime de change – notamment des deux solutions en coin qui sont l'ancrage pur ou le flottement libre – devient plus complexe lorsque l'analyse doit tenir compte de la source des chocs survenant sur l'économie. Le résultat le mieux partagé dans la littérature est qu'aucun des régimes n'est optimal. A ce propos, Frankel (1999 et 2004) a mis l'accent sur l'existence d'un large spectre dans le choix possible du degré de flexibilité/rigidité du taux de change, compte tenu de la variété des chocs qui affectent les économies ainsi que leur évolution au cours du temps. L'interprétation des chocs domestiques est plus délicate et nécessite de distinguer les chocs monétaires des chocs réels. Le modèle d'Allegret et al. (2006) inspiré de celui de Aizenman et Frenkel (1985) et Aizenman et Hausmann (2001) a mis en rapport le degré de flexibilité/rigidité du taux de change et les chocs affectant l'économie ainsi que les objectifs de politique économique. A cet effet, leurs résultats ont montré que le degré de flexibilité du taux de change tend à baisser lorsque : *i)* l'impact de la variation du taux de change sur les prix domestiques (pass-through) est élevé, *ii)* la volatilité des chocs nominaux relativement aux chocs réels est grande, *iii)* la perte associée à l'inflation est importante et *iv)* le biais discrétionnaire sur le marché du travail est élevé. En outre, la diminution du degré de flexibilité entraine une augmentation de bien-être dans une économie où les producteurs comptent sur le système bancaire pour financer leur besoin en capital.

Quel que soit l'objectif retenu par les autorités, la présence de chocs internes ou externes influence le choix du régime. Dans la mesure où il n'existe pas de régime de change qui soit approprié pour tous les pays en tout temps, Ripoll (2001) élabore une liste de facteurs pouvant aider les Etats à choisir leur propre régime de change. Ces facteurs sont notamment: la taille et de degré d'ouverture de l'économie, le niveau d'inflation, les chocs internes et externes, la mobilité du capital, le degré de flexibilité des prix et des salaires, le degré de crédibilité des autorités monétaires et le système de fixation des prix.

Dans un autre registre, de nouveaux travaux portant sur le recours aux modèles DSGE ont été récemment menés pour évaluer le comportement d'une économie à la suite d'un changement de régime de change. Daria et Curdia (2007), Kollmann (2002), Dam Niels et Linaa et Arne (2005a, 2005b), Holtemoller (2007), Ajevskis et Vitola (2009), Salins et Bénassy-Quéré (2010) ont, tour à tour, investi ce nouveau champ de l'analyse économique. Toutefois, la plupart des investigations de la nouvelle économie keynésienne portent sur une opposition entre régimes de change flexible et fixe tout en négligeant les régimes intermédiaires. Pour Salins et Bénassy-Quéré (2010), l'adoption très répandue du régime de change intermédiaire dans les pays émergents ou en développement, malgré la violation du triangle d'impossibilité de Mundell, est à chercher dans les arguments avancés par Calvo et Reinhart (2002). Selon ces auteurs, « la réticence des pays à laisser flotter leur monnaie est la conséquence de plusieurs facteurs tels que : les pratiques de tarification au marché ; l'endettement en monnaie étrangère ; les transactions, y compris domestiques, effectuées en devises (péché originel) ; et les marchés financiers très peu développés pour permettre une bonne couverture du risque de change». Cependant, la nouvelle économie keynésienne se focalise de moins en moins sur les solutions en coin et tente d'explorer une large gamme de régimes de change, dans le but de comparer leurs performances économiques. Dans ce sens, les réflexions menées par Salins et Bénassy-Quéré (2010) montrent que lorsqu'il n'y a pas frictions qui entravent l'ajustement des salaires, les résultats plaident en faveur des régimes de change flexible. Toutefois, pour une économie qui subit pour l'essentiel des chocs étrangers de productivité et du taux d'intérêt et en présence de viscosité des salaires, les simulations de Salins et Bénassy-Quéré prônent le choix du régime de change intermédiaire et montrent par la même occasion que les premiers modèles DSGE ont surestimé les mérites des régimes de change flottant pour avoir ignoré l'existence possible de rigidités nominales des salaires.

3. Quelques faits stylisés relatifs aux systèmes des régimes de change dans la CEDEAO

De nombreux travaux empiriques ont été menés pour aider à la formulation d'un choix clair du régime de change. Toutefois, les résultats ne permettent pas d'aboutir à des conclusions formelles et parviennent uniquement à établir les mérites de chaque type de régime de change. Ghosh, Ostry et Tsangarides (2010) ont confirmé cette absence de consensus. Cependant, leur étude fait ressortir certains enseignements qui peuvent se résumer ainsi :

• les régimes de change fixes conduisent à une inflation plus faible sans compromettre la croissance ;
• les régimes de change intermédiaires sont synonymes de bonne performance en matière de croissance économique, notamment dans les pays émergents, du fait qu'ils combinent une volatilité faible des prix et un niveau compétitif du taux de change;
• les régimes de change flottants ont plus de capacité à réduire la probabilité d'occurrence de crises financières.

Le but de cette partie est d'examiner quelques faits stylisés des économies dans les pays de la CEDEAO à la lumière des éléments théoriques et résultats empiriques bien connus. Cela

permet de procéder à une comparaison en termes de performance économique entre les régimes de change expérimentés depuis près de trois décennies.

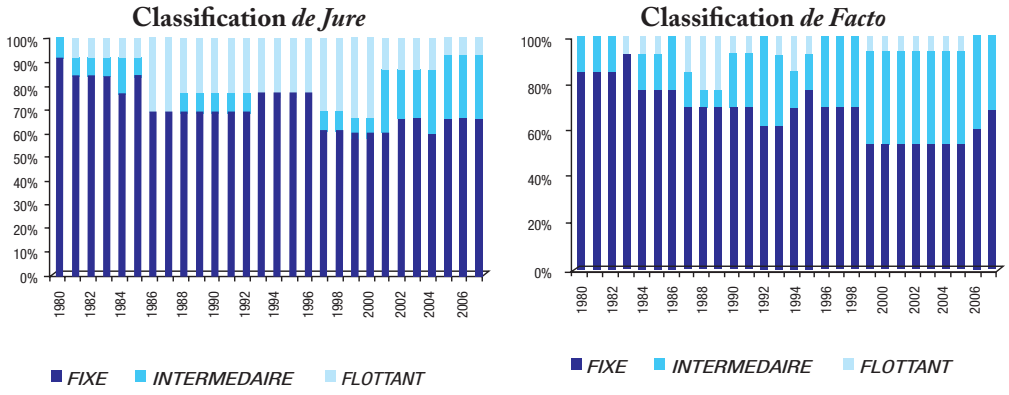
3.1 Analyse de l'évolution des régimes de change dans la zone CEDEAO

L'évolution des régimes de change dans la zone CEDEAO est présentée au graphique III.1. Cette évolution montre la prédominance du régime fixe le long de la période d'analyse. Cela s'explique par la constance du régime de change fixe dans les pays UEMOA qui constituent 53,3% des pays. Cependant, le poids du régime fixe réellement mis en œuvre (de facto) est légèrement moins élevé que celui du régime fixe déclaré (de jure), ce qui montre que certains pays entreprennent des ajustements plus ou moins importants sur leur taux de change malgré leur décision de le maintenir stable. Parmi ces pays, on peut citer la Guinée Bissau qui, avant son entrée dans la zone UEMOA était confrontée à la difficulté de stabiliser son taux de change. Sur la période récente, les politiques de change menées par le Cap-Vert et la Guinée sont, dans les faits, légèrement plus flexibles que celles déclarées par ces Etats. Le graphique III.1 décrit également une baisse tendancielle des pays adoptant un régime fixe. Cette baisse apparait plus clairement dans la distribution de facto où le taux des pays à régime de change fixe converge vers son niveau minimal de 53,3%.

En ce qui concerne le régime de change flottant, il existe un nombre non négligeable de pays ayant déclaré poursuivre cette politique, particulièrement sur la période allant de la moitié des années 80 à la fin des années 90. Cependant, peu de pays ont procédé à sa mise en œuvre effective. D'ailleurs, le graphique III.1 fait état d'une évanescence de la proportion de ces pays sur la période d'analyse. Comme il a été évoqué plus haut, le comportement lié à la « peur du flottement » est un phénomène bien connu en Afrique de l'Ouest. En effet, au-delà de la recherche d'une plus grande stabilité, les outils monétaires et financiers restent peu développés pour permettre à la plupart de ces pays de mener une politique de change flottant (voir Dufrénot et Sugimoto, 2009).

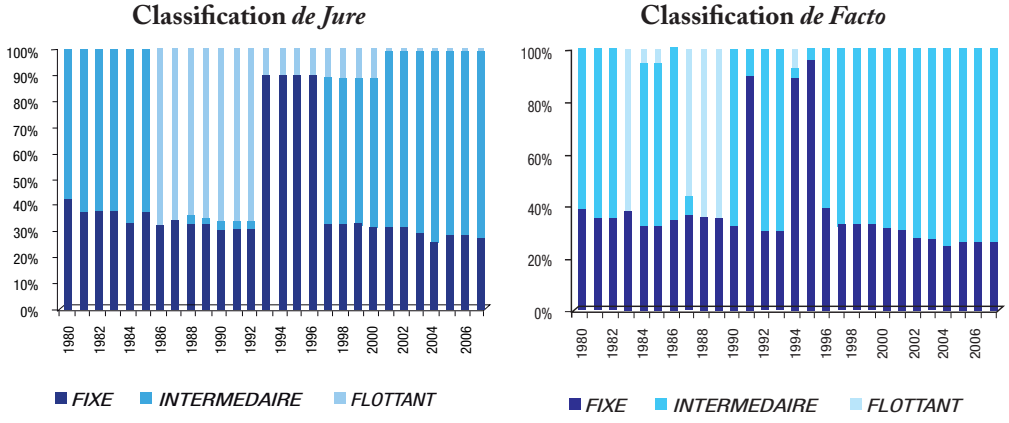
De toute évidence, la diminution progressive des régimes fixe et flottant est compensée par une augmentation mécanique du régime de change intermédiaire. Ce constat témoigne d'un certain abandon des « solutions en coin » qui pourtant ont été largement proposées dans la littérature économique. Durant la période 2000-2007, près de 30% des pays de la CEDEAO ont déclaré suivre ce régime tandis que 40% des pays ont opté pour son application effective. Sur les deux dernières années, la classification de facto note une disparition du régime de change flottant. Durant cette période, tous les pays membres de la ZMAO ont adopté un régime de change intermédiaire à l'exception de la Sierra Leone qui, à l'instar des pays de l'UEMOA, a opté pour une parité fixe.

GRAPHIQUE III.1 : Evolution des régimes de change des pays de la CEDEAO (*Sur la période* 1980-2007)



Sources : Données du FMI, calculs des auteurs.

GRAPHIQUE III.2 : Evolution des régimes de change avec prise en compte de la taille des économies (*Sur la période* 1980-2007)



Sources : Données du FMI, calculs des auteurs.

La prépondérance du régime intermédiaire est plus visible avec la prise en compte de l'importance de poids économique (graphique III.2). D'après la tendance des dernières années, le régime de change intermédiaire a concerné 75% de l'économie de la CEDEAO, tandis que le reste de l'économie a mené une politique de change fixe. Ce résultat est principalement lié à l'importance du poids économique du Nigéria dont le PIB représente près de 60% du PIB communautaire.

En résumé, les graphiques ci-dessus laissent apparaître que les pays de la CEDEAO ont privilégié les régimes de change fixe et intermédiaire. L'adoption de la future monnaie commune pourrait, à bien des égards, reposer sur le choix de l'un de ces deux régimes[1]. Il reste cependant à savoir le régime le plus approprié en termes de stabilité et de performance économique.

3.2 Régime de change et croissance dans les pays de la CEDEAO

Les développements théoriques mettant en relation le régime du taux de change nominal aux variables réelles ne sont pas fréquents. Cependant, il est possible de distinguer quelques canaux par lesquels le régime de change peut affecter la croissance économique. En premier lieu, le régime de change est supposé avoir une incidence sur le commerce international et sur l'inflation. Or, une plus grande ouverture vers l'extérieur et une inflation maîtrisée peuvent accélérer la croissance. En second lieu, le régime de change pourrait affecter les volatilités du taux de change réel (Baxter et Stockman, 1989) et des termes de l'échange (Broda, 2001), lesquelles peuvent réduire la croissance. Enfin, le régime de change pourrait agir sur le désalignement du taux de change réel (Mundell, 2000 ; Rodrik, 2008). En particulier, les pays à régime fixe sont souvent confrontés à un problème de surévaluation du fait d'une inflation plus élevée que celle du pays d'ancrage. La conséquence directe d'une surévaluation est la perte de compétitivité dont l'effet sur la croissance est négatif. Sur le plan empirique, l'impact du régime de change sur la croissance a fait l'objet de nombreuses études. Une importante contribution, à cet effet, est celle de Levy-Yeyati et Sturzenegger (2003). Ces derniers, à partir de données annuelles de 183 pays sur la période 1974-2000, ont montré que les pays à régimes de change flottant ont enregistré un taux de croissance annuel plus élevé de 0,78% par rapport aux autres pays. Cette différence de croissance a même atteint 1% lorsque les pays les plus avancés ont été écartés de la population. Pour conforter ces résultats sur le long terme, les données ont été agrégées sous forme de moyennes tandis que la variable du régime de change est mesurée par le pourcentage des années durant lesquelles un régime fixe est appliqué. Les estimations (en coupe instantanée) ont ainsi montré que la croissance est d'autant plus élevée que le régime de change est flexible. Selon Calvo (1999), les régimes de change fixes ont tendance à provoquer des craintes de dévaluation dues aux attaques spéculatives. En conséquence, les taux d'intérêt y sont élevés, ce qui peut réduire l'investissement et la croissance à long terme. D'ailleurs, la relation entre les crises de change et les crises bancaires (Kaminsky et Reinhart, 1999), ainsi que celle entre les crises bancaires et la croissance, sont également des facteurs déterminants qui soutiennent l'idée qu'une plus grande flexibilité est associée à des meilleures performances économiques. A partir de la régression de Levy-Yeyati et Sturzenegger sur les pays non industriels, Miles (2006) a ajouté un régresseur qui est la prime de risque dans le marché parallèle, laquelle est une source de distorsion dans l'économie. L'auteur a établi que le régime de change fixe pouvait agir négativement sur la croissance en augmentant la prime de risque. Ghosh, Gulde et Wolf (2003) ont estimé que l'arrimage à un panier de devises ainsi que divers régimes intermédiaires étaient plus favorables à la croissance que le régime de change flottant. Cependant, Husain, Mody et Rogoff (2005) ont montré que dans les pays les plus avancés, la croissance est plus rapide sous le régime de change flottant.

1 - Il faut toutefois noter que le débat reste ouvert quant à la pertinence des régimes fixe, intermédiaire et flottant dans la zone CEDEAO. Certains auteurs sont favorables à la mise en place d'un régime de change flottant, c'est le cas de Michailof (2007), Diboglu et Sissoko (2006).

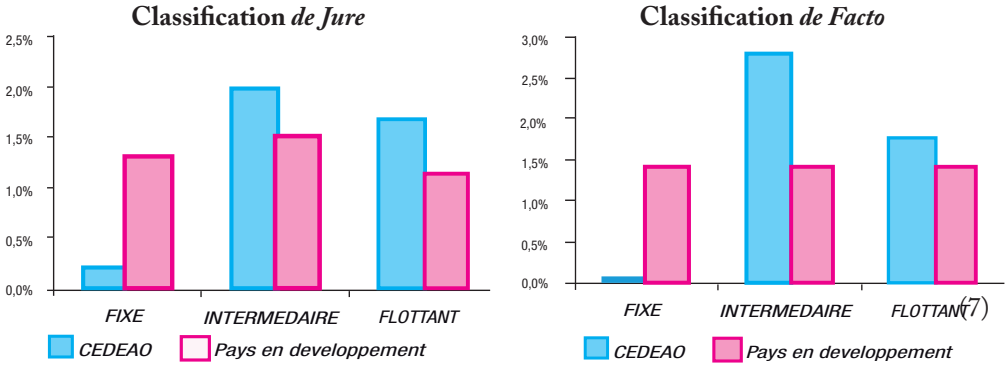
Bleaney et Fancisco (2007), quant à eux, ont attiré l'attention sur le fait que les méthodes de détermination des régimes de change pouvaient influencer les résultats. Selon eux, la classification de Reinhart-Rogoff minimise l'impact des régimes de change flottants par rapport à quatre autres types de classification[2]. Bleaney et Fancisco ont conclu que l'arrimage pur était associé à une croissance plus faible. Par contre, le flottement n'était pas lié à une croissance plus rapide. *Enfin, pour les pays en développement il n'existe pas de différence significative de croissance entre les régimes fixe et flottant*. D'une manière générale, *le régime de change n'est pas un facteur déterminant de croissance économique*. Les travaux de Klein et Shambaugh (2010) vont également dans le même sens. Ces derniers résultats peuvent être confirmés par les données empruntées à Ghosh, Ostry et Tsangarides (2010) et présentées au graphique III.7. Aussi bien sous la classification *de jure* que celle *de facto*, la différence des taux de croissance entre les régimes n'est pas importante même si le régime intermédiaire semble légèrement plus performant. Les estimations économétriques du tableau III.4 sont également cohérentes avec le graphique III.7. En effet, aucun des coefficients n'est significatif, excepté celui associé au régime fixe sous la classification de jure. Ce dernier, avec son signe négatif et significatif, corrobore l'idée de Miles (2006) selon laquelle, les régimes de change fixes déclarés sont dommageables à la croissance car ils entraînent une augmentation de la prime de risque du marché parallèle. Par ailleurs, le régime de change reste sans effets sur la croissance à long terme.

Considérant la CEDEAO en particulier, la différence de performance selon les régimes est bien perceptible. Les régimes de change intermédiaire et flottant donnent de meilleurs résultats en matière de croissance économique. Cependant, *il y a lieu de penser que les régimes ne sont pas nécessairement à l'origine de cette différence, comme le montrent les résultats économétriques*. Les explications peuvent de diverses.

Les pays à régime de change fixe sont essentiellement regroupés au sein de l'UEMOA. Durant les années 80 et 90, ces pays ont connu une succession de crises (crise d'endettement, crise bancaire, dévaluation) et de programmes d'ajustement qui ont rudement frappé leurs économies. Dans le même temps, la croissance démographique a régulièrement augmenté. Depuis, le début des années 2000, la Côte d'Ivoire, qui est la première économie de l'UEMOA, est exposée à une crise politique sans précédents. La conséquence de tous ces événements est que la croissance du PIB réel par tête est restée quasiment stable dans cette zone.

2 - Ces classifications sont celles de du FMI, de Levy-Yeyati et Sturzenegger, de Shambaugh, Bubula et Ötker-Robe

GRAPHIQUE III.7 Taux de croissance du PIB réel par tête des pays de la CEDEAO et des pays en développement



(7)

(8)

Sources : Ghosh, Ostry et Tsangarides (2010), données FMI/WEO, nos propres calculs pour le cas des pays de la CEDEAO.
Notes : les données des pays de la CEDEAO couvrent la période 1981 – 2007, celles des pays en developpement couvrent la période 1980 – 2007.

Les autres pays de la CEDEAO appliquent pour l'essentiel un régime intermédiaire ou flottant. Leur taux de croissance est plus élevé du fait de plusieurs facteurs. Le Nigéria est la deuxième puissance économique en Afrique et possède d'importantes ressources pétrolières qui lui permettent de maintenir un certain niveau de croissance. Le Ghana et le Cap-Vert ont mis en œuvre des politiques de développement dont l'efficacité se mesure à l'aune du niveau élevé de leurs taux de croissance.

TABLEAU III.4 : Réponses de la croissance économique aux différents régimes change, dans les pays en développement (estimations économétriques)

Variable dépendante	Taux de croissance annuel				Taux de croissance moyen sur 5 ans			
Taux de croissance du	De Jure		De Facto		De Jure		De Facto	
PIB par tête	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
Constante	-0,017	-0,67	-0,000	-0,01	-0,015	-0,29	-0,023	-0,44
Régime fixe	-0,007	-1,68*	-0,008	-1,21	0,006	0,77	0,002	0,11
Régime interm.	-0,001	-0,24	-0,002	-0,28	0,009	1,17	0,005	0,35
Nombre d'obs., R^2	767	0,19	913	0,18	188	0,23	188	0, 23

Source : Ghosh, Ostry et Tsangarides (2010)
Les astérisques indiquent la significativité aux seuils de 10 (*), 5 (**) et 1 (***) pourcent.

Enfin, les troubles politiques survenues au Libéria et à la Sierra Leone, ont fortement réduit la croissance démographique, atténuant ainsi la baisse du PIB réel par tête. Par ailleurs, pour les régimes de change intermédiaires, la nature pro-cyclique de la politique budgétaire peut, en partie, expliquer les performances économiques. En effet, en période de hausse de l'activité,

une expansion budgétaire peut exacerber la croissance. Rappelons que cette explication n'est que partielle car elle ne prend pas en compte les périodes de récession.

3.3 Régime de change et inflation dans les pays de la CEDEAO

L'assertion de Friedman et Schwartz (FS) selon laquelle « l'inflation est toujours et partout un phénomène monétaire » suggère que le régime de change exerce un effet indirect sur l'inflation. En particulier, l'une des fonctions essentielles du régime de change fixe est d'imposer la discipline dans la conduite de la politique monétaire. L'effet de discipline renvoie, lui-même, au contrôle strict de la croissance de la masse monétaire qui est la source de l'inflation selon la conception de FS. Cependant, la recherche théorique a identifié un autre canal par lequel la parité fixe peut exercer un effet direct sur l'inflation. Cette théorie suggère que la perception des agents économiques, quant aux préférences de la banque centrale en matière de politique monétaire, affecte directement l'inflation. Il est d'usage d'appeler ce phénomène « la crédibilité de la banque centrale ». Les études empiriques réalisées à ce sujet ont permis de corroborer cette thèse. Ainsi, il est raisonnable de s'attendre à ce que le régime de change fixe contribue à la maîtrise de l'inflation – au-delà de son effet de discipline sur la politique monétaire – dans la mesure où il renforce la réputation anti-inflationniste de la banque centrale. L'équation ci après permet de mieux saisir les effets de crédibilité et de discipline.

$$\pi_t = - \beta^{VC} FIX_t + \beta^{D} \%\Delta M_t - \beta_Y \%\Delta Y_t + \varepsilon_t$$

Effet de crédibilité **Effet de discipline**

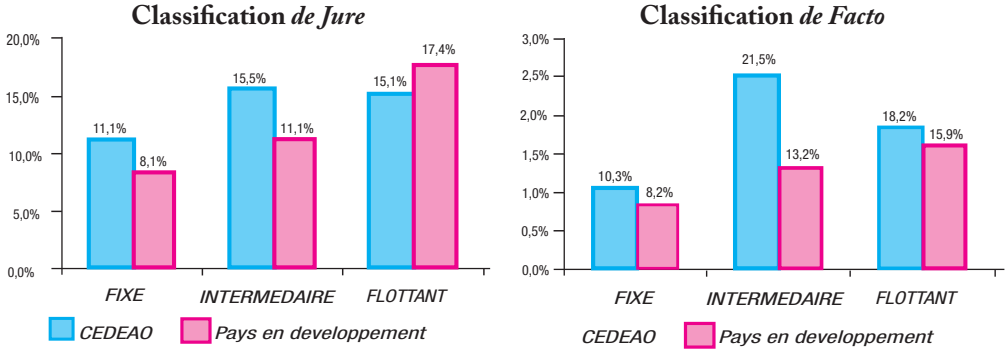
Avec π_t le taux d'inflation, FIX_t est une variable dummy qui est égale à 1 si le régime de change fixe et 0 s'il est flexible, $\%\Delta M_t$ le taux de croissance de la masse monétaire et $\%Y_t$ celui de revenu réel.

Ainsi le régime de change exerce un effet (direct) de crédibilité à travers la variable FIX et un effet (indirect) de discipline à travers la variable monétaire %ΔM. Cependant, l'effet de crédibilité du régime de change diffère selon l'horizon temporel considéré. Il est attendu que l'effet de crédibilité du régime de change soit important sur le court terme. En effet, les attentes de courte durée en termes d'inflation peuvent être influencées par la parité fixe et non pas seulement la croissance de la monnaie. Les estimations proposées dans cette partie s'inscrivent dans la logique du court terme. Par contre, à long terme cet effet direct disparait. A ce niveau, le régime de change n'exerce plus qu'un effet indirect, à travers la discipline monétaire.Il existe deux types d'études empiriques pour mesurer l'effet du régime de change sur l'inflation. L'un consiste à identifier les périodes durant lesquelles, le régime fixe est utilisé comme outil principal dans la stratégie de désinflation par les économies souffrant d'hyperinflation. Par exemple, Collins (1988) a remarqué que l'établissement du système monétaire européen (SME) en 1979 n'a pas été un facteur déterminant de la baisse du taux d'inflation observée les années subséquentes dans les pays membres. Végh (1992) et Calvo et Végh (1999) ont étudié le rôle de l'arrimage du taux de change dans la lutte contre l'hyperinflation.

Un second type d'analyse s'est orienté vers la recherche d'effets systématiques du régime de change sur l'inflation, sur la base d'un large panel de pays. Cette démarche est suivie dans le

cadre de cette analyse. Ghosh, Gulde et Wolf (1997) ont conduit l'une des premières études basées sur un large panel de pays en distinguant les régimes fixe, intermédiaire et flottant. Dans leur analyse portant sur les différences d'inflation, ces auteurs ont révélé que les taux d'inflation moyens étaient de 8,4% pour le régime fixe, 11,6% pour le régime intermédiaire et 15,2% pour le régime flottant. Il est à noter que ces chiffres ne sont pas très différents de ceux présentés dans cette étude pour les pays en développement (graphique III.8). Leur spécification économétrique est similaire à celle dont les résultats ont inspiré cette étude. Gosh et al. (1997) ont trouvé que, par rapport au régime flottant, les régimes fixe et intermédiaire ont permis de réduire l'inflation de 5% et 1,5%, respectivement, avec des coefficients significatifs. En ajoutant le taux de croissance de la masse monétaire dans le régression, leur résultats ont montré que la réduction de l'inflation sous le régime de change fixe est passé de 5% à1,8%, tandis que le coefficient du régime intermédiaire n'a pas été significatif. Par contre, la monnaie a exercé un effet positif et significatif. Gosh et al. (1997) ont conclu que le régime fixe a pu pleinement jouer son rôle en agissant sur la crédibilité et la discipline de la politique monétaire.

GRAPHIQUE III.8 : Taux de d'inflation des pays de la CEDEAO et des pays en développement



Sources : Ghosh, Ostry et Tsangarides (2010), données FMI/WEO, nos propres calculs pour le cas des pays de la CEDEAO.
Notes : les données des pays de la CEDEAO couvrent la période 1981 – 2007, celles des pays en developpement couvrent la période 1980 – 2007.

Ghosh, Gulde et Wolf (2002) ont étendu leur travail en distinguant les pays par le niveau de revenu. Pour les pays en développement, la varible dummie représentant à la fois les régimes fixe et intermédiaire est associée à un coefficient négatif et significatif. Levy-Yeyati et Sturzenegger (2001) ont trouvé le même résultat que Gosh et al. (1997) en ce qui concerne la baisse de l'inflation (1,8%) sous le régime fixe. Hussain, Mody et Rogoff (2005) ont également montré que l'impact du régime de change est différent selon le niveau de revenu du groupe de pays. A cet effet, le postulat selon lequel l'arrimage du taux de change exerce un effet négatif et significatif sur l'inflation, n'est valable que pour les pays émergents et en développement. Similairement, Bleaney et Francisco (2007) ont mis en évidence l'impact négatif de l'arrimage sur l'inflation, en spécifiant une régression qui ne comporte pas la croissance de la masse

monétaire. Enfin, un travail réalisé par Klein et Shambaugh (2010), a permis de confirmer que le rôle du régime de change fixe dans la maîtrise de l'inflation est surtout visible dans les pays en développement. Au-delà de ce résultat, leurs estimations ont corroboré l'hypothèse suivant laquelle sur le long terme, l'effet de crédibilité du régime de change fixe disparaît totalement. Seul l'effet sur la discipline monétaire reste apparent.

TABLEAU III.5 : Réponses de l'inflation aux différents régimes change, dans les pays en développement (*estimations économétriques*)

Variable dépendante	De Jure		De Facto		Consensus régime fixe	
Taux d'inflation	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
Constante	0.056	3.71***	0.048	2.20**	0.030	0.03
Régime fixe	-0.059	-8.93***	-0.051	-5.81***	-0.065	-6.70***
Régime interm.	-0.002	-0.28	0.003	0.33	0.010	0.54
Nombre d'obs., R2	1150	0.38	1106	0.32	928	0.34

Source : Ghosh, Ostry et Tsangarides (2010)
Les astérisques indiquent la significativité aux seuils de 10 (*), 5 (**) et 1 (***) pourcent.

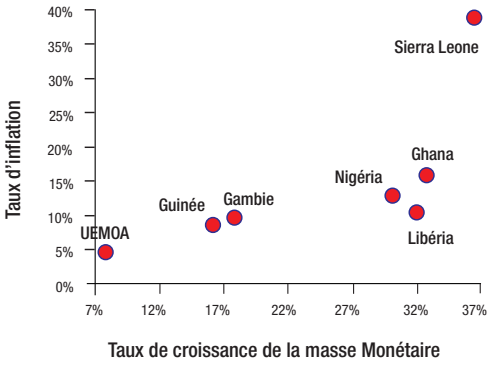
S'agissant des résultats empruntés de Ghosh, Ostry et Tsangarides (2010) et présentés au tableau III.6, ils indiquent clairement que l'adoption d'un régime de change fixe permet de réduire significativement l'inflation dans les pays en développement. Par exemple, sous la classification de jure, le passage du flottement à la parité fixe permet de réduire le taux d'inflation annuel de 6%. Par contre, cet impact est moins important de près de 1% sous la classification de facto. Selon les auteurs, les performances sous l'arrimage de jure, sont le reflet de la crédibilité que confère l'engagement formel de la banque centrale à maintenir la parité fixe. Pour confirmer cet argument, l'analyse a procédé au retranchement des observations concernant les régimes de change fixe de facto qui n'étaient pas considérés comme fixe sous la classification de jure. On remarque que le passage au régime de change fixe exerce un effet bien plus important (6,5%). Ce qui signifie que l'engagement formel de la banque centrale d'arrimer sa monnaie, suivi par sa mise en œuvre effective, renforce les performances en termes de maîtrise de l'inflation.
Les coefficients associés au régime de change intermédiaire ne sont pas significatifs. Cela implique qu'il n'y a pas de différence de performance entre les régimes de change intermédiaire et flottant, en matière de réduction de l'inflation.

Les résultats économétriques tendent à confirmer les observations faites sur les pays de la CEDEAO. En effet, le graphique III.8 indique que le régime de change fixe est associé à une inflation plus maîtrisée, tandis qu'il n'est pas toujours aisé de distinguer la différence d'inflation entre les régimes intermédiaire et flottant. En outre, la maîtrise de l'inflation dans la zone UEMOA, relativement aux autres pays ouest africains, est la confirmation que la combinaison entre l'engagement (de jure) et la mise en œuvre effective (de facto), donne une crédibilité accrue à la politique anti-inflationniste.

TABLEAU III.6 : Valeurs à long terme du taux de croissance de la Monnaie (effet de discipline) et du taux d'inflation

	Taux de croissance moyen de la masse monétaire	Taux moyen d'inflation
Gambie	17,8%	9,8%
Ghana	32,7%	15,9%
Guinée	16,2%	8,8%
Libéria	32,0%	10,3%
Nigéria	30,1%	12,9%
Sierra Leone	36,5%	38,9%
UEMOA	7,8%	4,6%

TABLEAU III.9 : Relation (à long terme) entre l'inflation et la monnaie (*Origines monétaires de l'inflation*)



Sources : FMI/IFS,WEO, nos propres calculs.
Notes : La période de calcul du taux de croissance de la monnaie diffèrent selon les pays en raison des contraintes de disponibilité des données monétaires. Les périodes d'estimation sont les suivantes : Gambie (1980-2009), Ghana (2003-2009), Guinée (1992-2005), Libéria (2001-2009), Nigéria (2001-2009), Sierra Leone (1980-2009) et UEMOA (1980-2009).

Les performances en matière d'inflation dans la zone UEMOA sont également à attribuer à la garantie de convertibilité du FCFA. En effet, du fait cette convertibilité toute demande excédentaire, qui aurait dû se traduire en inflation, est plutôt compensée par un accroissement des importations. De ce fait, les ajustements du solde commercial permettent de réguler les tensions sur le marché des biens et services pour contenir l'inflation à un niveau relativement satisfaisant. Par ailleurs, les régimes de change ont affecté l'inflation à long terme des pays membres de la CEDEAO via la discipline de la politique monétaire. Pour s'en convaincre, il suffit de constater que les pays de l'UEMOA, qui ont une longue tradition de politique de change fixe, affichent le taux de croissance de la monnaie (7,8%) le plus bas dans la zone ouest africaine. Pour les autres pays cités dans ce tableau, la moyenne des taux d'accroissement de la monnaie se situe à près de 25%. Le faible niveau du taux d'inflation dans la zone UEMOA est donc une conséquence de la maitrise du taux d'accroissement de la monnaie. D'ailleurs, le graphique III.9 suggère que la relation entre l'inflation et la création monétaire est très apparente comme l'ont déjà affirmé Friedman et Schwartz.

4. Une expérimentation à partir d'un modèle DGSE

L'approche proposée dans cette partie s'inscrit dans le cadre de la macroéconomie moderne. Elle s'inspire de la nouvelle théorie keynésienne dans la mesure où elle intègre un ensemble d'hypothèses propres à cette école de pensée notamment celles relatives à la rigidité nominale. De plus, ce paradigme incorpore certains développements méthodologiques récents de la macroéconomie se rapportant généralement à la théorie des cycles réels. Depuis quelques années, les modèles DSGE sont devenus de plus en plus populaires et amplement utilisés pour

des besoins de l'analyse de la politique économique en général, et monétaire, en particulier (voir Clarida, Gali et Gertler, 1999 ; Woodford, 2003). La démarche de cette étude s'inspire principalement des travaux de Gali et Monacelli (2005) et emprunte également des éléments méthodologiques aux travaux de Justiniano et Preston (2010a, 2010b), de Monacelli (2005) et de Medina et al. (2006). Cette démarche suppose une économie composée d'une infinité de consommateurs, d'une firme produisant un bien final à partir de biens intermédiaires et d'une autorité monétaire. L'étude propose un cadre plus général que celui de Gali et Monacelli (2005) dans lequel se côtoient deux économies (petite et grande économie) qui se spécialisent chacune dans la production de biens dans un univers marqué par une compétition imparfaite et une viscosité des prix. L'étude introduit en premier lieu une violation de la loi du prix unique. Par ailleurs, elle s'appuie sur l'existence de rigidités réelles et nominales (indexation, « habit formation », etc.) d'une part, et d'autre part, d'une variété plus large de chocs qui enrichissent l'analyse (Christiano, Eichenbaum et Evans, 2005 ; Smets et Wouters, 2003).

4. 1. Le ménage représentatif

L'économie est peuplée par un continuum de consommateurs indexé par j [0,1]
Soit un consommateur j maximisant son utilité espérée :

$$\underset{C_t,N_t}{\text{Max}}\, E_0\left[\sum_{t=0}^{+\infty}\beta^t\varepsilon_t^C\{u[C_t,H_t]-v[N_t(j)]\}\right]$$

Avec $u[C_t,H_t]=\frac{1}{1-\sigma}(C_t-H_t)^{1-\sigma}$ et $v(N_t)=\frac{1}{1+\varphi}N_t(j)^{1+\varphi}$

Le modèle prévoit l'existence de «habit formation» H_t tel que $H_t = hC_{t-1}$, $h \in (0,1)$. A la date t, le consommateur dispose comme revenu issu du travail ($W_t N_t$), des transferts (T_t) et par la même occasion, il dépense ses ressources en bien de consommation Ct, et en actifs domestiques B_t et étrangers B_t^*. Toutefois, à chaque fois que le ménage emprunte à l'étranger, il doit payer une prime de risque (Θ_t)[3]. La présence de cette prime permet de rendre le modèle stationnaire (voir Schmitt-Grohé et Uribe, 2003). Ainsi la contrainte budgétaire du consommateur devient :

$$P_{Ct}C_t + B_{t+1} + er_tB_t^* \leq R_{t-1}B_t + er_t\Theta_{t-1}R_{t-1}^*B_t^* + W_t(j)N_t(j) + T_t$$

Où er_t désigne le taux de change nominal, R_t est le taux de rendement brut sur une période d'un actif sans risque et R_t^* son équivalent sur le marché international.
On considère que le ménage représentatif consomme des biens locaux (C_Ht) et étrangers (C_{Ft}). La consommation est agrégée de la façon suivante :

$$C_t = \left[(1-\alpha)^{\frac{1}{\eta}}C_{Ht}^{\frac{\eta-1}{\eta}} + \alpha^{\frac{1}{\eta}}C_{Ft}^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}}$$

Où η>1 représente l'élasticité de substitution entre un panier de bien intérieur C_{Ht} et un panier de biens importés C_{Ft}, elle peut être variable par la suite. Plus elle est proche de l'unité plus on tend vers la concurrence pure et parfaite. Le coefficient $\alpha \in (0,1)$ désigne le degré d'ouverture.

3 - Cette prime est une fonction des avoirs extérieurs nets $\Theta_t = \Theta\left(-\frac{\varepsilon_{t-1}B_{t-1}^*(j)}{p_{t-1}\bar{y}} + \varepsilon_{t-1}^{uip}\right)$

4.1.1 Problème de minimisation des dépenses

La résolution du problème de minimisation des dépenses donne les indices de consommation C_{Ht} et C_{Ft} qui sont définis respectivement comme suit :

$$C_{Ht} = \left[\int_0^1 C_{Ht}(i)^{\frac{\varepsilon-1}{\varepsilon}} di\right]^{\frac{\varepsilon-1}{\varepsilon}} \quad \text{et} \quad C_{Ft} = \left[\int_0^1 C_{Ft}(i)^{\frac{\varepsilon-1}{\varepsilon}} di\right]^{\frac{\varepsilon-1}{\varepsilon}}$$

Où $C_{Ht}(i)$ et $C_{Ft}(i)$ sont respectivement les niveaux de consommation du ménage en i^{me} bien intérieur, avec $i \in [0,n]$, et en $i^{ème}$ bien importé, avec $i \in [n,1]$. Il est également supposé que l'élasticité de substitution intertemporelle $\varepsilon > 0$ entre les biens produits est le même pour les deux pays.

Les fonctions de demandes obtenues après allocation optimale pour les biens i sont données par les expressions suivantes :

$$C_{Ht}(i) = (1-\alpha)\left[\frac{P_{Ht}(i)}{P_t}\right]^{-\eta} C_{Ht} \quad \text{et} \quad C_{Ft}(i) = (1-\alpha)\left[\frac{P_{Ft}(i)}{P_t}\right]^{-\eta} C_{Ft}$$

Où $P_{Ht}(i)$ et $P_{Ft}(i)$ sont les prix du i^{me} bien intérieur et du i^{me} bien extérieur. Les fonctions de demande agrégées en biens C_{Ht} et C_{Ft} sont les suivantes :

$$C_{Ht} = (1-\alpha)\left[\frac{P_{Ht}}{P_t}\right]^{-\eta} C_t \quad \text{et} \quad C_{Ft} = (1-\alpha)\left[\frac{P_{Ft}}{P_t}\right]^{-\eta} C_t$$

Où P_Ht et P_Ft sont les indices de prix domestiques et étrangers :

$$P_{Ht} = \left[\int_0^1 P_{Ht}(i)^{1-\varepsilon} di\right]^{\frac{1}{1-\varepsilon}} \quad \text{et} \quad P_{Ft} = \left[\int_0^1 P_{Ft}(i)^{1-\varepsilon} di\right]^{\frac{1}{1-\varepsilon}}$$

De plus, l'indice des prix à la consommation est donné par :

$$P_t = \left[(1-\alpha)P_{Ht}^{1-\eta} + \alpha P_{Ft}^{1-\eta}\right]^{\frac{1}{1-\eta}}$$

4.1.2 Choix inter-temporel de consommation et linéarisation

En plus de la contrainte inter-temporelle du budget, le programme de maximisation du consommateur implique l'équation d'Euler suivante:

$$1 = \beta R_t \mathrm{E}_t \left[\frac{\varepsilon_{t+1}^c}{\varepsilon_t^c} \left(\frac{C_{t+1} - hC_t}{C_t - hC_{t-1}} \right)^{-\sigma} \frac{P_{t+1}}{P_t} \right]$$

Une hypothèse de taille est que les ménages du reste du monde font face au même problème d'optimisation et, en raison de sa petite taille, l'économie domestique n'exerce aucune influence sur celle du reste du monde.

4.1.3 Mécanisme de fixation des salaires

Pour décrire le processus conduisant à la fixation des salaires, il est supposé que les ménages évoluent dans un environnement monopolistique et chacun d'eux offre son service $N_t(j)$ aux firmes intermédiaires. La demande de travail formulée par les firmes intermédiaires et adressée au ménage j est donnée par :

$$N_t(j) = \left[\frac{W_t(j)}{W_t} \right]^{-\xi} N_t$$

Avec la demande agrégée de travail définie par l'expression suivante :

$$N_t = \left[\int_0^1 N_t(j)^{\frac{\xi-1}{\xi}} dj \right]^{\frac{\xi}{\xi-1}}$$

Le salaire agrégé est donné par l'expression ci après :

$$W_t = \left[\int_0^1 W_t(j)^{1-\xi} dj \right]^{\frac{1}{1-\xi}}$$

A l'instar d'Erceg et al. (2000), les salaires sont fixés selon le mécanisme de Calvo (1983). Ainsi, à chaque période t, tout ménage peut négocier un nouveau contrat avec une probabilité de $1\text{-}\theta_w$. De plus, suivant Rabanal et Rubio-Ramirez (2005), on peut admettre que le taux de salaire de la proportion de ménages qui ne négocient pas un nouveau salaire est partiellement indexé au taux d'inflation de la période précédente $\Pi_{t-1} = \frac{P_{t-1}}{P_{t-2}}$ ès lors, la condition de premier ordre de l'offre de travail du ménage représentatif est donnée par :

$$\mathrm{E}_t \left[\sum_{k=0}^{+\infty} (\beta\theta_w)^k \left\{ \left[\frac{\dot{W}_t}{P_{t+k}} \Pi_{t+k-1}^{\gamma} (C_{t+k} - H_{t+k})^{\sigma} - (1+\mu^w) N_{t+k}^{\varphi} \right] N_{t+k} \right\} \right] = 0$$

W_t est le taux de salaire optimal à négocier, capte le degré de l'indexation partielle, et le terme $(1+\mu^w)$ désigne la marge bénéficiaire (markup) salarial brut optimal.

4.2. Les firmes domestiques et processus de fixation des prix

4.2.1 Les firmes intermédiaires

Le système productif est composé par une infinité de firmes *f* agissant dans des conditions monopolistiques. La technologie de production individuelle est définie comme suit :

$$Y_H(f) = A_t N_t(f)$$

Où le logarithme de A_t est un processus stochastique décrivant les chocs de productivité.

$$a_t = \rho_a a_{t-1} + \varepsilon_t^a$$

Avec $a_t = log(A_t)$ et $\varepsilon_t^a \rightarrow iid(0, \sigma^a)$

Le facteur travail de chaque firme, $N_t(f)$ suit une agrégation de type CES :

$$N_t(f) = \left[\int_0^1 N_t(j,f)^{\frac{\xi-1}{\xi}} dj\right]^{\frac{\xi}{\xi-1}}$$

Avec $N_t(j,f)$ la demande de travail adressée au ménage j par la firme *f*.

4.2.2 Agrégation des biens

On suppose l'existence d'une firme finale dont le rôle est de transformer les biens des firmes f en un seul bien composite dont l'agrégation est faite suivant une technologie CES (voir Dixit et Stiglitz, 1977) :

$$Y_t = \left[\int_0^1 Y_H(f)^{\frac{\xi_H-1}{\xi_H}} df\right]^{\frac{\xi_H}{\xi_H-1}}$$

Avec $\xi_H > 1$ l'élasticité de substitution entre biens intermédiaires

On définit également $\Lambda_t = \frac{\xi_H}{\xi_H - 1}$ comme étant le facteur de marge pratiqué par la firme en l'absence de rigidité nominale, supposé suivre un processus AR(1) : $\ln(\Lambda_t) = \rho_\Lambda \ln(\Lambda_{t-1}) + \varepsilon_t^\Lambda$

4.2.3. Mécanisme de fixation des prix

4.2.3.1 Firmes domestiques

Les biens intermédiaires sont produits selon la technologie décrite plus haut qui utilise uniquement le facteur travail car le capital est supposé fixe à court terme. Dans les modèles néo-keynésiens, les firmes intermédiaires évoluent dans un environnement monopolistique. Le programme des firmes intermédiaires s'effectue en deux étapes. Elles maximisent leur profit en prenant leur salaire comme une donnée dans un premier temps et dans une seconde phase, elles fixent le prix des biens intermédiaires selon le mécanisme préconisé par Calvo (1983). Cette modélisation des prix intermédiaires permet d'introduire la rigidité nominale des prix. En effet, cette démarche suppose qu'à chaque période une partie 1-θ_H des firmes (choisies de manière aléatoire) réajustent leur prix tandis que les autres firmes ne font que reporter leur prix de la période précédente. Cependant, comme le font remarquer Gali et Gertler (1999) et plus tard Smets et Wouters (2002), le report des prix de la période précédente se fait moyennant une indexation partielle au taux d'inflation précédente. Puisque le report ne concerne qu'une partie des firmes (θ_H), ce paramètre peut bien alors servir de facteur d'indexation. L'indexation partielle est donnée par l'expression suivante :

$$P_{Ht}^{I}(f) = P_{Ht-1}(f)\left(\frac{P_{Ht-1}}{P_{Ht-2}}\right)^{\theta_H}$$

Le prix domestique agrégé est donné par :

$$P_{Ht} = \left\{(1-\theta_H)\bar{P}_{Ht}^{1-\rho} + \theta_H\left[P_{Ht-1}\left(\frac{P_{Ht-1}}{P_{Ht-2}}\right)^{\theta_H}\right]^{1-\rho}\right\}^{\frac{1}{1-\rho}}$$

La fixation du prix optimal requiert la résolution du programme de maximisation de la valeur actualisée des profits pour les entreprises qui décident de réajuster leur prix. Le programme suivant :

$$\underset{\bar{P}_H}{\text{Max}} \sum_{k=0}^{+\infty} \theta_H^k \mathrm{E}_t\left[Q_{t,t+k} Y_{t+k}(f)(\bar{P}_{Ht} - MC_{t+k} P_{Ht+k})\right]$$

Sous la contrainte :

$$Y_{t+k} \leq \left[\frac{\bar{P}_{Ht}}{P_{Ht+k}}\right] Y_t$$

Où MC_t est le coût marginal réel et $Q_{t,t+1} = \frac{1}{R_{t+1}}$ un facteur d'actualisation. La condition de premier ordre est donnée par (voir Chuantantikamon, 2008 ; Haider et Khan, 2008):

$$\sum_{k=0}^{+\infty} \theta_H^k \mathrm{E_t}\left[Q_{t,t+k} Y_{t+k}(\mathrm{f})\left(\bar{P}_{Ht} - \frac{\xi_H}{\xi_H - 1} NMC_{t+k}\right)\right] = 0$$

Avec $NMC_t = MC_t P_{Ht}$ le coût marginal nominal et $\frac{\xi_H}{\xi_H - 1}$ le coût marginal réel lorsque tous les prix sont flexibles.

En utilisant quelques manipulations algébriques, on obtient la nouvelle Courbe de Phillips peut être réécrite de la manière suivante : $\pi_{Ht} = \beta(1-\theta_H)\mathrm{E}_t(\pi_{Ht+1}) + \theta_H \pi_{Ht-1} + \frac{(1-\beta\theta_H)(1-\theta_H)}{\theta_H} mc_t$

Où mc_t est la composante cyclique du coût marginal réel en logarithme

4.2.3.2 Firmes importatrices

Tout comme Monacelli (2005), l'étude suppose qu'il existe des détaillants qui importent des biens différentiés. La courbe de Phillips qui en découle est similaire à celle qui est développée dans le cas des firmes domestiques. Ainsi on obtient:

$$\bar{P}_{Ft} = P_{Ft-1} + \pi_{Ft} + \sum_{k=1}^{\infty} (\beta\theta_F)^k \{\mathrm{E}_t[\pi_{Ft+k}] + (1-\beta\theta_F)\mathrm{E}_t[\Psi_{Ft+k}]\}$$

Après quelques réarrangements, on obtient :

$$\pi_{Ft} = \beta(1-\theta_F)\mathrm{E}_t(\pi_{Ft+1}) + \theta_F \pi_{Ft-1} + \frac{(1-\beta\theta_F)(1-\theta_F)}{\theta_F}\psi_{Ft}$$

4.3. Condition d'équilibre

L'équilibre sur le marché des biens et services assure l'égalité entre la production, et la consommation et les exportations :

$$y_t = (1-\alpha)c_{Ht} + \alpha c_{Ht}^*$$

En remplaçant la consommation et les exportations par leurs expressions linéarisées, on a :

$$y_t = (1-\alpha)c_t + \alpha c_t^* + (2-\alpha)\eta s_t + \alpha\eta\psi_t$$

4.5 Politique monétaire

Il est fréquent dans ce type de modèle de recourir à la famille de règles de Taylor (1999) pour traiter le comportement de l'autorité monétaire. Cette règle indique la réponse du taux d'intérêt, suite aux variations de l'inflation et du PIB.

Ainsi, lorsque les autorités adoptent un régime de change flexible, on a :

$$r_t = \rho_{1r} r_{t-1} + (1-\rho_{1r})\left[\Gamma_{1\pi}\pi_t + \Gamma_{1y} y_t + \Gamma_{1e}(e_t - e_{t-1})\right] + \varepsilon_{1rt}$$

Dans ce régime, l'autorité monétaire a une politique de ciblage de l'inflation. Le paramètre Γ_{1e} est d'autant plus petit que le régime de change est flexible. La condition UIP accompagnant cette règle est la suivante :

$$r_t = r_t^* + \mathrm{E}_t(\hat{e}_{t+1}) - \hat{e}_t - \chi nfa_t + \varepsilon_t^{UIP}$$

Dans le cas du régime de change fixe, Kollmann (2001) et Lane et al. (2006) ont montré que l'on peut travailler avec la même règle de Taylor, mais en modifiant le paramètre associé à la variation du taux de change :

$$r_t = \rho_{2r} r_{t-1} + (1-\rho_{2r})\left[\Gamma_{2\pi}\pi_t + \Gamma_{2y} y_t + \Gamma_{2e}(e_t - e_{t-1})\right] + \varepsilon_{2rt}$$

avec $\Gamma_{2e} \to +\infty$

D'autre part, la banque centrale peut également adopter un régime de change fixe mais modifiable en ce sens qu'elle peut fixer une parité centrale et tolérer une fluctuation du taux de change autour d'une bande. Cette stratégie fut adoptée par plusieurs pays au lendemain de la fin du Système de Bretton-Woods. A cet égard, Svensson (1994), Daria et Curdia (2007) ont proposé un cadre permettant de traiter ce cas de figure.

Formellement, il s'articule comme suit :

$$e_t = e_t^c + e_t^d$$

Cette équation permet de distinguer deux composantes du taux de change nominal. La première composante est la parité centrale (e_t^c) et la seconde (e_t^d), sa déviation par rapport à cette cible. Ainsi, le réalignement anticipé est donné par :

$$\mathrm{E}_t(e_{t+1}) - e_t = [\mathrm{E}_t(e_{t+1}^c) - e_t^c] + \left[\mathrm{E}_t\left(e_{t+1}^d\right) - e_t^d\right]$$

L'ajustement de la composante cyclique s'opère comme suit :

$$[\mathrm{E}_t(e_{t+1}^c) - e_t^c] = \vartheta_t + \rho_d e_t^d$$

Avec : $\vartheta_t = \rho_\vartheta \vartheta_{t-1} + \varepsilon_{\vartheta t}$

Ainsi, le réalignement devient :

$$\mathrm{E}_t(e_{t+1}) - e_t = \mathrm{E}_t\left(e_{t+1}^d\right) + \vartheta_t - (1-\rho_d)e_t^d$$

Dans ce régime, l'autorité monétaire a plus de marge de manœuvre que lorsqu'elle adopte le régime de change totalement fixe. En effet, elle peut utiliser la politique monétaire à d'autres fins même si, par ailleurs, elle doit garantir la proximité du taux de change nominal à sa parité centrale. De plus, elle adopte une règle de Taylor qui prend en compte, en dehors de ses fonctions traditionnelles, les déviations du taux de change par rapport à sa composante centrale.

4.6 Evaluation du bien-être

Pour mesurer les effets du choix d'un régime de change, on introduit en général des critères basés sur le rapport des écarts types de l'output gap d'un régime de change sur un autre et celui de l'inflation dans ces deux cas de figure. Rappelons, tout simplement, qu'il est usuel en économie monétaire d'évaluer le bien-être de la Banque Centrale, représentant donc la nation, par une fonction de perte quadratique mettant en jeu les écarts de production et d'inflation (Woodford 2003 et Walsh, 2003). D'autre part, l'évaluation du bien-être peut être appréhendée par l'approche utilisant une métrique reposant sur le développement de second ordre de Taylor pour éviter les problèmes liés à l'équivalence certaine (Kollmann (2002), Woodford 2003 et Kim et Kim 2003). En suivant les investigations de Campolmi (2010) qui ont étendu celles de Gali et Monacelli (2005) en introduisant la viscosité des prix et des salaires, on peut définir une fonction de bien-être qui dépend des variances de l'output gap, l'inflation des prix domestiques et des salaires. En réalité, selon cette démarche, l'introduction de la viscosité des salaires ajoute un terme supplémentaire relatif à la volatilité de l'inflation salariale. D'autre part, un autre critère décrivant le bien-être peut être calculé suivant l'approche de Benigno et Woodford (2004). Cette dernière fait une approximation du second ordre de la fonction d'utilité. Ainsi, on a :

$$W_t = U(C_t, H_t, \varepsilon_t^C) - \int_0^1 v(L_t, \varepsilon_t^C)\, dh$$

$$W_t = \frac{\varepsilon_t^C}{1-\sigma}(C_t - H_t)^{1-\sigma} - \frac{\varepsilon_t^C}{1+\varphi}\int_0^1 N(h)^{1+\varphi}\, dh$$

Après quelques manipulations algébriques, on obtient la formule suivante :

$$\begin{aligned} W_t = \overline{U}(C) + \overline{U}_C(C)C\Big[&(C_t - hC_{t-1}) + \frac{1}{2}(C_t^2 - h^2C_{t-1}^2) - \frac{\sigma}{2(1-h)}(C_t - h^2C_{t-1})^2 \\ &+ \frac{1-h}{2(1-\sigma)}(\varepsilon_t^C)^2 + \hat{\varepsilon}_t^C(C_t - h^2C_{t-1}) - u_1\left(\pi_{w,t} - \phi_w\pi_{w,t-1}\right)^2 \\ &- u_2(\pi_t - \phi_H\pi_{t-1})^2 - u_3(y_t)^2 - u_4y_ta_t - u_5y_t(1+\varepsilon_t^C)\Big] \end{aligned}$$

Avec

$u_1 = \frac{\theta_w \xi(\xi\varphi+1)(1-\Xi)}{2(1-\theta_w)(1-\beta\theta_w)}$; $u_2 = \frac{\theta_H \xi_H (1-\Xi)}{2(1-\theta_H)(1-\beta\theta_H)(1+\phi)}$; $u_3 = \frac{(1-\Xi)(2-\varphi)}{2(1+\phi)^2}$; $u_4 = \frac{(1-\Xi)(2-\varphi)}{(1+\phi)^2}$; $u_5 = \frac{(1-\Xi)}{(1+\phi)}$;

$\Xi = 1 - \frac{\xi_H - 1}{\xi_H}\frac{\xi-1}{\xi}$.

Reste du monde - S'agissant des variables étrangères telles que le PIB, le taux d'intérêt mondial et l'inflation étrangère, on adopte une modélisation de type VAR qui sera greffée au modèle :

$$\begin{bmatrix} y_t^* \\ \pi_t^* \\ i_t^* \end{bmatrix} = \Theta_1 \begin{bmatrix} y_{t-1}^* \\ \pi_{t-1}^* \\ i_{t-1}^* \end{bmatrix} + \begin{bmatrix} \varepsilon_{yt}^* \\ \varepsilon_{\pi t}^* \\ \varepsilon_{it}^* \end{bmatrix}$$

4.7 Estimation

L'estimation bayésienne s'appuie sur les travaux de Fernandez-Villaverde et Rubio-Ramirez-Ramirez (2004), Schorfheide (2003) et Smets et Wouters (2003), An et Schorfheide (2007), De Jong et al. (2000). Cette approche permet de prendre en compte, d'une part, l'information a priori, et d'autre part de contourner les problèmes d'identification liés à la méthode du maximum de vraisemblance (Canova, 2007 ; Canova et Sala, 2006). La solution du modèle log-linéarisée peut être représentée sous une forme espace-état, afin d'écrire la fonction de vraisemblance des données en appliquant le filtre de Kalman :

$$\hat{s}_t = A(\Theta)\hat{s}_{t-1} + B(\Theta)\hat{\eta}_t$$

$$\hat{x}_t = C(\Theta)\hat{s}_t$$

Où $\hat{x}_t$ contient les variables observées alors que le vecteur $\hat{s}_t$ renferme des éléments inobservés tels que les espérances conditionnelles, les variables naturelles ou les processus des chocs. Le vecteur $\hat{\eta}_t$ regroupe les variables *i.i.d.* de moyenne nulle et de matrice de variances-covariances $\Sigma(\Theta)$. L'ensemble Θ représente les paramètres du modèle.

Soit $p(\Theta)$ la distribution a priori de Θ et $L(\Theta|X^T)$ la fonction de vraisemblance associée aux variables observées $X^T = \{\hat{x}_t\}_{t=1}^T$. La distribution a posteriori du vecteur de paramètres est proportionnelle au produit de la fonction de vraisemblance et de la distribution a priori de Θ et s'exprime comme suit : $p(\Theta|X^T) \propto L(\Theta|X^T)p(\Theta)$

L'approche bayésienne nécessite l'utilisation de simulations stochastiques, notamment les techniques de Monte Carlo par chaînes de Markov (*Metropolis- Hasting algorithm*).

Les données sont issues du World Economic Outlook (2010) du FMI, de World Macroeconomic database. La période d'estimation s'étend de 1980 à 2008 et l'agrégation des données pays a été

nécessaire pour calculer les variables relatives à l'UEMOA. Les données portent sur le déflateur du PIB, les prix à la consommation, le PIB, le taux d'intérêt de l'économie domestique et du reste du monde.

5. Les résultats

Les distributions a priori reflètent l'idée que l'expérimentateur se fait sur les paramètres à estimer. Certaines sont issues de la littérature économique (voir annexes). Certains paramètres qui doivent être positifs suivent des distributions qui leur garantissent la positivité (variance des chocs et probabilité de réception des signaux pour les firmes intermédiaires).

De façon générale, les estimations ont montré que la plupart des distributions a posteriori sont différentes des distributions a priori[4]. Ce qui traduit un apport d'informations par les données.

L'élasticité de substitution intra-temporelle entre biens locaux et importés est supérieure à 1 pour l'ensemble des pays à l'exception du Nigéria et de la Sierra Leone et du Liberia. Il convient de rappeler que ce résultat traduit la capacité des consommateurs ouest africains à s'ajuster dès lors que le rapport des prix entre les biens produits localement et les biens étrangers se modifie. Par ailleurs, l'importance des élasticités de substitution peut être expliquée par la rapidité de réaction des consommateurs face aux mouvements des prix des biens alimentaires. Toutefois, il est difficile de démontrer un tel argument à travers ce modèle qui ne fait pas la distinction entre les biens alimentaires et non alimentaires.

Les estimations montrent que, globalement, la probabilité pour que les firmes ajustent leurs prix est plus faible pour les firmes domestiques que pour les firmes importatrices. Ce phénomène peut être expliqué par l'amplitude des variations du taux de change, synonyme d'incertitude et d'ajustements fréquents de prix. Par ailleurs, les entreprises des pays de l'UEMOA – et dans une certaine mesure de la Gambie et du Cap vert – ont une plus grande capacité à optimiser leur prix selon une optique d'anticipation néokeynésienne. Cela peut être un élément justificatif d'une plus grande maîtrise de l'inflation dans ces pays. Ce comportement forward looking est moins visible dans les autres pays. Ainsi, on peut craindre que la future Banque centrale de la CEDEAO ne serait pas à l'abri de la difficulté de mener une politique monétaire commune, sans avoir au préalable trouvé une solution pour harmoniser les comportements des agents économiques qui ne s'ajustent pas leurs prix de la même manière.

Cependant, de manière générale, la fréquence d'ajustement des prix des biens locaux et importés est relativement faible. D'autre part, ces deux types de firmes intermédiaires présentent un système d'indexation des prix relativement élevé. Autrement dit, les entreprises ont tendance à tenir en compte le niveau général des prix dans leur processus de fixation des prix pour préserver leur marge.

La persistance des habitudes de consommation est relativement faible à l'exception du Ghana et de la Sierra Leona.

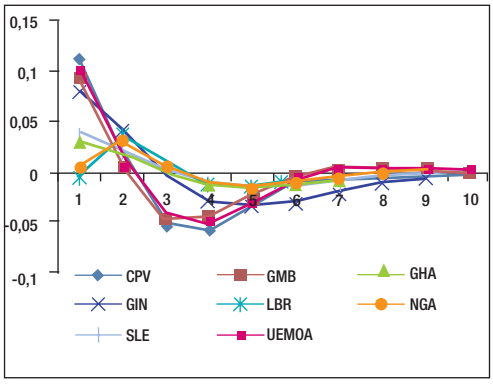
4 - Ces résultats sont disponibles sur demande des auteurs. Ils ont été omis pour alléger le document.

La plupart des chocs ne sont pas tous persistants à l'exception de ceux relatifs aux préférences des consommateurs et à la condition UIP. Concernant les écart-types des chocs, ils sont à l'image de ceux qui sont rencontrés dans la littérature.

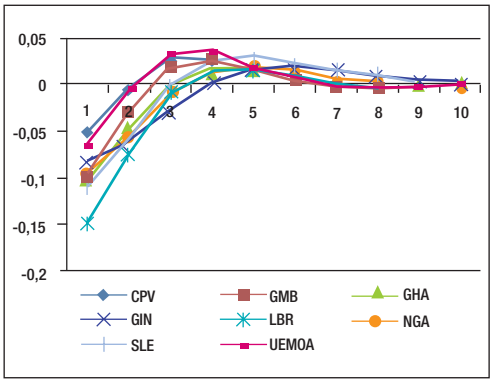
5.1. Fonctions de réponses impulsionnelles

L'analyse des fonctions impulsionnelles montre que le sens des réponses instantanées est conforme à la théorie et aux expériences empiriques. Cependant, la dynamique d'ajustement vers l'équilibre varie selon les pays. En ce qui concerne les chocs technologiques, la tendance générale est que la production augmente pour se situer au-delà de son niveau de long terme (graphique V.1) avec un retour à l'équilibre au bout de six ans. L'ampleur de la variation des réponses semble plus importante pour les régimes de change fixe (UEMOA, Cap-Vert) et la Guinée. Ainsi, une plus grande flexibilité du régime pourrait donc atténuer les variations de l'output gap. De plus, l'effet cumulé (à long terme) est plus faible pour ces pays. Ce qui prouve que, en dehors des politiques économiques mises en œuvre dans les pays, les régimes de change fixes enregistrent une croissance plus faible à long terme (voir faits stylisés). Quant à la réponse de l'inflation, elle semble être mieux maîtrisée dans les pays à régime fixe. Ce résultat est aussi conforme aux faits stylisés.

GRAPHIQUE V.1 : Réponse de la production à un choc de productivité :



GRAPHIQUE V.2 : Réponse de l'inflation à un choc de productivité:



Source : Calculs des auteurs

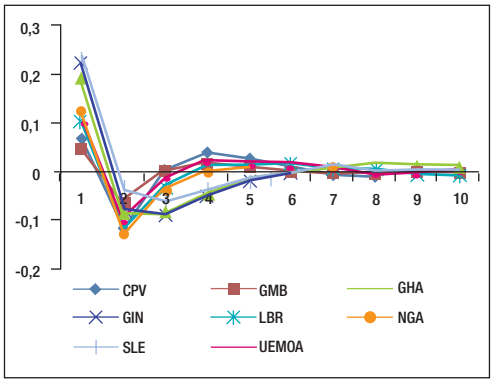
Pour ce qui est des chocs sur les préférences qui constituent un choc de demande, son relèvement induit une augmentation des prix à la consommation et de l'activité économique dans tous les pays de la CEDEAO. Un choc de demande matérialisé ici par une impulsion sur les préférences induit un accroissement de l'inflation.

En réalité, même si l'activité économique sous l'effet de ce choc, une demande plus forte de la part des consommateurs se traduit par une hausse plus faible des prix que celle de la production des pays de la CEDEAO. L'ajustement favorable de la production a permis de contenir l'inflation par la demande.

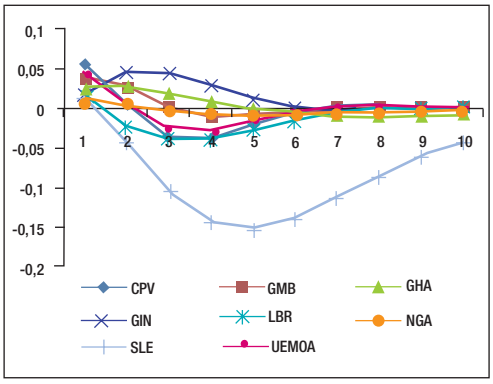
Les niveaux généraux des prix dans les pays de la CEDEAO réagissent positivement suite à un accroissement des prix mondiaux.

Toutefois, il convient de signaler que les pays sous régime de change fixe sont les plus exposés. En effet, force est de constater que ces économies ne disposent pas d'une marge de manœuvre suffisante en matière de politique monétaire pour contrer les effets pervers de la hausse des prix des biens importés. Ce constat est en phase avec les travaux récents menés pour expliquer le rôle important des économies sous le régime de change intermédiaire.

GRAPHIQUE V.3 : Réponse de la production à un choc de demande :

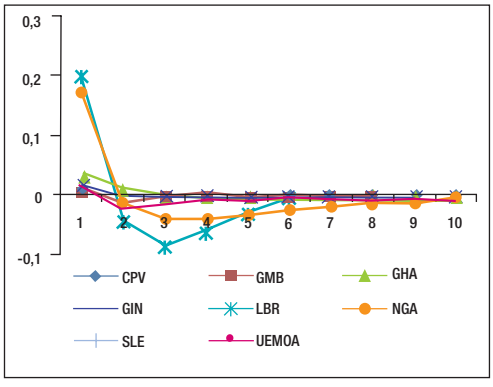


GRAPHIQUE V.4 : Réponse de l'inflation à un choc de demande :

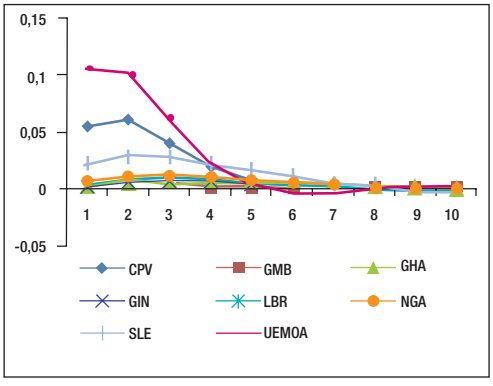


Source : Calculs des auteurs

GRAPHIQUE V.5 : Réponse de la production à un choc de production étrangère :



GRAPHIQUE V.6 : Réponse de l'inflation à un choc de d'inflation étrangère :



Source : Calculs des auteurs

5.2. Effets du choix du régime de change

L'analyse du bien-être selon le type de régime de change montre que les simulations militent en faveur du régime de change intermédiaire. D'ailleurs, le type de régime de change est largement en vigueur dans l'espace ouest africain. En effet, à l'exception de l'UEMOA, du Cap-Vert et de la Sierra Léone, tous les autres pays mènent une politique de régime de change intermédiaire. Concernant la dominance du régime de change fixe par rapport à tous les autres régimes telle que déclinée dans la plupart des investigations, il apparaît dans cette étude que tel n'est pas toujours le cas.

En réalité, pour l'UEMOA, le Ghana et la Gambie, le régime de change fixe est préférable à celui flottant. En effet, comme l'ont montré récemment Bénassy-Quéré et Salins (2010), le régime de change flottant est plus adapté si l'économie doit fréquemment faire face à des chocs de demande étrangère et de prix étrangers.

TABLEAU V.1 : Evaluation du bien-être selon le type de régime de change

	CPV	GMB	GHA	GIN	LBR	NGA	SLE	UEMOA
Fixe	-3.89	-4.58	-3.07	-3.78	-3.89	-4.54	-8.33	-2.98
Intermédiaire	-2.01	-2.96	-1.79	-3.95	1.29	-3.39	19.05	-2.80
Flottant	-2.62	-8.52	-4.06	-3.11	-3.81	13.88	-5.11	-3.02

Source : Calculs des auteurs.

L'une des principales conclusions qui découle de cette investigation est qu'en se focalisant trop sur les régimes en coin, la littérature économique et notamment les premiers modèles de la nouvelle économie keynésienne ont certainement surestimé les mérites des régimes de changes flottants par rapport à des régimes visant une certaine stabilité du change. Ce résultat découle en partie de l'absence de la prise en compte des rigidités nominales liées aux salaires. D'autre part, la peur du flottement, la recherche de stabilité, un marché financier peu développé concourent à la préférence des ménages ouest africains au régime de change intermédiaire. Ainsi, l'adoption de la future monnaie commune pourrait reposer sur un tel choix. Toutefois, cela devra s'accompagner par une certaine maîtrise de la surveillance multilatérale notamment une discipline dans la politique budgétaire.

6. Conclusion

Cette étude est une contribution à la réflexion sur les répercussions économiques éventuelles de l'adoption d'un régime de change commun par les pays de la CEDEAO, dans la perspective de la création de la future monnaie unique. Dans un premier temps, elle a cherché à mesurer les impacts liés au choix d'un régime de change sur les résultats macroéconomiques de l'espace communautaire. Dans un second temps, les économies qui composent la CEDEAO sont soumises à l'expérience empirique d'un modèle dynamique d'équilibre général stochastique (DSGE).

L'analyse des faits stylisés a montré que la « peur du flottement » est une caractéristique commune à tous les pays de la CEDEAO, si bien qu'ils ont privilégié les régimes de change fixe et intermédiaire. Ainsi, l'adoption de la future monnaie commune pourrait, à bien des égards, reposer sur le choix de l'un de ces deux régimes.

Considérant la mise en œuvre des politiques économiques, les résultats trouvés pour les pays en développement n'ont pas permis de conforter ceux des pays de la CEDEAO. En effet, il semble que la rigidité du taux de change n'apparaît pas comme une contrainte à la mise en œuvre des politiques budgétaire et monétaire. Pour les pays à régime de change fixe, notamment les pays de l'UEMOA, la flexibilité des politiques économiques s'explique essentiellement par les relations économiques qu'ils entretiennent avec la zone euro. Pour les autres pays adoptant essentiellement un régime intermédiaire, la «peur du flottement» peut constituer une contrainte à la flexibilité des politiques économiques.

Concernant la croissance économique, les résultats tirés de l'expérience des pays en développement ont montré qu'il n'existe pas de différences significatives de performance entre les régimes de change. Par contre, le cas particulier des pays de la CEDEAO, la différence de performance selon les régimes est bien perceptible. Les régimes de change intermédiaire et flottant donnent de meilleurs résultats en matière de croissance économique. Cependant, il y a lieu de penser que les régimes ne sont pas nécessairement à l'origine de cette différence, comme le montrent les résultats économétriques. Les différences de performance sont à mettre en rapport avec l'histoire des politiques économiques mises en œuvre, les ressources minières et pétrolières, la stabilité politique ainsi que d'autres facteurs culturels affectant la productivité des facteurs.

S'agissant de la maîtrise de l'inflation, les résultats empiriques sur les pays en développement confirment les idées reçues de la théorie économique selon lesquelles les régimes de change fixes sont plus performants. Les observations faites sur les pays de la CEDEAO vont également dans le même sens. Il est montré que les effets de crédibilité et de discipline du régime de change fixe ont pleinement joué leur rôle de stabilisateur de prix.

A priori les avantages du régime de change fixe semblent l'emporter sur ceux du régime de change intermédiaire dans les pays de la CEDEAO. Cependant les capacités de résistance d'ajustement face aux chocs internes et externes peuvent être à l'avantage du régime de change intermédiaire. C'est ce qui est ressorti comme principal résultat du modèle dynamique d'équilibre général stochastique (DSGE). Ce dernier, à travers des simulations qui tiennent compte aussi bien des régimes de change que de chocs, a mesuré leur effet final sur le bien-être. Ainsi, pour l'essentiel, le régime de change intermédiaire offre de meilleurs résultats. En conséquence, l'analyse des faits stylisés et des résultats empiriques des modèles économétriques et DSGE s'inscrivent dans la perspective des positions nuancées formulées récemment par les travaux de Ostry et Tsangarides (2010). En effet, les régimes plus rigides permettent d'ancrer les anticipations inflationnistes, soutiennent la croissance de la production et favorisent l'intégration économique. Toutefois, ils limitent le recours aux politiques macroéconomiques, accroissent la vulnérabilité aux crises et freinent l'ajustement extérieur.

Cet argument également s'inscrit dans la lignée des modèles de la nouvelle économie keynésienne qui ont mis l'accent sur le fait que l'omission des rigidités nominales entraîne la surestimation des mérites du régime de change flottant par rapport à des régimes visant une certaine stabilité du change.

Enfin, il convient de souligner qu'en cas de fusion monétaire entre l'UEMOA et les autres pays de la CEDEAO, la garantie de convertibilité illimitée de la nouvelle monnaie par le Trésor français pourrait être remise en cause, dès lors que la taille économique de l'Union et les mouvements de capitaux deviendront plus importants. A cet effet, l'adoption de la parité fixe exposerait l'économie de l'Union à des attaques spéculatives et, par ricochet, à des crises de change. Ainsi, la principale recommandation qui découle de cette investigation est que la future monnaie commune pourrait s'appuyer sur un régime de change intermédiaire. Il n'empêche qu'un tel choix devra s'accompagner d'une stratégie de surveillance multilatérale notamment en matière de discipline monétaire et budgétaire.

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Inflation and Economic Growth in Nigeria: Evidence from a Threshold Regression Model

Leonard Nosa Aisien and Milton A. Iyoha*

Abstract

This study examines the relationship between inflation and economic growth in Nigeria using a threshold regression model and quarterly time-series data for the period 1981-2012. The empirical results are obtained using the non-linear least squares estimator pioneered by Khan and Benhadji (2001) and show that there exists a non-linear relationship between inflation and economic growth, with an inflation threshold of 8%. Up to the threshold point, inflation has a positive and significant impact on economic growth. Beyond the threshold, inflation has a negative impact on economic growth. The study thus concluded that double digit inflation rate would only retard economic growth in Nigeria. Since a key macroeconomic goal of Nigeria is to achieve accelerated economic growth, appropriate policy should be put in place by the Central Bank of Nigeria to reduce the inflation rate to 8 percent or less.

JEL Classification: E31

Key words: Inflation threshold, Economic growth, Double digit inflation, Nigeria

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1. Introduction

One of the fundamental objectives of macroeconomic policy in any modern economy is the attainment of economic stability. This goal involves promoting and sustaining high economic growth combined with low inflation. In attaining this desirable objective, the nature of the relationship between economic growth and inflation rate must be well understood. Theoretical and empirical studies give divergent conclusions regarding the impact of inflation on economic growth. High inflation is known to have many adverse effects: it imposes welfare costs on society, it impedes efficient resource allocation by obscuring the signaling role of relative price changes, it inhibits financial development by making intermediation more costly, it hits the poor excessively because they do not hold financial assets that provide a hedge against inflation, it reduces a country's international competitiveness by making its exports relatively more expensive, thus impacting negatively on the balance of payment and perhaps most importantly, it reduces long-term economic growth, see Ocran (2007) and Khan and Senhadji (2001). Moreover, inflation can interact with the tax system to distort borrowing and lending decisions, raise the cost of capital, hence discouraging investment and impeding rapid economic growth, Feldstein (1982). On the other hand, there is a basic consensus among analysts that moderate inflation may help to promote economic growth, Mubarik (2005). Inflation can induce growth in the short run through expansionary macroeconomic policies, but this effect is not sustainable in the long run. In the long run, the relationship between inflation and growth is undoubtedly negative. See Barro (1995); Fischer (1993) and Bruno and Easterly (1998)

Theoretically, various models have been developed to predict the nature of the relationship between inflation and economic growth. These models can be categorized principally into four, namely:

i. The postulate that there is no effect of inflation on growth (money is super-neutral)

ii. The model that money is a substitute for capital, causing inflation to have a positive effect on long-run growth;

iii. Cash-in-advance model in which money is complementary to capital, causing inflation to have a negative effect on long-run growth;

iv. The threshold models in which inflation has a negative effect on long-run growth, but only if the level of inflation is above a threshold level.

In the sixties, models of inflation and growth were dominated by the portfolio substitution mechanism, which maintained that higher inflation makes capital more attractive than money, which induces increased per capita investments and brings higher growth. Economic studies of the 50s and 60s did not show any significant negative relationship between inflation and growth. Rather, a slight positive correlation was found. In the 1970s and 80s, empirical models that demonstrated a negative correlation between inflation and growth were proposed. As Fischer (1983) pointed out, higher inflation is associated with lower growth because lower real balances reduce efficiency of factors of production, which leads to lower output growth.

Fischer (1993) was one of the first researchers to propose the idea of a nonlinear relationship between inflation and output growth. He postulated that though there is basically a negative relationship between the two, at some low levels of inflation, one can find positive correlation with output growth. This idea gave birth to a number of studies devoted to finding the threshold rate of inflation at which the impact of inflation on output growth changes its sign. In this regard, papers by Sarel (1996) and Khan and Senhadji (2000) are noteworthy. In recent times there has been a general consensus that moderate inflation helps to promote economic growth, unlike high and volatile inflation rates that may create uncertainty and hamper economic growth. This consensus raises an interesting policy issue of how much inflation is too much; that is, at what rate of inflation will it become inimical to economic growth? Several studies have addressed this issue for both developed and developing countries. However, Khan and Senhadji (2001) in their seminal study actually calculated the threshold levels of inflation for both developing and developed countries. For developing countries, their result suggested a threshold level in the range of 7-11 percent.

The study by Khan and Senhadji (2001) covers a wide range of countries. However, countries vary in economic structure; hence, specific studies on individual countries would be more useful for policy makers. Thus, increasingly, studies based on specific countries have been conducted; but only few have been on Nigeria. Therefore, the broad aim of this study is to empirically ascertain the existence of a non-linear relationship between inflation and growth for Nigeria using quarterly data from 1981 through 2012. Specifically, this paper will attempt to answer two inter-related questions, viz. (i) Is there a non-linear relationship between inflation and output growth in Nigeria? (ii) If yes, what is the threshold level of inflation in Nigeria?

For easy readability, this paper is structured into six sections. Section 1 is the introduction while section 2 covers the review of relevant literature. Section 3 presents the stylized facts regarding inflation and economic growth in Nigeria. The theoretical framework and model specification are contained in section 4, while section 5 covers the empirical analysis. Section 6 summarizes the study and offers some concluding remarks.

2. Literature Review

A sizeable amount of empirical work on the relationship between inflation and growth has been reported in the literature, but the results are decidedly mixed. Fisher (1993) identified a non-linear relationship where low inflation rates have a positive impact on growth but the relationship turns negative as inflation rates increase. Bruno and Easterly (1998) agreed with the finding of a negative effect for high inflation rates but were skeptical about the growth-enhancing effect of low inflation. Many studies have found a negative relationship between inflation and economic growth. See especially Adamu (2013), Barro (2013), Chimobi (2010), Quartey (2010), Ahmed and Mortaza (2005), Shitundu and Luvanda (2000) and Fisher (1993). However, other studies have found a positive effect of inflation on economic growth, see Umaru (2012), Mallik and Chowdhury (2001), and Barro (1996).
For countries that have not attained full employment, there is a general consensus among economists that some amount of inflation would spur growth. In other words, there is a

threshold level of inflation that will enhance growth, after which it becomes inimical to growth, although, there is no accord among economists as to the accepted threshold of inflation in different countries. Currently, there exists a considerable amount of literature on inflation threshold and economic growth. However, the extant empirical literature on the threshold effect of inflation on economic growth is dominated by cross country panel studies. Yet, due to the peculiarity of certain economies, especially developing economies, specific country studies might be warranted since they may reveal specific evidences peculiar to the country under study.. In this regard, some country specific studies, especially on developing countries, on the inflation-economic growth nexus will be fully discussed. They include Ahmed and Mortaza (2005) for Bangladesh; Hussain (2005) and Mubarik (2005) for Pakistan; Hodge (2005) for South Africa; Fabayo and Ajilore (2006), Chimobi (2010), and Bawa and Abdullahi (2012) for Nigeria and Frimpong and Oteng-Abayie (2010) for Ghana.

Sarel (1996) makes use of data on population, GDP, consumer price indices, terms of trade, real exchange rates, government expenditures and investment rates. A joint panel database was produced combining continuous annual data from 87 countries, during the period from 1970-1990. The empirical findings give evidence of the existence of a structural break that is significant. The break is estimated to occur when the inflation rate is 8%. Below that rate, inflation does not have any effect on growth or it may even have slightly positive effect. However, when the inflation is above 8%, inflation's effect on growth is estimated to be significantly negative and robust. The results suggest a specific recommendation for policy makers: keep inflation below the 8%.

Khan and Senhadji (2001) examined the issue of existence of threshold effects in the relationship between inflation and growth, using econometric techniques originally developed by Kung-Sig and Tsay (1998) and Hansen (1999; 2000). They used data set from 140 countries (comprising both industrialized and developing countries) and generally covered the period from 1960-1998. Due to non-availability of some data for some developing countries, the analysis was conducted by them using an 'unbalanced panel'. The empirical results suggest the existence of a threshold beyond which the inflation-growth relationship becomes negative. Inflation rates below the threshold level have no effect on growth, while inflation rates above the threshold have significant negative effect on growth. The empirical results estimate threshold levels of 1-3 percent and 7-11 percent for industrialized and developing countries respectively. The results clearly suggest that the threshold is lower for industrialized countries than for developing countries.

Gillman et al. (2002), based on a panel data of the Organization for Economic Cooperation and Development (OECD) and Asia-Pacific Economic Cooperation (APEC) countries, showed that the reduction of high and medium inflation (double digits) to moderate single digit figures has a significant positive effect on growth for the OECD countries, and to a lesser extent for the APEC countries. They further add that the effect of an expected deceleration of inflation might only be observed when the world economy is not facing a sudden growth rate deceleration due to shocks. If there are no such shocks, a reduction in inflation rate can produce a considerably higher growth rate.

In a study designed to capture the inflation threshold levels in both developed and developing countries, Kremer, Bick and Nautz (2009) utilized a dynamic panel threshold model to confirm the impact of inflation on long-run economic growth. They arrived at the conclusion that developed economies who utilize an inflation targeting framework should select a target of 2 percent. Further, they stated that the observed level at which inflation would not negatively affect economic growth for developing countries is 17 percent. Below these thresholds, the impact of inflation on economic growth remains insignificant. They suggested that the empirical results did not reveal any indication of growth-enhancing effects of inflation in developing countries. They further suggested that the appropriate level of the inflation target might be country-specific. They recommended that the identification of country-specific inflation thresholds in the inflation-growth nexus might provide useful information about the appropriate location and width of an inflation targeting band.

We now proceed to give considerable attention to an examination of the important studies on the relationship between inflation and economic growth in Nigeria and in some selected developing economies of the world. Hodge (2005) studied the relationship between inflation and growth in South Africa. Two main issues were addressed: Do tests of the South African data support the findings of cross-section studies that inflation has a negative effect on growth over the longer term? And, can higher growth be gained at the cost of higher inflation in the short run? The findings were that inflation drags down growth in South Africa over the longer term and that, in the short run, growth above its trend requires accelerating inflation. Thus, for growth to be pulled substantially above its then low trend, inflation targeting in South Africa would have to be abandoned. However, this would be counterproductive over the longer term, once the negative relationship between inflation and growth manifests itself.

Mubarik (2005) estimated the threshold level of inflation in Pakistan using annual dataset from 1973 to 2000. The results obtained 9 percent as the threshold level of inflation above which inflation is inimical to economic growth. Kheir-El-Din and Abou-Ali (2008) addressed the relationship between inflation and growth in Egypt for the last quarter century. Two distinct sub-periods were observed: Somewhat higher and more volatile GDP growth rate is associated with higher inflation prior to 1990/1991; from this year onwards, lower and less volatile growth is associated with significantly lower inflation. It was found that the impact of inflation on GDP growth is not significantly different between the two periods. Testing for non-linear effects of inflation on growth in Egypt, it appears that there is no threshold of inflation, beyond which it is harmful to growth. To the contrary, the findings suggest that inflation at any level negatively impacts economic growth. It is thus beneficial to focus monetary policy towards maintaining price stability.

Frimpong and Oteng-Abayie (2010) estimated the threshold effect of inflation in Ghana for the period 1960-2008 using threshold regression models designed to estimate the inflation thresholds instead of imposing them. They found evidence of a threshold effect of inflation on economic growth in Ghana. They obtained an inflation threshold level of 11%, being the level at which inflation starts to significantly hurt economic growth in Ghana. Below the 11% level, inflation is likely to have a mild effect on economic activities, while above this threshold level, inflation would adversely affect economic growth. The study thus concluded that the

current medium term inflation target of 6-9% annual average set by the Bank of Ghana and the Government respectively is appropriate as it well below the 11% threshold.

Mohanty, Chakraborty, Abhiman and Joice (2011) examine the issue of the existence of threshold effects in the relationship between inflation rate and real GDP growth in India using three different approaches. In view of the structural changes of the economy, the empirical analysis uses data for the period of Q1:1996-97 to Q3:2010-11 in order to capture the most recent picture of the inflation-growth nexus. A specific question addressed in this paper was: does inflation in India have to reach some minimum «threshold» before the growth effects turn adverse? The findings clearly suggest that inflation threshold in the sense of structural break point exists for India and this implies a non-linear relationship between inflation and growth. Empirical results suggest that there exists statistically significant structural break in the relation between output growth and inflation between 4.0 and 5.5 per cent inflation above which inflation retards the growth rate of GDP and below the threshold level, there is a statistically significant positive relationship between inflation and economic growth.

Salami and Kelikume (2010) estimated inflation threshold level for Nigeria. The study used annual time series data spread over two periods 1970-2008 and 1980-2008 to determine the inflation threshold for Nigeria and to establish whether there is significant change in the threshold level for the two periods. Using a non linear inflation-growth model control variables such as growth in the ratio of broad money supply to GDP and growth in the terms of trade, they established an inflation threshold of 8 percent for Nigeria over the sample period 1970-2008. For the period 1980-2008 they estimated an inflation threshold of 7 percent although failing the test of significance.

Fabayo and Ajilore (2006) in their paper titled "Inflation – How Much is too Much for Economic Growth in Nigeria?" used annual data from 1970-2003 and identified the existence of threshold inflation level of 6 per cent for Nigeria. They explained that above this threshold, inflation retards growth performance of the economy while below it, the inflation-growth relationship is significantly positive. They suggested that the goal of macroeconomic management in Nigeria should be to bring down inflation to a moderate single digit of 6 per cent (optimal inflation target policy).

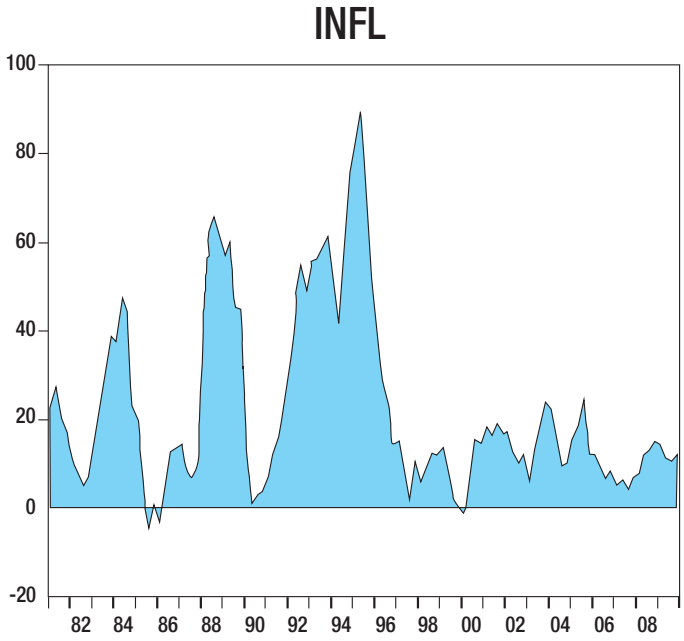
Bawa and Abdullahi (2012) utilized quarterly time-series data for the period 1981-2009 to estimate a threshold level of inflation for Nigeria. Using a threshold regression model developed by Khan and Senhadji (2001), the study estimated a threshold inflation level of 13 per cent for Nigeria. Below the threshold level, inflation was found to have a mild effect on economic activities, while above it, the magnitude of the negative effect of inflation on growth was high. The results were to robust with respect to changes in econometric methodology, additional explanatory variables and changes in data frequency.

3. Some Stylized facts of Inflation and Economic Growth in Nigeria

The rate of inflation in Nigeria was very erratic during the period under study (1981-2012). In the first quarter of 1981, inflation rate was 22.73% but fell to 10.91% in the first quarter of

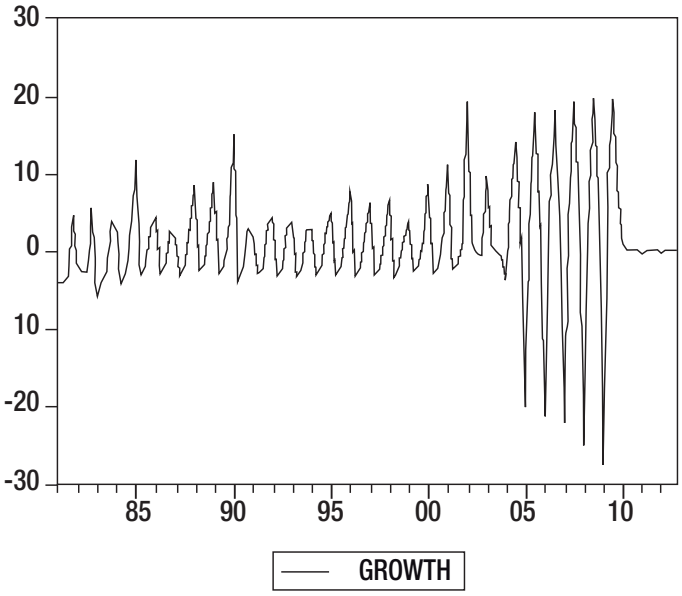
1982 and to 6.94% in the fourth quarter of 1982. Between first quarter of 1983 and first quarter of 1985 the inflation was double digit climaxing in second quarter of 1984 with inflationary rate of 47.52%. The economy witnessed the highest inflationary pressure during the 1990's, specifically between second quarters of 1991 to first quarter of 1997. In the second quarter of 1995, the rate of inflation was as high as 89.57% (see CBN statistical bulletin, 2009). The trends in the rate of inflation and real GDP over the period are shown in Figs. 1, 2 and 3. The rates of inflation and economic growth have been so volatile that it was difficult to visually discern any clear relationship between them. However, using the simple correlation coefficient, r, between them, it was found that between 1981Q1 and 2012Q4, the correlation coefficient was -.03 while it was -.06 between 2001Q1 and 2012Q4. Thus, there was an unmistakable but low negative correlation between inflation and economic growth in Nigeria during the period of analysis.

Figure 1: Trends in Inflation (CPI) in Nigeria, 1981-2009



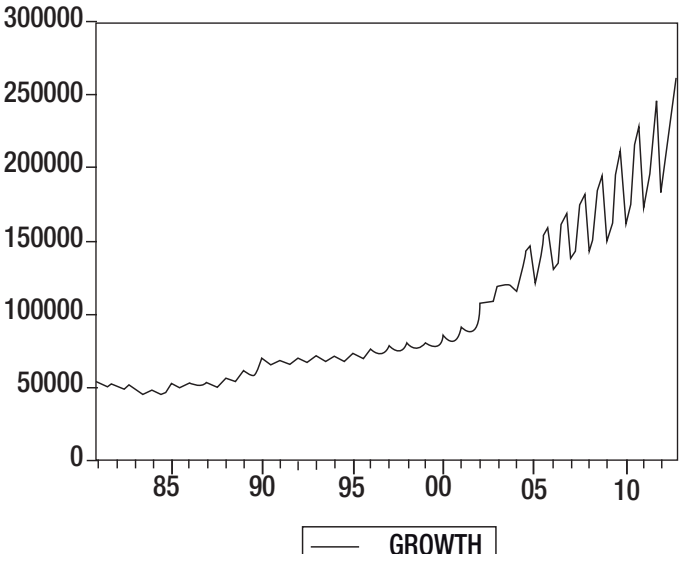
Source: Authors' plot using data from CBN's Statistical Bulletins

Figure 2: Growth rate of real GDP in Nigeria (1981 – 2012)



Source: Authors' plot using data from CBN's Statistical Bulletin

Figure 3: Real GDP trend in Nigeria (1981 - 2012)



Source: Authors' plot using data from CBN's Statistical Bulletin

Nigeria like other Africa countries reported a dismal economic performance during the last quarter of the 20th Century. See Figs. 2 and 3. The growth rate in Nigeria in the first half of the 1980's was mostly negative with few quarters of moderate performance. However between 1985 –1989, the annual growth was on the average of 5.0%. This fell again in the decade of the 1990' to an average of 3.2%. However, the last decade witness some improvement. According to CBN (2010) in their annual report, the economy witnessed an average growth rate of 6.7% between 2006 and 2010.

Agriculture accounted for the greatest share of the GDP growth rate, as it contributed 2.4%. This was followed by the services sector with 2.1% contribution. The industrial sector contributed 1.1%. This performance was attributed to sound and stable monetary and fiscal policies as well as the favourable weather conditions which boosted agricultural output. Other drivers of growth include the increase in crude oil production, stability in the prices and supply of petroleum products, successful implementation of the federal government amnesty program, huge investment in infrastructure and the continued expansion in the telecommunication sub sector. (see CBN annual report, 2012).

4. Methodology and model specification

From avalable eviedence, a consensus has now emerged that inflation has a non-linear impact on growth in many countries. While below a threshold level, inflation has a positive effect on growth, it tends to have an adverse effect on growth once it crosses the threshold. Many studies have attempted to estimate the threshold level of inflation in given countries using different methodologies. Prominent among these methodologies are those proposed by Sarel (1996), Khan and Senhadji (2001) and Espinoza *et al.* (2010). Sarel (1996) came out with an estimation procedure for inflation threshold which basically involves running a series of regression equations and finding the threshold value of inflation which maximizes R-squared or minimizes the Root Mean Square Error (RMSE). The procedure could be defined in following steps:

i. Define the concept of extra inflation (π^E) by using a dummy ($D\pi^*$). Let π^* be the inflation threshold. Then $\pi^E = D\pi^*(\pi - \pi^*)$ where $D\pi^* = 1$ if $\pi > \pi^*$; = 0 otherwise.

ii. Estimate a regression equation on economic growth (Δy) using ordinary least squares (OLS) with π E and π along with other relevant variables as regressors. The equation can be represented as follows:

$$\Delta y = \alpha + \beta\, 0\pi + \Theta' X + e \qquad \text{if } \pi \leq \pi^*$$
$$\Delta y = \alpha + \beta\, \pi + \beta\, (\pi - \pi) + \Theta' X + e \qquad \text{if } \pi > \pi^*$$

X is the vector of all other control variables and Θ the corresponding parameter vector.

iii. With a chosen basic model, the OLS regression is iterated with different π^* values. This generates a series of regression statistics corresponding to different chosen values of π^*. The structural break occurs at the value of π^*, for which the RMSE value is the minimum.

iv. The coefficient of π^E indicates the difference in the inflation effect on growth between the two sides of the structural break and its t-statistic value tests whether or not the structural break is significant.

v. It should be noted that at some value of π^* the sum of the coefficients of πE and π significantly change sign at π^*. Therefore, analysis of the entire set of coefficients is equally important in deciding about the threshold inflation level.

Khan and Senhadji (2001) used a different estimation procedure arguing that π^* is unknown and, thus, it has to be estimated along with the other regression parameters using the non-linear least squares (NLLS) estimating technique. If π^* is known, then OLS estimation could be used. Since it is unknown, it should be estimated along with the other regression parameters. Hence NLLS is the appropriate estimator. Since π^* enters in a non-linear and non-differential manner, conventional gradient search techniques to implement NLLS are inappropriate. Instead, a method that is sometimes called conditional least squares is employed by Khan and Senhadji (2001) for threshold inflation estimation.

The method is as follows. For any π^* the model is estimated by OLS, yielding the sum of squared errors as a function of π^*. The least squares estimate of π^* is found by searching over π^* and selecting the value that yields the lowest sum of squared errors. For this value of π^* the slope parameters are estimated by OLS. Chan and Tsay (1998) have shown that these NLLS estimates are consistent and asymptotically normal, and these authors also provide estimates of the asymptotic variance–covariance matrix. Compared to Sarel (1996) in this procedure a different formulation is used following Khan and Senhadji (2001) and Cox et al. (2003)

$$\Delta y = \alpha + \beta\, 1(\pi - \pi) + \Theta' X + e \qquad \text{if } \pi \leq \pi^*$$
$$\Delta y = \alpha + \beta_2 (\pi - \pi) + \Theta' X + e \qquad \text{if } \pi > \pi^*$$

To test for threshold the null hypothesis H0: $\beta 1 = \beta 2$ is tested against H1: $\beta 1 \neq \beta 2$

Espinoza *et al*. (2010) used a Logistic Smooth Transition Regression (LSTR) model to estimate the threshold and the speed of transition from one regime (low effect of inflation on growth) to another (high effect of inflation on growth). The basic difference between their methodology and that of Khan and Senhadji (2001) is that instead of using dummy variable to differentiate the regimes they assigned weights based on a logistic function.

This study adopts the method used by Khan and Senhadji (2001) to test for the existance of inflation threshold and obtain the rate of inflation at the threshold piont based on quarterly time series data from Nigeria. The parameter k (that is the threshold inflation level) has a property that the relationship between economic growth and inflation is given by: (i) b_1 represents low inflation; (ii) $(b_1 + b_2)$ represents high inflation. The high inflation means that when the long-run inflation estimate is significant then both coefficients $(b_1 + b_2)$ would be added to see their impact on growth and that would be the threshold level of inflation.

The model and source of data

Following Khan and Senhadij (2001), the threshold model to be estimated is given as follows

$$GROWTH_t = \Phi 0 + \Phi_1 INF_t + \Phi_2 D_t[INF - K] + \Phi_3 FDGR_t + \Phi_4 POPGR + \Phi_5 INVTGR_t + U$$

$$\Phi_1 > 0, \Phi_3 > 0, \Phi_5 > 0, \Phi_4 < 0 \quad \text{and } (\Phi 1 + \Phi 2) < 0$$

Where:
GROWTH = Real GDP growth rate
INF = Inflation rate
POPGR = Population growth rate
FDGR = Growth rate of the ratio of broad money supply to real GDP (Proxy for financial Development)

D = $\begin{Bmatrix} 1 : INF > K \\ 0 : INF \leq K \end{Bmatrix}$ Dummy variable

k = Inflation threshold above which inflation is inimical to economic growth
INVTGR = Growth rate of investment

The data were sourced from the Central Bank of Nigeria *Statistical Bulletin* (various issues), the Central Bank of Nigeria *Annual Reports* (various issues) and the National Bureau of Statistics (NBS) *Annual Abstract of Statistics*.

5. Emprical results

The above model was estimated using the least square procedure on the range of inflation value $k \leq 6$ to $k \geq 12$. The following results were obtained.

Table 1: Inflation Threshold Estimate Dependent Variable RGDP Growth Rate (1981Q1 – 2012Q4)

%	Variable	Coef.	T stat	prob	R^2	F stat	D W	RSS
6%	INF	-0.0258	-1.8106	0.069	0.7166	042.6193	2.3327	1980.6
	D(INF-K)	0.1594	0.1729	0.863				
	POPGR	2.3207	1.7869	0.076				
	INVTGR	0.1085	2.9027	0.004				
	FDGR	-0.3464	8.5504	0.000				
	C	0.8086	0.6921	0.490				

7%	INF	-0.0531	-2.1349	0.010	0.71711	42.7310	2.2155	1976.9
	D(INF-K)	0.2353	1.7751	0.079				
	POPGR	2.0627	1.5592	0.122				
	INVTGR	0.1059	2.8289	0.005				
	FDGR	-0.3532	-8.7281	0.000				
	C	1.3754	1.2407	0.217				

8%	INF	-0.0321	-2.1226	0.014	0.7181	42.9514	2.2007	1969.7
	D(INF-K)	0.9095	1.7205	0.087				
	POPGR	1.9345	1.4615	0.146				
	INVTGR	0.10637	2.8457	0.005				
	FDGR	-0.35961	-8.7076	0.000				
	C	1.6226	1.4893	0.139				

9%	INF	-0.0618	-3.9125	0.000	0.7167	42.6628	2.2197	1979.2
	D(INF-K)	-0.5925	-1.7716	0.081				
	POPGR	2.1105	1.5790	0.117				
	INVTGR	0.1064	2.8458	0.005				
	FDGR	-0.3518	8.6353	0.000				
	C	1.2175	1.1536	0.251				
10%	INF	-0.0344	-2.1280	0.012	0.7179	42.9014	2.2178	1971.3
	D(INF-K)	-0.6345	-0.76917	0.443				
	POPGR	1.8717	1.3800	0.170				
	INVTGR	0.10544	2.8270	0.005				
	FDGR	-0.3558	8.7660	0.000				
	C	1.5276	1.4572	0.148				

11%	INF	-0.0356	-2.2428	0.009	0.7165	42.6095	2.2268	1981.0
	D(INF-K)	-0.0758	-0.0996	0.921				
	POPGR	2.2427	1.7628	0.080				
	INVTGR	0.1076	2.8949	0.004				
	FDGR	-0.3489	8.6844	0.000				
	C	1.0085	1.1548	0.250				

12%	INF	-0.0315	-1.9423	0.049	0.7175	42.8338	2.2300	1973.5
	D(INF-K)	-0.5080	0.6755	0.501				
	POPGR	2.2877	1.8324	0.069				
	INVTGR	0.1045	2.8020	0.006				
	FDGR	-0.3497	8.7969	0.000				
	C	1.1171	1.4343	0.154				

By estimating regressions for different values of k which is chosen in an ascending order, the optimal value of k is obtained by finding the value that maximizes the R2 from the respective regressions. In other words, the optimal threshold level (k*) is that which minimizes the Residual Sum of Squares (RSS).

This methodology gives an inflation threshold level of 8 percent for Nigeria over the period (1981Q1-2012Q4). At this rate of inflation, a maximum value of the coefficient of determination (R2=0.7181) is obtained and a minimum value of the residual sum of square (RSS= 1969.7) is obtained over the range of inflation values $6 \leq k \leq 12$.

At 8 percent level of inflation rate, the coefficient D(INF - K) is statically significant at the 5 percent level of significant as shown by the p-value of (0.014). At 8 percent threshold level, inflation had a positive and significant impact on real GDP growth rate, increasing economic growth by the sum of the coefficients of INF and D (INF - K) (-0.0321+ 0.9095 = 0.8774). Above this threshold level, inflation depresses economic growth by (-0.0618 – 0.5925 = -0.6543).

From this finding, it can be concluded that the inflation threshold for Nigeria is 8 percent. This can be compared with the results obtained by Bawa and Abdullahi (2012) who, using quarterly data ending in 2009Q4, found a threshold inflation level of 13 per cent for Nigeria. We may therefore consider their 13 percent estimate as an upper limit. Hence we recommend that policy makers at the Central Bank of Nigeria should set an inflation target of 8 percent and ensure that under no circumstances should the inflation rate be allowed to exceed 13 percent. Any level of inflation above this upper limit would definitely be inimical to economic growth.

6. Policy Recommendations and Conclusion

This study has examined the relationship between inflation rate and economic growth rate using the threshold modeling approach and quarterly time series data from Nigeria. Our study has extended the research efforts of Fabayo and Ajilore (2006) and Bawa and Abdullahi (2012). While Fabayo and Ajilore (2006) used annual data, we have used quarterly series (high frequency) data like Bawa and Abdullahi (2012); but while their data series ended in 2009, we have extended the data series for our study to 2012Q4. The use of quarterly data is preferable since the negative relationship between inflation and growth holds mostly in high frequency observations, as established by Bruno and Easterly (1998).

The empirical results obtained in our study are that:

i. A non-linear relationship exists between inflation and economic growth in Nigeria.

ii. The inflation threshold for Nigeria is 8 percent.

iii. At the threshold, inflation has a positive and significant impact on economic growth and thus can increase economic growth by 0.8774%

iv. Inflation rate beyond the threshold will depress economic growth by 0.6543%.

A conclusion from this result is that the current inflation rate of 11.3% in Nigeria is too high and can retard economic growth. Since a principal macroeconomic goal for Nigeria is to achieve accelerated economic goal, we recommend that appropriate policies and measures should be put in place by the Central bank of Nigeria to reduce the current double digit inflation rate to the optimal level of 8 percent.

Drawing on a recent study by Iyoha, Adamu and Korsu (2012) which found that inflation in Nigeria is mainly driven by increases in the money stock, we recommend that the monetary authorities give special attention to the control of the stock of money in the economy. In this regard, it would be desirable for the CBN to maintain its policy of using the Monetary Policy Rate (MPR) and withdrawal of excess liquidity from the economy as key instruments for controlling the inflation rate in the Nigerian economy.

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Regional Integration, Trade and National Efficiency in ECOWAS Countries

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Abstact

In this paper, we robustly examine whether regional integration, trade openness and landlockness have any effects on national efficiency of ECOWAS countries over the 1970-2010 periods. We utilise a variant of a complex time 'decay' specification of the stochastic frontier model in which the inefficiency effects are non-monotonic, thereby allowing for the control of the time invariant random component in our specification. We find that trade policy on openness play a significant and quantitatively important role in explaining national efficiency of ECOWAS countries. Landlockness and regional integration, however, have insignificant effects on national efficiency. Our findings indicate the need to deepen regional coordination and cooperation to vigorously create and invest in regional public goods which bring positive spillover effects and increase efficiency.

JEL Classification: D24 ·047· 055

Key words: National efficiency, stochastic frontier analysis, Sub-Saharan Africa

1. Introduction

Over the past four decades the growth performance of sub-Saharan African (SSA) countries has been poor compared to that of other developing countries. Especially, the average sub-Saharan African per capita real GDP growth has hardly exceeded two percent, while East Asia and Pacific countries have been experiencing impressive growth rates in the ranges of four to eight percent[5]. The poor sub-Saharan African growth performance is worrisome given that the region needs to grow at a much higher level in order to achieve the MDG target of halving the fraction of population living below $1 per day by 2015. It is estimated that the average annual growth performance in the region at three and half percent during 1997-2002 (considered as a growth recovery period) is even less than half of the estimated growth needed to achieve the poverty reduction goal of the MDG (Tahari et al., 2004). A large body of studies (Collins and Bosworth, 2003; Ndulu and O'Connell, 2000, 2003; Berthelemy and Söderling , 2002; Hoeffler , 2002; Fosu, 2009; Tahari et al., 2004) suggest that low total factor productivity growth is the main impediment to the poor SSA growth performance.[6] Current quantifiable progress reports of the Millennium Development Goals (MDGs) and Poverty Reduction Strategy Papers (PRSPs) in most ECOWAS countries (and Sub-Saharan African as a whole) still indicate that a significant boost in TFP growth is required in order to double the average annual growth rate to achieve the targets set out in these programs.

Improvements in efficiency and technical progress are means of achieving increases in TFP growth. Explained in the context of production possibilities frontier (PPF), efficiency change brings about a movement of a country towards or away from the PPF, whilst technical progress entails a shift of the PPF. Cross-country differences in the level of technical efficiency have been identified as key to understanding the evolution of the world income distribution. Differences in efficiency explain most of the differences in productivity amongst countries (Prescott, 1998; Jerzmanowski, 2007). In other words, the low levels of output per worker in many countries are largely attributed to countries efficiency in using available resources and technology. The magnanimous role of technical efficiency to the growth of nations in regions like SSA which undertake little domestic R&D[7] (or innovation/technical progress) can therefore not be underestimated. It is thus expected that, by effective utilizing new technologies from developed countries, overall efficiency will be boosted as a result of the increase in trade volumes and flows. .

Regional integration plays an important role in boosting efficiency. Following from economic growth models (see Valdes, 1999), when countries integrate into the same economic space by eliminating trade barriers and freeing the movement of commodities and people, economic integration would force the integrated economies to compete with one another. This would, at least partly remove economic inefficiencies in the use of the available resources, and this, in turn, would raise output for the existing amount of inputs. Therefore, regional integration leads to a rise in output out of the same resource due to efficiency gains. Trade also plays a

5 - This divergence of SSA growth is well documented as the "African growth tragedy" (see Easterly and Levine, 1997).
6 - Along this same line, Devarajan et al. (2003) argue strongly that it is total factor productivity rather than the level of investment that has been the constraint to growth.
7 - The contribution of SSA countries to scientific and technical journal and, the number of royalties and licences received as at 2007 was just 0.06%. The number of patents applications received from the SSA region was 0 (WDI, 2009).

central role in explaining efficiency. Studies by Grossman and Helpman (1991) and Barro and Sala-i-Martin (1997), indicate that larger trade implies greater openness which helps in the adoption of more efficient techniques of production[8]. Geography (that is, natural climate, geology etc) affects the efficiency of resource allocation and economic growth partly by raising transportation cost. Landlocked countries are limited in their ability to access large economic markets, which in turn is an obstacle to exploiting economies of scale and increasing productive efficiency. In addition, technology diffusion to such regions is slow (see Sachs and Warner, 1997; Jones, 1999; Bloom et al., 2002; Bosworth and Collins, 2003).

Most of the studies explaining national efficiency levels have focused on OECD countries. The few studies on developing countries tend to have a limited or restricted set of explanatory variables generally focusing exclusively on either technology transfer or absorptive capacity (see Christopoulos, 2007; Mastromarco and Ghosh, 2008; Henry et al., 2009). This study focuses on ECOWAS countries and draws from a distinctive set of explanatory variables by using regional integration blocs (ECOWAS and UEMOA as proxies) and trade to aptly explain national efficiency.

This paper is an attempt to contribute to the sparse literature on the national efficiency in SSA. Broadly speaking, the paper makes two distinctive contributions. Firstly, unlike much of the existing studies that have focused on OECD countries[9], this paper looks at the specific case of ECOWAS countries. Secondly, the paper robustly examines the role of regional integration, trade and landlockness on national efficiency of ECOWAS countries. The paper utilises a variant of the stochastic frontier model proposed by Battese and Coelli (1995), henceforth BC as the vehicle for the empirical analysis. Specifically, we use a non-monotonic version of the complex time 'decay' model of Battese and Coelli (1995). This formulation of the Battese and Coelli (1995) model allows us to control the time invariant feature of the random component, which is still a substantive and detrimental restriction in the Battese and Coelli model (see Greene 2005, 2007).

The remainder of the paper is organised as follows: Section 2 contains a brief review of the related literature while section 3 contains the methodology and the data upon which the study is based, section 5 is empirical analysis of results and section 4 concludes. .

2. Survey of Related Literature

Most of the available empirical studies on the impact and effects of regional integration and other measures of trade openness have focused on explaining how trade, landlockedness or regional integration affects economic growth using larger datasets. Studies on explaining national efficiency are also scanty in the literature. In the following, we review some studies and provide a link between the explanatory variables and economic growth, productivity and efficiency.

8 - Technology transfer and therefore international trade takes on even greater importance for productivity growth in developing countries, which as a group undertake little domestic R&D and therefore have few domestic sources of new technology.

9 - With the exception of Christopoulos (2007), Mastromarco and Ghosh (2008) and Henry et al. (2009) have explored the question in the context of developing countries.

Regional economic integration is essentially characterized by the formation of regional cooperation groups of countries with a liberalised intra-community trade and increased mobility of factors of production. In theory, the economic benefits from regional integration and the drive towards regionalism have been justified in terms of the trade creation and trade diversion effects that are characterised with integration when the barriers to trade are removed among members within the regional cooperation (African Development Bank, 2000). Additionally, Helpman and Krugman (1985) and Grossman and Helpman (1991) posit that dynamic gains from trade provide the fundamental argument for free trade and a vital causal link between exports and economic growth. Aggregate levels of intra- regional trade in ECOWAS and Africa as a whole remain the lowest in the world, around 10 percent for Africa (UNCTAD, 2009). This is in a sharp contrast to the European Union, where levels of intra-block trade are much higher, typically around 70 percent of the total (UNCTAD, 2009). Generally, the lower levels of intra- regional trade in Africa can be attributed to small size of African economies; trade orientation towards markets outside the continent rather than neighbours; the level and type of specialization; and higher tariff rates within the region (OECD, 2010). Thus the economic basis for meaningful exchange and complex specialization that takes place amongst large and widely diversified economies, and is so crucial to ensure the distribution of the gains from forming regional economic integration, may possibly elude many regional bodies like ECOWAS in Africa.

Mayer (2001) argues that trade is a carrier of knowledge and focuses on imports as a way of introducing foreign (relatively advanced) technology into domestic production, which in turn has a positive effect on productivity growth. In particular, certain kinds of imports, namely, machinery and equipment relating to foreign R&D, are expected to generate more technology transfer than others. Evidence in the literature suggests that there is positive correlation between trade and growth (see Grossman and Helpman 1994). Trade openness, whether through national reforms, regional agreements or multilateral negotiations, exerts leverage on the economy through several transmission channels: (i) it increases the market size and thus allows for increasing scale returns, (ii) it improves business competitiveness and promotes a better allocation of resources, (iii) it constitutes an important vector for the transmission of technological innovations among trading partners. The empirical literature supports the argument that development requires economic growth to alleviate poverty, and greater access to world markets is perceived as a necessary condition for more rapid growth. Thus, developing countries have a great deal to gain from trade (Krueger, 1999; Srinivasan, 1999; Tangermann and Josling, 1999; Huff, 2000; Stiglitz, 2000; and Isaksson, 2001).

Poor geography clearly affects possibilities to enjoy the fruits of technology transfer and this obviously influences national efficiency and productivity growth. Diamond (1997) maintains that geography is a key determinant of cross-country differences in technology. He suggests that, distance to coastlines have a negative impact on income levels. Sachs and Warner (1997) and Gallup, Sachs and Mellinger (1999) find that landlockedness has a negative effect on growth. Gallup and Sachs (1998) also investigate the role of geography, in terms of being landlocked (countries with coast matters for trade and productivity, and cities along coastlines tend to be growth engines in an economy). They find that geography, openness, and the quality of public institutions are significant explanatory variables for income levels. An assessment of determinants of African exports based on a gravity model has shown that landlockedness, poor

infrastructure among others are important explanatory variables for boosting intra-African trade (UNECA, AU and AfDB (2010)).

From the above review, we observe that although most of the studies have looked at trade or regional integration, there is a lack of studies on how these variables explain national efficiency. To the best of our knowledge, we have not sighted any study using this set of explanatory variables (regional integration, trade and landlockedness) to explain national efficiency in ECOWAS region. This paper is an effort to contribute to the sparse literature on explaining national efficiency in ECOWAS and SSA.

3. Methodology, Description and Sources of Data

We apply stochastic frontier analysis (SFA) approach developed simultaneously by Aigner et al. (1977), Meeusen and van den Broeck (1977) and Battese and Corra (1977) in a macroeconomics context, where countries are producers of output given inputs. The stochastic frontier method constructs an efficient frontier by imposing a common production frontier technology across all countries in the sample. Deviations from the frontier are decomposed into inefficiency and noise. The introduction of the disturbance term to represent noise captures the effects of exogenous shocks beyond the control of the analysed unit, thereby reducing the volatility in the temporal patterns of efficiency measures. This closely matches the concept of frontier technology and the innovation of technology found in growth theory (Aghion et al., 1998, 2002; Acemoglu et al., 2006). In this context, countries can be thought of as operating either on or within the frontier, with the distance from the frontier reflecting inefficiency[10].

Two methodological approaches have been adopted in the SFA literature to study the effects of explanatory variables on inefficiency. The first approach, known as the two stage approach, consists of estimating efficiency scores in a first stage, and then in the second stage regress these scores against a set of explanatory variables. However, this approach suffers from a fundamental contradiction (see Pitt and Lee, 1981 and Kalirajan, 1981). Indeed, the first stage assumes that that inefficiencies are independent and identically distributed while the second stage contradicts the identical distribution assumption of the first stage (see Kumbhakar et al., 1991; and Reifschnieder and Stevenson, 1991). The Battese and Coelli (1995) model for applications in panel data is preferred over other frontier techniques in that it overcomes this contradiction and allows the simultaneous estimation of the parameters of the stochastic production frontier and the inefficiency effects model[11]. In this paper, we employ a variant of the Battese and Coelli (1995) model which allows the variance effects to be non-monotonic.

3.1 Production frontier

In order to simplify our analysis and remain consistent with the existing literature, we follow the models of economic growth in assuming that technology is global (see Solow, 1956; Howitt, 2000). The production frontier estimated using the SFA represents the maximum

10 - Over time, a country can reduce its inefficiencies and reach the frontier or the frontier itself can shift outwards over time, indicating technical progress.

output that can be obtained from any given input vector, that is, the upper boundary of the production possibilities set. The input – output combination of each country is located on or below the production frontier[12]. We define the input vector as consisting of physical capital stock (*K*), labour force (*L*) and the stock of human capital (*H*). A time trend (*T*) common to all countries that capture technical progress over time is also included. Therefore, the stochastic frontier production function can be described as:

$$Y_{it} = f(K_{it}, L_{it}, H_{it}, T; \beta) TE_{it} e^{v_{it}} \quad (1)$$

where Y_{it} is output in country *i* at time *t* and, K_{it} ,L_{it} and H_{it} are physical capital stock, labour and human capital in country *i* at time *t*. *TE* is technical efficiency. The production technology in logarithms is set out in equation (2), where y_{it} represents the maximal output in country *i* at time *t*,

$$y_{it} = f(k_{it}, l_{it}, h_{it}, T; \beta) + lnTE_{it} + lne^{v_{it}} \quad (2)$$

Given that technical efficiency, $TE_{it} = e^{-uit}$, equation (2) can be written as

$$y_{it} = f(k_{it}, l_{it}, h_{it}, T; \beta) + v_{it} - u_{it} \quad (3)$$

where u_{it} *(0<* $u_{it} \leq 1$*)* measures technical inefficiency and v_{it} captures random character of the frontier caused by measurement error or other effects not captured by the model.

An important issue with regard to the estimation of equation (3) is the functional form of the production frontier. As a result of the questions raised over the suitability of the Cobb–Douglas functional form and the inclination for the translog stochastic frontier specification (see Duffy and Papageorgiou, 2000; Kneller and Stevens, 2003), we apply the translog specification (with non- neutral technology) in equation (4) to characterise the production frontier (see also table 1 for test of Cobb-Douglas against the translog):

$$y_{it} = \beta_0 + \sum_{n=1}^{3} \beta_n lnx_{nit} + \frac{1}{2} \sum_{n=1}^{3} \sum_{j=1}^{3} \beta_{nj} lnx_{nit} lnx_{jit} + \sum_{n=1}^{3} \beta_{tn} Tlnx_{nit} + \beta_t T + \frac{1}{2} \beta_{tt} T^2 + \sum_{r=1}^{3} \rho_r D_r + v_{it} - u_{it} \quad (4)$$

where y_{it} is log output of country *i* in time *t*, x_{nit} is the nth factor input used by the *i*th country in time *t* to produce y_{it}. We include three inputs into the production process, specifically physical capital, labour and human capital respectively. Equation (4) also includes regional dummies (D_r) for Latin America and the Caribbean (LAC), Sub Sahara Africa (SSA) and Asia (ASIA). These capture variances in the initial level of technology for these regions and are preferred to country-specific fixed effects (Temple, 1999). The variable *t* is a proxy for technical progress and is explicitly intended to capture domestic technical progress. The β's are parameters to be

11 - Kumbhakar et al. (1991), Reifschnieder and Stevenson (1991) and Huang and Liu (1994) are some of the earlier studies that presented models to overcome this problem by estimating both the frontier and efficiency effects in one stage.
12 - In order to account for the possible complementarity between human capital and physical capital, human capital is included as a separate term in the production function(see Griliches, 1969; Mankiw et al.,1992; Kneller and Stevens, 2006).

estimated. Finally, u_{it}, where $u_{it} \geq 0$ is the technical inefficiency error component and v_{it} with v_{it} *: iid N (0,* σ^2_v*)*, being the random noise error component.

3.2 Inefficiency effects

Much of the empirical literature on efficiency using panel data models have examined intermediate cases, in which the inefficiency term was of a form more or less like

$$u_{it} = g(zit)\ |Ui|, \tag{5}$$

where *Ui* is half normal or truncated normal. In this case, inefficiency varies through time, but in a somewhat restricted fashion. Most current studies employing the SFA have used the Battese and Coelli monotonic 'decay' specification,

$$u_{it} = exp[\eta(t-T)] \times |Ui|, \tag{6}$$

where *t* is the period, *T* is the last period. The stochastic part is *Ui* which is time invariant. Thus, in this form, there is a patterned variation through time, a simple exponential function determined by the parameter η.

However, Greene (2005b; 2007) notes that, even with the time variation produced by *g(t)*, the assumption of time invariant *Ui* can severely distort the estimated model and the implied inefficiency estimates. Greene (2007) shows that results from the monotonic 'decay' specification are still vastly different from models in which the random part varies with time. These results therefore, suggest that, the reality that the random component is still time invariant remains a substantive and detrimental restriction in the popular BC monotonic 'decay' specification. Therefore the assumption of time invariance of the random term is a major component of this model. As indicated, we use an alternative formulation which allows the variance effect to be non-monotonic. The baseline specification is:

$$u_{it} = exp[\eta 1(t-T) + \eta 2(t-T)^2] \times |Ui|, \tag{7}$$

which makes the BC monotonic model somewhat more general[13]. Therefore, the non-monotonic specification of the BC 'decay' model to some extent can control the time invariant property of the random component (Greene, 2007). Inefficiency is thus specified as:

$$u_{it} = \delta z_{it} + \Omega_{it}, \tag{8}$$

where u_{it} are technical inefficiency effects in the stochastic frontier model that are assumed to be independently but not identically distributed, z_{it} is a vector of explanatory variables, including year time dummies which may influence the technical efficiency of a country and δ is the vector of coefficients to be estimated. Ωit is a random variable distributed as a truncated normal distribution with zero mean and variance σ^2_u, such that the point of truncation is $-\delta z_{it}$.

13- We note, however that, this specification is not the same as the time varying inefficiency, since Ui is still time invariant.

Inefficiency is modeled as dependent on regional integration, trade openness (TO), and landlocked index (LAND). The Regional integration variable captures both ECOWAS and UEMOA (monetary union). Consistent with the base specification of the non-monotonic 'decay' model, time (year) dummies, ζ_t, are included in order to generalise the BC model and importantly control for the patterned variation of u_{it} through time. The main model for the inefficiency effect is defined as:

$$u_{it} = \delta 0 + \delta 1 TOit + \delta_2 LAND_j + \delta_3 ECOWAS_j + \delta_4 UEMOA_j + \zeta t + \Omega it \quad (9)$$

The expectation therefore is that, increased trade openness will reduce aggregate inefficiency. If trade openness reduces inefficiency, then δ_1 would be negative. We use an indicator of openness to international trade by Wacziarg and Welch (2008) to determine the importance of trade openness in explaining deviations from the frontier.

The dummy variable representing landlocked index takes the value of 1 if the country is landlocked and 0 if it is not. If being landlocked increases inefficiency (or the distance from the frontier) then δ_2 would be positive. In the same way, the dummy variable representing regional integration takes the value of 1 if country is regionally integrated and 0 if it is not. This is done for both ECOWAS and UEMOA. If been a member of ECOWAS reduces inefficiency then δ_3 would be negative. Also if been a member of UEMOA reduces inefficiency then δ_4 would be negative.

3.3 Data

The dataset used in this study is a panel of 57 countries (including 11 ECOWAS and 7 UEMOA countries) for the period 1970-2010. The dataset is expanded to include other countries in order to enable us determine the globally efficient frontier (see Appendix A, table A1 for list of countries)[14]. It is also important to note that we limit our sample of ECOWAS and UEMOA countries to 11 and 7 respectively because of data availability. Description and source of data for the production frontier, i.e. real GDP, physical capital stock, labour force and human capital are defined as follows: (1) real GDP data is derived from the WDI (2012); (2) In line with the existing literature (see Collins and Bosworth, 2003; Ndulu and O'Connell, 2003), the total labour force is measured by the economic active population (that is, the population aged between 15 and 64 years) and is also sourced from the WDI (2012); (3)We follow the methodology by Nehru and Dhareshwar (1993) for our dataset on physical capital stock. We use the perpetual inventory method with a revised depreciation rate of 0.05 percent[15]. (4) We use Barro and Lee (2010) dataset on total human capital - this new dataset exploits new sources of information and introduce different corrections to improve the signal-to-noise ratio in the schooling series; the educational attainment estimates of Barro and Lee (2010) are measured by the mean years of schooling in the population aged 15 years and over.

14 - Studies in this area have found that the globally efficient frontier was not defined by only industrialised countries but also countries such as Singapore (see Milner and Weyman–Jones, 2003), Iran, Venezuela and Mexico (see Koop et al., 2000; Suhariyanto and Thirtle, 2001; and Kumar and Russell, 2002) which are included in our sample were identified as defining the efficiency frontier.

With regards to the explanatory variables for the inefficiency effects, the Sachs–Warner indicator of openness to international trade which is defined as the average years 'open' over period was obtained from Wacziarg and Welch (2008). The landlocked index is a dummy variable with a value of 1 for landlocked countries and 0 if it is not. The regional integration variables are also dummy variables. For countries in ECOWAS, the dummy takes the value of 1 if the country is in ECOWAS and 0 if it is not. Countries which belong to UEMOA take the value of 1 and 0 if it is not.

4 - Empirical Analysis of Results

4.1 Hypotheses tests

The results of all the hypotheses tests associated with our model specification are shown in Table 1. The first issue is the testing of the statistical (and economic) relevance of countries' inefficiency. The stochastic approach allows us to explicitly test for the presence of technical inefficiency in a specific production process. In practice, the null of the joint significance of the coefficients in equation (9) is tested, i.e., H_0: $\eta = \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$. The test procedure uses a generalised likelihood ratio (LR) statistic. Examination of the LR test statistic shows that the null hypothesis is rejected at the 5% significance level; therefore, implying that the null hypothesis of no inefficiency is rejected. The rejection of the null of no inefficiency effects provides support for the stochastic frontier model specification.

The functional form of the stochastic frontier model can be of a Cobb–Douglas or a more flexible translog form. The next step consists of testing the appropriate functional form, with the null hypothesis of a Cobb–Douglas specification, using a LR test. We find support for the translog production function. Finally, LR tests are also used to examine the existence and nature of technical change, which are modelled through the incorporation of a time trend in the production function. The null hypotheses that there is no technical change and technical change is Hicks-neutral are rejected respectively. These decisions show that non-neutral technological progress and technical change are adequate representations for our model.

Table 1: Generalised likelihood-ratio (LR) tests of null hypotheses for parameters in the stochastic frontier production function and efficiency model

Null hypothesis(H0)	LR- test Statistics	Critical value (α=0.05)	Decision
No inefficiency effects	291	11.070	Reject H_o
A Cobb-Douglas function is adequate	281	12.592	Reject H_o
No technical change	182	9.487	Reject H_o
Technical change is Hicks- neutral	652.2	7.814	Reject H_o

The critical values are at 5% level of significance and are obtained from Table 1 of Kodde and Palm (1986).

15 - We obtained the initial dataset on physical capital stock by Nehru and Dhareshwar (1993) from Susan Collins. We are grateful to Susan Collins for access to the data.

4.2 National efficiency and covariates

Table 2 shows the results for estimating the parameters of the models defined in equations (4) and (9). We estimate a main model for the whole sample and two nested models for ECOWAS and UEMOA. Since the explained variable in the model is inefficiency, a negative sign on the coefficient of an explanatory variable represents an increase in efficiency.

Table 2: Maximum likelihood estimates of the parameters of the translog stochastic frontier production function with efficiency component.

	Main model	Nested models	
		ECOWAS	UEMOA
Production function	[1]	[2]	[3]
	22.4771***	23.9946***	23.6349***
Constant	(2.1929)	(2.2446)	(2.0968)
	-.7959***	-.8152***	-.7868***
K	(.0658)	(.0684)	(.0649)
	.3289	.1525	.1482
L	(.2292)	(.2214)	(.2184)
	.99337208***	.8503***	1.0813***
H	(.18572176)	(.1660)	(.1698)
	-.0285***	-.0236**	-.0288***
TREND	(.0093)	(.0093)	(.0092)
	-.5367D-05	-.5489D-05	-.5471D-05
K2	(.4379D-05)	(.4413D-05)	(.4441D-05)
	-.1065***	-.0977***	-.0955***
L2	(.0153)	(.0144)	(.0143)
	.0260	.1055***	.1044***
H2	(.0265)	(.0287)	(.0283)
	.0007***	.0007***	.0007***
TREND2	(.6797D-04)	(.6285D-04)	(.6443D-04)
	.0753***	.0771***	.0756***
K*L	(.0044)	(.0046)	(.0044)
	.1173***	.1104***	.1048***
K*H	(.0087)	(.0081)	(.0074)
	-.0024***	-.0021***	-.0021***

K*TREND	(.0003)	(.0003)	(.0004)
	-.2558***	-.2383***	-.2448 ***
L*H	(.0109)	(.0113)	(.0112)
	.0056***	.0048***	.0051***
L*TREND	(.0004)	(.0005)	(.00049476)
	.0018***	-.0002	.0002***
H*TREND	(.0007)	(.0008)	(.0008)
	1.0331*	.9811	1.0011
LAC	(.5367)	(.6567)	(.6251)
	-.5574	-.5321	-.5320
SSA	(.5231)	(.6441)	(.6238)
	1.0166**	.9404	.9655
ASIA	(.5169)	(.6408)	(.6282)
Inefficiency effects model			
	-.0165***	-.0603 ***	-.0698***
Openness	(.0058)	(.0281)	(.0268)
	.4190	.6362	.6303
Landlocked	(1.3813)	(6.5045)	(6.4977)
	.6864	.1587	.0679
ECOWAS	(2.8113)	(1.2090)	(.9606)
	-.1599	-.1599	-.2292
UEMOA	(3.6254)	(1.7511)	(1.4014)
Variance parameters			
	11.0515***	7.9355***	8.0789***
Lambda	(.0189)	(.0201)	(.0197)
	1.2339***	.8867***	.9026***
Sigma(u)	(.3877)	(.1137)	(.1201)
log-likelihood	934.1775	921.0512	920.5468

Note: Standard errors in parentheses.
Inefficiency effects model follows a non –monotonic time decay specification. Year dummies are included in the inefficiency effects component.
A negative sign on the coefficient of a zit vector variable represents a reduction in inefficiencies.
*** and ** represent significance at the 1% and 5% level respectively.

In column [1], we estimate the main model which comprises the whole sample of 57 developing countries. The results show that trade openness, landlockness and UEMOA have

the expected signs, but only trade openness is statistically significant in explaining variation in aggregate inefficiency. Surprisingly, the coefficient on ECOWAS carries the wrong sign and it is not statistically significant. In column [2], we estimate a nested model which comprises ECOWAS countries. The estimates show that openness to trade in ECOWAS countries significantly reduces inefficiencies. Inefficiency however increases for landlocked ECOWAS countries. Finally, in column [3], the estimates indicate that openness to trade in UEMOA countries also leads to a reduction in efficiency significantly while landlocked UEMOA countries experiences increases in efficiency.

Our results indicate a strong influence of international trade on efficiency in developing countries as well as in ECOWAS or UEMOA. Specifically, a greater orientation towards trade or trade openness is shown to increase national efficiency scores of countries in ECOWAS/UEMOA. In other words, trade may enhance technology transfer to ECOWAS/UEMOA countries. This finding demonstrates that while lowering barriers to trade between ECOWAS countries is important, the objective of regional integration should not be only to increase intra-regional trade per se but also to enhance trade both within the region and more importantly the rest of the world.

In terms of the impact of location and related factors on inefficiency, our estimation shows that landlocked countries in developing economies and in ECOWAS/UEMOA are technically inefficient. The transfer or diffusion of technology to such regions may be very slow due to higher transportation cost among others. This finding thus lends support to those researchers that argue that aspects of geography and their correlates negatively affect output growth in particular groups of countries. It also echoes earlier findings by Bloom et al. (2002) and Hall and Jones (1999) of the importance of geography in determining the level of productivity.

Finally, regional integration (in this case, ECOWAS and UEMOA) has had little influence on national efficiency. This may be due to the pervasiveness of poor infrastructure in ECOWAS and Africa in general. This finding suggests that without scaling up infrastructural upgrade in the ECOWAS region in particular, and Africa in general, the much anticipated efficiency gains from trade that are associated with regional integration will continue to elude member countries. In this regard, regional coordination and cooperation efforts should be directed at creating regional public goods - goods that countries cannot cost effectively provide on their own. In the absence of a strong regional approach there would be underinvestment in cross-border trade facilitation activities which have positive spillover effects on efficiency within the region.

5. Conclusions

In relation to the importance of efficiency improvements as a means of achieving productivity increases, this paper investigates the role of regional integration, trade openness and landlockedness in explaining national efficiency in ECOWAS countries over the 1970-2010 periods. We use the stochastic frontier model, i.e., a modified version of the BC complex time 'decay' specification in which the inefficiency effects are non- monotonic, thereby allowing for the control of the time invariant random component in the monotonic specification.

We find that trade openness plays a significant and quantitatively important role in explaining efficiency scores in ECOWAS countries. Landlockedness and regional integration (i.e. ECOWAS and UEMOA) however, has an insignificant effect on inefficiency.

Our findings indicate the need for ECOWAS countries to take pragmatic steps to open up their economies to trade. Regional integration could be used as a means to focus on the rest of the world which generates 98.7% of world GDP and therefore achieve greater global integration. There is also the need to deepen regional coordination and cooperation to vigorously create and invest in regional public goods which bring positive spillover effects and increase efficiency within the region.

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Appendix A

Table A1: List of Countries

Sub- Saharan Africa		
Benin	Mauritius	
Burkina Faso	Mozambique	
Cameroon	Rwanda	
Congo Dem. Rep	Niger	
Congo Rep	Nigeria	
Gambia, The	Senegal	
Ghana	Sierra Leone	
Ivory Coast	Togo	
Kenya	Uganda	
Malawi	Zambia	
Mali	Zimbabwe	

Asia		
Bangladesh	Korea Rep	Sri Lanka
China	Malaysia	Thailand
Hong Kong	Philippines	
Indonesia	Pakistan	
India	Singapore	

Latin America		
Argentina	Guatemala	Peru
Bolivia	Honduras	Trinidad and Tobago
Brazil	Jamaica	Uruguay
Chile	Mexico	Venezuela
Colombia	Nicaragua	
Costa Rica	Panama	
Dominican Rep.	Paraguay	
Ecuador	Papua New Guinea	
El Salvador		

Others
Algeria
Egypt
Iran
Jordan
Syria
Tunisia

An empirical investigation into the monetary policy transmission mechanism in Nigeria

Adedapo T. Adenekan and Christian R. Ahortor

Abstract

The objective of this paper is to review the frameworks for monetary policy implementation in Nigeria. Applying the vector autoregressive (VAR) approach, it assessed the monetary policy measures between 2000 and 2009, to determine how monetary policy actions transmit to the rest of the economy. The empirical findings show that the basic model involving broad money is more robust and stronger than the credit, interest and exchange rate channels, which are found to be weak. Evidence also suggests that the monetary authority is more price stability focused than growth, as targets for monetary aggregates are monitored closely and the relationship between price and broad money is consistently more robust than all the other variables within the model. Weak transmission mechanisms in credit, interest and exchange rates are indicative of weak and shallow financial system. This constraint can be reduced by strengthening and deepening the financial system and ensuring adherence to supervision.

JEL Classification: E52, E58, F55

Keywords: monetary policy, transmission mechanism, inflation, growth, Nigeria*

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1. Introduction

Instruments of monetary policy are pivotal to macroeconomic stability. It is the case that monetary policy must be exercised cautiously, as its timing and effect are very critical, considering that it operates with a time lag amid varying speed of transmission mechanism. Such variations are even more pronounced across countries because of their different economic structures amidst dissimilar institutional features with attendant differing counterbalance effects. Monetary policy affects the real sector of the economy through some transmission channels, such as interest rates, credit, exchange rate, etc., importance of which are greatly influenced by the structure of the economy. Thus, for monetary policy to be effective, an understanding of the relationship between operating monetary policy instruments and the ultimate goals of such policy including, output growth or price stability must be established for policy directives purposes.

Like most monetary authorities in developing countries, the thrust of monetary policy in Nigeria is the achievement of price stability, without losing focus on growth. Over the years, the Central Bank of Nigeria (CBN) has adopted various monetary frameworks that suited the prevailing macroeconomic conditions and level of development in the country. In the early to mid 1970s, due to the relative underdeveloped nature of the financial markets and restraints on interest rates, the use of market-based instruments was not feasible. Major features of the monetary management included credit ceilings, selective credit controls, administered interest and exchange rates, as well as the prescription of cash reserve requirements and special deposits. The inherent systemic structural imperfections brought about distortions, restrictive and inefficient allocation and utilization of resources posing serious challenges to successful attainments of monetary target[16]. Furthermore, the rigidly controlled interest rate regime, especially with the various rates at very low level, encouraged monetary expansion without promoting the rapid growth of the money- or capital markets. The direct control method of monetary policy lasted until 1985.

Commencing 1986, the era of the Structural Adjustment Programme (SAP), the monetary authority shifted from direct control to indirect (market-based) tools, driven by an environment of major macroeconomic reforms and liberalization policies that led to financial market deepening. With the monetary policy focus based on short-term (one year), the primary instrument employed was the open market operation by means of the Nigerian Treasury Bills (NTB), complemented with reserve requirements and discount window operations. Minimum rediscount rate (MRR) was employed as an indicative policy rate consistent with the liquidity condition, with the CBN essentially focusing on ensuring sound management and maintenance of Deposit Money Banks' balance sheet position. Other measures included mandatory sales of special treasury bills to banks, as well as a requirement of 200 percent treasury instruments as collateral for foreign exchange demand at Autonomous Foreign Exchange Market (AFEM).

In 2002, the authority introduced a medium term (two-year) monetary policy strategy as an endeavor to ease the problem of time inconsistency and the need to minimize the impact

16 - For example, majority of the banks did not comply with credit guidelines to bring about effective implementation of credit ceilings and selective credit control fundamental with the monetary control framework. Other challenges included the non-harmonization of fiscal and monetary policies.

and magnitude of temporary shocks to the system. The monetary authority also conducted a managed float exchange rate arrangement with the reintroduction of a biweekly Dutch Auction System (DAS) in July 2002, replacing the Inter-bank Foreign Exchange market (IFEM). Furthermore, monetary guidelines were to be reviewed every six month to ensure consistency with monetary and financial markets' conditions and developments. And, in line with the proposed single currency agenda for the West African Monetary Zone (WAMZ) of which Nigeria is a member, monetary policy has been focusing on attaining and maintaining single digit inflation as well as stability in the exchange rates regime. Currently, CBN employs broad money (M2) as the nominal anchor for monetary policy.

The broad objective of this study is to identify transmission channels through which monetary shocks impact the real economy in Nigeria. Understanding the transition mechanism of monetary policy allows us to evaluate the responsiveness of output and prices to monetary policy shocks in terms of the magnitude of the effect, the speed of adjustment, and importantly, the channels through which the effects are transmitted. This study is particularly relevant, to the extent that Nigeria, along with other Member-States of the WAMZ[17] is preparing for a monetary union in 2015. Hence, additional insight into dynamic interrelationship of key monetary variables would be beneficial for monetary management and related purposes. In addition, the continued double digit inflation rates experienced in Nigeria while real GDP growth is high suggests that it is imperative to uncover the relevant channel(s) of monetary policy transmission in Nigeria.

This rest of the paper is structured as follows. The next section reviews the previous studies, providing both the theoretical foundation and empirical survey. In section three, we present the methodology and estimation result, while section four presents the conclusion and policy recommendations.

2. Literature Review

2.1 Theoretical Review

The theoretical basis for the monetary transmission mechanism is deeply rooted in one of the oldest surviving economic doctrines, "the quantity theory of money," which also forms the cornerstone of the post-Keynesian monetarist doctrine. Its simplistic mathematical representation is the famous equation of exchange as formulated by Irvin Fisher, MV = PY; where, M is the stock of money, V is the velocity of circulation; P is the price level, and Y, the physical volume of market transaction. Money is autonomous and velocity is assumed constant. The central theme of the theory is the hypothesis about how the stock of money (M) relates as the main determinant to the price level; i.e., a direct and proportional link between money supply and level of prices, and by implication the level of economic activities. Implicit in the set of interrelated propositions of the Quantity Theory, among others, is the active or causal role that money plays in the monetary transmission mechanism, involving the process of adjusting to a new equilibrium level following a shock to the money stock.

17 - Other Member States are The Gambia, Ghana, Guinea, Liberia and Sierra Leone.

More specifically, within the context of this study, the theory implies that the channel of influence runs from monetary aggregates to price level. For example, following a disequilibrium invoked by changes in money stock, prices (along with other economic related activities) react until the disequilibrium dissipates. It therefore implies that the adjustment process must have required some mechanism, channel or linkage whereby monetary impulses transmit to price level. Thus, the agitation to x-ray the so-labeled "black-box" of the reduced-form-monetarists' continues to spur the mutable debates and empirical research works. Variations of theories regarding monetary policy transmission mechanism have been proposed, but for analytical purpose they can be generally condensed into three views, namely: traditional interest rate effect, other asset price effects, and credit views. [See Mishkin (2006) for detailed synopsis and analytical presentation of these views].

The interest rate channel as a monetary transmission mechanism forms the core Keynesians' argument that monetary policy works indirectly through interest rates and investment. Even, earlier economists have, for long, held the view about interest rates having a pivotal role in monetary policy formulations. For example, Irving Fisher's 1896 piece had posited that rising nominal interest rates indicates that economic agents expect and adjust to higher rates of inflation. The rising nominal interest rates continue until the inflationary premiums fully compensate creditors for the eroding purchasing power of money. Within the framework of Keynesians' interest rate-output space analysis, any monetary expansion will lead to a fall in real interest rate, which lowers the cost of capital and thereby causes an increase in investment spending (including other interest-rate-sensitive consumer durable goods, such as automobiles, refrigerators, residential housing, etc.). The overall effect will be an increased aggregate demand and output.

Post-Keynesian (*modern*) monetarists acknowledged that transmission mechanism operates through a complicated portfolio involving numerous interest rates affecting wide range of assets, which bring to the fore the relevance of other asset price effects depending on its instrumental source, including exchange rate, wealth, or Tobin's Q[18] effects. Exchange rate effect occurs through a monetary expansion that leads to lower domestic real interest rates and exchange rate depreciation as domestic currency deposit becomes less attractive relative to foreign currency deposit. All things being equal, the exchange rate depreciation will boost net export, and facilitate overall increase in nation's income. Wealth effect also operates through stock price responses to a change in monetary policy. With unexpected rise in net worth of the stock holders due to rising price of equity, lifetime resources of consumers increasing, so that their consumption increase. Conversely, an unexpected loss in financial wealth reduces the lifetime resource of consumers, thus spending is reduced by the fraction of the change in wealth, while maintaining new spending level over time. [Modigliani, (1971), pp. 9–84].

18 - Tobin (1969) developed the Q-theory to illustrate a rational investment behavior of a firm, wherein Q is defined as the ratio of the market value of a firm's existing share capital to the replacement cost of the firm's physical assets. When the share capital value and its replacement cost are equal so that Q = 1, this represents a state of equilibrium and the firm should maintain its current level of assets. Q > 1 implies the market price of firm is relatively higher than replacement cost of capital; hence, additional investment will make sense. Conversely, Q < 1 indicates the firm will be better off selling its assets instead of putting them to use, since the relative cost of capital exceeds the market value of firm.

The famous Tobin Q has been widely considered relevant when evaluating the impact of monetary policy on the real activities, because stock market is an important destination for public spending. A monetary ease and excess cash balances increases demand for stocks, leading to higher prices of stocks. As the value of equity increases, Tobin's Q rises, indicating a plausibility of additional investment, consequently increasing national output. Of course, the increase in demand for stock could emanate through the substitution effect from selling off bonds (and stocks becomes more attractive) in the face of lower interest rates and the consequential lower bond yield, induced by monetary shock.

The third prong in the channels of monetary transmission mechanism is the credit view. While earlier theory by Miller and Modigliani (1958) undermines the role of credit in their "irrelevance of the capital structure of firms" postulates, credit view emerged in the 1970s, emphasizing the relevance of capital market imperfections and the uniqueness of bank loans. Credit view proponents ascribed a crucial role to the existence of "information asymmetry" that creates problems of adverse selection and moral hazard in financial market. The presence of information asymmetry informed the identification of two sources of monetary transmission mechanism by the proponents of credit view channel; that is, bank lending and household's balance sheets (or broad credit effects)[19]. The efficacy of bank lending within the context of transmission mechanism hinges on bank's credit supply. Monetary policy worked primarily by affecting the availability of financial intermediary credit. Restrictive monetary policy contracts total bank loans through the decline in banks' transactions and core deposit. For example, small firms relying heavily on bank lending and having no alternative source of finance are more adversely impacted. Similarly, small banks suffer the same fate as they are less able to secure additional source of funding in such situation of monetary tightening, with the ultimate adverse effect on output or prices.

An alternative view, balance sheets or broad credit channel, argues that an increase in money supply raises price of equity (in the balance sheets) and the firms' net-worth, thereby increasing household's financial wealth, even as firm's cash flow increases because of the attendant drop in nominal interest rate (cash flow channel). Positive outlooks for firms and household reduce the risk or severity of moral hazard and adverse selection problem for firms and probability of financial distress for household. Lending and investment for firms therefore increase. Household sector also boost their spending on consumer durables and housing, so that the ultimate effect is increase in aggregate output. Central to balance sheet channel, like bank lending's, is the role of information asymmetry and its moral hazard and adverse selection implication as they influence or shape the workings of the monetary policy

2.2 Empirical Review

There is much literature on the monetary policy transmission mechanism in the developed world as well as developing countries, including sub-Sahara Africa. Bernanke and Blinder

19 - The balance sheet approach is not of monetarist origin per se. It was actually developed within the frameworks of Keynes and J. R. Hick in the mid 1930s, and was elaborated subsequently by Tobin and others. It became emphasized as literatures began to raise doubt over bank lending channel's ability to stand the test of time, especially in the United States, where the channel had been found to be less relevant, and led economist to shift focus, probing further into other broad credit effects. Hence, the birth of balance sheets or other asset approaches.

(1992) provided robust empirical evidence to understanding the mechanism through which monetary policy operates in the United States. They found monetary transmission mechanism operates through bank loans, albeit slowly with an eventually substantial response to monetary innovations. Initial monetary tightening may have little effect on loans as banks redistribute the composition of their assets and selling of security holdings in the short run. As the brunt of tighter monetary policy persist, banks loans are eventually affected as banks terminate old loans, while refusing to make new ones. The ultimate effect is a depressed economy as bank loan dependent borrowers no longer have access to credit. An interesting feature in Bernanke and Blinder work is the choice of the federal funds rate as a measure for the policy rate. The paper showed the relevance of information content in the federal funds rate as a 'markedly superior' proxy to both monetary aggregates or other interest rates as a forecaster of the economy.

Investigating the responses of retail interest rates to changes in the money market rates in euro area countries, Mojon (2000) found that short term loan rate reacts most rapidly in this region. The study also found that deposit rates react more fully than mortgage rates in Belgium and Germany, while Italy appeared to demonstrate weak short term responses. These findings synchronizes with Dornbusch et al (1998) observations that lack of competition in some euro area banking sectors accounts for why they are more reluctant to transfer official rate changes immediately to customers. Also, "the relatively less rapid response could be attributed to the facts that banks in continental Europe tend to have more inter-linked relations with their borrowers." (EMU Study (2003), pp.17).

Carpenter (1999) examines the relevance of credit provision by authority and the existence of informal credit market in Korea. His findings show that increase in money supply is expansionary, and there exists positive and significant responses of price level to changes in interest rate, explaining that higher cost of credit translate to higher cost of inputs. This is consistent with the earlier studies by Montiel (1991) and, partly, with Wijnbergen (1982)). Several other studies have established the relevance of bank lending channel in other developing economies, some examples include, Namibia (Uanguta and Sylavanus, 2002), Pakistan (Agha, et al, 2005), Chile (Alfaro, et al (2003). For Turkey, Aslan and Korap (2007) analysis indicated exchange rate channel, through capital inflow, as strongly influential on real output and stock index. Ehrmann et al (2003) also revealed that loan supply of less liquid banks is more severely affected by changes in the monetary policy in Europe. This is in congruent with the empirical findings by Kashyap and Stein (2000) for the United States, which favored the relevance of bank lending channel with impact mostly driven through small banks with less liquid balance sheets.

For other developing countries, Hwee (2004) explored the mechanism in Singapore, and Hsing (2004) studied the case of Argentina. Goh, Chong and Yong (2007) also looked at the bank lending channel in Malaysia; and Disyatat and Vongsinsirikul (2003) analyzed the case of Thailand. Poddar, Sab, and Khatrachyan (2006) also studied the monetary transmission mechanism in Jordan. Most of these studies were based on a VAR approach and focused on exploring the reduced-form relationship between monetary policy and output growth. Typical variables often considered include; real output, inflation, interest rates, credit growth, REER, foreign reserves etc.

A host of studies have focused on sub-Sahara Africa's economy, particularly, in the West African Monetary Zone (WAMZ) sub-region. For example, in Ghana, investigation revealed exchange rate channel as highly relevant for the medium of transmission mechanism (Philip Abrada, et al, (2003)), while Amidu (2006) avers the validity of bank lending channel even as it emphasizes that banks size and liquidity sway banks' ability to extend credit. Also, according to Ogunkola and Tarawalie (2008), bank lending channel was also strongly relevant, with private sector being particularly sensitive to monetary shocks in Sierra Leone while the interest rate channel was found to be insignificant. Their study further affirms that the transmission via exchange rate channel was prominent on inflation, while its impact on output was imperceptible. Such imperceptibility may be attributed to the plausible sluggishness of the economy's real sector to a weak financial sector development.

With respect to Nigeria, empirical findings have been mixed. While some have identified either a weak interest rate channel and pronounced credit or exchange rate channels, others ascribed a limited role for expectation in these channels in the course of transmitting monetary shocks to the economy (Uchendu (1994) Oke (1995), Ojo (2000), and Adebiyi (2006). More recently, Aliyu and Englama (2009) estimated the quantitative relationship between inflation, monetary policy instruments and output in an attempt to evaluate Nigeria's readiness for adopting inflation targeting framework. The result suggested a joint significance of policy variable on prices and output. The study posited that interest rate and money supply drive output, with interest rate channel being a strong driver of productivity in the economy. Inflation is found to be impassive to monetary transmission, hence establishing a weak link between prices and credit or interest rate channels. However, innovations in exchange rate drive consumer price index (CPI) very strongly, emphasizing the pass-through effect of exchange rate depreciation. In this context, exchange rate channel is very important as a means of checking inflation.

Oyaromade (2008) also analyses the role of bank credit and credit rationing in the monetary transmission mechanism in Nigeria. His findings indicate that one-way relationships existed between bank credit and real GDP, money supply and prices and investment and real GDP with the causation running from credit to output, from money supply to real GDP and from investment to real GDP; unexpected shock to interest rate caused a significant decline in the level of real GDP and real GDP also responded significantly to bank credit innovations, while shocks to output and investment were found to be significant in explaining variability in real investment, accounting for 35 and 54 per cent respectively of one year forecast variance in investment; hence, interest rate and the credit channels played significant roles in the transmission of monetary impulse to the real sector in Nigeria, the study concluded.

Employing a structural vector autoregressive (SVAR) technique to investigate the effectiveness of bank credit channel of monetary policy transmission following Nigeria's adoption of deregulatory measures, Ogun and Akinlo (2010) found bank credit channel to be ineffective. This finding presumes a minimal role, if any, for the efficacy of monetary policy on bank lending in Nigeria. To Ogun and Akinlo, banks do not find monetary tightening prohibitively costly to expand loan supply, as the experience in the era of financial deregulation in Nigeria showed a banking sector with excess liquidity and widespread adoption of balance sheet liability management, rendering the bank credit channel an ineffective transmission mechanism.

The foregoing review suggests that, evidently, the debate is yet unsettled. In the face of the ongoing monetary integration process in the West African Monetary Zone (WAMZ), and with the features of Nigeria as the largest economy in the sub-region, the handling of monetary policy and its impact on the economy needs to be closely monitored.

3. Model Specification and Empirical Results

3.1 The Model

Within the framework of the vector auto-regression (VAR) model, our model is estimated to determine the effectiveness of the various channels of monetary policy transmission mechanism in Nigeria. VAR is generally used to analyze the dynamic impact of random disturbances on the system of variables. An important advantage for using the VAR model is its non-structural approach to modeling the relationships among the variables under study; circumventing the need for structural modeling therefore allows us to treat each variable as endogenous in the system. In its mathematical representation, the reduced form VAR is specified thus:

$$Z_t = A_1 Z_t - 1 + \ldots + A_p Z_{t-p} + Bx_t + e_t \quad (1)$$

where:

Z_t = k vector of endogenous variables
x_t = d vector of exogenous variables
e_t = the vector of innovations
$A_1, \ldots, A_p$; B = the matrices of coefficients to be estimated.

It is assumed that innovations, e_t, may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables. The VAR model to analyze the impact of monetary policy, in its reduced form representation, has the vector of endogenous variables defined accordingly:

$$Z_t = (Y_t, P_t, CPS_t, TBR_t, ER\_INDEX_t, M_t)' \quad (2)$$

The variables under consideration are defined as follows:

Y = Nominal gross domestic product
P= Consumer price index
CPS = Domestic credit o private sector
TBR = Treasury bill rate
ER_INDEX = Exchange rate index
M = Broad money (M2)

To evaluate each channel, our estimation procedure involves the following stages, consistent with each channel under investigation, with all variables entered in log transformation:

$$Z_t = (NOMGDPLN, LNCPI, LNM2)' \quad (3)$$

$$Z_t = (NOMGDPLN, LNCPI\ LNCPS, LNM2\ )' \quad (4)$$

$$Z_t = (NOMGDPLN, LNCPI\ LNTBR, LNM2\ )' \quad (5)$$

$$Z_t = (NOMGDPLN, LNCPI, LNER\_INDEX, LNM2\ )' \quad (6)$$

Employing the quarterly data from 2000Q1 to 2009Q4, we evaluate the relevance of the monetary policy transmission mechanisms in Nigeria. Data sources for all variables are the International Monetary Fund (IMF) International Financial Statistics (IFS) database as well as the Central Bank of Nigeria (CBN)'s Reports.

Following the basic relation that deals with output, price and broad money, the model is extended to include other channels, i.e., the credit, interest rates and exchange rate channels, as specified in equation (3) to (6). Broad money (M2) is used to proxy for monetary policy shocks because the growth rate of M2 is considered as an operating target in formulating and implementing monetary policy at the CBN.

3.2 Estimation Techniques

We conduct a preliminary VAR estimation as a prelude to identifying the appropriate lag structure of each variable, after which the proper VAR estimations were conducted based on the appropriate number of lag(s) identified. The impulse response function (IRF) and variance decomposition (VD) statistics are then generated to analyze the dynamic interaction between the variables under study. The conventional approach is to draw inferences from generated statistics of each endogenous variable to highlight the linkages between and among them. IRF traces the effect of one standard deviation innovation to the orthogonalized innovations in the current and future value of each endogenous variable between and among themselves. The VD on the other hand gauges the relative importance of an innovation in explaining the behavior a variable in the system.

In estimating IRF and VDs, the paper follows Gospodinov et al (2013) who noted that estimating IRFs from unrestricted VAR in levels is more robust than estimation from unit root pre-test VAR models (differenced VAR or VECM). Drawing from Sims, Stock and Watson (1990), they showed that, even in the presence of unit roots and possible cointegration, the IRF estimated from VAR in levels are consistent and individually normally distributed. Confirming the views of Lutkepohl and Reimers (1992), they note that when the response horizon is fixed with respect to the sample size, the impulse response estimators are under weak regularity conditions, consistent and asymptotically normally distributed.

Moreover, according to Haan (2011), a reduced form VAR can be estimated by Ordinary Least Squares (OLS), equation by equation, even if the model variables are integrated of order 1, [I~(1)]. He shows that the source of spurious regression is not that the model variables are I~(1), but there is no single value for the coefficients of the right hand side variables to make

the residuals stationary. However, by introducing lagged dependent variable at the right hand side, the residuals could become stationary. Thus, constructing IRFs does not require testing for stationarity, but inclusion of adequate lags to generate consistent estimates. In addition, any autoregressive process of order p, (p-lags), is covariance stationary, provided the first and second moments of the process are time independent. On the basis of the foregoing theoretical and empirical support, the paper conducts the IRF and VD estimation from an unrestricted VAR model with the variables in levels.

4. Empirical Results

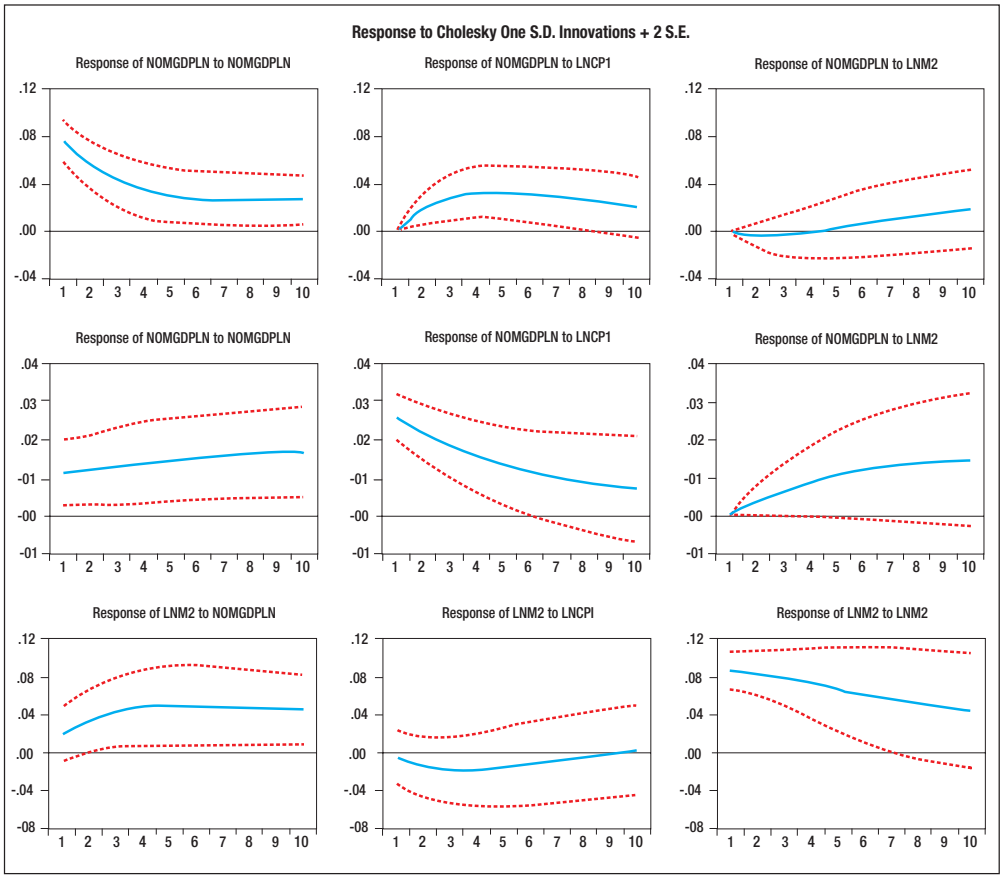
Lag Length Selection

As a prelude to our estimation, we evaluate the appropriate lag length in an effort to avoid the problem of over-parameterization due to elongated lags, or spurious regression as a result of using insufficient lags. Our lag order selection criteria is based on the Schwarz Bayesian Criterion (SBC) and Akaike Information Criterion (AIC) for selecting the appropriate lag length structure of variables to include in VAR, As illustrated in Appendix Table 1, the criteria generally agree on an optimum of one lag. The only exception is the credit channel that suggested a mixture of one or six lag. Since each case is supported by the two criteria respectively, we decide on one lag length for the credit channel as well. First, this will be consistent and comparable to other channels; and most especially, to the extent that we have a limited number of observations, one lag rather than six makes sense in addressing the potential data insufficiency and the associated degrees of freedom problems.

Analysis of IRFs and VDs

Figure 1 shows the impulse response functions (IRF) from the baseline (the basic) model, the model with income, price and broad money. A cursory check at the IRF charts for the basic model involving only nominal gross domestic product (NGDP), price (CPI), and broad money (M2), reveals the responses of nominal GDP to money, and money to price are not significant, but all others are. A closer examination indicates that initial response of NGDP to its own one-standard deviation shock was an 8 percent jump, before declining steadily to about 2 percent by the sixth quarter ahead, where it remained through the tenth period. The response of NGDP to a one-standard-deviation shock to CPI was about approximately 2 percent rise, although with a two quarter lag, and then increased slightly to 3 percent in the next period, before settling at 2 percent where it hovered through tenth period ahead. Price responded by a one percentage points to innovations in nominal GDP and broad money in the first and fourth period, respectively, and remained at that level through the forecast period ahead. Although very sluggish through the two periods ahead, the response of NGDP to innovation in price rose gradually to approximately 3 percent by the fourth quarter, before it slide to plateau at 2 percent. More importantly, increase in money supply increases the price level while it decreases income initially and increases it later.

Figure 1: Impulse Response Function for the Basic Model



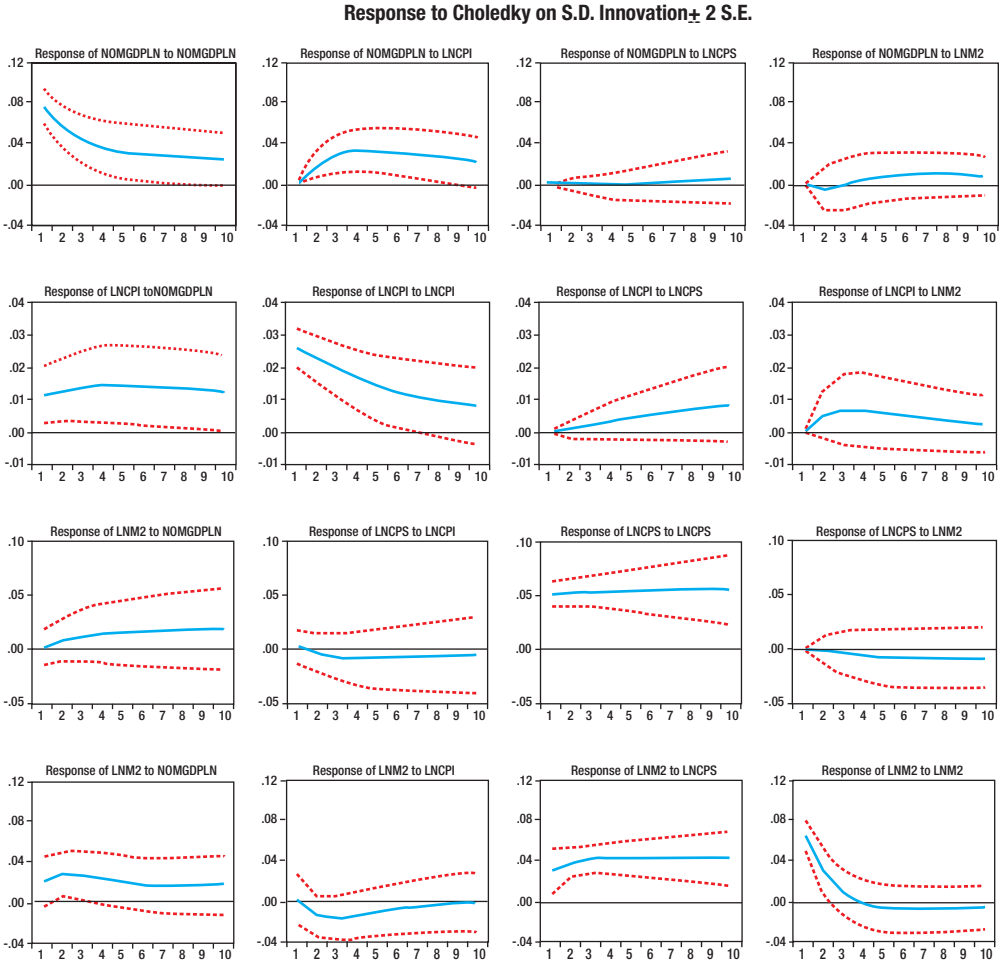
Evaluating the VD estimates, as illustrated in Table 1, the forecast error variances in NGDP is fully explained by its past value in the first period, as would be expected (given that NGDP leads the variables ordering). By the third quarter, however, the decomposition in NGDP began to be largely explained by variance in price, but not money. By the end of ten periods under observation, variations in prices have contributed about 30 percent to the variations in NGDP. Decomposition of price is also largely explained by its past values (84.1%) in the first period, the contribution of the variances in NGDP is high in the first period, at 16 percent, and remained progressively important. The relative importance of money, which kicked in at the third period at 3 percent, increased steadily, accounting for approximately 21 percent of the variance in price by the tenth period observed. The decomposition of money also revealed NGDP's relative importance, from 5 percent in the first period to approximately 31 percent by the end of period under observation.

Table 1: Variance Decomposition for the Basic Model

Variance Decomposition of NOMGDPLN:				
Period	S.E.	NOMGDPLN	LNCPI	LNM2
1	0.076898	100.0000	0.000000	0.000000
2	0.097275	95.82892	3.999582	0.171497
3	0.110361	89.59646	10.15934	0.244200
4	0.120391	83.66820	16.11988	0.211919
5	0.128558	78.47475	20.89830	0.231446
6	0.135434	75.23691	24.30752	0.455575
7	0.141424	72.51628	26.51217	0.971551
8	0.146839	70.45473	27.74869	1.796579
9	0.151903	68.84760	28.25743	2.894972
10	0.156761	67.55189	28.24718	4.200928
Variance Decomposition of LNCOI:				
Period	S.E.	NOMGDPLN	LNCPI	LNM2
1	0.028498	15.89173	84.10827	0.000000
2	0.038264	18.95666	80.06831	0.975030
3	0.045052	22.12605	74.88908	2.984870
4	0.050564	25.19958	69.13952	5.660901
5	0.055439	28.03685	63.32667	8.636479
6	0.059951	30.56620	57.80876	11.62503
7	0.064221	32.77104	52.78559	14.44337
8	0.068299	34.66901	48.33314	16.99785
9	0.072203	36.29401	44.44866	19.25733
10	0.075941	37.68456	41.08767	21.22778
Variance Decomposition of LNM2 :				
Period	S.E.	NOMGDPLN	LNCPI	LNM2
1	0.089906	5.204141	0.228100	94.56776
2	0.129369	9.958521	1.409476	88.63200
3	0.159189	14.18686	2.237438	83.57570
4	0.182775	17.79151	2.621490	79.58700
5	0.201749	20.84533	2.688876	76.46579
6	0.217243	23.43789	2.578118	73.98399
7	0.230118	25.64599	2.393315	71.96069
8	0.211032	27.53249	2.201123	70.26639
9	0.250477	29.14947	2.038265	68.81227
10	0.258815	30.54087	1.920538	67.53860
Cholesky Ordering: NOMGDPLN LNCPI LNM2				

As depicted in the results for the credit channel in Figure 2, including credit to the private sector (CPS) to examine the relevance of the credit channel indicates insignificant responses of the NGDP and CPI to innovations to credit. However, the responses of money to CPS innovation are very robust and significant. Money rose initially to about 3 percent in the first quarter, and then to 4 percent in the second quarter, where it remained consistently through ten periods ahead. The initial response of CPS to its own innovation was an increase of 5 percent throughout the period considered. This suggests that money growth is partly driven by the credit to the private sector, consistent with the money creation explanations. Likewise, given that the impact of CPS on NGDP and CPI are not statistically significant and the effect of CPS on money is robust, the implication is that shocks to the CPS may be affecting the economy through its effect on broad money. In addition, increase in credit increases money supply, the price level but reduces income initially while it increases it later, suggesting the delayed effect of credit on income.

Figure 2: Impulse Response Function for the Credit Channel



The VD of credit to the private sector (CPS), shown in Table 2, also indicates credits as the dominant contributor to its own variance, with very minimal relative impact from NGDP (about 6 to 7 percent). But, the decomposition of variance for money indicates a highly relative importance from the CPS. The proportion of variances from CPS, which in the first quarter stood at 16 percent, risen steadily to 50 percent by the sixth period. By the end of tenth period under study, proportion of variance from CPS toward the explanation of monetary aggregate has reached 61 percent, even as money explained only 21 percent of its own innovation by the end of this period.

Table 2: Variance Decomposition for the Credit Channel

Variance Decomposition of NOMGDPLN:					
Period	S.E.	NOMGDPLN	LNCPI	LNCPS	LNM2
1	0.078010	100.0000	0.000000	0.000000	0.000000
2	0.098493	96.04148	3.774002	0.014136	0.170385
3	0.111914	89.86617	0.961854	0.037839	0.134141
4	0.122652	83.82877	15.89537	0.048030	0.227824
5	0.131669	78.96115	20.45993	0.043431	0.535499
6	0.139262	75.38909	23.62589	0.043422	0.941602
7	0.145645	72.87664	25.72034	0.072815	1.330200
8	0.151026	71.12588	27.07680	0.152276	1.645039
9	0.155605	69.88653	27.94211	0.295647	1.875707
10	0.159551	68.97704	28.47911	0.510728	2.033131
Variance Decomposition of LNCPI:					
Period	S.E.	NOMGDPLN	LNCPI	LNCPS	LNM2
1	0.028732	16.24976	83.75024	0.000000	0.000000
2	0.039300	19.46289	78.69377	0.035020	1.808323
3	0.046490	22.98769	73.33292	0.196631	3.482758
4	0.051850	26.34614	68.65107	0.533886	4.468907
5	0.056071	29.26884	64.76757	1.053400	4.910190
6	0.059538	31.66966	61.56084	1.740002	5.029499
7	0.062486	33.57370	58.87001	2.572544	4.983747
8	0.065062	35.05312	56.55405	3.531422	4.861408
9	0.067367	36.18797	54.50439	4.600521	4.707124
10	0.069467	37.04852	52.64288	5.766649	4.541948
Variance Decomposition of LNCPS:					
Period	S.E.	NOMGDPLN	LNCPI	LNCPS	LNM2
1	0.051474	0.069136	0.374155	99.55671	0.000000
2	0.074406	1.342710	0.482997	98.14600	1.808323
3	0.093160	2.674772	1.003413	96.12985	3.482758
4	0.109511	3.743421	1.411242	94.38808	4.468907
5	0.124083	4.556604	1.630007	93.07522	4.910190
6	0.137263	5.189398	1.707306	92.12307	5.029499
7	0.149345	5.707540	1.699965	91.42652	4.983747
8	0.160564	6.155205	1.647971	90.89808	4.861408
9	0.171100	6.559030	1.575084	90.47672	4.707124
10	0.181092	6.934075	1.494297	90.12328	4.541948
Variance Decomposition of LNM2:					
Period	S.E.	NOMGDPLN	LNCPI	LNCPS	LNM2
1	0.076827	6.770482	0.066522	15.76924	77.39375
2	0.095880	12.27893	2.265256	26.19742	59.25843
3	0.109338	15.08443	4.074158	34.77167	46.06974
4	0.120444	15.98200	4.677320	41.31150	38.02918
5	0.129942	16.02224	4.603818	46.38850	32.98544
6	0.138301	15.76935	4.297100	50.46374	29.46981
7	0.145892	15.45961	3.953523	53.81911	26.76776
8	0.152978	15.17971	3.635346	56.62857	24.55637
9	0.159731	14.95492	3.354543	59.00882	22.68172
10	01.166255	14.78615	3.108623	61.04457	21.06065

For the interest rate channel, shown in Figure 3 the interest rate variable (TBR) performed poorly, as it does not have any significant relationships with either NGDP or CPI. In addition, a one-standard-deviation increase in interest rate increases money supply, the price level and income. Also, the variance decomposition estimates, shown in Table 3 indicates that TBR has no relative statistical importance in contributing to variances in NGDP and CPI. The proportion of variance recorded in each instance is around one percent. As may be expected however, only in the variance decomposition of money is TBR contributed 7 percent in the first quarter, which is better than other variables. But then, it declined in importance henceforth, just as the variances in NGDP kicks in by the second period to explain the variances in money.

Figure 3: Impulse Response Function for the Interest rate Channel

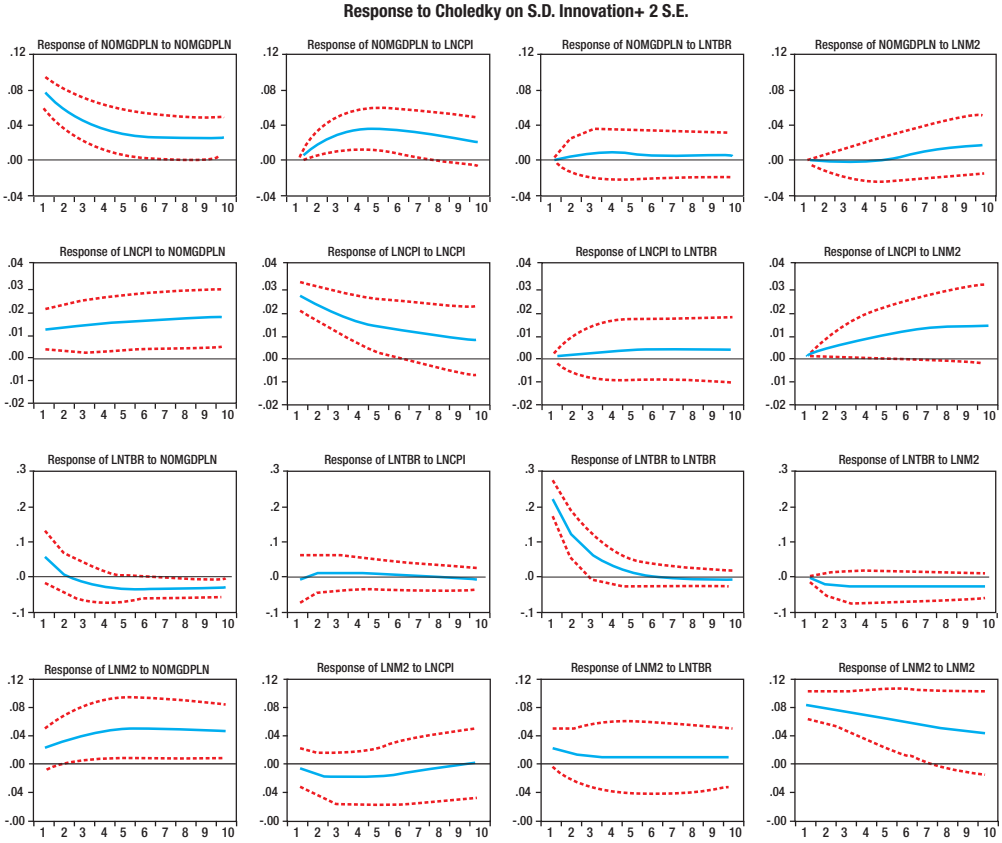
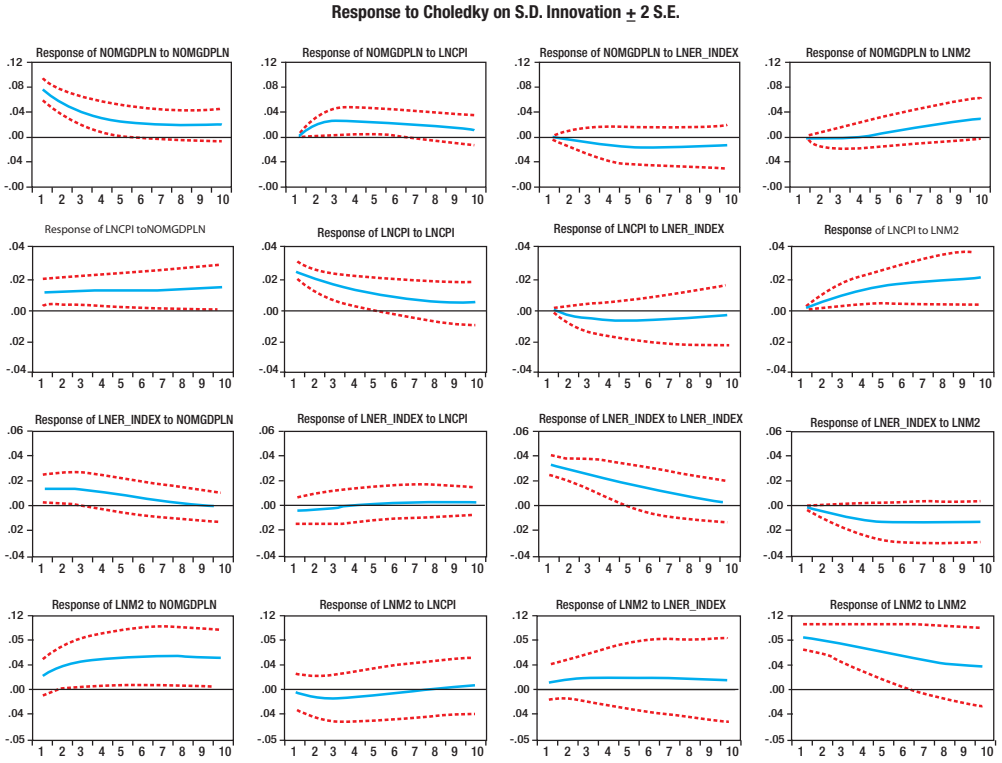


Table 3: Variance Decomposition for the Interest Rate Channel

Variance Decomposition of NOMGDPLN:					
Period	S.E.	NOMGDPLN	LNCPI	LNTBR	LNM2
1	0.077526	100.0000	0.000000	0.000000	0.000000
2	0.099447	95.50843	4.058220	0.331365	0.101986
3	0.113783	88.89842	10.27776	0.683102	0.140171
4	0.124726	82.67047	16.27819	0.932781	0.118552
5	0.133515	77.68310	21.07465	1.091281	0.150972
6	0.140771	73.95129	24.50107	1.191925	0.355720
7	0.146949	71.21862	26.71651	1.259653	0.805217
8	0.152409	69.20584	27.96668	1.309053	1.518427
9	0.157419	67.68843	28.49303	1.347989	2.470551
10	0.162162	66.50686	28.50309	1.380651	3.609398
Variance Decomposition of LNCPI:					
Period	S.E.	NOMGDPLN	LNCPI	LNTBR	LNM2
1	0.028912	15.99787	84.00213	0.000000	0.000000
2	0.038860	19.21925	79.77717	0.103159	0.900416
3	0.045766	22.45715	74.55397	0.257846	2.731043
4	0.051344	25.56387	68.85580	0.421932	5.158395
5	0.056244	28.42963	63.13155	0.577453	7.861366
6	0.060759	30.99531	57.69984	0.717605	10.58724
7	0.065019	33.24609	52.74284	0.840861	13.17021
8	0.069084	35.19668	48.33348	0.948075	15.52177
9	0.072977	36.87720	44.47254	1.041009	17.60925
10	0.076708	38.32297	41.12090	1.121617	19.43451
Variance Decomposition of LNTBR:					
Period	S.E.	NOMGDPLN	LNCPI	LNTBR	LNM2
1	0.235280	6.415048	0.163793	93.42116	0.000000
2	0.264857	5.158073	0.213406	94.02050	0.608025
3	0.273985	5.195212	0.382035	92.76852	1.654233
4	0.278802	6.027299	0.499028	90.68023	2.793440
5	0.282595	7.175186	0.537782	88.44862	3.838416
6	0.286002	8.361450	0.533442	86.36734	4.737770
7	0.289140	9.469524	0.522535	84.50513	5.502816
8	0.292049	10.46781	0.525242	82.84493	6.162016
9	0.294768	11.36029	0.547602	81.34934	6.742765
10	0.297332	12.16237	0.587805	79.98333	7.266503
Variance Decomposition of LNM2					
Period	S.E.	NOMGDPLN	LNCPI	LNTBR	LNM2
1	0.090695	5.909090	0.281585	6.551513	87.25781
2	0.128518	10.22341	1.635956	4.615110	83.52552
3	0.157240	14.33588	2.664940	3.614879	79.38430
4	0.180307	18.01687	3.186110	3.067321	75.72970
5	0.199145	21.23173	3.314683	2.755583	72.69800
6	0.214718	24.00911	3.208553	2.574291	70.20805
7	0.227779	26.39518	2.995223	2.467738	68.14186
8	0.238922	28.43920	2.759689	2.404608	66.39650
9	0.248608	30.18888	2.550474	2.366675	64.89397
10	0.257784	31.68856	2.389744	2.343201	63.57850
Cholesky Ordering: NOMGDPLNLNCPI LNTBRLNM2					

Finally, in the estimation for exchange rate channel, the IRF chart for innovations in exchange rates (Figure 4) reveals that none of the variables in the model is significantly related or responsive toward innovations to exchange rate. While the response of exchange rate to its own innovation is statistically significant, such significance relationship truncates after the fifth period. Also, the slightly relevance of variances of exchange rate to the nominal GDP did not commence until after sixth period ahead, when exchange rate recorded about 5 to 7 percent through tenth period. For the variance decomposition of price, the relative importance of exchange rate behaved in similar manner. However, variances in money, followed by NGDP are fairly relatively important in explaining the variance in exchange rate

. Figure 4: Impulse Response Function for the Exchange Rate Channel



4. Conclusion

The study identified and assessed the linkages between and among various monetary policy variables to assess the channels through monetary policy variables affect the Nigerian economy. Following a review of the three-prong approach to understanding the theory of monetary transmission and previous empirical studies, a VAR is specified with the analysis of impulse response and variance decomposition tools.

The findings from the impulse response function and variance decomposition validate the baseline model, with the broad money as the significantly dominant variable driving the level of output and price. The credit variable records a slightly significant relationship, through broad money but neither interest rate nor exchange rate indicates any significant impact in driving output or price. Further implication from the findings suggest that monetary authority appears to be more price stability focused than growth or exchange rate management focus and targets for monetary aggregates are monitored closely. Moreover, the relationship between price and broad money is consistently more robust than that between any set of variables within the model.

To the extent that the monetary authority is concerned with inflation, it is also important to engender policy coordination with the fiscal authority. This would curb the possible time inconsistency of monetary policy as well as reduce potential monetary accommodation, thus enhancing monetary policy impact through changes in interest rates.

Weak transmission mechanisms in credit, interest and exchange rates are indicative of weak financial system. Ineffective interest rate management policy in particular could be attributable to policy pronouncement that tend to be reactionary and a suspicion of some systemic imperfections outside of the control of the monetary authority. To ensure effective policy transmission through these channels, there is a need for a deepened and competitive financial sector, with sound banking. This also calls for increased financial education and inclusion in Nigeria. In this direction, deepening of the cash-lite policy of the Central Bank of Nigeria is imperative.

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APPENDIX TABLE 1

VAR Lag Order Selection Criteria

Endogenous variables: NOMGDPLN LNCPI LNM2

Lag	LogL	LR	FPE	AIC	SC	HQ
0	31.47114	NA	3.76e-05	-1.674773	-1.540094	-1.628844
1	151.7230	212.2091*	5.43e-08*	-8.218998*	-7.680283*	-8.035281*
2	159.4363	12.25059	5.94e-08	-8.143312	-7.200560	-7.821807
3	167.5856	11.50494	6.47e-08	-8.093273	-6.746484	-7.633979
4	173.8769	7.771536	8.13e-08	-7.933934	-6.183109	-7.336853
5	178.2869	4.669416	1.20e-07	-7.663935	-5.509073	-6.929065
6	184.6870	5.647179	1.69e-07	-7.511001	-4.952103	-6.638344

Endogenous variables: NOMGDPLN LNCPI LNCPS LNM2

Lag	LogL	LR	FPE	AIC	SC	HQ
0	64.73344	NA	3.30e-07	-3.572555	-3.392984	-3.511316
1	217.5192	260.6345*	1.07e-10	-11.61878	-10.72092*	-11.31258
2	229.2074	17.18856	1.43e-10	-11.36514	-9.748995	-10.81399
3	244.0521	18.33762	1.72e-10	-11.29719	-8.962751	-10.50108
4	269.2218	25.16961	1.26e-10	-11.83657	-8.783853	-10.79551
5	296.5283	20.88150	1.00e-10*	-12.50167	-8.730658	-11.21564
6	320.3406	12.60648	1.42e-10	-12.96121*	-8.471914	-11.43023*

Endogenous variables: NOMGDPLN LNCPI LNTBR LNM2

Lag	LogL	LR	FPE	AIC	SC	HQ
0	33.12149	NA	2.12e-06	-1.713029	-1.533457	-1.651790
1	159.0377	214.7982*	3.33e-09*	-8.178686	-7.280827*	-7.872490*
2	170.6798	17.12082	4.49e-09	-7.922342	-6.306196	-7.371190
3	191.5382	25.76626	3.77e-09	-8.208131	-5.873697	-7.412022
4	207.7905	16.25223	4.68e-09	-8.222968	-5.170247	-7.181903
5	223.8969	12.31670	7.18e-09	-8.229230	-4.458221	-6.943208
6	250.5761	14.12427	8.61e-09	-8.857416*	-4.368120	-7.326438

Endogenous variables: NOMGDPLN LNCPI LNER_INDEX LNM2

Lag	LogL	LR	FPE	AIC	SC	HQ
0	79.74652	NA	1.36e-07	-4.455678	-4.276106	-4.394439
1	221.9197	242.5307*	8.23e-11*	-11.87763	-10.97977*	-11.57143*
2	235.7007	20.26618	9.79e-11	-11.74710	-10.13095	-11.19595
3	247.7072	14.83154	1.39e-10	-11.51219	-9.177754	-10.71608
4	271.7004	23.99323	1.09e-10	-11.98238	-8.929656	-10.94131

5	287.4965	12.07938	1.70e-10	-11.97038	-8.199376	-10.68436
6	316.4144	15.30944	1.79e-10	-12.73026*	-8.240961	-11.19928

* Indicates lag order selected by the criterion; LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion

APPENDIX TABLE 2

Vector Autoregression Estimates for Basic Model

Standard errors in ( ) & t-statistics in [ ]

	NOMGDPLN	LNCPI	LNM2
NOMGDPLN(-1)	0.633814	0.020860	0.260188
	(0.11768)	(0.04361)	(0.13759)
	[5.38578]	[0.47830]	[1.89103]
LNCPI(-1)	0.736784	0.853446	-0.404896
	(0.23841)	(0.08835)	(0.27874)
	[3.09046]	[9.65973]	[-1.45262]
LNM2(-1)	-0.046075	0.043216	0.969830
	(0.05827)	(0.02160)	(0.06813)
	[-0.79068]	[2.00117]	[14.2350]
C	2.890820	-0.266269	-1.553602
	(0.88890)	(0.32942)	(1.03927)
	[3.25213]	[-0.80830]	[-1.49490]
R-squared	0.985522	0.993361	0.985861
Adj. R-squared	0.984281	0.992792	0.984649
Sum sq. resids	0.206965	0.028424	0.282910
S.E. equation	0.076898	0.028498	0.089906
F-statistic	794.1435	1745.638	813.4775
Log likelihood	46.81731	85.53098	40.72207
Akaike AIC	-2.195760	-4.181076	-1.883183
Schwarz SC	-2.025138	-4.010454	-1.712561
Mean dependent	14.91104	4.482551	14.86486
S.D. dependent	0.613338	0.335661	0.725644
Determinant resid covariance (dof adj.)		3.09E-08	
Determinant resid covariance		2.23E-08	
Log likelihood		177.5343	

Akaike information criterion	-8.488937
Schwarz criterion	-7.977072

APPENDIX TABLE 3

Vector Autoregression Estimates for Interest Rate Channel

Standard errors in ( ) & t-statistics in [ ]

	NOMGDPLN	LNCPI	LNTBR	LNM2
NOMGDPLN(-1)	0.631068	0.020761	-0.313531	0.263246
	(0.11872)	(0.04427)	(0.36029)	(0.13888)
	[5.31571]	[0.46893]	[-0.87022]	[1.89546]
LNCPI(-1)	0.759641	0.854270	0.443178	-0.430356
	(0.24284)	(0.09056)	(0.73698)	(0.28409)
	[3.12815]	[9.43292]	[0.60134]	[-1.51487]
LNTBR(-1)	0.029000	0.001045	0.549622	-0.032303
	(0.04398)	(0.01640)	(0.13346)	(0.05145)
	[0.65945]	[0.06374]	[4.11827]	[-0.62791]
LNM2(-1)	-0.037487	0.043525	-0.243775	0.960264
	(0.06018)	(0.02244)	(0.18262)	(0.07040)
	[-0.62296]	[1.93954]	[-1.33486]	[13.6409]
C	2.633778	-0.275534	7.333486	-1.267280
	(0.97726)	(0.36445)	(2.96584)	(1.14325)
	[2.69506]	[-0.75603]	[2.47265]	[-1.10849]
R-squared	0.985705	0.993362	0.818513	0.986023
Adj. R-squared	0.984023	0.992581	0.797161	0.984379
Sum sq. resids	0.204352	0.028421	1.882133	0.279667
S.E. equation	0.077526	0.028912	0.235280	0.090695
F-statistic	586.0994	1271.975	38.33524	599.6479
Log likelihood	47.06515	85.53331	3.768939	40.94689
Akaike AIC	-2.157187	-4.129913	0.063131	-1.843430
Schwarz SC	-1.943910	-3.916636	0.276408	-1.630153
Mean dependent	14.91104	4.482551	2.345510	14.86486
S.D. dependent	0.613338	0.335661	0.522409	0.725644

Determinant resid covariance (dof adj.)	1.57E-09
Determinant resid covariance	9.05E-10
Log likelihood	184.6986
Akaike information criterion	-8.446083
Schwarz criterion	-7.592974

APPENDIX TABLE 4

Vector Autoregression Estimates for Exchange Rate Channel

Standard errors in ( ) & t-statistics in [ ]

	NOMGDPLN	LNCPI	LNER_INDEX	LNM2
NOMGDPLN(-1)	0.654455	0.052982	0.034853	0.231394
	(0.13116)	(0.04689)	(0.06142)	(0.15321)
	[4.98969]	[1.12989]	[0.56749]	[1.51027]
LNCPI(-1)	0.662360	0.737627	0.017165	-0.301078
	(0.31200)	(0.11154)	(0.14609)	(0.36446)
	[2.12296]	[6.61294]	[0.11749]	[-0.82610]
LNER_INDEX(-1)	-0.082893	-0.129000	0.889452	0.115632
	(0.22018)	(0.07872)	(0.10310)	(0.25719)
	[-0.37649]	[-1.63881]	[8.62731]	[0.44959]
LNM2(-1)	-0.035856	0.059119	-0.046939	0.955575
	(0.06494)	(0.02322)	(0.03041)	(0.07586)
	[-0.55210]	[2.54621]	[-1.54351]	[12.5959]
C	3.150790	0.138300	0.605408	-1.916248
	(1.13438)	(0.40555)	(0.53117)	(1.32511)
	[2.77754]	[0.34102]	[1.13976]	[-1.44611]
R-squared	0.985582	0.993847	0.873584	0.985945
Adj. R-squared	0.983886	0.993123	0.858712	0.984291
Sum sq. resids	0.206106	0.026343	0.045190	0.281238
S.E. equation	0.077859	0.027835	0.036457	0.090949
F-statistic	581.0378	1372.956	58.73840	596.2505
Log likelihood	46.89844	87.01350	76.48993	40.83765
Akaike AIC	-2.148638	-4.205820	-3.666150	-1.837828
Schwarz SC	-1.935361	-3.992543	-3.452873	-1.624551
Mean dependent	14.91104	4.482551	4.655264	14.86486

S.D. dependent	0.613338	0.335661	0.096991	0.725644
Determinant resid covariance (dof adj.)		3.36E-11		
Determinant resid covariance		1.94E-11		
Log likelihood		259.6104		
Akaike information criterion		-12.28771		
Schwarz criterion		-11.43461		

Cyclicality, Stability and Stabilizing Impact of Remittances and Other Financial Flows: Evidence from Sub-Saharan Africa

Uchechi Shirley Anaduaka and Jude Okechukwu Chukwu *

ABSTRACT

Claims that international remittances have become a substantial, stable and relatively more reliable source of external development finance, continues to stimulate the interest of researchers who attempt to determine the behaviour of remittances in relation to macroeconomic indicators, more particularly whether the former moves counter- or pro-cyclically with the latter in recipient countries. To answer this question, this study examines the cyclicality, stability and stabilizing impact of remittances, foreign direct investment and official development aid in selected sub-Saharan African countries. The main findings are that: i) official development aid is more stable than remittances and foreign direct investment, and remittances are the least stable in the sub-region; ii) all three series, remittances, overseas development assistance and, foreign direct investment are all pro-cyclical in the sub-region iii) All three financial flows are destabilizing in more than seventy per cent of the countries examined. Foreign Direct Investment has no stabilizing impact in any of the countries examined. The empirical findings suggest that it is necessary to examine counter-cyclicality separately from the stabilizing impact, since the counter-cyclicality does not always imply that the financial flow is stabilizing.

JEL Classification: F21, F22, O55.

Keywords: Financial flows, Remittances, sub-Saharan Africa.

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1. Introduction

International remittances have become a major source of external development finance, and have been found to be relatively more stable and more dependable than other forms of foreign-exchange inflows such as Portfolio Equity (PE), Foreign Direct Investment (FDI) and Overseas Development Assistance (ODA), and may even be counter-cyclical in times of economic hardship (Ratha, 2003; Buch and Kuckulenz, 2004). The flow of remittances to developing countries attracts increasing attention because of the volume and impact on receiving countries. Between 2000 and 2010, individuals living outside their countries grew from 175 to 215 million people, representing 3.2% of the world's population[20]. Most often, the remittances transfer are backed by altruistic or self-interest motives[21]. In 2010, official recorded remittances received amounted to US$ 293 billion, exceeding total official development aid (US$90 billion), and amounted to roughly sixty-three per cent of foreign direct investment inflows (US$463 billion) received by developing countries in that year[22,23].

Countries face a lot of unprecedented economic shocks as a result of fall in commodity prices (such as oil and other petroleum products, coffee, steel, gold and wheat), civil conflict and wars, crop and livestock loss as natural disasters[24]. These countries must cope with such shocks as they affect the national wealth, the government's future financial plans and the growth of the economy. They do this by relying on external financial flows in times when they experience these transitory income shocks.

From the macroeconomic perspective, international remittances constitute a major source of foreign exchange, influence the national balance of payments, and represent a substantial share of the gross domestic product in many countries (Acosta et al., 2008; Jacques, 2004). They are also believed to reduce inequality among countries as it exceeds official aid transfers in some regions and act as a buffer from economic shocks (Ratha, 2003). In contrast, over-reliance on international remittances will leave households vulnerable to changes in migration cycles, if spent on unproductive investment and short-term consumption gains, remittances could increase inequality between households with access to remittances and those without, transit negative cultural practices that reduce the quality of life, reduce GDP when there are fluctuations in exchange rates, increase the growth of the parallel foreign exchange markets and money laundering (Chimhowu, Piesse and Pinder, 2005).

Sub-Saharan Africa (SSA) is described as one of the poorest and least developed regions of the world, prone to political and economic instability, religious and civil conflicts, high levels of unemployment, corruption, rent-seeking, poor governance, weak regulatory frameworks and decayed institutions. These factors among others have resulted in high levels of poverty and

20 - Estimates on the number of individuals living outside their countries of birth are from Migration and remittances fact-book (2011), while data on world population are from World Bank Database (2011).
21 - Reasons for remitting include pure altruism, exchange, investment, insurance and pure self-interest
22 - Migrant remittances are defined as the sum of workers' remittances, compensation of employees, and migrants' transfers. Aid and FDI figures are from World Bank (2011).
23 - Migrant remittances are defined as the sum of workers' remittances, compensation of employees, and migrants' transfers. Aid and FDI figures are from World Bank (2011).
24 - Main natural disasters include; weather variation, drought, pests, earthquakes, tsunamis and fire.

general economic deprivation leading to regular and consistent migration of both skilled and unskilled labour to other regions of the world in search of greener pastures.[25] The current classification of countries into income groups by United Nations shows that more than half of the Sub-Saharan African (SSA) countries are also classified as fragile states.[26&27] In some cases, 60-90% of its labour force is employed in agriculture, with most of its activities still at the subsistence level, therefore, vulnerable to climate change and global warming.

According to World Bank estimates, after a dramatic rise between 1970 and 2000 from 93.11 million US dollars to 5.2 billion US dollars, remittances have steadily increased to 19.02 billion US dollars in 2010, approximately, 2 per cent of the regional GDP (Freund and Spatafora, 2005)[28]. However, the recorded remittances are only a small fraction of the total remittances to the sub-region. Informal remittances to sub-Saharan Africa are relatively high, at 45-65 per cent of the amount of formal remittances (Freund and Spatafora, 2005). Relative to GDP, remittances were approximately 34% of GDP in Lesotho, and approximately 5% in the Gambia, Togo, Senegal, Cape Verde, Kenya, Guinea-Bissau, Uganda, Nigeria and Mali.

As part of a private welfare system, remittances transfer purchasing power and help to reduce poverty, smooth consumption, affect labour supply, provide working capital and can have multiplier effects through increased spending. Are remittances countercyclical and stable for sub-Saharan African countries? Do remittances have a stabilizing impact for sub-Saharan African countries? We shed light on these research questions by examining the cyclical nature of remittances and other financial flows in the sub-Saharan African region. The methodology relies on coefficients of variations to assess the stability and stabilizing impact, whereas cyclical nature is evaluated using correlations between national income and the external financial flows.

The remainder of this paper is organized as follows: Section 2 reviews literature and presents an overview of Sub-Saharan Africa. Section 3 discusses the methodology and the data. Section 4, discusses the results, and section 5 in the conclusion.

2. Literature Review

2.1 Cyclicality and Stability of Remittances in Theory

The decision to migrate from one's region to another most often is due to the search of better economic opportunities -greener pastures (Sjaastad, 1962). The decision to remit on the other hand is dependent on many reasons, key of which are, altruism and self-interest. When migrants are motivated by altruistic motives, it is mostly because they are concerned about the

25 - See United Nations Human Development reports.
26 - Angola, Burundi, Cameroon, Central African Republic, Chad, Comoros, Congo, Dem Rep, Congo, Republic, Cote d'Ivoire, Eritrea, Guinea, Gambia, Guinea-Bissau, Liberia, Sao Tome and Principe, Sierra Leone, Somalia, Sudan, Togo and Zimbabwe
27 - A fragile state is defined as having either: a) a composite World Bank, African Development Bank and Asian Development Bank Country Policy and Institutional Assessment rating of 3.2 or less; or b) the presence of a United Nations and/or regional peace-keeping or peace-building mission (e.g. African Union, European Union, NATO), with the exclusion of border monitoring operations, during the past three years (World Bank, 2012)
28 - All figures are in 2005 constant US dollars.

well-beings of their families back in their countries of origin, the migrants are of the opinion that they should assist their family members (which are most often aged parents, wives and children) (Vanwey, 2004; Chami et al, 2005). The second reason for remittance transfers is backed by self-interest. Lucas and Stark (1985) posit that migrants also remit to ensure that they maintain good family ties to improve their standing for inheritance purposes or to ensure that their assets back home are properly taken care of. These migrants remit for investments and wealth accumulation or because it makes them eligible for family inheritance or communal resources. Other motives behind remittance transfers include informal contracts of insurance, signal to show commitment to families as well as help to provide access to formal and informal markets. All the motives behind the remittance transfers have different implications whenever their countries of origin experience economic downturns or recession.

A financial inflow, is counter-cyclical (pro-cyclical), if the correlation with GDP is negative (positive) that is, if the financial flow is negatively correlated (positively correlated) with the overall state of the economy. It is stabilizing (destabilizing) if the coefficient of variation of the sum of GDP and the financial inflow is smaller (larger) than that of GDP. The fact that a financial inflow is counter cyclical, does not ensure that it is stabilizing. Whether it is stabilizing or not, will depend on the level of both its variance and its mean. If its variance is large but its mean small, the financial inflow might be countercyclical and destabilizing at the same time. A possible but less likely situation is for the financial inflow to be pro-cyclical as well as stabilizing. This would most likely be valid for small and poor countries with very low levels of GDP, high levels of migrants and recipients of large amounts of remittances (Neagu and Schiff, 2009).

2.2 Cyclicality and Stability of Remittances: Empirical Evidence

Recent studies have tried to examine the cyclical nature of remittances but the results remain conflicting. The cyclical nature of remittances may help confirm whether migrants are moved by altruistic or self-interest motives. Ebeke (2010) measured the role remittances play as insurance for recipients and found that during the mid-1990s that, half of the sample examined was defined by a strong counter-cyclical relationship. Neagu and Schiff (2009) found a pro-cyclical relationship for 70% of their sample of 116 countries. Counter-cyclicality implies that remittances would be expected to move in the reverse direction with periodically observed fluctuations of GDP, increasing whenever there is an economic crisis, and declining whenever there is a boom in the origin countries of the migrants. If true, remittances will serve as a macroeconomic stabilizer to smooth-out large fluctuations in the national income observed over different phases of the business cycle (Sayan, 2004).[29] The stability of these inflows opens up an opportunity for developing countries to lower borrowing costs in international capital markets by securitizing future flows of remittances.[30] Remittance inflows remained substantial during conflict in Cote d'Ivoire (Black, et al, 2004). Also, remittances increased following natural disasters suffered by Jamaican, Indian and Philippine households (Clarke and Wallsten, 2003; Gupta, 2006; Yang, 2008). Ratha (2006) indicates that remittance inflows

29 - A strong case in point can be made by considering the disastrous consequences of the first Gulf War for economies receiving large amounts of remittances from Kuwait and other Gulf countries (Wahba, 1991).

30 - However, since remittances are private transfers, foreign borrowing against such flows would only be possible with additional stipulations like surrender requirements, prohibition of foreign currency accounts and/or taxes on remittances.

increased after natural disasters in Bangladesh, the Dominican Republic, Haiti and Honduras, as well as in response to conflicts in Albania and Sierra Leone.

Conversely, remittances do not seem to increase in the wake of natural disasters and are more pro-cyclical in countries with shallower financial systems (Lueth and Ruiz-Arranz, 2007; Giuliano and Ruiz-Arranz, 2009). Finally, counter-cyclicality and stability of remittances is observed less often than pro-cyclicality and instability, suggesting that, for majority of the larger number of countries examined, the investment motive of remitting is stronger than the altruistic motive (Neagu and Schiff, 2009).

3. Methodology and Data

3.1 Methodology

The methodology relies extensively on correlations between financial flows and GDP to evaluate the cyclical nature, while coefficients of variations are used to assess the stability and stabilizing impact of financial inflows. De-trending makes it possible to separate fluctuations around the trend of each time series, allowing the examination of the statistical properties of the co-movements of deviations of real GDP, real remittances, real ODA and real FDI from their respective trends (Lucas, 1977; Kydland and Prescott, 1990).

In light of this definition, we work with original and de-trended series, $x_t \in \{y_{it}^H, r_{it}^H, o_{it}^H, f_{it}^H\}$ where y^H represents the home country's real GDP, r^H represents the home country's real remittances receipts, o^H represents the home country's real overseas development assistance receipts, f^H represents the home country's real foreign direct investment net inflows, with i representing each of the sub-Saharan countries employed for this study and t representing the time period of the study (1980-2010).

We first analyse the co-movements of each of the three financial series against national income, without trending. We then de-trend each series x_t to separate its trend (growth) component, τ_t, from the cyclical components, c_t:

$$c_t = x_t - \tau_t \qquad (1)$$

We employ the Hodrick-Prescott (HP) filter (1997) which is widely used by economists; it proves to be a useful de-trending device, most often producing similar results to the polynomial filters.[31] When respective trends are properly filtered out from real remittances and output series for each country, the remaining cyclical components would be stationary with zero mean for each variable. Then, contemporaneous and asynchronous cross-correlations between the cyclical components of respective series can be calculated to identify cyclical characteristics of remittances. Pro-cyclicality (counter-cyclicality) of remittances in the context of this study refers to the tendency of real remittance receipts by each country to move above (below) its trend, whenever the corresponding real GDP is above (below) its respective trend. In the absence of such tendencies, remittances and output are said to be acyclical (Sayan, 2006).

31 - The Hodrick Prescott filter add-in for excel was downloaded from http://www.web-reg.de/hp_addin.html

3.2 Data and their Characteristics

We employ the following indicators of financial flows namely: Remittances, Foreign Direct Investment (net inflows), Official Development Aid and GDP.[32] The Gross domestic product (GDP) for home countries was chosen as an appropriate measure of national income against the Gross national product (GNP), due to the fact that the latter includes the net factor income from abroad (NFI).[33] Raw data have been obtained from the World Bank's World Development Indicators database (WDI). Where necessary, the series were converted from nominal to real terms and have been seasonally adjusted.[34]

The sample includes 45 sub-Saharan African countries out of which 26 are low income, 12 lower middle income and 7 upper middle income countries. By geographical grouping, 7 are Central African countries, 17 from Eastern Africa, 5 from Southern Africa and 16 from Western Africa.[35] Appendix Table A lists the names of the countries and the classifications by income group and by regions.

Table 1 presents summary statistics related to the shares of REM, FDI and ODA in GDP. Panel a includes means, medians, standard deviations, and the maximum values for all countries and years pooled together, while panel b lists the same for country averages (across years). Both panels reveal that ODA is more important than REM as a share of GDP. The series have a large dispersion as shown by the magnitude of standard deviations relative to that of the means. The maximum values of the three series range from 66.80% for FDI to 74.14% for ODA in panel a, and from 41.95% for ODA to 262.15% for FDI in panel b.

Table 1: Summary Statistics

	a) Statistics of indicators by country and year					b) Statistics of country averages				
Variables (%)	Obs	Mean	Median	Std dev	Max	Obs	Mean	Median	Std dev	Max
REM/GDP	**1395**	4.11	0.722	11.53	67.91	**45**	4.11	1.05	9.82	60.42
FDI/GDP	**1395**	8.86	1.324	120.04	66.80	**45**	8.86	1.85	38.8	262.15
ODA/GDP	**1395**	13.38	9.79	16.25	74.14	**45**	13.38	10.93	10.8	41.95

32 - The remittance figure is the sum of the "workers' remittances", "compensation of employees", and "migrants' transfers" items in the IMF's IFS data for all countries not listed as high income in the World Bank's income groupings.
33 - Since NFI includes net remittance receipts, home country's GDP series leave out remittances sent home by migrant workers in the country in question, and thus would be a more appropriate measure to analyse the cyclical behaviour of real remittances sent home by migrant workers against the home country output.
34 - All the series employed are in US dollars and have been converted into real terms by using the GDP deflator with 2005 as the base year gotten from the Louis Fed database.
35 - Appendix Table A1 lists the names of the countries and the classifications by income group (using the World Bank (July 2012) classification and by regions (using United Nations classification).

4. Empirical Results

4.1 Cyclicality of remittances

The altruistic motive for remittances predicts that in periods of economic crisis characterised by declining GDP, migrants send more money to their families in their home countries. To investigate the cyclical nature of the financial flows vis-à-vis GDP, correlations between GDP on the one hand, and REM, ODA and FDI on the other, are calculated for each country, at the aggregate level, geographical and income-level groups. We present results using both the original indicators and the de-trended series. Additionally, the tables also include correlations between GDP and the sum of all three indicators, REM+ODA+FDI. Correlations between GDP and the sum of two of the three indicators (REM+ODA, REM+FDI, ODA+FDI) are provided in Appendix Tables A2 through A5.

Table 2 reports the coefficients of correlation for various country aggregations. The correlation between GDP and REM across all the countries is positive, and varies widely in size. The figure for all 45 countries is 0.41 and 0.57, for original and de-trended indicators, respectively. Most groups have positive correlation coefficients, which indicate pro-, rather than counter-cyclicality. The finding that Remittance transfers acts in this nature implies to a large extent that the investment motive for remitting dominates the insurance motive, that is, that migrants are more motivated by self-interests rather than altruism towards their families. When the cyclical components are separated from the trend, the three series remain positive but, foreign direct investment declines to 0.18, whereas remittances and overseas development assistance increase to 0.55 and 0.21, respectively.

Table 2: Averages of country level correlation coefficients between various inflows and GDP, 1980-2010.

	REM		FDI		ODA		REM + FDI + ODA	
	original	de-trended	original	de-trended	original	de-trended	original	de-trended
All Sub-Saharan Countries	0.41	**0.57**	0.55	**0.18**	0.2	**0.21**	0.51	**0.42**
Central Africa	0.55	**0.83**	0.04	**0.30**	0.26	**0.48**	0.15	**0.62**
Eastern Africa	0.74	**0.39**	0.54	**0.20**	0.63	**0.32**	0.81	**0.41**
Southern Africa	0.35	**0.12**	0.54	**-0.06**	0.73	**0.19**	0.60	**-0.01**
Western Africa	0.86	**0.71**	0.80	**0.42**	0.46	**0.17**	0.83	**0.6**
Low Income	0.55	**0.56**	0.09	**0.09**	0.71	**0.63**	0.75	**0.63**
Lower Middle Income	0.80	**0.74**	0.76	**0.51**	0.46	**0.24**	0.82	**0.66**
UpperMiddle Income	0.75	**0.39**	0.48	**-0.1**	0.61	**0.01**	0.57	**-0.09**

The share of countries with the non-de-trended indicators of interest negatively correlated with GDP is provided in table 3. On one hand, 27% and 29% of countries have countercyclical REM and ODA respectively (between 8 and 60% in the various groups for the former, and between 19 and 57% in the various groups for the latter). We see an increase although slightly of the percentage of countries for which REM is negatively correlated with GDP, whereas only 9% show counter-cyclicality in terms of ODA, when the series are de-trended. REM

is more counter-cyclical for Southern African and low income and Upper Middle Income countries. FDI are more counter-cyclical in Central African and low income countries, but when de-trended they prove to be more counter-cyclical in Southern Africa and Upper Middle Income countries. ODA are more counter-cyclical in Central African and lower middle income countries, when de-trended it appears to be more counter-cyclical in Western Africa and Upper Middle Income countries.

Table 3: Cyclicality: Percentage of countries for which Inflow A is negatively correlated with GDP, 1980-2010.

	Number of countries	REM		FDI		ODA		REM + FDI + ODA	
		original	de-trended	original	de-trended	original	de-trended	original	de-trended
All Sub-Saharan Countries	45	27%	**29%**	18%	**24%**	29%	**9%**	9%	**13%**
Central Africa	7	14%	**43%**	29%	**57%**	43%	**14%**	14%	**29%**
Eastern Africa	17	24%	**35%**	24%	**18%**	29%	**12%**	12%	**6%**
Southern Africa	5	60%	**40%**	20%	**40%**	40%	**20%**	20%	**60%**
Western Africa	16	25%	**13%**	6%	**13%**	19%	**0%**	0%	**0%**
Low Income	26	31%	**19%**	19%	**19%**	23%	**8%**	8%	**4%**
Lower Middle Income	12	8%	**42%**	17%	**25%**	25%	**8%**	8%	**17%**
UpperMiddle Income	7	43%	**43%**	14%	**43%**	57%	**14%**	14%	**43%**

4.2 Stability

In order to evaluate the stability of Remittances, Overseas Development Assistance and Foreign Direct Investment, coefficients of variation covering the period 1980-2010 are calculated for each indicator by country. Additionally, these coefficients of variation are calculated across all countries, as well as for separate geographical regions and income level groups. The averages of the coefficients of variation for various aggregates are presented in Table 4.

Across the 45 sub-Saharan countries, ODA is the most stable of all the inflows (with CV of 1.25), followed by FDI (3.23) and REM (3.83). The ranking of stability from the most stable to the least stable is ODA-FDI-REM. This pattern is robust to aggregations in Eastern African and Western African geographical regions, low income and lower middle income countries.

Table 4: Stability of Capital Inflows; Averages of coefficients of variation, 1980-2010

	REM	FDI	ODA
All Sub-Saharan Countries	**3.83**	**3.23**	**1.25**
Central Africa	2.22	2.78	1.01
Eastern Africa	2.33	2.197	0.92
Southern Africa	0.85	1.55	0.73
Western Africa	4.15	3.35	1.53
Low Income	2.15	2.06	0.96
Lower Middle Income	3.01	2.34	1.51
Upper Middle Income	1.66	2.91	1.15

The finding that Remittances are the most unstable may pose a problem for the countries that depend heavily on the inflows of remittances to their countries. This pattern varies across incomes and geographical regions. For Central African, Southern African and Upper Middle income countries, Foreign Direct Investment is the least unstable of the three financial flows. The stability of FDI decreases with countries' income, with Upper Middle Income countries like South Africa. Remittances are most stable for Upper Middle Income countries and Southern Africa, which also confirms that the remittance transfers to South Africa may be driving our results substantially. Overseas development assistance is most stable for Low income countries, and this may be as a result of the presence of conflicts in those areas. For the geographical classifications, all the three indicators, REM, ODA and FDI are most stable for Southern Africa, and are least stable for Western Africa. Again, the presence of South Africa and Nigeria may be behind our results.

Table 5: Stability: Percentages of countries with more stable Inflow A than B*, 1980-2010

	Number of countries	Series A		
		REM	REM	ODA
		Series B		
		ODA	FDI	FDI
All Sub-Saharan Countries	45	27%	82%	96%
Central Africa	7	14%	100%	100%
Eastern Africa	17	24%	76%	100%
Southern Africa	5	80%	100%	100%
Western Africa	16	19%	75%	88%
Low Income	26	15%	77%	100%
Lower Middle Income	12	42%	92%	83%
Upper Middle Income	7	43%	86%	100%

*Stability is measured by the coefficient of variation.

Table 5 summarizes the country-level situation by presenting the percentage of countries for which a particular inflow (series A) is more stable, that is, has a lower coefficient of variation than another inflow (series B). Remittance inflows are more stable than overseas development assistance in 27% of the countries, but are more stable than FDI in 82%of the countries employed in the study. ODA is significantly more stable than FDI in almost all of the countries examined which represents all of the Central African, Eastern African, Southern African, Low Income and Upper Middle Income countries and, REM in 73% of the countries employed in the sample.

4..3 Stabilizing Impact of remittances

Table 6 below presents the shares of countries for which Capital Inflow A is more stabilizing than GDP. The results depict overseas development assistance (ODA) as the most stabilizing of the three inflows with 29 per cent of analysed countries having its coefficient of variation greater than that of the nation's gross domestic product (GDP). This is followed by remittances at 20

per cent; Foreign Direct Investment has no stabilizing impact on the sub-Saharan economies employed in the study. Remittances are most stabilizing in Southern Africa and Upper Middle Income. For overseas development assistance, it is most stabilizing in Western Africa and Lower Middle Income countries. Remittance inflows have destabilizing impact in more than three-quarters of the countries employed in the study and FDI have no stabilizing impact in all of the sub-Saharan countries. The stabilizing impact of REM increases with countries' income, but increasing income has no effect on the stabilizing impact of FDI. Remittances have the most stabilizing impact in Southern Africa and the least in Central Africa. For ODA, the stabilizing impact is most effective on Lower Middle Income and Western African countries. Table 3 and 4 implies that all three capital flows are more pro-cyclical and are more often than not, destabilizing for sub-Saharan Africa.

Table 6: Stabilizing impact: % of countries for which the Capital Inflow is Stabilizing, 1980-2010

		A			
	Number of countries	REM	FDI	ODA	REM +FDI + ODA
All Sub-Saharan Countries	45	20%	0%	29%	29%
Central Africa	7	0%	0%	29%	0%
Eastern Africa	17	18%	0%	18%	41%
Southern Africa	5	80%	0%	20%	40%
Western Africa	16	13%	0%	44%	25%
Low Income	26	12%	0%	27%	31%
Lower Middle Income	12	25%	0%	42%	33%
Upper Middle Income	7	43%	0%	14%	14%

5 Conclusion and Policy Implications

It is received wisdom that remittances are a growing source of foreign exchange to recipient countries. The question lies in whether these remittances are counter-cyclical and stable for developing countries, hence, the study investigated the stability, cyclicality and stabilizing impact of remittances, FDI and ODA. Both at the country and aggregate levels, it was found that Remittance inflows to the sub-region are less stable than Overseas Development Assistance and Foreign Direct Investment, net inflows. Second, while ODA is counter-cyclical in 29% of the countries (9% according to analysis based on de-trended indicators), remittances and FDI are counter-cyclical in only 27% and 18% of the countries examined (29% and 24% if variables are de-trended).

Although, remittances are seen to increase during periods of major upheavals such as natural disasters, armed conflicts and/or economic crises in migrants' source countries thus being altruistic in nature, we find them to be pro-cyclical as well as destabilizing for a majority of developing countries over large periods of times. Moreover, adding REM to FDI and ODA

inflows raises the pro-cyclicality of these inflows as well as their destabilizing impact. The results should be treated cautiously as large remittances to countries like Nigeria and South Africa could be affecting the analysis. This suggests that the cyclical and stabilizing virtues of remittances inflows be examined on a country-by-country basis. The country-level patterns in the observed behaviour of remittances and other inflows require further empirical examination. The objective of this paper was to simply provide evidence on the behaviour of remittances, as well as ODA and FDI. The results would help provide an insight into the motives behind remittance transfers.

Our conclusions should also be treated cautiously based on the fact that they are drawn solely based on the examination of formal remittance flows; while informal channels are estimated by the researchers to still attract about 50% of remittances (Ratha, 2006). The lack of appropriate report on informal remittance flows prevents its inclusion in our study. Therefore, the cyclical behaviour of informal remittances cannot be established, and neither is it possible to know the impact of including informal remittances on our findings. Remittance flows being pro- or counter-cyclical and stabilizing or not may also depend on their importance relative to GDP and other sources of inflows.

The policy implications of the results are numerous. On one hand, the fact that the financial flows are pro- rather than counter-cyclical implies that their presence are most often felt when the economies are on a path of growth. This does not mean that the financial flows have no role to play in the economy, it means they play a better role, when the national incomes of the economies are growing, making it a viable environment for setting up businesses or investment in key sectors like the financial, power and real estate sectors. On the other hand, this means that in the presence of shocks to national income, the inflows from these capital indicators may be on the flat or even non-existent. Policy makers must thus ensure that alternative means are set up such as foreign reserve accounts, to provide aid in the presence of transitory income shocks. The destabilizing nature of these financial flows in the sub-region may thus, be as a result of their pro-cyclical nature. However, even though REM may be small as a share of GDP, it may amount to a large share of the income of recipient households and may therefore have a substantial impact on the stability of these households' income and play a role in insuring the families against transitory shocks to income.

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APPENDIXA:

List of sub-Saharan African countries employed in the study

WORLD BANK LIST OF SUB-SAHARAN COUNTRIES (JULY 2012)							
	COUNTRY	COUNTRY CODE	INCOME GROUP	LENDING CATEGORY	GEOGRAPHICAL REGION	OTHER (1)	OTHER (2)
1	ANGOLA	AGO	UMI	IDA	CENTRAL AFRICA		Fragile State
2	BENIN	BEN	LI	IDA	WESTERN AFRICA	HIPC	
3	BOSTWANA	BWA	UMI	IBRD	SOUTHERN AFRICA		
4	BURKINA FASO	BFA	LI	IDA	WESTERN AFRICA	HIPC	
5	BURUNDI	BDI	LI	IDA	EASTERN AFRICA	HIPC	Fragile State
6	CAMEROON	CMR	LIM	IDA	CENTRAL AFRICA	HIPC	
7	CAPE VERDE	CPV	LMI	BLEND	WESTERN AFRICA		Fragile State
8	CENTRAL AFRICAN REPUBLIC	CAF	LI	IDA	CENTRAL AFRICA	HIPC	Fragile State
9	CHAD	TCD	LI	IDA	CENTRAL AFRICCA	HIPC	Fragile State
10	COMORES	COM	LI	IDA	EASTERN AFRICA	HPC	Fragile State
11	CONGO, REP	COG	LMI	IDA	CENTRAL AFRICA	HIPC	Fragile State
12	COTE D'IVOIRE	CIV	LMI	IDA	WESTERN AFRICA	HIPC	Fragile State
13	ERITREA	ERI	LI	IDA	EASTERN AFRICA	HIPC	Fragile State
14	ETHIOPIA	ETH	LI	IDA	EASTERN AFRICA	HIPC	
15	GABON	GAB	UMI	IBRD	CENTRAL AFRICA		Fragile State
16	GAMBIA, THE	GMB	LI	IDA	WESTERN AFRICA	HIPC	
17	GHANA	GHA	LMI	IDA	WESTERN AFRICA	HIPC	
18	GUINEA	GIN	LI	IDA	WESTERN AFRICA	HIPC	Fragile State
19	GUINEA-BISSAU	GNG	LI	IDA	WESTERN AFRICA	HIPC	Fragile State
20	KENYA	KEN	LI	IDA	EASTERN AFRICA		
21	LESOTHO	LSO	LMI	IDA	SOUTHERN AFRICA		
22	LIBERIA	LBR	LI	IDA	WESTERN AFRICA	HIPC	Fragile State
23	MADAGASCAR	MDG	LI	IDA	EASTERN AFRICA	HIPC	
24	MALAWI	MWI	LI	IDA	EASTERN AFRICA	HIPC	
25	MALI	MLI	LI	IDA	WESTERN AFRICA	HIPC	
26	MAURITANIA	MRT	LI	IDA	WESTERN AFRICA	HIPC	
27	MAURITIUS	MUS	UMI	IBRD	EASTERN AFRICA		
28	MOZAMBIQUE	MOZ	LI	IDA	EASTERN AFRICA	HIPC	
29	NAMIBIA	NAM	UMI	IBRD	SOUTHERN AFRICA		
30	NIGER	NER	LI	IDA	WESTERN AFRICA	HIPC	
31	NIGERIA	NGA	LMI	IDA	WESTERN AFRICA		
32	RWANDA	RWA	LI	IDA	EASTERN AFRICA	HIPC	
33	SAO SOME & PRINCIPE	STP	LMI	IDA	CENTRAL AFRICA	HIPC	Fragile State
34	SENEGAL	SEN	LMI	IDA	WESTERN AFRICA	HIPC	
35	SEYCHELLES	SYC	UMI	IBRD	EASTERN AFRICA		
36	SIERRA LEONE	SLE	LI	IDA	WESTERN AFRICA	HIPC	Fragile State
37	SOMALIA	SOM	LI	IDA	EASTERN AFRICA	HIPC	Fragile State
38	SOUTH AFRICA	ZAF	UMI	IBRD	SOUTHERN AFRICA		
39	SUDAN	SDN	LMI	IDA	EASTERN AFRICA		Fragile State
40	SWAZILAND	SWZ	LMI	IBRD	SOUTHERN AFRICA		
41	TANZANIA, UNITED REPUBLIC	TZA	LI	IDA	EASTERN AFRICA	HIPC	
42	TOGO	TGO	LI	IDA	WESTERN AFRICA	HIPC	Fragile State
43	UGANDA	UGA	LI	IDA	EASTERN AFRICA	HIPC	
44	ZAMBIA	ZMB	LMI	IDA	EASTERN AFRICA	HIPC	
45	ZIMBABWE	ZWE	LI	BLEND	EASTERN AFRICA		Fragile State

Source: World Bank and the United Nations databases (2012).

LI (Low Income) - S1,025 or less; LMI (Lower Middle Income) - S1,026-S4,035; UMI -S4,036-S12,475
IDA-International Development Association (lend to countries with per capit income of less than S1,195).; IBRD-
International Bank for Reconstruction and development (lend to countries with per capita income of S1,195or more.

A2: Cyclicality: Averages of country-level correlation coefficients between pairs of Inflows and GDP, 1980-2010.

Simple Average

	REM+FDI		REM+ODA		FDI+ODA	
	original	de-trended	original	de-trended	original	de-trended
All Sub-Saharan Countries	0.55	**0.41**	0.37	**0.5**	0.49	**0.25**
Central Africa	0.06	**0.59**	0.3	**0.77**	0.13	**0.41**
Eastern Africa	0.72	**0.36**	0.8	**0.4**	0.71	**0.34**
Southern Africa	0.56	**-0.04**	0.61	**0.18**	0.59	**-0.03**
Western Africa	0.85	**0.64**	0.78	**0.59**	0.76	**0.37**
Low Income	0.51	**0.34**	0.78	**0.69**	0.69	**0.56**
Lower Middle Income	0.83	**0.69**	0.77	**0.65**	0.73	**0.46**
Upper Middle Income	0.53	**-0.09**	0.75	**0.12**	0.52	**-0.10**

A3: Cyclicality: Percentage of countries for which capital Inflow A is negatively correlated with GDP, 1980-2010

	Number of countries	A					
		REM+FDI		REM+ODA		FDI+ODA	
		original	de-trended	original	de-trended	original	de-trended
All Sub-Saharan Countries	45	16%	**20%**	11%	**9%**	11%	**11%**
Central Africa	7	14%	**43%**	14%	**14%**	14%	**29%**
Eastern Africa	17	24%	**12%**	12%	**12%**	18%	**6%**
Southern Africa	5	20%	**60%**	20%	**20%**	20%	**40%**
Southern Africa	16	6%	**6%**	6%	**0%**	0%	**0%**
Low Income	26	19%	**12%**	12%	**8%**	12%	**4%**
Lower Middle Income	12	8%	**15%**	8%	**8%**	8%	**8%**
Upper Middle Income	7	14%	**43%**	14%	**14%**	14%	**43%**

A4: Stabilizing Impact: Percentage of countries for which Capital Inflow is stabilizing, 1980-2010.*

	Number of countries	A		
		REM+FDI	REM+ODA	FDI+ODA
All Sub-Saharan Countries	45	2%	42%	16%
Central Africa	7	0%	43%	0%
Eastern Africa	17	0%	35%	24%
Southern Africa	5	20%	40%	0%
Western Africa	16	0%	50%	19%
Low Income	26	0%	42%	19%
Lower Middle Income	12	8%	50%	17%
Upper Middle Income	7	0%	29%	0%

* CV(A) < CV (GDP)

A5: Top 10 countries with the highest total remittances received, 2010.

	Country	Total remittances (in millions) US$	GDP (in millions)	Total Population	Total Remittances as % of GDP	Total remittances per capita
1	Nigeria	10045.020	202522.959	158.423	4.960	63.406
2	Sudan	1973.796	62045.783	43.552	3.181	45.320
3	Kenya	1776.987	32198.151	40.513	5.519	43.862
4	Senegal	1346.047	12855.298	12.434	10.471	108.255
5	South Africa	1119.266	363910.426	49.991	0.308	22.389
6	Uganda	914.502	17010.766	33.424	5.376	27.361
7	Lesotho	745.903	2179.351	2.171	34.226	343.576
8	Mali	436.210	9251.389	15.370	4.715	28.381
9	Togo	333.095	3153.401	6.028	10.563	55.258
10	Benin	248.060	6633.056	8.850	3.740	28.029

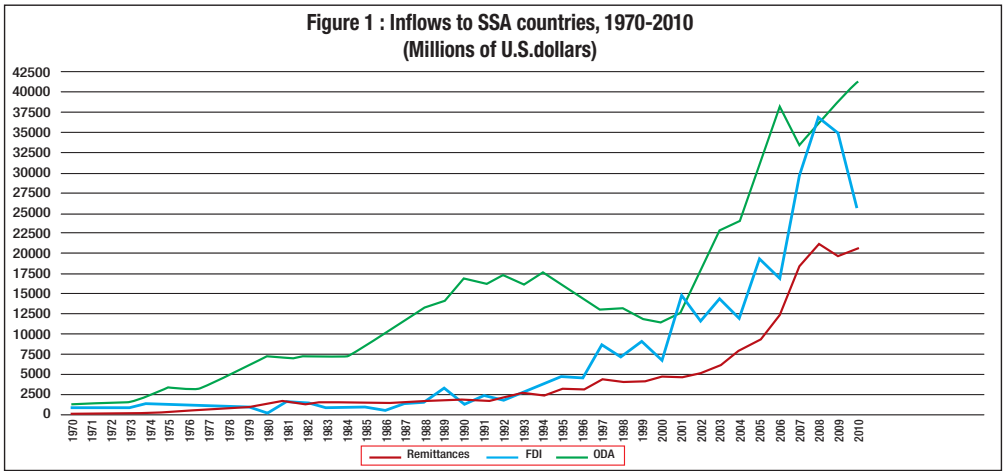
The data presented in the above table are from the World Bank databank. "Total remittances" refers to the sum of the 1) workers' remittances 2) compensation to employees, and 3) migrant transfers reported by each country.

A6: Top 10 countries with the highest total remittances received per capita, 2010.

	Country	Total remittances (in millions) US$	GDP (in Millions)	Total Population	Total Remittances as % of GDP	Total remittances per capita
1	Lesotho	745.903	2179.351	2.171	34.226	343.576
2	Cape Verde	138.637	1648.093	0.496	8.412	279.509
3	Mauritius	226.410	9723.858	1.281	2.328	176.744
4	Seychelles	10.837	936.609	0.087	1.157	124.560
5	Senegal	1346.047	12855.298	12.434	10.471	108.255
6	Swaziland	109.000	3697.607	1.056	2.948	103.220
7	Gambia, The	115.699	806.524	1.729	14.345	66.917
8	Nigeria	10045.020	202522.959	158.423	4.960	63.406
9	Togo	333.095	3153.401	6.028	10.563	55.258
10	Botswana	99.511	14858.674	2.007	0.670	49.582

The data presented in the above table are from the World Bank databank. "Total remittances" refers to the sum of the 1) workers' remittances 2) compensation to employees, and 3) migrant transfers reported by each country.

B1. Figure 1: Inflows to sub-Saharan countries.



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