STUDIA

UBB

OECONOMICA

3

SUMAR – SOMMAIRE – CONTENTS – INHALT

ESTIMATING A SYSTEM OF DEMAND EQUATIONS FOR LOW-INCOME HOUSEHOLDS FROM A BIASED SURVEY OF EXPENDITURES

Odd I. LARSEN
Molde University College, Norway

Wynand C.J. GROBLER [*]
North-West University, South Africa

Abstract. A few consistent demand systems for household expenditures have been around for many years. In this study we tested an alternative system that also satisfies the restrictions that theory places on such systems. The test shows how a survey of expenditures, with biased and missing reporting, can be treated as long as a subsample is reasonably accurate with respect to reporting of expenditures, and the reporting of income is reasonably accurate for the whole sample. Estimation of a model on this subsample enables us to devise a consistent model that allows the initially biased reporting to be corrected and also furnishes corrected expenditure shares and demand elasticities. Demand elasticities can give us important insights into expenditure patterns and how these are affected by price and income changes. The spending patterns of households are rooted in the fundamental forces of the socio-economic circumstances of societies. Policies targeted at specific socio-economic groups can therefore be made more efficient through knowledge about the target groups' specific expenditure patterns and demand elasticities. The averages of such measures for the population at large are of limited use in this respect. Estimates from a specific area can be used to simulate how subsistence quantities, own price elasticities and income elasticities may vary from household to household within specific income groups. Knowledge of how demand elasticities and spending patterns change with household income may thus facilitate policy efforts of government to serve the needs of those communities better. The estimated demand elasticities discussed in this paper show some interesting patterns when income increases or the prices of broad expenditure groups change.

JEL Classification: D51, D11, D 50

Keywords: system of demand, expenditures

1. Introduction

Spending patterns of households are rooted in the fundamental forces of changes in the socio-economic circumstances of societies and therefore policies targeted at specific income groups should also be based on the target group's elasticity estimates rather than on average elasticities for the population at large.

---

[*] Corresponding author. Adress: School of Economic Sciences, North-West University Vanderbijlpark, South Africa, Email: wynand.grobler@nwu.ac.za

This implies that estimates for a specific area can be used to simulate how subsistence quantities, own price elasticities and income elasticities may vary from household to household within specific income groups. Knowledge of how demand elasticities and spending patterns change with household income may facilitate policy efforts of government to serve the needs of those communities better (Raper et al. 2002). Son and Kakwani (2006) noted that people in lower income groups will most likely have expenditure patterns that differ from those of higher income groups. There is much evidence to show that the lower income groups will spend more of their budget on necessities than on luxuries compared to the total population. Consequently the poor will be affected more adversely by price increases of necessities.

The main objective of this paper is to show the impact of changes in income on household expenditure. Household expenditure has long been an important area of research and many researchers have studied this phenomenon to provide a better understanding of how the demand for specific expenditure groups changes when income and prices change. See for example Stavrev and Kambourov (1999) and Ulimwengu and Ramadan (2009). Studies that analyse household expenditure can be traced back at least to Working (1943). Since then many researchers have over the years estimated demand elasticities with different approaches to demand systems, for example, Diewert (1974),Theil (1965), Barten (1966), Deaton and Muelbauer (1980), Gallant (1981) and Barnett and Serletis (2008). A recent estimation for South Africa is also reported by Koch and Bosch (2009).

In this paper a demand system is proposed and tested. It satisfies the main restrictions that theory imposes on such systems. In the application of the system we show how a survey with biased and missing reporting can be treated as long as a subsample is reasonably accurate with respect to reporting of expenditure and income. Estimation of a consistent model on this subsample allows correction of the initially biased reporting and gives corrected expenditure shares and demand elasticities for the whole sample on the assumption that reported income, as opposed to expenditure, is reasonably correct for the whole sample. This gives us important insights into expenditure patterns and how these are affected by price and income changes in a poor community.

This paper is structured as follows: in section 2 we review the theoretical concept of demand systems and elasticity estimation; section 3 gives the background to the survey and the Bophelong area; section 4 gives a brief description of the aggregation of the original survey file into a household; section 5 deals with the reporting of income and expenditure; in section 6 the estimation of income and price elasticities is presented; in section 7 the results are discussed; and a conclusion is drawn in section 8. Appendix 1 gives a more detailed description of the model used.

2. The theoretical concepts of demand systems and elasticity estimation

Two approaches can be taken for the estimation of demand equations and elasticities. The first directly derives elasticities from reduced-form demand functions with consumption as the dependent variable and income, prices and socio-demographic factors as independent variables (Bouis, Haddad, and Kennedy 1992; Sahn 1988; Subramanian and Deaton 1996). The second approach is to

estimate a complete demand system. The advantage of the latter is that it can capture household income constraint and restrictions on demand functions implied by the microeconomic theory of consumer behaviour in a better way. Among the comprehensive systems, Linear Expenditure System (LES) Stone (1954) , the model of Jorgenson, Lau and Stoker (1982), Deaton and Muellbauer's (1980) Almost Ideal Demand system (AID system) and Banks, Blundell and Lewbel's (1997) Quadratic Almost Ideal Demand System (QAIDS) can be mentioned. A recent review by Barnett and Serletis (2008) outlines the theory of demand systems and consumer preference and discusses the different systems that have been proposed.

2.1. Demand systems without reference to utility

In the traditional demand systems with no reference to utility, the demand for a commodity is specified as a function of nominal income and prices. In these systems, the coefficient for income elasticities of demand measures the percentage change in quantities per 1% change in income or price. An example of this approach is Working's model (1943), in which the budget share of a good is expressed as a linear function of logged income. This model of Working applies to household-level data where prices exhibit little variation, and the model needs to be extended (Barnett and Serlitis op. cit.).

2.2. The neoclassical consumer theory

The neoclassical consumer theory introduces the Lagrange multiplier. By using budget constraints as part of the analysis, the first-order conditions can be obtained where the partial derivative is the marginal utility of the good. By introducing the concept of marginal utilities and the concept of utility maximisation of households, a demand system can be obtained which gives the quantity demanded as a function of the prices of all goods and income. In this approach, the demand system can also be expressed in the equivalent budget share form with demand for a commodity expressed as its share of total expenditure. The maximum attainable level of utility, given prices and income, defines the indirect utility function. The neoclassical approach includes Roy's identity, which is based on the indirect utility function and is a condition that should be satisfied for a consistent demand system.

2.3. The Rotterdam model, differential and parametric approach

A model which is widely used to estimate elasticities of income and price elasticities is the Rotterdam model introduced by Theil (1965) and Barten (1966). This theory, which is based on the neoclassical consumer demand theory, avoids the necessity of using a particular form for the utility function.

The parametric approach to empirical demand analysis, on the other hand, explicitly specifies a differentiable form for the indirect utility function. The demand system can then be derived from Roy's identity. By using the demand system and data, the parameters can be estimated and income and price elasticities can be calculated (Barnett and Serlitis, op. cit.). As stated by Barnett and Serlitis, the literature on demand systems concentrated on the use of globally regular

functional forms that satisfy the theoretical regularity conditions for rational neoclassical economic behaviour globally at all positive prices and income. This approach was based on the assumption that constant pairwise elasticities of substitution must exist independently of the quantities of the pairs of goods consumed. However, Uzawa (1962) proved that it is not possible to have a model that can simultaneously have constant elasticities of substitution and also attain arbitrary elasticities of substitution.

Another form is the locally flexible functional form which is a second-order approximation of an arbitrary function. In this regard, Diewert (1971) define second-order approximations. Another locally flexible functional form is the generalised translog (GTL) developed by Pollak and Wales (1980). The linear translog approach was developed from the GTL approach with Engel curves (income consumption paths at fixed prices) The Almost Ideal Demand System (AIDS) was introduced by Deaton and Muellbauer (1980) as another flexible demand system. The problem with locally flexible demand models according to Caves and Christensen (1980) and Barnett and Lee (1980) is that these models have very small regions of theoretical regularity and sacrifice global integrability. This problem has led to the development of effective globally regular flexible functional forms. The Minflex Larent (ML) model of Barnett (1983). and the quadratic AIDS (QUAIDS) model are examples of this model. In a model such as this, the functions typically have regular regions that include almost all data points in a sample. It also increases the regularity region as real expenditure levels increase.

The functional forms discussed so far are actually only capable of approximating an arbitrary function locally at a single point for demand. This led to the semi-nonparametric inference approach by Gallant (1981) which uses series expansions in infinite dimensional spaces. The idea in this approach is to expand the order of the series expansion as the sample size increases, until the semi-nonparametric function converges asymptotically on the true data-generating process. This led to the Asymptotically Ideal Model (AIM) developed by Barnett and Jonas (1983). In general we can say that there has been a search for flexible demand systems that satisfy certain theoretical conditions of the whole relevant range of prices and incomes. An ideal system has not yet been found. The systems applied in empirical work have so far been more or less good approximations of an ideal system. The demand system introduced in this paper is inherently non-linear. It has strong links to the random utility models (RUMs) of choice among discrete alternatives, and is particularly associated with the works of Daniel McFadden – see for example McFadden (1974, 1980), McFadden and Train (2000), Hausmann et al. (1995) and Ben Akiva and Lerman (1985). We have not yet explored all the properties of the system, but it satisfies Roy's identity and is quite flexible with respect to functional forms. Budget shares and demand elasticities depend systematically and non-linearly on income. A more detailed description is given in Appendix 1.

3. Background to Bophelong and the survey

This study used information from a household survey conducted in the township of Bophelong in 2009 to estimate the demand elasticities for various groups of expenditures. The purpose was two-fold. Firstly, information on

expenditures and demand elasticities for an area mainly populated by poor or low-income households will tell us how they adapt to changing economic circumstances, be they changes in income or in the prices of different items of consumption. Our knowledge about such matters usually comes from national surveys intended to be representative of the total population. Secondly, we wanted to test a new method of estimating demand systems at the household level, which has some methodological interest in its own right.

Bophelong is located in the Emfuleni municipal area in southern Gauteng, South Africa. The township was established in 1955, and in the late 1990s the area was extended by 10 000 new low-cost (RDP) houses. Most of the people who settled in the new houses were poor – those who could not afford a house before. The population of Bophelong in 2001 is estimated at 38 000, which is 5.7% of the total Emfuleni population. The number of households is estimated at 12 000 (Stats SA, 2001). The average household size in Bophelong, calculated from Stats SA data (2001) is 3.06 persons per household. The average household size for Emfuleni as a whole is 3.52 (Stats SA, 2001).

Maps of Bophelong were obtained and a sample stratification was designed in accordance with the geographical distribution and concentration of people in the areas. A questionnaire was designed to obtain the desired information. The area was divided into the different extensions and the questionnaires were distributed evenly in the inhabited sites. The plots/sites at which the fieldworkers were to complete the questionnaires were identified individually on the map before the fieldworkers set out. However, where people could not be found for an interview, or where it was impossible to trace a house, the next pre-selected household was interviewed. Information was preferably obtained from the head of the household or the spouse, but in about 30% of the cases children or someone else had to be interviewed.

A total of 300 households were interviewed by four fieldworkers. Almost all the households approached were willing to participate in the survey, and 300 questionnaires were completed in May 2009. Experience of surveys conducted previously by the Employment Research Unit (ERU), the VRG and other institutions (e.g. the Bureau of Market Research) has shown that samples of this size with a low refusal rate supply statistically reliable data within reasonable limits.

4. Aggregation to the household file

The original file from the survey consisted of one record per person in each household. The respondent's record contained most of the information related to the household and responses to questions on environmental aspects. Some data cleaning and recoding of data was necessary, mainly due to coding errors. As the relevant unit of analysis for the topic of this study was the household, a household file was more convenient. However, some of the relevant variables for the analysis came from information about the individuals who made up the household. Consequently a household file was constructed that which contained most of the information obtained from the respondents' records, with some available information added which pertained to the different members of the household. A number of variables that were not considered relevant for present analysis were also deleted when the household file was constructed. The household file contains

282 records with 138 variables per record, mainly related to the respondent, household composition, income, expenditure and environmental aspects.

We must expect that the accuracy, especially of the information given about economic matters, will depend on the position of the respondent in the household. Generally we should expect that the head of the household will be best informed. The distribution of respondents is given in Table 1. As can be seen from the table, the head of the household is the respondent in only 39% of the questionnaires. The head of household and spouse together make up nearly 70% of the respondents.

Table 1: Distribution of the respondents

Respondents:	Number	%
Head of hh	110	39.0
Spouse	84	29.8
Child	58	20.6
Ext. fam. Member	13	4.6
Boarder	5	1.8
Missing, no info	12	4.3
Total	282	100.0

5. Reporting of income and expenditure

Any analysis using expenditure and expenditure patterns as well as income will need reasonably accurate data on the relevant variables. A first test might be to look at the relationship between reported income and reported expenditure. As reported expenditure as defined here includes savings and repayment on loans, there should – in principle – be a very close relationship between expenditure and income. Households may spend more than their monthly income in any given month by drawing on savings or selling assets, but for the respondents in Bophelong we can probably safely assume that the difference between income and expenditure is quite small on average. From the survey data, the total reported income for different household members was aggregated to give total household income. Likewise all expenditures on different items were aggregated to total household expenditure. Different types of income per month are reported for each household member. The types of income reported were:
- Wages and salaries (formal)
- Pension/remittance
- Child grant from government
- Other grants from government
- Help (from family and relatives, also help in kind)
- Informal activities
- Subsidies (e.g. housing)
- Interest/dividends
- Other

The different types of income were aggregated for all household members to give total household income. The questionnaire contained altogether 27 expenditure

items and was thus very detailed. As most households only reported expenditures on a small subset of these items, we decided initially to aggregate to 11 expenditure items.
These were:

#	ITEM:	Includes:
1	EL_ENGY	Electricity, coal & paraffin, etc.
2	FOOD	Food
3	CLEANMAT	Cleaning materials
4	TRANSPRT	Taxi, car, car repayment, other transport
5	CLOTHING	Clothing
6	TOBALGEN	Cigarettes & tobacco, alcohol, lotteries & gambling, entertainment
7	SCHOOL	School
8	PHONE	Telephone & cellphone
9	SAVELOAN	Savings & loan repayment
10	OTHEREXP	Medical expenditures, insurance, licences, furniture, other
11	HOUSING	Housing

There was obviously some unrealistic reporting, and from the total of 282 households we initially selected the households with reported income greater than zero and less than R20 000 per month and also reported expenditure on food > 0. That left us with 266 households. The basic statistics for household income and expenditures for these households are given in Table 2.

Overall, the difference between reported expenditures and income seems to increase with reported income as shown by the regression of expenditure on household income in Table 3.

Table 2: Basic statistics on income and expenditures – Rand/month

Variable	Mean	Std Dev	Minimum	Maximum
HHINCOME	2 025	1 740	50	10 000
EL_ENGY	89	101	0	1 000
FOOD	494	318	90	2 000
CLEANMAT	80	79	0	500
TRANSPRT	126	277	0	2 200
CLOTHING	44	189	0	2 240
TOALGAEN	44	144	0	1 180
SCHOOL	64	188	0	1 500
PHONE	29	70	0	688
SAVELOAN	59	212	0	2 100
OTHEREXP	162	380	0	3 374
HOUSING	13	49	0	349
TOT.EXPEND.	1 204	1 168	190	8 250

Table 3: Regression of total expenditure on household income

Valid cases:	266	Dependent variable:	Total expenditure	
R-squared:		0.459	Rbar-squared:	0.457
Variable	Estimate	Std.Error	t-value	
CONSTANT	283.360	81.041	3.50	
Hhincome	0.455	0.030	14.97	

As the respondents were to a large extent low income or poor, they may have been quite aware of, and concerned about, income. The income of different household members might therefore be something that the household members frequently discussed. If so, the earnings of different household members might have been well known to the respondents, so income might have been quite accurately reported irrespective of the respondents' position in the household. However, depending on the respondents' position in the household, the knowledge and awareness of expenditures may have been far less accurate, especially if some household members kept some of their income for their own discretionary expenditures. This is partly confirmed by similar regressions done for male and female heads of households and for other respondents. Although heads of households reported higher expenditures relative to the income reported by other respondents, underreporting increases systematically with income, also for heads of households. In order to get a better grasp of the relationship between expenditure patterns and household income, we started by assigning the households to two sub-samples:

- Households with reported total expenditures exceeding 50% of reported household income (=168 households).
- Households with reported total expenditures less than 50% of reported household income (=98 households).

The basic statistics for these two groups are shown in Tables 4 and 5.

Table 4: Total expenditure ≥ (household income)/2 (obs=168) – Rand/month

Variable	Mean	Std Dev	Minimum	Maximum
HHINCOME	1 603	1 563	50	8 000
EL_ENGY	104	117	0	1 000
FOOD	485	310	100	2 000
CLEANMAT	93	86	0	500
TRASPORT	151	314	0	2 200
CLOTHING	57	229	0	2 240
TOALGAEN	63	175	0	1 180
SCHOOL	78	200	0	1 300
PHONE	38	84	0	688
SAVELOAN	72	242	0	2 100
OTHEREXP	221	460	0	3 374
HOUSING	15	50	0	349
TOTEXP	1 379	1 336	190	8 250

In Table 4 we see that the difference between mean income and mean total expenditure is within reasonable bounds. The mean value of reported expenditures now amounts to 86% of reported income.

Table 5: Total expenditure < (household income)/2 (obs=98) – Rand/month

Variable	Mean	Std Dev	Minimum	Maximum
HHINCOME	2 747	1 798	460	10 000
EL_ENGY	63	56	0	250
FOOD	509	332	90	2 000
CLEANMAT	60	59	0	500
TRASPORT	83	190	0	1 100
CLOTHING	22	85	0	565
TOALGAEN	10	39	0	300
SCHOOL	41	163	0	1 500
PHONE	13	24	0	120
SAVELOAN	35	145	0	1 200
OTHEREXP	59	116	0	605
HOUSING	10	48	0	300
TOT.EXP.	905	716	205	3 593

The mean reported expenditure in Table 5 only amounts to 1/3 of reported income. There is obviously also a bias with respect to different expenditure items. Only the mean expenditure on food is higher in Table 5 despite the fact that reported income is more than 70% higher than in the other sub-sample. Thus although income might be quite accurately reported, this sub-sample is not suitable for analysis of expenditure patterns.

For the analysis of expenditure patterns and the relationship between expenditures and income, we relied on the hypothesis that reporting of income has been reasonably accurate in both sub-samples and that the main problem is underreporting and biased reporting of expenditures for the subsample in Table 5.

6. Estimation of income and price elasticities – the household subsample

Among the households included in Table 4 there were still a few extreme observations. For the final analysis we selected only households where:
$(\text{household income})/\sqrt{\text{number of household members}} \geq 200 \; Rands.$
This left 156 households, or 55% of the total sample of 283 households, for the final analysis of expenditures. With only 156 records left for estimation, 11 expenditure groups are excessive. A model that explains expenditure patterns and provides estimates of demand elasticities will then need 11 x 2 - 2 = 20 parameters as a minimum. From a statistical point of view this may cause a high number of insignificant parameters. In order to get a simpler model that could be estimated with confidence, we therefore made a further aggregation into 6 expenditure groups. The aggregation key is given below.

Group 1	ENERGY&H	EL_ENGY + HOUSING
Group 2	FOOD&CLN	FOOD + CLEANMAT
Group 3	TRANSP	TRANSPORT
Group 4	MISC_	CLOTHING + TOALGAEN + PHONE
Group 5	SCHOOL	SCHOOL
Group 6	FIN& OTH	SAVELOAN + OTHEREXP

Groups 1 and 2 can be considered as basic necessities, while the remaining groups contain goods and services that people living under economic hardship can do without for a shorter or longer period. An advantage of aggregating to a few expenditure groups is also that we can assume that the substitution possibilities are small. If for example food prices rise, low-income households cannot substitute food for transport, energy or some more luxury consumption items. However, if food prices in general rise, they may substitute between different foods in order to get a cheaper "menu". Or, if the prices of some foods rise relative to others, they may also substitute between different types of food. Thus the consumption of separate items contained in an expenditure group may be quite sensitive to price changes and have high price elasticity even if the group as a whole has low price elasticity due to moderate substitution between expenditure groups.

The price sensitivity of a whole expenditure group should therefore mainly reflect what is termed the "income effect" as opposed to what is usually termed the "substitution effect". The pure substitution effect is a theoretical construct that refers to the change in demand for a commodity when its price changes and income at the same time is changed to keep economic "welfare" at the same level as before. The relationship between different elasticities is given by what is called the "Slutsky equation" in demand analysis.

If we use e_i as the notation for the total price elasticity of a commodity "i", ε_i as the notation for the substitution elasticity, E_i as the notation for the income elasticity and α_i as the budget share of the commodity, the Slutsky equation gives us:

$$e_i = \varepsilon_i - \alpha_i E_i$$

For a poor household, a basic necessity such as food will have a high budget share and high income elasticity and the second term on the right-hand side (the income effect) can be expected to dominate the price elasticity of food in general, while ε_i will be small and probably negligible. However, if we look at a particular food item it may have a low budget share and it can be substituted in the diet by other food items. This means that the first term on the right-hand side can be quite high compared with the second term and have a big impact on the total price elasticity. The implication is that an estimate of the income elasticity in combination with the budget share will give a fairly accurate estimate of the total price elasticity *for a commodity group*. However, the substitution elasticity is hardly zero. Thus using only the second term will usually imply a slight under-estimation of the absolute value of the total price elasticity for an expenditure group.

For very poor households we might even observe what is called the "Giffen case". Very poor households may have a very high expenditure share for some staple food. When income rises they consume less of this staple food, which implies that the staple food is an "inferior" good, a term used for commodities that

have negative income elasticity. Now if the budget share is initially high and E_i is negative, the second term on the right hand side of the Slutsky equation will be positive and its numeric value may be higher than ε_i which is always ≤ 0. The "paradox" is that in this case, a price increase of the staple food will increase demand, a result that otherwise might be considered as rather perverse. In order to detect this apparent paradox we must look at the details of food consumption by very poor households.

In order to estimate within-group price elasticities we would also need an extended sample that includes price variations and not only a cross-section survey for a particular short time period where all households face (approximately) the same prices. The basic statistics of the aggregated groups for the final sample is shown in Table 6. The mean and standard deviation here are based only on the non-zero values, but column 7 gives the mean, with missing treated as zero. As can be seen, even with this aggregation, a substantial number of households will have no reported expenditure in one or more of the expenditure groups.

Table 6: Basic statistics for final sample used for estimation – Rand/month

Variable	Mean	StdDev	Min	Max	Valid	Missing	Mean, incl. zeros
1	2	3	4	5	5	6	7
ENERGY&H	121.0	128.9	10	1000	155	1	120.2
FOOD&CLN	590.6	345.6	160	2300	156	0	590.6
TRANSP	371.9	403.2	15	2200	68	88	162.1
MISC_	226.2	502.7	5	3878	116	40	168.2
SCHOOL	260.5	296.6	10	1300	50	106	83.5
FIN& OTH	489.6	708.0	17	4050	99	57	310.7

For this sub-sample a regression between total reported expenditure and total reported household income gave the results in Table 7.

Table 7: Regression of total expenditure on household income – final sample

Valid cases:	156	Dependent variable:	Total expenditure	
R-squared:		0.707	Rbar-squared:	0.705
Variable	Estimate	Std.Error	t-value	
CONSTANT	196.984	87.236	2.26	
Hhincome	0.726	0.038	19.29	

The fit is considerably better than in Table 3. However, even for this sample there seems to be a systematic underreporting of expenditures for "high income" households. The regression line shows that for households with above R750 in monthly income, the mean reported income is higher than the mean reported expenditure. Thus even the final sample seems to be biased with respect to reported expenditures. The structure and specification of the estimated model builds on the concept of (indirect) utility functions from microeconomic theory. For each expenditure group a utility function is defined that depends on income, prices,

the number of persons in the household and a few other household characteristics. From the way the model is formulated, it fulfils the adding-up constraints on budget shares and income elasticities that theory says should be satisfied. The composite utility function also satisfies the condition for a proper indirect utility function that is termed Roy's identity. To our knowledge this particular model has not previously been used to estimate demand systems.

The model is non-linear and was estimated with a maximum likelihood procedure. Altogether the model as specified and estimated contains 16 parameters, but two of these are not identifiable from data and are normalised to 0 and 1 respectively. The other parameters are conditional on the normalisation used, but the predictions of the model with respect to demand elasticities and budget shares are independent of the normalisation. The concept of income used in the model is the household income divided by the square root of the number of household members. As there are some economies of scale in household size, this is probably a better option than dividing income by the number of household members. A household with two members does not need twice as much of every expenditure item as a household with only one person. In bigger households there will usually also be some small children and/or elderly people who are less demanding on most consumption items than the average person in the age group between, say, 18 and 50 years. An alternative to scaling income by the square root of the number of persons in the household is to covert the members of the household into an equivalent number of adult persons (in terms of consumption). Yatchew et al. (2003) estimated a formula for such a conversion. However, for our sample the square root has a very high correlation (R = 0.99) with the equivalent number of adults as calculated by this formula.

7. Results

Estimation of the model proved to give quite satisfactory results from a statistical point of view. When the model had been estimated it could be applied to every household in the sample that was used to estimate the model. The basic statistics of estimated budget shares and elasticities from this application are given in Table 8. The right-most column is the mean values when the calculated budget shares and elasticities for each household are weighted by the households' share of total income. This column should therefore be an estimate of budget shares and elasticities for the aggregate of all households in this sample.

While both the weighted and the unweighted mean of income elasticities are reasonably close to 1, the impact of income is clearly evident from *the range* of elasticities and expenditure shares found when the model is applied to all households. This range is given by the minimum and maximum values. For expenditures on school the number of children in the age group 7–12 is a variable in the model and for this expenditure group the range of expenditure share and elasticities also reflects the presence and non-presence of children in this age group in the households. Incidentally, expenditures on schooling may be a case where the households will not necessarily face the same price due to income-dependant subsidies. The weighting of observation has probably been corrected reasonably well for the bias in reported expenditures. While reported expenditures for Group 1 and Group 2 may have been reasonably accurate, the underreporting was probably mainly confined to the other expenditure groups, thus exaggerating

the share of expenditures going on basic necessities. While reported expenditures on food made up 55% of total expenditures for the households in this sub-sample, the real share was probably more like the estimated 40%, provided that the reporting of income was reasonably accurate.

Observed expenditure shares are usually applied as weights in consumer price indices. These weights are based on aggregate expenditure for the households in a representative national sample of households. If all prices moved in parallel, this would also give the compensation in terms of percentage increase in income that different households would need to be compensated for inflation. There is a relatively large difference between the mean and weighted mean of expenditure shares, especially for food. This is troublesome when prices for all expenditure groups do not move in parallel. The weighted budget shares will be biased towards the consumption patterns of rich households that have the highest total expenditure. Koch and Bosch (2009) discuss the mean and the weighted mean of budget shares under the heading of "democratic" and "plutocratic" weights respectively. The two columns with the mean and weighted mean respectively thus show the difference in the two weighting schemes for this particular sample. The maximum and minimum values for expenditure shares also show a big variation among households. Koch and Bosch (op. cit.) use a national sample of South African households for their study of weighing schemes and divide the households into the bottom 40%, the middle 30% and the top 30% with respect to total expenditures. Most of our sample will fall into the bottom 40%, which is certainly the case for the households used in the estimation of the model.

We return to the index issue at the end of this section. It is an important topic if we want to monitor the economic welfare of different types of households over time. An increase in one or more prices will amount to an equivalent reduction in income, which gives the amount needed to bring the household back to the initial level of economic welfare. If income rises over time in combination with different rates of price increases, the question also arises as to whether there has been an increase or a decrease in the economic welfare of different types of households. In this perspective the weighting schemes in price indices is also crucial for the conclusions.

On the assumption that reported income is reasonably accurate for the households reporting expenditures amounting to less than 50% of income, the model can be applied to the total sample with the exemption of a few extreme observations. Table 9 give similar results for the whole usable sample of 261 households.

The mean reported household income for the 98 housholds that were not used in the estimation was more than 70% higher than for the households used for estimation. This should mean that inclusion of these housholds when we estimate budget shares and elasticities should reduce the budget share of groups with income elasticities below 1 and increase the budget shares for the others. This was in fact the case.

Table 8: Expenditure shares and elasticities for households used in the estimation (156)

Variable	Mean	Std Dev	Minimum	Maximum	Income-weighted mean
Observed expenditure shares					
ENERGY&H	0.0974	0.0763	0	0.4795	****
FOOD&CLN	0.5514	0.2387	0.1232	0.9630	****
TRANSP	0.0929	0.1512	0	0.7005	****
MISC_	0.0761	0.1123	0	0.6269	****
SCHOOL	0.0468	0.0965	0	0.5869	****
FIN& OTH	0.1353	0.1651	0	0.7388	****
Estimated expenditure shares					
ENERGY&H	0.100	0.024	0.040	0.150	0.081
FOOD&CLN	0.485	0.103	0.204	0.641	0.401
TRANSP	0.103	0.018	0.069	0.154	0.114
MISC_	0.081	0.049	0.024	0.264	0.122
SCHOOL	0.062	0.019	0.024	0.088	0.057
FIN& OTH	0.168	0.072	0.053	0.351	0.224
Estimated price elasticities					
ENERGY&H	-0.069	0.025	-0.122	-0.014	-0.050
FOOD&CLN	-0.356	0.120	-0.565	-0.074	-0.261
TRANSP	-0.128	0.014	-0.165	-0.095	-0.130
MISC_	-0.141	0.073	-0.387	-0.048	-0.201
SCHOOL	-0.056	0.021	-0.090	-0.013	-0.046
FIN& OTH	-0.251	0.086	-0.447	-0.091	-0.312
Estimated income elasticities					
ENERGY&H	0.665	0.119	0.320	0.839	0.567
FOOD&CLN	0.708	0.119	0.363	0.882	0.610
TRANSP	1.255	0.119	0.910	1.428	1.156
MISC_	1.813	0.119	1.468	1.986	1.714
SCHOOL	0.880	0.119	0.535	1.054	0.782
FIN& OTH	1.539	0.119	1.194	1.713	1.441

The "FOOD" group we use here includes cleaning materials, but not beer, wine and spirits. The group is therefore not entirely equal to "food" as defined in the study by Koch and Bosch (op. cit.). However, our estimated budget share for the total sample of 0.379 is roughly equal to the budget share of food for the bottom 40% reported by these authors, where the budget share of "grains", "protein", "fruit & vegetables" and "other food & beverages" adds up to 0.363. Thus applying the estimated model to the whole usable sample seems to give estimates that adjust reasonably well for underreporting of expenditures.

There is also a downward adjustment for energy and housing, while the expenditure shares for groups 3–6 increase substantially. The elasticities remain roughly equal as these are only based on income and household size, but some slight change shows up because average household income is higher for the added observations.

Table 9: Expenditure shares and elasticities for households – model applied to all usable observations (261)

Variable	Mean	Std Dev	Minimum	Maximum	Income-weighted mean
Observed expenditure shares					
ENERGY&H	0.094	0.092	0.000	1.000	…
FOOD&CLN	0.595	0.258	0.000	0.985	…
TRANSP	0.080	0.142	0.000	0.742	…
MISC_	0.060	0.099	0.000	0.627	…
SCHOOL	0.039	0.088	0.000	0.587	…
FIN& OTH	0.109	0.153	0.000	0.787	…
Estimated expenditure shares					
ENERGY&H	0.093	0.024	0.037	0.150	0.076
FOOD&CLN	0.454	0.105	0.204	0.648	0.379
TRANSP	0.108	0.017	0.067	0.154	0.117
MISC_	0.095	0.051	0.024	0.264	0.132
SCHOOL	0.059	0.020	0.022	0.088	0.053
FIN& OTH	0.192	0.076	0.053	0.373	0.243
Estimated price elasticities					
ENERGY&H	-0.061	0.026	-0.122	-0.012	-0.044
FOOD&CLN	-0.318	0.122	-0.565	-0.074	-0.233
TRANSP	-0.130	0.013	-0.165	-0.095	-0.131
MISC_	-0.162	0.076	-0.387	-0.047	-0.216
SCHOOL	-0.051	0.021	-0.090	-0.012	-0.041
FIN& OTH	-0.279	0.089	-0.475	-0.091	-0.335
Estimated income elasticities					
ENERGY&H	0.628	0.123	0.320	0.839	0.539
FOOD&CLN	0.671	0.123	0.363	0.882	0.582
TRANSP	1.218	0.123	0.910	1.428	1.128
MISC_	1.776	0.123	1.468	1.986	1.686
SCHOOL	0.843	0.123	0.535	1.054	0.754
FIN& OTH	1.502	0.123	1.194	1.713	1.413

Underreporting of expenditures is a well-known phenomenon in surveys of expenditures, but is not a particular trait of this survey. This is also why expenditure surveys that are used for constructing price indices are quite expensive undertakings. A sample of households is usually paid to keep accurate diaries of expenditures for an extended period of time, but even then certain expenditures tend to be underreported.

How shall we interpret the results with respect to expenditure shares and elasticities? Firstly, even if these variables are initially calculated for each household, this does not mean that they are household specific. They must be interpreted as mean or representative values for households with the same characteristics as the household in the sample with respect to income, household size and number of children of school age. Any particular household will deviate more or less from the mean values due to the preferences of the household. The details of the composition of the household as well as other unspecified variables

will also play a role. A model such as the one estimated will capture some systematic patterns, but around these patterns there will be variations that can be considered as more or less random from an observer's perspective.

The income elasticities tell us how much the consumption of the commodities in an expenditure group changes in percentage terms when income increases, for example –by 10%. An income elasticity of, say, 0.9 then tells us that consumption will increase by 9%. If the elasticity is less than 1 for a group, the groups' share of total expenditure will decrease as income increases. The opposite is the case if the income elasticity is greater than 1.

Thus the weighted income elasticities in Table 8 tell us that if household income for the households in Bophelong increases by 10% and prices remain the same, expenditures on food and energy will increase overall by approximately 5.4 and 5.8% respectively and on transport by 12.8%. The largest percentage increase will be for the expenditure group termed MISC_ which comprises "cigarettes&tobacco", "alcohol", "lotteries&gambling", "entertainment", "phones" and "clothing". Here it seems that expenditures will increase by 16.9%. On closer examination, this might not be surprising, because for low-income households this expenditure group might be considered as "affordable" luxuries, while commodities and services that richer households may consider as luxuries are out of reach. The third group with income elasticity exceeding 1 is "FIN& OTH" which comprises items such as "savings", "loan repayment", "medical expenses", "insurance", "licences"," furniture" and " other" (unspecified). The total expenditure on these items will – according to the estimated model – increase by 14.1% if the income of all households increases by 10%. The income elasticity of energy and housing warrants a comment. Expenditure surveys and estimation of household demand for different commodities usually shows that this expenditure group has an income elasticity close to one, implying that expenditures are nearly proportional to income. Here we have a low budget share and low income elasticity compared to many other studies. The main reason for this is probably that the great majority of the households live in RDP houses and report none or very low expenditure on housing. As long as they reside in Bophelong the opportunities for improving housing standards when income permits it are limited and this will also be reflected in estimated income elasticities.

The price elasticities, on the other hand, tell us how consumption and expenditures are affected by price changes. The estimated price elasticity of -0.233 for food indicates, for example, that a 10% increase in food prices will increase the expenditure on food by $10*(1- 0.23) = 7.7\%$, i.e. somewhat less than the price increase, and that the volume of food consumption will be reduced by 2.3%. An impact such as this conceals a combination of two effects: food consumption in general will be reduced, but some of the effect will involve a substitution of less expensive food items.

From the Slutsky equation it is evident that if $\varepsilon_i \cong 0$ the price elasticity mainly depends on the product of the expenditure share and the income elasticity. It implies that a price increase for the group MISC_ will have little effect on the consumption of this group because the budget share is small initially and the price increase will therefore have little effect on real income.

The "driving force" with respect to expenditure shares and elasticities is income. Figure 1 shows an example of how expenditure shares develop when

income increases for a household with five persons that we can take as a young couple with three children, one of whom is of school age.

Figure 1: Development of budget shares with increasing income. Example household
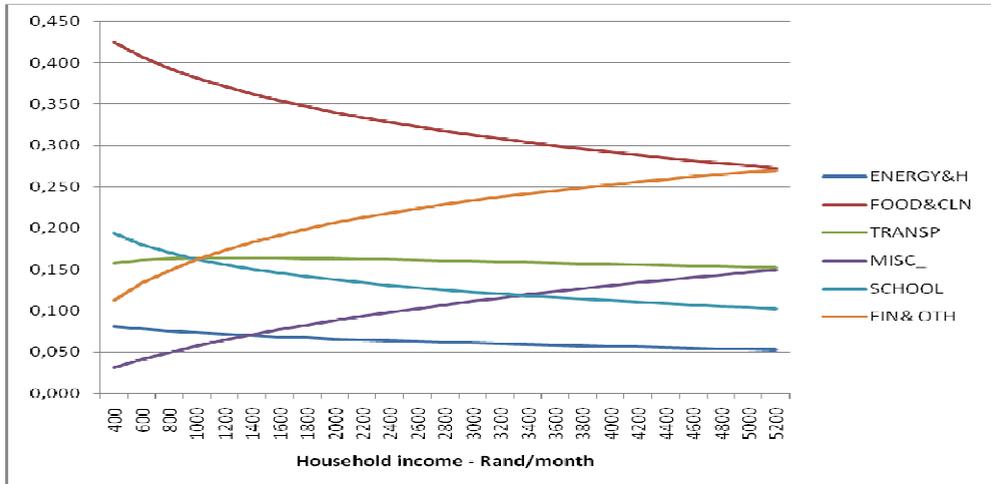
The lowest incomes in the diagram are below "survival level" for households of this type. Slabbert (unpublished research data, 2009) estimates the "survival" level for this type of household at approximately R2 195 per month in 2009 for Bophelong, based on the cost of a "minimum" basket of goods mainly composed of necessities.

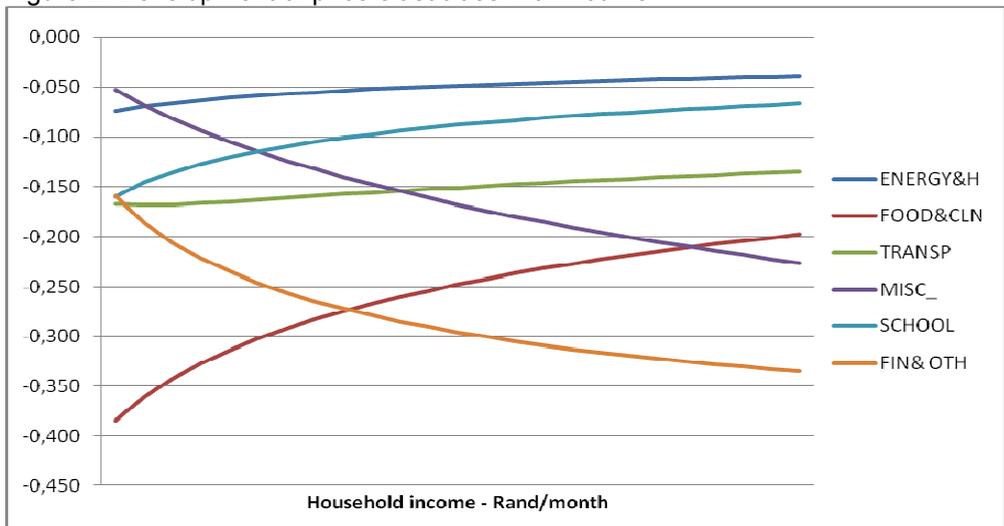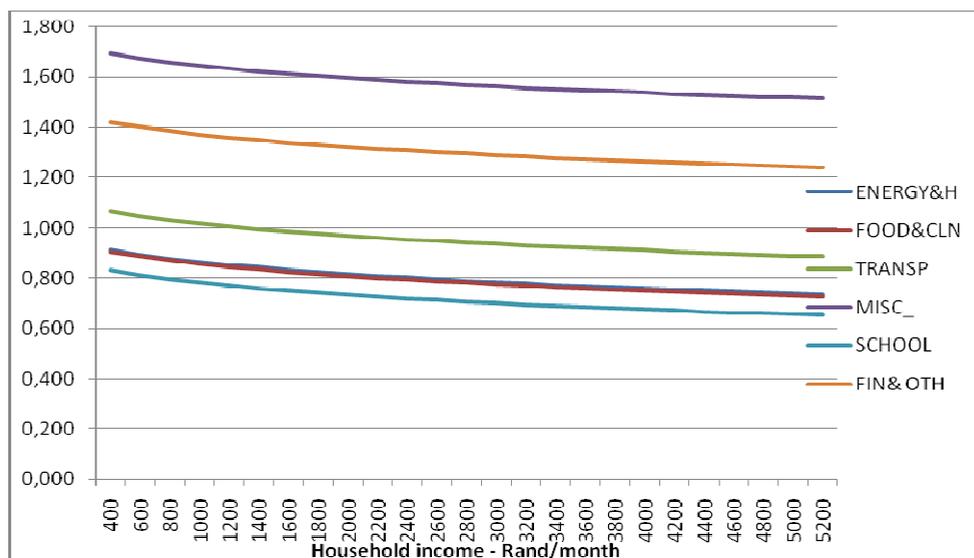Figure 2: Development of price elasticities with income

Figure 3: Development of income elasticities with income

The income elasticities of "FOOD&CL" and "ENERGY&H" are indistinguishable in Figure 3 and move completely in parallel. All income elasticities decline with income. A commodity with an income elasticity exceeding 1 is often termed a luxury commodity. In the figure we see that "TRANSP" crosses this line around an income of R1 400 per month. Thus for the very poor we can say that transport must be considered a "luxury".

In the same way as the model estimated by Koch and Bosch (op. cit.), the model we estimated can also be used to estimate the increase in income needed to compensate for price increases of different commodity groups. For small price increases of, say, 1%, the initial budget shares times 0,01 gives a very accurate estimate of the percentage increase in income needed to compensate for the price increase. For big price increases of, say, 30%, the necessary income compensation must be calculated from an "ideal" price index based on the new budget shares after the price increase for each household.

8. Conclusions

A few consistent demand systems for household expenditures have been around for many years. Here we tested an alternative system that also satisfies the restrictions that theory places on such systems, at least as long as we assume that substitution elasticities are zero.

The methodological side shows how a survey with biased and missing reporting can be treated as long as a subsample is reasonably accurate with respect to reporting of expenditures. By estimating a model on this subsample we are able to devise a consistent model that allows us to correct the initially biased reporting and also furnishes us with corrected expenditure shares and demand elasticities that can give us important insights into expenditure patterns and how these are affected by price and income changes.

The estimated demand elasticities show us some interesting patterns that can show up when income increases or prices of broad expenditure groups change. The estimated model also allows us to construct a more comprehensive – and probably more accurate – measure of economic welfare than income or income per person. This measure can also be used to estimate measures of inequality that are strongly correlated with more traditional measures, but more comprehensive.

REFERENCES

Banks J., Blundell R., Lewbel A. (1997) Quadratic Engel curves and consumer demand, *Review of Economics and Statistics*, 79(4): 527-539.

Barnett W.A. (1983) New indices of money supply and the flexible Laurent demand syste, *Journal of Business and Economic Statistics*, 1(1): 7-23.

Barnett W.A., Jonas A.(1983) The Muntz-Szatz demand system: An application of a globally well behaved series expansion, *Economics Letters*, 11(4), 337-342.

Barnett W.A., Lee Y.W. (1985) The global properties of the miniflex Laurent, general Leontief, and Translog functional forms, *Econometrica*, 53(6), 1421-1437.

Barnett W.A., Serletis A. (2008) Consumer preferences and demand systems. *Journal of Econometrics*, 147(2), 210-224.

Barten A.P. (1966) *Theorie en empirie van een volledig stelsel van vraagvergelijkingen*. Doctoral diisertation, Nertherlands School of Economics, Rotterdam.

Ben-Akiva M., Lerman S. (1985) *Discrete choice analysis. Theory and Applications to Travel Demand*, MIT press, Cambridge.

Bouis H., Haddad L., Kennedy E. (1992) Does it matter how we survey demand for food?: Evidence from Kenya and the Philipines, *Food Policy*,17(5): 349-360.

Caves D.W., Christensen L.R. (1980) Global properties of flexible functional forms, American Economic Review, 70(3): 422-32.

Deaton A.S., Muellbauer J.N. (1980) An almost ideal demand system, *American Economic Review*, 70(3): 312-326.

Diewert W.E. (1971) An Application of the Shephard duality theorem: a generalized Leontief production function, *Journal of Political Economy*, 79(3): 481-507.

Diewert W.E.(1974) Applications of duality theory, In Intriligator M., Kendrick D. (Eds), *Frontiers in quantitative economics*, Vol 2, North Holland, Amsterdam.

Gallant A.R. (1981) On the bias of flexibile functional forms and an essentially unbiased form: The fourier functional form, *Journal of Econometrics*, 15(2): 211-245.

Hausman J., Jerry A., Leonard G.K., McFadden D. (1995) A utility-consistent, combined discrete choice and count data model Assessing recreational use losses due to natural resource damage, *Journal of Public Economics*, 56(1), 1-30.

Jorgenson D.W., Lau L.J., Stoker T.M. (1982) The transcendental logarithmic model of aggregate consumer behavior, *Advances in Econometrics*, vol 1.

Koch S., Bosch A. (2009) Inflation and the household: Towards a measurement of the welfare cost of inflation, *Working papers 200917, SARB, South African Reserve Bank*, Pretoria, South Africa.

McFadden D., Kenneth T. (2000). Mixed MNL models for discrete response, Journal of Applied Econometrics, 15(5): 447-470.

McFadden D. (1974) The measurement of urban travel demand, Journal of Public Economics, 3(4): 303-328.

McFadden D. (1980) Econometric Models for Probabilistic Choice among Products, *Journal of Business*, 53(3): 13-29.

Pollak R.A., Wales T.J. (1980) Comparison of the Quadratic Expenditure System and Translog Demand Systems with alternative Specifications of Demographic Effects, *Econometrica*, 48(3): 595-612.

Raper C.K., Wanzala M.N., Nayaga M. (2002) Food expenditures and household demographic composition in the US: a demand system approach, *Applied Economics*, 34(8): 981-992

Son H.H., Kakwani N. (2006) Measuring the impact of price changes on poverty, *UNDP Working Paper 33*, United Nations Development Program.

Statistics South Africa. (2003) Census data 2001. Pretoria. [Web:] http://www.statsa.gov.za. [Date of access: 14 September 2003].

Stone R. (1954) Linear Expenditure Systems and Demand Analysis: An Application to the Pattern of British Demand, *The Economic Journal*, 64: 511-527.

Stavrev E., Kambourov G. (1999) Estimation of Income, Own- and Cross-Price Elasticities: An Application from Bulgaria, Institute for Advanced Studies, *Transition Economics Series no 6*, Vienna.

Subramanian S., Deaton A. (1996) The demand for food and calories, *The Journal of Political Economy*, 104(1), 133-162.

Theil H. (1965) The information approach to demand analysis, *Econometrica*, 33(1): 67-87.

Ulimwengu J.M., Ramadan R. (2009) Hoe does food price increase affect Ugandan Households?: An augmented Multimarket Approach, *IFPRI Discussion Paper 00884*, International Food Policy Research Institute

Uzawa H. (1962) Walras existence theorem and Brouwers fixed-point theorem, *Economic Studies Quarterly*, 13: 59-62.

Working H. (1943) Statistical laws of family expenditure, *Journal of the American Statistical Association*, 38: 43-56

APPENDIX 1

A model of household expenditures

An expenditure group is an aggregate of different commodities and services with different prices. However, let us assume that we can construct an "aggregate" commodity and a price or price index for the group. The budget share of group "g" is then given by:

$$\alpha_g = \frac{p_g x_g}{X} \quad .$$

(1)

where

X = total expenditure, p_g = price and x_g = volume

When an expenditure group includes savings and repayment of loans we must expect that correctly reported expenditures will closely follow income (R). A very close relationship between total income and total expenditure will imply that the elasticity of X with respect to household income is approximately equal to 1, i.e. $El(X:R) \cong 1$.

If we take the log of the budget share we have:

$$\ln(\alpha_g) = \ln(p_g) + \ln(x_g) - \ln(X)$$

(2)

Taking the elasticity of the budget share with respect to income (R) we get:

$$El(\alpha_g:R) = El(x_g:R) - El(X:R) \cong El(x_g:R) - 1$$

(3)

or

$$El(x_g:R) \cong El(\alpha_g:R) + 1$$

(4)

Thus if we are able to estimate the elasticity of the budget share with respect to income, we should get a very accurate estimate of the income elasticity of the group by adding 1 to this estimate.

Now budget shares are interdependent and should add up to 1. From the budget constraint the sum of income elasticities weighted by the budget share should add up to 1, i.e.:

$$\sum_{g=1}^{G} \alpha_g El(x_g:R) \cong 1$$

(5)

Estimation of income elasticities should consequently satisfy the adding-up constraint on budget shares and on the weighted sum of income elasticities. It also means that only G-1 income elasticities can be estimated independently. The latter will be given by the two constraints.

By the same reasoning we also find that the direct price elasticity is given by:

$$El(x_g : p_g) \cong El(\alpha_g : p_g) - 1 \qquad (6)$$

Now suppose that the "indirect utility function" for household "j" for expenditure group "g" takes the form:

$$U_g^j = U_g\left(p, R^j, z_g^j; \theta_g\right) \qquad (7)$$

where z_g^j are household-specific variables that influence the indirect utility function for this expenditure type; θ_g is a vector of parameters that determines the effect of different variables; and p is a vector of prices (or price indices) for different commodity groups.

Assume also that a household has an integer number of monetary units (X) that can be distributed on different expenditure groups with integer amounts X_1, X_2,...., X_G. Expenditures on a group can also be zero. The allocation of expenditures between groups will presumably be done with the aim of maximising the total utility of the household. Now households do not necessarily have identical preferences for the distribution of expenditures even if they have *the same income, total expenditure* and *observable* characteristics.

Assume further that for a particular household we can write the probability of observing the distribution X_1, X_2,...., X_G as a multinomial model of the following form:

$$Q(X_1, ..., X_g; X) = \frac{X!}{X_1! \cdots X_G!} q_1^{X_1} \cdots q_G^{X_G} \qquad (8)$$

and let the probabilities be defined by:

$$q_g = \frac{e^{U_g}}{\sum_{i=1}^{G} e^{U_i}} \quad for\ g = 1, ..., G \qquad (9)$$

This formulation of the probability function can be termed a multinomial probability model with "logit" probabilities.

Taking the log of this expression and introducing superscript for household, we get:

$$\ln(P^j) = \ln(X^j!) - \sum_{g=1}^{G}\left[\ln\left(X_g^j!\right) + \sum_{g=1}^{G} X_g^j U_g^j - X^j \ln\left(\square\right] \sum_{g=1}^{G} e^{U_g^j}\right)$$

$$= \ln(X^j!) - \sum_{g=1}^{G}\ln\left(X_g^j\right) + X^j\left[\sum_{g=1}^{G} v_g^j U_g^j - \ln\left(\sum_{g=1}^{G} e^{U_g^j}\right)\right] \tag{10}$$

Here

$v_{1g}{}^j{}_j = (X_{1g}{}^j{}_j)/X^j(j) = observed\ budget\ share\ for\ group\ "\backslash"g\backslash"\ for\ household\ \backslash"j\backslash"$

By summing over all households, we obtain a proper likelihood function for estimating parameters in the utility functions, i.e. the log-likelihood function for this problem can be written as:

$$LLH = \sum_{j=1}^{J}\ln(P^j) \tag{11}$$

The parameters in the "utility functions" can therefore be estimated by maximising the likelihood function. Maximum likelihood as a principle of estimation implies that we can find a set of parameters that maximises the probability of observing the distribution on expenditure groups that we actually observe in the sample.

As the two first terms on the right-hand side of equation (9) are unaffected by maximisation, we can instead maximise the following pseudo-likelihood function LLH^* which will have the same maximum as the likelihood function with respect to parameters:

$$LLH^* = \sum_{j}X^j\left[\sum_{g=1}^{G} v_g^j U_g^j - \ln\left(\sum_{g=1}^{G} e^{U_g^j}\right)\right] \tag{12}$$

LLH^* implies that each observation is weighted by total expenditure. This model can be estimated with the same methodology as a logit model for discrete choice except for the weighting of utility functions and observations.

Some general properties of the model

In the multinomial model the expected expenditure on group "g" is give by:

$$E\left[X_g^j\right] = X^j \cdot q_g^j \quad \Rightarrow \quad q_g^j = \frac{E\left[X_g^j\right]}{X^j} \quad (g = 1,\ldots,G) \tag{13}$$

The probabilities in this model are thus equal to the expected budget shares, and consequently:

$$\alpha_g^j = \frac{e^{U_g^j}}{\sum_{i=1}^{G} e^{U_i^j}}$$ = expected budget share of group $g = 1, ..., G$ for a household of type "j".

The expected budget shares thus add up to 1 in the same way as the probabilities and must be interpreted as the mean or "typical" budget share for households with similar characteristics as household "j" in the sample.

The income elasticity of the budget share in this model is given by:

$$El(\alpha_g : R) = \left[\frac{\partial U_g}{\partial R} - \sum_{i=1}^{G} \alpha_i \frac{\partial U_i}{\partial R} \right] R \quad for \ g = 1, ..., G \tag{14}$$

From (14) it follows that the income elasticity has the form:

$$El(x_g : R) = \left[\frac{\partial U_g}{\partial R} - \sum_{i=1}^{G} \alpha_i \frac{\partial U_i}{\partial R} \right] R + 1 \quad for \ g = 1, ..., G \tag{15}$$

Multiplying both sides by α_g and summing over "g" shows that the sum of budget share weighted income elasticities does in fact equal 1.

In the same way the direct price elasticity is given by:

$$El(x_g : p_g) = \left[\frac{\partial U_g}{\partial p_g} - \sum_{i=1}^{G} \alpha_i \frac{\partial U_i}{\partial p_i} \right] p_g - 1 \quad for \ g = 1, ..., G \tag{16}$$

Thus if we are able to estimate the parameters in the indirect utility functions, we can calculate the income and price elasticities. These will be household dependent in the sense that only households with the same income and characteristics that are included in the model will have the same budget shares and elasticities.

Analogous to the discrete choice model, we can also define the composite (indirect) utility of a typical household of type "j" which includes all expenditure groups by the "logsum":

$$V^T j = \ln(\Sigma_i (i = 1)^{\mathsf{T}} G \boxtimes e^{\mathsf{T}}(U_i i^{\mathsf{T}} j) \ ) \tag{17}$$

What remains is to specify the indirect utility functions for each group. These should be homogeneous of degree zero in prices and income. To satisfy the theoretical properties of a demand system for individual households, the demand equations should also satisfy Roy's identity for the specified utility functions. If we

disregard the substitution effect V^j as defined in equation (17), it can be taken as a proper indirect utility function.

Assume that we have an initial situation with the price index for each group normalised to 1 and budget shares $\alpha_1^0, \ldots \ldots, \alpha_G^0$. In a new situation the price indices become: $I_1^1, \ldots \ldots, I_G^1$.

The ideal price index will then be:

$$I^1 = \sum_{g=1}^{G} \alpha_g^1 \cdot I_g^1$$

(18)

This is a matter of finding the new budget shares. To do this we solve the simultaneous equation system:

$$\alpha_g^1 = \frac{e^{U_g\left(\frac{R}{I^1}\right)}}{\sum_{i=1}^{G} e^{U_i\left(\frac{R}{I^1}\right)}} \quad for \ g = 1, \ldots, G$$

(19)

Numerically this is a straightforward problem to solve, although the problem does not have a closed-form solution and it immediately gives us the ideal price index for the new situation.

Roy's identity
When V^j denotes the indirect utility function, Roy's identity for household "j" can be written as:

$$x_i^j \equiv -\frac{\frac{\partial V^j}{\partial p_i}}{\frac{\partial V^j}{\partial R}} \Big| \qquad i=1,\ldots,G$$

(20)

Where x_i^j is demand for commodity "i" by household "j" and p_i is the price of commodity "i".

Now assume that a general utility function for commodity "i" can be written in the form:

$$U_i^j = \rho_i^j + \omega_i F_i\left(\frac{R^j}{I^j}\right) + H_i^j(I, R^j) \quad i = 1, \ldots, G$$

(22)

I^j is the ideal price index for household "j", i.e. the price index of each commodity weighted by the budget share. I is the vector of price indices. $F_i(.)$ is homogeneous of degree zero in prices and income. Let H_i^j also be homogeneous of degree zero in prices and income. Now the composite utility function of household "j" is defined

as:

$$V^j = \ln\left[\sum_{i=1}^{G} e^{u_i^j}\right] - \sum_{i=1}^{G} \alpha_i^j H_i^j(I, R) \tag{23}$$

This indirect utility function will always satisfy Roy's identity and yields:

$$x_i^j \equiv -\frac{\frac{\partial V^j}{\partial I_i}}{\frac{\partial V^j}{\partial R}} = \frac{R}{I^j}\alpha_i^j \tag{24}$$

A specific form of H_i^j can, for example, be:

$$H_i^j = \gamma_i \frac{\sum_{g=1}^{G} \beta_{ig} \cdot I_g}{P^j} \quad with \quad \sum_{g=1}^{G} \beta_{ig} = 1 \ for \ all \ i, \qquad \beta_{ii} = -1 \ and \ \gamma_i > 0 \tag{25}$$

Consequently the "logit" budget shares model can satisfy all the constraints that may be placed on a demand system by the theory of consumer demand and is quite flexible with respect to estimation. A specification such as equation (25) will actually allow us to estimate G-1 differences ($\gamma_i - \gamma_*$), where γ_* is an arbitrary choice among the G parameters, even if there is no variation in prices.

Choice of utility functions for estimation

For the purpose of estimating a model, the original 27 expenditure items specified in the questionnaire were finally aggregated into six groups. The model thus has six indirect "utility functions" – one for each expenditure group. After some experimenting with different variables and functional forms, we ended up with the following specification:

$$U(1) = \rho_1 + \omega_1 \cdot \ln\left(\frac{hhincome}{I \cdot 100 * \sqrt{\#persons}}\right)$$

$$U(2) = \rho_2 + \omega_2 \cdot \ln\left(\frac{hhincome}{I \cdot 100 * \sqrt{\#persons}}\right) + \theta_{21} \cdot veg_{gard}$$

$$U(3) = \rho_3 + \omega_3 \cdot \ln\left(\frac{hhincome}{I \cdot 100 * \sqrt{\#persons}}\right)$$

$$U(4) = \rho_4 + \omega_4 \ln\left(\frac{hhincome}{I \cdot 100 * \sqrt{\#persons}}\right)$$

$$U(5) = \rho_5 + \omega_5 \cdot \ln\left(\frac{hhincome}{I \cdot 100 * \sqrt{\#persons}}\right) + \theta_{51} \cdot d_{school}$$

$$U(6) = \rho_6 + \omega_6 \cdot \ln\left(\frac{hhincome}{I \cdot 100 * \sqrt{\#persons}}\right) + \theta_{61} \cdot gups31up$$

hhincome = total reported household income in Rand/month
#persons = number of persons in household
veg_gard = 1 if household has vegetable garden and 0 otherwise
d_school = 1 if household has members of school age (7–18 years) and 0 otherwise
gups31up = number of household members of age ≥ 31 years
ρ_1-ρ_6 = alternative specific constants to be estimated
ω_1-ω_6 = parameters for log income to be estimated
$\theta_{21}, \theta_{51}, \theta_{61}$ = parameters for other household characteristics to be estimated
I = price index (equal to 1)

The price index must be taken as:

$$I^J = \sum_{g=1}^{G} \alpha_g^J \cdot I_g$$

When all sub-indices I_g = 1 at the time of the survey, this household-specific price index I^J will also be 1 for all households. As only five of the parameters ρ and ω can be identified by estimation, one of each has to be normalised. For this purpose we chose to have ρ_6 = 0 and ω_6 = 1. There was no variation in prices, so they were normalised to 1 for each household, which implies that the functions $H_i^J(1, R) = K^J$, i.e. they are constant across different commodity groups and thus cancel out in the budget share equations. Income is measured in R100 per month. With log income as the variable, this is just a matter of scaling, which only affects the magnitude of $\rho_1, \ldots, \rho_6$. The income is also divided by a price index. With prices normalised to 1 in the base situation, this index will just be the sum of budget shares and equal 1.

TRANSPARENCY AND DISCLOSURE IN E.U. REGULATION – A DIFFERENT APPROACH … THE SAME RESULTS?

Cristina Alexandrina STEFANESCU [*]
Babes-Bolyai University of Cluj Napoca, Romania

Abstract. The purpose of this study is to compare our empirical findings related to the level of disclosure ensured by corporate governance codes in force in European Union member states, by referring in this respect to OECD principles, with prior related research results. The research methodology used for achieving our goal is based on econometric analysis using various statistical tools, like descriptive analysis, mainly based on computing means, and correlations for identifying the relationship between our results and those of others researchers. The results of the performed analysis reveal that the compliance of corporate governance codes with OECD principles is consistent with prior research findings related to disclosure considering codes' issuer type and countries' legal regime.

JEL Classification: M41, G30

Keywords: corporate governance, disclosure, transparency, European Union

1. Introduction

Corporate governance has always been a controversial subject in various fields and consequently in the academic one, too. Many authors tried to define this concept from various perspectives, but unfortunately there is not a unique definition, yet. Moreover, different models of corporate governance have been developed along time. Thus, corporate governance became one of the most debated topic of discussions all around the world. The academic environment proved to be interested on this research topic all the time. One of the most important concerns of researchers was the convergence of corporate governance systems across countries, many surveys being focused on this aspect or at least being aimed to compare regulations enforced by different jurisdictions. Therefore, many questions related to convergence have been addressed along time, some of them receiving a more or less comprehensive answer, while others are still unsolved.

---

[*] Corresponding author. Adress: Babeş-Bolyai University, Cluj-Napoca, Romania, Faculty of Economics and Business Administration, Accounting and Audit Department, Address: Teodor Mihai Street, no.58-60, 400591, Cluj-Napoca, Romania, Tel: +40 264 418 654, Email: cristina.palfi@econ.ubbcluj.ro

Basing on this background, we aimed to provide a comparative analysis between some prior research findings and own empirical results as regards corporate governance codes by approaching these from a particular perspective that of transparency and disclosure, often blamed for the latest financial crisis. Moreover, unlike the most related research literature, which compared codes by referring to the Anglo-Saxon model, often appreciated as the best model of corporate governance, our study makes use of another widely well-known framework (OECD), offering as a well a model of best practices through its principles.

The comparative analysis is justified by the fact that our paper approached corporate governance form transparency and disclosure perspective, using other framework for comparison and a different methodology for measuring the disclosure level (Jaccard's similarity coefficient) than those used in previous studies (Latent Semantic Analysis technique or the Leximetric one). The comparative analysis performed considered various features of corporate governance codes already studied, such as their issuer type or country's legal regime.

The results of the performed analysis reveal that our empirical results, providing a disclosure index developed for all European Union member states, are not consistent with prior research findings related to disclosure as "primary theme" of corporate governance codes. On the other hand, by analysis these codes considering their issuer type we have reached to the same conclusion as other researchers interested on this same topic. Thus, those codes issued in collaboration of several institutions, coming from various economic fields, reached the highest level of disclosure, while those developed by industry or trade associations and groups proved to be the less interested in transparency. Similar was the conclusion reached after comparing the level of disclosure in corporate governance codes by grouping them according to countries' legal regimes. The most relevant result in this respect is that Common law regime ensures the highest level of transparency through corporate governance requirements.

The paper proceeds as it follows. Firstly, we briefly review the literature regarding comparative studies on corporate governance codes and their convergence, hence reaching our main research question "Is corporate governance codes' compliance with OECD principles consistent with prior research findings?" starting from this question, we developed our hypothesis considering three issues (disclosure theme weight of each code, its type of issuer and country's legal regime), which were previously analysed closely related to our particular approach on corporate governance. After explaining in detail the data collection method and analysis design, we test our hypotheses using information from corporate governance codes currently in force in all 27 European Union member states. Finally, we provide the research findings and discuss their implications, closely related to previous studies focused on the same goal.

2. Literature review

The wide prior international literature focused on corporate governance codes started from finding out what exactly constitutes convergence, trying to establish the major impediments that are standing in its way, finally looking for empirical evidence to prove that codes are moving towards or away from

convergence (Yoshikawa and Rasheed, 2009). Thus, many researches interested on this topic have been wondering if will ever exist convergence in corporate governance systems. Because Anglo-American model of corporate governance was considered to be "the winner" (Hansmann and Kraakman, 2004), everyone expected to find substantial convergence toward it, being often used as a term of comparison (Coffee, 1999; Goergen and Renneboog, 2008). Starting from its primary objective of maximizing the shareholder value, many studies were conducted along time with the purpose of examining convergence based upon an international comparison of corporate governance provisions ability to protect various stakeholders, such as shareholders, especially the minority ones (Bebchuk, 2000), creditors (Martynova and Renneboog, 2010), investors (Cernat, 2004; LaPorta et al, 2002) and even workers (Siems, 2009).

Such studies lead to different types of convergence that have been distinguish along time, namely "functional", "formal" and "contractual" convergence (Gilson, 2004), "de jure" and "de facto" convergence (Khanna et al, 2006), "hybrid convergence" (Rose, 2001), "normative convergence" (Milhaupt, 2001) and "institutional convergence" (Chamy, 1998). Considering the aim of our study – the comparison analysis of corporate governance codes – we appreciate our study as a research on "de jure" convergence of corporate governance codes in force in European Union member states towards a general accepted framework of good principles, issues by OECD.

Similar previous studies focused on comparative analysis of corporate governance regulatory systems were mainly theoretical, prior literature providing little empirical evidence in this respect. These studies reveal that "there does seem to be convergence on certain common core principles based usually around the OECD Principles of Corporate Governance" (Mallin, 2004), mainly due to the common elements introduced in major European regulations, as well as to the similarities in forthcoming legislation of the European directives (Wymeersch, 2002). On the other hand, the majority of the codes of the European Union countries are not in full accordance with the priorities of the European Commission (Hermes, et al., 2006). This is the conclusion reached after an analysis performed for identifying to what extent the contents of these codes are driven by external (internationally accepted corporate governance best practices) or domestic (national institutions) forces.

Among empirical research conducted before on this topic we should mention the attempts of analyzing European corporate governance codes on their content, variability and convergence, from different perspectives, like their theme, their issuer and legal regime. Various research methodologies have been used in this respect, like correlations (Cicon, et al., 2010) or a textual methodology based on Latent Semantic Analysis (LSA) (Deerwester et al., 1990). Such studies manly reach to the conclusion that some elements of continental governance codes are converging to the U.K. model while others diverge, thus failing to find empirical evidence of "total" convergence towards Anglo-Saxon model of corporate governance.

Another research methodology applied for measuring the convergence of corporate governance regimes across the countries was based on indices developed in this respect. Thus, Siems (2009) developed indices that indicate how well countries considered for sampled analysis (France, Germany, UK, US and India) protect shareholders, creditors and workers, by using 144 legal variables

coded for each country-year, covering a relatively long time period (1970 to 2005). By calculating the differences between each variable in the law of a particular legal system, using "leximetrics" methodology (Lele and Siems, 2007; Siems, 2008), the authors could conclude if there is a formal convergence, persistence, or divergence of rules, the general conclusion reached revealing that the laws have converged in shareholder protection, diverged in worker protection, and evened out in creditor protection.

Other researchers (Martynova and Renneboog, 2010) developed indices that indicate how the law in each country addresses various potential agency conflicts, using a unique database that comprises the main changes in corporate governance regulations in the US and all European countries between 1990-2005. Hence, empirical analysis is focused this time on a wide range of countries but covers a shorter period of time. Instead, information used for the performed analysis are more comprehensive, being based on the study of various corporate governance regulations, on the results from a detailed questionnaire sent to more than 150 legal experts, and on direct interviews with some of these experts. In contrast to the LLSV ranking system (La Porta, et al., 1997), the three new corporate governance indices that reflect the quality of national laws aimed at protecting corporate shareholders from being expropriated by management, minority shareholders from being expropriated by large blockholder, and creditors from being expropriated by shareholders, capture a broader scope of corporate governance regulation reforms and their dynamics.

The conclusion reached reveal that countries of English legal origin still provide the highest quality of shareholder protection, while Continental European countries have improved their legal system up to the standard set by the English one, the dominant legal strategy across countries to address this protection being *the improvement of corporate transparency.*

3. Hypotheses development

Consequently, basing on these approaches on corporate governance codes' comparison, we decided to use a different international guidance in this respect - OECD principles of corporate governance, whose recommendations have the character of good governance principles, thus arising our main research question:

Q: Is corporate governance codes compliance with OECD principles consistent with prior research findings?

Looking for an answer to this question we briefly review prior related literature, upon its results identifying that codes developed by stock exchanges and governments have the strongest enforceability, thus being the most likely to effect actual governance practices (Aguilera and Cuervo-Cazurra, 2004), while codes in force in common law countries provide shareholders and creditors the greatest amount of protection against expropriation by insiders, unlike civil law countries that offer the least (LaPorta et al, 1997). These findings reveal that corporate governance codes were analyzed before from various perspectives, like issuer's identity (Enrione, et al, 2006; Zattoni and Cuomo, 2008), code's primary theme (Cicon et al, 2010) or country's legal regime (Denis and McConnell, 2003), thus

offering outlooks for our research. Accordingly, for performing our comparative analysis, we separate our sample of corporate governance codes in different groups according to prior research findings based on the above mentioned topics, hence arising the following hypotheses:

H_1: *The compliance of corporate governance codes with OECD principles is consistent prior research findings related to disclosure as "codes' primary theme".*

H_2: *The compliance of corporate governance codes with OECD principles is consistent with prior research findings related to disclosure considering "countries' legal regimes".*

H_3: *The compliance of corporate governance codes with OECD principles is consistent with prior research findings related to disclosure considering "codes' issuer type".*

4. Empirical design and results

Sample Selection and Variable Measurement

For achieving our goal we selected a sample countries, made of all 27 European Union member states, whose corporate governance codes currently in force are available on the website of the European Corporate Governance Institute - an international scientific non-profit association promoting best practice on corporate governance issues, which was the main source of information for our research. For performing the comparative analysis with related research findings we considered one dependent variable revealing the level of disclosure and transparency in corporate governance codes compared with OECD requirements, and three independent variables, used in prior literature (Cicon et al., 2010; La Porta et al., 1997).

The dependent variable (D&T S_Index) is the Jaccard's similarity index established for each corporate governance code, revealing the degree of similitude between them and OECD principles as regards the compliance with disclosure and transparency requirements and recommendations (Stefanescu, 2011).

The independent variables are:
- IT (Issuer Type), the following four identities being considered: "Composite", made of groups that contain representatives from at least two of the subsequent groups, "Government", referring to national legislatures or governmental commission/ministries, "Exchange", represented by national stock exchanges and "Industry", referring to industry or trade associations and groups, as in prior related literature (Cicon et al., 2010);
- LR (Legal Regime), in this respect being used classifications made by both La Porta, et al. (1997), who distinguished between "Common law", "German civil", "French civil", "Former socialist" and "Scandinavian civil" and Cicon et al. (2010), who introduced two new legal regimes ("Baltic civil" and "Global governance practices") instead of "Former socialist" and "Scandinavian civil";

- DTW (Disclosure theme weight), which is represented by two themes ("Accounting/Disclosure" theme and "Shareholder protection" theme), identified by Cicon et al. (2010) in its sample of national codes of corporate governance, as being related to disclosure or transparency.
- T_Index, which is represented by Transparency index, part of the newly constructed corporate governance index by Martynova & Renneboog (2010) for measuring convergence and diversity of national corporate governance regulations.

The research methodology used, appropriate for such empirical studies, is based on comparative analysis, making use of econometric tools using SPSS software.

Data analysis and hypothesis test results

To ensure comparability between our empirical results and prior findings in order to test our first hypotheses, we reduced our sample just at the European Union member states previously analyzed (Cicon et al., 2010), considering their classification according to the issuer's type.

Table 1 : Comparative analysis between "Disclosure" Indices

Country	D&T S_Index	$DTW_1^{*)}$	$DTW_2^{**)}$	$T\_Index^{***)}$
Austria	0.605	0.450	0.040	3.000
Hungary	0.605	0.070	0.110	3.000
Luxembourg	0.605	0.410	0.080	5.000
UK	0.579	0.290	0.350	6.000
Slovakia	0.579	0.100	0.390	1.000
Belgium	0.579	0.290	0.270	5.000
Latvia	0.447	0.460	0.010	4.000
Slovenia	0.447	0.280	0.160	3.000
Greece	0.447	0.220	0.160	6.000
Finland	0.447	0.030	0.180	7.000
Poland	0.421	0.200	0.250	6.000
Czech Republic	0.421	0.170	0.320	2.000
Spain	0.395	0.320	0.330	6.000
The Netherlands	0.395	0.220	0.230	6.000
Portugal	0.368	0.030	0.080	7.000
Sweden	0.289	0.040	0.210	3.000
Romania	0.237	0.100	0.200	4.000
Germany	0.211	0.440	0.120	6.000
Estonia	0.211	0.490	0.060	5.000
Italy	0.211	0.290	0.310	7.000
France	0.184	0.150	0.370	6.000

*) these values represent "Accounting / Disclosure" theme weight Cicon et al. (2010)
**) these values represent "Shareholder protection" theme weight Cicon et al. (2010)
***) these values represent "Transparency Index" Martynova & Renneboog (2010)

Table 1 comprises a detailed situation of codes distribution across country, providing as well the values of disclosure index (our own developed D&T S_Index and T_Index from prior literature) and disclosure themes weight from prior related studies, comprising both "Accounting/Disclosure" theme and "Shareholder protection" theme. The reason of considering both themes for our comparison was the methodology of decomposing corporate governance codes using keywords most frequently occurred. Consequently, while "Accounting/Disclosure" theme is convincing by its name, "Shareholder protection" theme referred among others to disclosure, too.

a) testing the 1st hypotheses - The compliance of corporate governance codes with OECD principles is consistent prior research findings related to disclosure as "codes' primary theme"

For performing the correlation analysis considered suitable for testing our first hypotheses, we calculated Pearson coefficient that is usually used for measuring the strength of linear dependence between two variables, giving a value between "1", that describes the perfect direct relationship and "-1", that reveals an indirect one, "0" value meaning that there is no linear correlation between variables. Table 2 shows the values of Pearson correlations among all considered variables:

Table 2. Correlations between Disclosure index and related themes from prior literature

		D&T S_Index	DTW_1	DTW_2	T_Index
D&T S_Index	Pearson Correl.	1	.026	-.080	-0.357
	Sig. (2-tailed)		.912	.730	0.112
	N	21	21	21	21

The values of Pearson coefficient reveal that there is not any relationship between de dependent variable (D&T S_Index) and all independent ones (DTW_1 and DTW_2, as well as T_Index). Consequently, our first hypothesis (H1) is rejected. Thus, we cannot assert that the compliance of corporate governance codes with OECD principles is consistent prior research findings related to disclosure as "codes' primary theme".

Looking for an answer for this inconsistency we find as a possible explanation the wider extent of both themes identified in prior literature and considered as being related to disclosure and transparency, compared with the results of our OECD similarity analysis conducted. Thereby, the disclosure indices of "Accounting/Disclosure" theme (DTW_1) were determined by considering other issues, more or less closer to the overall concept of disclosure, such as "supervisory", "effective", "audit", "internal", "controls", "review" or "guidance". The same explanation is valid for "Shareholder protection" theme (DTW_2), too, among issued considered in this case being issued, other than those related to disclosure, too, like "committee", "investor", "rights", "vote" or "chairman". The same results have been reached when considering the transparency index (T_Index), too, which was developed by assessing the quality of information about company, its ownership structure, and management available to investors, thus looking for small area of disclosures namely the managerial compensation, transactions between

management and company, the frequency of financial reports or the implementation of a "Comply or explain" rule.

b) testing the 2nd hypotheses - The compliance of corporate governance codes with OECD principles is consistent with prior research findings related to disclosure considering "countries' legal regimes"

The situations appeared to be different when testing our second hypotheses, where we considered for our analysis countries' legal regimes, as these were defined in prior literature (La Porta, et al., 1997; Cicon, et al., 2010; Martynova & Renneboog, 2010). This time, for performing the comparative analysis we determined an average value of the disclosure indices (D&T S_Index) of all countries classified in each of the five legal regimes defined, as well as an average value (DTW) of indices for DTW_1 and DTW_2, respectevly, an average value of transparency index (AT_Index)

Table 3 shows these values, separately for legal regimes identified by La Porta, et al. (1997), as well as for those recently updated by Cicon et al. (2010). As it can be seen, by comparing the average indices, the English corporate governance code (Common law) ranks first overall, thus being the most focused on promoting transparency and disclosure. Thus, our disclosure index reached the highest value of 0.579, in accordance with the average value (31,91%) of disclosure theme weights from prior findings. The less interest in this respect came from codes issued in countries being under Scandinavian civil (Finland and Sweden), D&T S_Index as well as DTW reaching the lowest values (0.368, respectively 9.69%). Corporate governance codes issued under German and French civil gave a medium attention to disclosure and transparency recommendations, D&T S_Index being very closer (0.408, respectively 0.398), thus being in accordance with Cicon et al. (2010) results. On the other hand, our finding are not consistent with the percentages for the new legal regimes defined by the same author. Thus, while our disclosure index shows the lower average value for Baltic civil (0.329), on the prior literature the last ranked is Global Governance Practices regime (16.14%).

Table 4 comprises the average values for transparency index used by Martynova & Renneboog (2010), mainly based on based on the quality of information about company, its ownership structure, and management available to investors, used for measuring the convergence and diversity of national corporate governance regulations. As regards the legal regime used in their study, it is actually the same with the one of Cicon et al. (2010), only the names used being slightly different (eg. Scandinavian instead of Baltic, or the use of a general term "EU Accesion 2004" for the former socialist one), the results being alike similar, too (the highest value reached in case of Common law regime, while the lowest one recorded by "EU Accesion 2004" countries.

Consequently, our second hypothesis (H_2) is partially accepted. Thus, we can assert that the compliance of corporate governance codes with OECD principles is consistent with prior research findings related to disclosure considering "countries' legal regimes".

Table 3. Distribution of codes across legal regimes and "disclosure" themes weight

LR_1[*)	Average D&T S_Index	DTW_1	DTW_2	DTW[**)
Common Law	0.579	28.98%	34.83%	31.91%
Former Socialist	0.421	23.42%	18.72%	21.07%
German civil	0.408	31.18%	10.55%	20.87%
French civil	0.398	24.18%	22.89%	23.54%
Scandinavian civil	0.368	4.18%	15.20%	9.69%
[*) – these represent legal regimes defined by La Porta, et al. (1997) [**) - these values express the average of DTW_1 and DTW_2				

LR_2[*)	Average D&T S_Index	DTW_1	DTW_2	DTW[**)
Common Law	0.579	28.98%	34.83%	31.91%
Global Practices	0.421	12.71%	19.57%	16.14%
German civil	0.408	44.27%	7.87%	26.07%
French civil	0.395	25.10%	25.45%	25.26%
Baltic civil	0.329	47.63%	3.44%	25.54%
[*) – these represent legal regimes defined by Cicon et al. (2010) [**) - these values express the average of DTW_1 and DTW_2				

Table 4. Distribution of codes across legal regimes and transparency index

LR_3[*)	Average D&T S_Index	AT_Index[**)
Common Law	0.579	6.0
EU after 2004	0.421	3.5
German	0.408	4.5
French	0.395	6.0
Scandinavian	0.329	5.0
[*) – these represent legal regimes considered by Martynova & Renneboog (2010) [**) - these values express the average of T_Index		

c) testing the 3rd hypotheses - *The compliance of corporate governance codes with OECD principles is consistent with prior research findings related to disclosure considering "codes' issuer type"*

Our last hypotheses is of great importance, too, considering prior literature, which shows that corporate governance codes' issuers varies across countries (Aguilera and Cuervo-Cazurra, 2004; Enrione et al., 2006; Zattoni and Cuomo, 2008), and consequently it might influence importance given to disclosure and transparency requirements settled. The latest empirical evidence in this respect reveals differences between codes by comparing the relative importance given to various issues (including disclosure ones), after classifying the codes into particular groups (Cicon, et al., 2010). Basing on their findings showing "disclosure" theme weight on each type of issuer defined, our paper is aimed to compare it with the importance given to disclosure and transparency requirements by each group of codes, expressed by the average value of D&T S_Index. Table 5 provides data on distribution of codes across issuer type and "disclosure" theme weight, respectively the average values of disclosure index.

Values of the average disclosure index are consistent with prior findings, which reveal that the "composite" group focused on "accounting and disclosure" weighted

this dimension of corporate governance more highly than any other issuer, being followed by "exchange" and "government" issued codes that also placed high emphasis on this theme. However, our index show higher values for all types of issuers and, unlike prior findings, little difference between "government" and "industry" issued codes.

Table 5. Distribution of codes across issuer type and "disclosure" theme weight

IT[*)]	Average D&T S_Index	DTW
Composite	0.592	41.78%
Exchange	0.417	34.18%
Government	0.394	29.03%
Industry	0.368	9.76%
[*)] - these categories represent codes issuer types (Cicon et al., 2010)		

Anyway, the importance given to "disclosure" by each type of issuer shows the same order, thereby allowing us to accept our last hypotheses (H_3). Thus, we can assert that the compliance of corporate governance codes with OECD principles is consistent with prior research findings related to disclosure considering "codes' issuer type".

5. Findings and conclusions

Corporate governance codes have been the subject of many studies, most of them looking for a best model toward all these might converge. Thus, generally, these codes have been analyzed as a whole, by referring mostly to the Anglo-Saxon model of corporate governance. Unlike these studies, our paper presents a different approach of corporate governance codes, providing a more comprehensive analysis on the particular issue of transparency and disclosure, by referring to a different framework – OECD principles of corporate governance. All these ensure originality to our paper, giving also the possibility to compare our empirical results with prior literature findings, which was the main aim of our study. The results of the performed analysis provide an affirmative answer to our research question: "Is corporate governance codes compliance with OECD principles consistent with prior research findings?"

Our answer is mainly justified by the status of the hypothesis formulated, excepting the first one, all of the rest being accepted. Consequently, we did not find any correlation between the disclosures indexed resulted from our empirical study and the importance given to disclosure by each corporate governance code assessed by other authors through the weight of this theme in the whole text of regulations. But, on the other hand, after grouping corporate governance codes firstly according to each country's legal regime, and secondly to codes' issuer type, we reached to the conclusion that our findings are consistent with prior related research results. Thus, Common law legal regime proved to ensure the highest level of disclosure in corporate governance codes, while Scandinavian civil codes were the less interested in this respect. Corporate governance codes in force in countries being under German or French civil had a medium level of disclosure. The new legal regimes recently defined by Cicon et al. (2010) lead us to opposite results than prior findings of the same author. Thus, while our disclosure index

shows the lower average value for Baltic civil, on the prior literature the last ranked is Global Governance Practices regime.

As regards the issuer's type, those codes developed in collaboration of several institutions, coming from various economic fields, reached the highest level of disclosure, while corporate governance codes issued by industry or trade associations are in the last place, but much closer to previous group than prior research findings.

In conclusion, the performed empirical analysis provided consistent evidence, therefore allowing us to accept two of our hypothesis (H_2 and H_3) and to reject one of these (H_1). Finally, we can assert that the compliance of corporate governance codes with OECD principles is consistent with prior research findings related to disclosure considering codes' issuer type and countries' legal regime.

REFERENCES

Aguilera R., Cuervo-Cazurra A. (2004) Codes of Good Governance Worldwide: What is the Trigger?, *Studies in Organizational Management*, 25(3) : 415-443.

Bebchuk L., Roe M. (2000) A Theory of Path Dependence of Corporate Ownership and Governance, Stanford Law Review, 52: 775-808

Cernat L. (2004) The Emerging European Corporate Governance Model: Anglo-Saxon, Continental, or Still the Century of Diversity?, *Journal of European Public Policy*, 11(1): 147-166.

Chamy D. (1998) The German Corporate Governance System, Columbia Business Law Review, 1: 145-165.

Cicon J.E., Ferris S.P., Kammel A.J, Noronha G. (2010) European Corporate Governance: A Thematic Analysis of National Codes of Governance, European Financial Management, doi: 10.1111/j.1468-036X.2010.00542.x.

Cicon J.E., Ferris S.P., Kammel A.J., Noronha G. (2010) Soft Information and European Corporate Governance – the Contributions of Textual Analysis, *Proceedings of the 19th International Scientific Conference, Faculty of Economics and Management, Prague*, Czech Republic, 29-33.

Coffee J. (1999) The future as history: The Prospects for Global Convergence in Corporate Governance and its Implications, *Northwestern University Law Review*, 93: 641-707.

Denis D.K., McConnell J.J (2003) International Corporate Governance, *Journal of Financial and Quantitative Analysis*, 38(1): 1-36.

Deerwester S., Dumais S.T., Furnas G.W., Landauer T.K., Harshman R. (1990) Indexing by Latent Semantic Analysis, *Journal of the American Society for Information Science*, 41(6): 391-407.

Enrione A., Mazza C., Zerboni F. (2006) Institutionalizing Codes of Governance, *American Behavioral Scientist*, 49(7): 961-973.

Fontes A., Rodriguez L.L., Craig, R. (2005) Measuring Convergence of National Accounting Standards with International Financial Reporting Standards, *Accounting Forum*, 29(4): 415–436.

Gilson R.J. (2000), Globalizing Corporate Governance: Convergence of Form or Function, *Stanford Law School*, *Working paper, no. 192*: 1-35.

Goergen M., Renneboog L. (2008) Contractual Corporate Governance, *Journal of corporate finance*, 14(3): 166-182.

Hansmann H., Kraakman R. (2004) *The End of History for Corporate Law, Convergence and persistence in corporate governance*, Cambridge University Press, 33-68.

Hermes N., Postma T.J.B.M., Zivkov O. (2006) Corporate Governance Codes in the European Union: Are They Driven by External or Domestic Forces?, *International Journal of Managerial Finance*, 2(4): 280 – 301.

LaPorta R.F., Lopez de Silanes F., Schleifer A., Vishny R. (1997) Legal Determinants of External Finance, *Journal of Finance*, 52(3): 1131-1150.

LaPorta R., Lopez-de-Silanes F., Shleifer A., Vishny R. (2002) Investor Protection and Corporate Valuation, *Journal of Finance*, 57(3): 1147-1170.

Lele P., Siems M.M. (2007) Shareholder Protection: A Leximetric Approach, *Journal of Corporate Law Studies*, 17(1): 17-50.

Khanna T., Kogan J., Palepu K. (2006) Globalization and Similarities in Corporate Governance: A Cross-Country Analysis, *Review of Economics and Statistics*, 88(1): 69-90.

Mallin C. A. (2004) Corporate Governance, Oxford: Oxford University Press, pp. 207.

Martynova M., Renneboog, L. (2010) Corporate Governance Index: Convergence and Diversity of National Corporate Governance Regulations, *ECGI Finance, Discussion paper 2010-17*: 1-35.

Milhaupt C.J. (2001) Creative Norm Destruction: The Evolution of Nonlegal Rules in Japanese Corporate Governance, *University of Pennsylvania Law Review*, 149(6): 1-36.

Qu X., Zhang G. (2010) International Accounting Convergence in China: An Empirical Study of Standards on Assets Measurement, *The International Journal of Accounting*, 45(3): 334-355.

Rose P. (2001) EU Company Law Convergence Possibilities After Centros, *Transnational Law and Contemporary Problems*, 11: 120-139.

Siems M.M. (2009) Convergence in Corporate Governance - A Leximetric Approach, *The Journal of Corporation Law*, 35(4): 729-756.

Siems M.M (2008), Shareholder Protection Around the World (Leximetric II), *Delaware Journal of Corporate Law*, 33(1): 111-147.

Stefanescu C. (2011) Disclosure and transparency in E.U. corporate governance codes vs. OECD - empirical comparative approach, Working paper, submitted for review.

Wymeersch, E. (2002), Convergence or divergence in corporate governance patterns in Western Europe? in J. A. McCahery et al. (2002) *Corporate Governance Regimes: Convergence and Diversity*, Oxford: Oxford University Press, 230–250.

Yoshikawa T., Rasheed A.A. (2009) Convergence of Corporate Governance: Critical Review and Future Directions, *Corporate Governance: An International Review*, 17(3): 388–404.

Zattoni A., Cuomo, F. (2008) Why Adopt Codes of Good Governance? A Comparison of Institutional and Efficiency Perspectives, *Corporate Governance: An International Review*, 16(1): 1-15.

Acknowledgment

THE RELATIVE EFFICIENCY OF BANKS IN LENDING AND BORROWING: EVIDENCE FROM DATA ENVELOPMENT ANALYSIS

Gert van der WESTHUIZEN [*]
North-West University, South Africa

Abstract. DEA is used to estimate the relative technical, allocative, cost and scale efficiency of the four largest South African banks over a period of sixteen years. Two models are applied to determine whether there is a difference in the efficiency with regard to the lending and borrowing activities of the banks. On average, three banks were more technical efficient, all four banks more allocative efficient, and three banks more cost efficient in the borrowing activities (deposits). To a large extent, the banks were operating at increasing returns to scale, meaning that they were operating at a scale that was too small.

1. Introduction

Banks and other financial institutions have their own unique objectives. Some wish to grow faster and achieve some long-range objective. Others seem to prefer the quit life, minimizing risk and conveying the image of a sound institution, but with modest rewards for their shareholders (Rose and Hudgins, 2005). In its efforts to achieve these objectives banks have to manage various types of risks, which are differentiated according to the source of losses, market movement or default on payment obligations of borrowers (Bessis, 2010). Banking risks include, *inter alia*, credit risk, interest rate risk, liquidity risk, market risk and a number of other risks, of which, according to Bessis (2010), credit risk is the most important risk. Another important risk is the interest rate risk which is the risk of declines of net interest income, or interest revenues minus interest costs, due to the movements of interest rates. Most of the loans and receivables of the balance sheet of banks, and term or saving deposits, generate revenues and costs that are driven by interest rates (Bessis, 2010).

Banks, as managers of risks, claim a reward for managing these risks. Banks act as intermediaries between surplus units (lenders) and deficit units

---

[*] Corresponding author. Adress: School of Economic Sciences, North-West University, Vaal Triangle Campus, PO Box 1174, Vanderbijlpark, 1900, South Africa, Tel: +27-82-782-3245/ +27-28-435-6252, E-mail: gvdwesthuizen@absamail.co.za

(borrowers) in the economy. This role of financial intermediation exists because of the conflict between the requirements of lenders and borrowers, in terms of risk, return and term to maturity. Therefore, the banks will issue financial liabilities that are acceptable as assets to the lenders and use the funds so obtained to acquire claims that reflect the requirements of the borrowers (Faure, 1999).

The reward for managing the interest rate risk is interest income. The difference between the borrowing rate and the lending rate is known as the interest rate gap. According to Bessis (2010) the interest rate gap is a standard measure of the exposure to interest rate risk. There are two types of gaps namely, the fixed interest rate gap and the variable interest rate gap. The fixed interest rate gap, for a given period, is defined as the difference between fixed-rate assets and fixed-rate liabilities, while the variable interest rate gap, for a given period, is defined as the difference between the interest-sensitive assets and interest-sensitive liabilities.

A bank's asset and liability management committee (ALCO) is responsible for measuring and monitoring interest rate risk. It also recommends pricing, investment, funding and marketing strategies to achieve the desired trade-off between risk and expected return (Koch and MacDonald, 2003). In managing the interest rate risk the ALCO co-ordinates, or directs, changes in the maturities and types of bank assets and liabilities to sustain profitability in a changing economic environment (Falkena *et al*., 1987). This means that the ALCO manages part of the asset side of the balance sheet (loans and advances) as well as part of the liability side of the balance sheet (deposits and purchased funds).

Analysing the balance sheet of various banks, it is clear that there are vast differences in the composition of the balance sheets of the banks. On the asset side of the balance sheets the differences are evident with regard to the types of loans the bank prefer to be involved in. There are also differences with regard to the maturities and risks involved in those various types of loans. Usually a higher risk is compensated by a higher reward. On the liability side of the balance sheet, differences in the types of deposits and purchased funds are also evident. The differences in the composition of the balance sheets may be the result of differences in objective as well as differences in the types of clients and areas served. Some banks may target young upcoming wealthy professional people as clients while others may be targeting less wealthy people as clients. The result may be that some banks are more efficient (productive) in managing the asset side (*inter alia* loans and advances) of their balance sheet while others may be more efficient (productive) in managing the liability side (*inter alia* deposit and purchased funds) of the balance sheet. This may also be the case with regard to bank branches. According to Thanassoulis (1999) some bank branches may specialize in granting loans while others may specialize in attracting deposits, and this could make perfect commercial sense from the bank's perspective.

According to Mittner (2011) banks are no longer chasing market share. This is reflected in the South African Reserve Bank's BA 900 returns for November 2010. Now, after the financial crisis, it's all about profitability and efficiencies. For the first time in ten years, the top two of the big four South African banks, are starting to lose their dominance in the retail market. Both banks have lost significant ground in personal and instalment loans and mortgages. This means that banks were collecting deposits and minimise the lending activity.

The two most widely used quantitative techniques for measuring relative

efficiency (or relative productivity) are Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA). Stochastic Frontier Analysis (SFA) involves specifying the functional form of the frontier and then estimating its unknown parameters using econometric techniques. Data Envelopment Analysis (DEA) effectively estimates the frontier by finding a set of linear segments that bound (or envelop) the observed data. DEA is a technique for combining all the input and output data on the firm into a single measure of productive efficiency, which lies between zero (meaning the firm is totally inefficient) and one (which signals that the firm is fully efficient). DEA has previously been used to study the performance of banks at both the firm/corporate level (e.g. Drake (2001); Seiford and Zhu (1999); Devaney and Weber (2000); Berger and Humphrey (1997); Halkos and Salamouris (2004); Mendes and Rebello (1999); Luo (2003); Resti (1997); van der Westhuizen (2008); and van der Westhuizen and Oberholzer (2009)), and at the branch level (e.g. Sherman and Ladino (1995); Sherman and Gold (1985); Vassiloglou and Giokas (1990); Oral and Yolalan (1990); O'Donnell and van der Westhuizen (2002); van der Westhuizen and Oberholzer(2003); Oberholzer and van der Westhuizen (2004), and van der Westhuizen (2010)).

Van der Westhuizen (2004) used SFA to study the performance of bank branches in South Africa, with regard to lending and borrowing, while van der Westhuizen (2005) used DEA to conduct a similar study, This will be the first attempt to use DEA to estimate the relative efficiency of South African banks, with regard to lending and borrowing, at the firm/corporate level. It is believed that, just as certain bank branches are more efficient in managing a certain side of the balance sheet, so is the case with banks at the firm/corporate level.

The purpose of this paper is to use Data Envelopment Analysis (DEA) to estimate the relative efficiency (relative performance) of the four largest banks in South African bank with regard to lending and borrowing activities. DEA is used because it lends itself more easily to the analysis of multiple-output firms, especially in cases where the behavioural objective of the firms may not be clear (perhaps because of government regulations or other constraining features of the firms' operating environment).

The remainder of the paper is divided into four sections. In Section 2 the measure of efficiency is briefly discussed. In Section 3 the data and model are explained. In Section 4 the DEA results are presented and discussed. The paper is concluded in Section 5.

2. Measures of efficiency

Economists interested in efficiency measurement, are usually interested in four main types of efficiency, namely technical, allocative, cost and scale efficiency. A firm is said to be technically efficient if it produces a given set of outputs using the smallest possible amount of inputs. Allocative efficiency reflects the ability of a firm to use the inputs in optimal proportions, given their respective prices. A firm is cost efficient if it is both technically and allocatively efficient. The firm is said to be scale efficient if it operates on a scale that maximises productivity.

Charnes *et al*. (1978) developed DEA as a linear programming (LP) technique to evaluate the efficiency of public sector non-profit organisations. Sherman and Gold (1985) were the first to apply DEA to banking (Molyneux *et al*., 1996).

In order to measure technical efficiency, DEA can be thought of as a technique for choosing a set of $J + I$ weights for each firm in such a way that each firm's measured productivity is maximised (i.e. so each firm is cast in the best possible light). In the case of N firms, and if the production technology exhibits constant return to scale (CRS), the DEA problem for firm n is formulated as

$$\max_{u_n, v_n} \frac{u_n'y_n}{v_n'x_n} \qquad \left(\text{i.e. max productivity} = \frac{\text{output index}}{\text{input index}}\right) \quad (1)$$

$$\text{s.t.} \quad \frac{u_n'y_m}{v_n'x_m} \leq 1 \qquad \text{for } m = 1, ..., N \quad \text{(boundary constraints)}$$

$$\text{and} \quad u_n, v_n \geq 0 \qquad \text{(nonnegativity constraints)}$$

where y_n is the J x 1 vector of observed outputs of firm n, x_n is the I x 1 vector of observed inputs, and u_n and v_n are unknown vectors of (nonnegative) output and input weights. This form of the DEA problem is known as the *ratio* form.

In the ratio form of the DEA problem, the boundary constraints serve to ensure that the maximised value of the objective function is no greater than one. Under this constraint it can be shown that the maximised value of the objective function is also a measure of the technical efficiency of firm n. Important to note is that there are infinitely many sets of weights that will maximise the objective function. To identify a unique set of weights, analysts typically normalise or scale the weights so that the input index for firm n is equal to one. Then the DEA problem becomes:

$$\max_{u_n, v_n} \ u_n'y_n \qquad (2)$$

$$\text{s.t.} \quad u_n'y_m - v_n'x_m \leq 0 \quad \text{for } m = 1, ..., N$$
$$\quad v_n'x_n = 1 \qquad \text{(normalisation constraint)}$$
$$\quad u_n, v_n \geq 0$$

This is a standard LP and is known as the *multiplier* form of the DEA problem. The maximised value of the objective function in (2) is the DEA estimate of the technical efficiency of firm n (under CRS) and lies between zero and one. Solving the DEA problem (2) for each firm in the sample identifies those points that support the DEA frontier. One other form of the DEA problem is obtained by invoking the theory of duality in linear programming, which says that any LP can be solved as either a maximisation or a minimisation problem. The minimisation problem corresponding to (2) is

$$\min_{\theta_n, \lambda_n} \ \theta_n \qquad (3)$$

$$\text{s.t.} \quad Y\lambda_n - y_n \geq 0$$
$$\quad \theta_n x_n - X\lambda_n \geq 0$$
$$\quad \lambda_n \geq 0 \ \mathbf{0}, \theta_n \geq 0$$

where $\mathbf{Y} = (\mathbf{y}_1, ... , \mathbf{y}_N)$ is a *J x N* matrix of observed outputs, $\mathbf{X} = (\mathbf{x}_1, ... , \mathbf{x}_N)$ is an *I x N* matrix of observed inputs, $\boldsymbol{\lambda}_n$ is an unknown *N x 1* vector, and θ_n is an unknown scalar. This standard LP is known as the *envelope* form of the DEA problem. The envelope form is popular in empirical work because it typically involves fewer constraints than the multiplier form and may therefore be computationally easier to solve. As can be seen below, the vector $\boldsymbol{\lambda}_n$ that is obtained as the solution to the envelope form can be used to identify input and output targets for firm *n*.

Scale efficiency can be estimated by dividing a CRS estimate of technical efficiency by a variable return to scale (VRS) estimate. The DEA problem (3) is underpinned by a CRS assumption, so the minimised value of the objective function in (3) can be regarded as a CRS estimate of technical efficiency. A VRS estimate is obtained as the minimised value of the objective function in the following LP:

$$\min_{\theta_n, \lambda_n} \theta_n \qquad (4)$$

$$\text{s.t.} \quad \mathbf{Y}\boldsymbol{\lambda}_n - \mathbf{y}_n \geq 0$$
$$\theta_n \mathbf{x}_n - \mathbf{X} \boldsymbol{\lambda}_n \geq 0$$
$$\mathbf{j'} \boldsymbol{\lambda}_n = 1 \qquad \text{(VRS constraint)}$$
$$\boldsymbol{\lambda}_n \geq 0 , \theta_n \geq 0$$

where **j** is an *N* x 1 vector of ones. The VRS problem (4) is identical to the CRS problem (3) except for the inclusion of the VRS constraint $\mathbf{j'} \boldsymbol{\lambda}_n = 1$. For details see Coelli *et al.* (2005:172).

The minimised values of the objective functions in (3) and (4) are DEA estimates of the technical efficiency of firm *n* under CRS and VRS. In this section we present LP problems that can be used to obtain CRS and VRS estimates of cost efficiency. Estimates of allocative efficiency can then be obtained residually using (5). A CRS estimate of the cost efficiency of firm *n* is obtained by first solving the LP problem:

$$\min_{x_n, l_n} \mathbf{w}_n' \mathbf{x}_n^* \qquad (5)$$
$$\text{s.t.} \quad \mathbf{Y} \boldsymbol{\lambda}_n - \mathbf{y}_n \geq 0$$
$$\mathbf{x}_n^* - \mathbf{X} \boldsymbol{\lambda}_n \geq 0$$
$$\boldsymbol{\lambda}_n \geq 0 , \mathbf{x}_n^* \geq 0$$

where $\mathbf{w}_n$ is an *I* × 1 vector of input prices and $\mathbf{x}_n^*$ is an unknown *I* × 1 vector of cost minimising inputs. The constraints in this problem are identical to the constraints in (3) except that θ_n the level of technical efficiency has been set to one. Thus, the LP (5) chooses the set of input quantities that minimises the cost of placing the firm on the technically efficient frontier. Having solved this LP, the CRS estimate of the cost efficiency of firm *n* is

$$CE_n = \frac{w_n{}'x_n^*}{w_n{}'x_n} \qquad (6)$$

That is, cost efficiency is calculated as the ratio of (DEA-predicted) minimum cost to observed cost.

Finally, a VRS estimate of cost efficiency can be obtained in a similar fashion after simply adding the VRS constraint $j'\,\lambda_n = 1$ to the problem (5). Both the CRS and VRS cost efficiency estimates measure the proportionate reduction in input costs that will be achieved (under CRS and VRS) if an inefficient firm manages to become both technically and allocatively efficient. (See O'Donnell and van der Westhuizen, 2002).

3. Data and model

Financial statement data, at year-end from 1994 to 2009, were obtained from the McGregor BFA database. At the time of data extraction, 2009 was the latest year for which all the banks in the sample had complete data. The South African financial sector is dominated by four large banks, namely ABSA, First National Bank, Nedbank and Standard Bank. According to the BA 900 reports (Department of Bank Supervision, 2009) these four banks control over 84% of total deposits and assets in South Africa. The descriptive statistics (values in rand, the South African currency) are presented in Table 1.

Table 1: Descriptive statistics (R,000)

Variable	Mean	Std dev	Minimum	Maximum
Loans	285064303	250577809	3914160	1175647000
Deposits	238315972	179910104	3567576	843815000
Interest income	29701309	21273987	374250	105589000
Non-interest income	8945315	7299893	67365	31756000
Labour costs	6722754	4499742	1242000	19871000
Interest expense	16170770	11173330	6360	54983000
Operating costs	5409647	3767339	928000	18093000

Measuring scale and technical efficiency using DEA requires data on output and input quantities. Measuring allocative and cost efficiency also requires data on input prices.

According to Sathye (2001) there are two main approaches to defining the outputs and inputs of banks: the production and intermediation approaches. The production approach views banks as firms which "produce" different types of deposits (e.g. savings, term and demand deposits) and loans (e.g. commercial, housing and personal loans) using inputs such as capital, labour and materials (Berger *et al.*,1987). Under this approach, numbers of deposit accounts, loan accounts and transactions processed are used as measures of bank outputs. Input costs are measured as operating costs excluding interest paid.

The intermediation approach views banks as intermediaries who facilitate the transfer of funds from holders of surplus funds to economic agents who are in

need of funds – they 'intermediate' surplus funds into loans and other assets. Under this approach, the dollar volumes (i.e. values) of loans and deposits are used to measure bank outputs, while input costs are measured as operating costs including interest paid.

Favero and Papi (1995) identify three more approaches to defining bank outputs and inputs. The asset approach is a variant of the intermediation approach in which outputs are strictly defined by assets. In the user-cost approach, outputs are chosen on the basis of net contributions to bank revenue. In the value-added approach, outputs are chosen on the basis of share of value added. Neither the user-cost nor the value-added approaches appear to adequately account for all the functions carried out by banks.

According to Resti (1997), a pivotal issue throughout the whole literature based on stock measures of banking products, is the role of deposits. On the one hand, it is argued that they are an input in the production of loans (intermediation or asset approach). Yet, other lines of reasoning (value-added approach, or user cost approach) suggest that deposits themselves are an output, involving the creation of value added, and for which the customers bear an opportunity-cost. In this paper the intermediation approach is adopted. The main reason for using this approach is because the production approach requires the number of accounts and transactions processed (output measures under the production approach) that were unavailable. Two models are specified in this paper. Similar inputs were used in all three models, but to compare the relative efficiency of the banks with regard to loans and deposits, the outputs were adjusted. The following models were specified:

Output model 1
y_1 = rand value of loans
y_2 = rand value of interest income

Output model 2
y_1 = rand value of deposits
y_2 = rand value of interest income

Inputs (both models):
x_1 = rand value of labour
x_2 = rand value of interest expense
x_3 = rand value of operational expense.

Input prices:
w_1 = x_1/(number of staff)
w_2 = x_2 / (rand value of advances)
w_3 = production price index (Index P0142.1 by Statistics, South Africa)

The inputs used for both models are very much similar to those used by Stavarek (2002), Chen (1998), Charnes *et al.* (1990), and Olivei (1992). The outputs for both models are a modified mixture of those used by Charnes *et al.* (1990), Chen (1998), and Yue (1992).

4. Results

The software package DEAP Version 2.1 by Coelli (1996) is purpose-built to solve the DEA problems outlined in Section 3 and has been used in this paper to

generate measures of scale, technical, allocative and cost efficiency for each observation in the data set (i.e. for each bank in each year).

Annual efficiency estimates of technical (te), allocative (ae), cost (ce) and scale (se) efficiency for Bank A are presented in Table 2. These estimates have been calculated under the assumption of variable returns to scale (VRS), mainly because it is less restrictive (in an economic sense) than the assumption of constant returns to scale (CRS).

Table 2: Relative efficiency estimates for Bank A

Year	Model 1					Model 2				
	te	ae	ce	se	return	Te	ae	ce	se	return
1994	0.852	0.938	0.799	0.842	irs	0.846	0.933	0.790	0.848	irs
1995	0.886	0.910	0.806	0.875	irs	0.882	**0.913**	0.806	0.879	irs
1996	0.923	0.956	0.882	0.928	irs	0.921	**0.957**	0.882	0.930	irs
1997	0.690	0.364	0.251	0.979	irs	0.690	0.364	0.251	0.979	irs
1998	0.687	0.404	0.277	0.997	irs	0.687	0.404	0.277	0.997	irs
1999	0.779	0.425	0.331	0.939	drs	0.779	0.425	0.331	0.939	drs
2000	0.628	0.435	0.273	0.970	irs	0.627	0.435	0.273	0.971	irs
2001	0.575	0.472	0.272	0.946	irs	0.575	0.472	0.272	0.947	irs
2002	0.602	0.520	0.313	0.974	irs	0.571	0.512	0.293	0.962	irs
2003	0.586	0.604	0.354	0.992	drs	0.586	0.604	0.354	0.992	drs
2004	0.550	0.631	0.347	0.986	irs	0.538	**0.661**	**0.356**	0.982	irs
2005	0.703	0.810	0.569	0.994	irs	0.703	0.810	0.569	0.994	irs
2006	0.724	0.784	0.567	0.994	drs	0.642	**0.897**	**0.576**	0.982	irs
2007	0.738	0.834	0.615	0.998	drs	**0.851**	**0.958**	**0.815**	0.996	irs
2008	1.000	1.000	1.000	0.926	drs	1.000	1.000	1.000	0.941	drs
2009	0.819	0.932	0.763	1.000	-	0.910	1.000	**0.910**	0.980	drs
Mean	0.734	0.689	0.526	0.959		**0.738**	**0.709**	**0.547**	0.957	
Min	0.550	0.364	0.251	0.842		0.538	0.364	0.251	0.848	
Max	1.000	1.000	1.000	1.000		1.000	1.000	1.000	0.997	

It can be seen from the second column of Table 2, that under Model 1, Bank A was fully technically efficient during 2008 with a technical efficiency estimate of 1.000. During the remainder of the sample period, the bank was never fully technically efficient. The technical efficiency estimate for the remainder of the sample period is in the range of 0.550 to 0.923, with an average value of 0.734. This means that, on average, Bank A can reduce its inputs by 26.6% without reducing its outputs. Turning to Model 2, it can be seen from the seventh column of Table 2, that Bank A was also fully technically efficient during 2008, but during the remainder of the sample period, the bank was never again fully technically efficient. During the remaining period, the technical efficiency estimate was in the range of 0.538 to 0.921 with an average value of 0.738. This means that, on average, Bank A can reduce its inputs by 26.2% without reducing its outputs, very much similar to the situation under Model 1.

The allocative efficiency estimates (column three) reported in Table 2 indicate that under Model 1, Bank A was fully allocatively efficient during 2008, the same year that the bank was also fully technically efficient. A similar situation exists in the case of Model 2 where the bank was also fully allocatively efficient. Under Model 1 the allocative efficiency estimate for the remainder of the sample period, was in the range of 0.364 to 0.956 with an average value of 0.689. This

means that, on average, Bank A should be able to reduce its input costs by 31.1% by altering its input mix. Under Model 2 the bank was also fully allocatively efficient (column eight) during 2008 and 2009, with an average efficiency estimate of 0.709. This means that the bank should, on average, be able to reduce its input costs by 29.1% by altering its input mix.

Under both models, Bank A was fully cost efficient (column four and column nine) during 2008. Under Model 1 the cost efficiency estimate for the remainder of the sample period was in the range of 0.251 to 0.882 with an average efficiency estimate of 0.526. This means that, on average, Bank A should be able to reduce its input costs by 47.4% if it were to become both fully technically and allocatively efficient. Under Model 2 the bank was also fully cost efficient during 2008 and for the remainder of the sample period the efficiency estimate was in the range of 0.251 to 0.910 with an average efficiency estimate of 0.547. In this situation it means that the bank should, on average, be able to reduce its input costs by 45.3% if it were to become both fully technically and allocatively efficient.

The bank was only once fully scale efficient (column five) during the sample period, namely during 2009, under Model 1. This means that the bank was operating at the optimal scale during 2009, while for the remainder of the sample period, the bank was operating at either increasing return to scale (irs) or decreasing returns to scale (drs). Under Model 2 the bank was not once fully scale efficient (column ten). Under Model 1, the bank was operating at increasing returns to scale (column six) on ten occasions and under Model 2 (column eleven) on twelve occasions, meaning that the bank was operating at a scale that was too small. The bank was operating under decreasing returns to scale, under Model 1 on five occasions and under Model 2 on four occasions, meaning that the bank was operating at a scale that was too large.

Analysing the efficiency estimates for Bank A, moving from Model 1 to Model 2, the following is evident: On five occasions the bank experienced an improvement in allocative efficiency and on four occasions an improvement in cost efficiency (printed in bold). On three occasions the bank experienced deterioration in allocative efficiency and on two occasions a deterioration in cost efficiency. For the remainder of the sample period the efficiency estimates for allocative and cost efficiency remained unchanged.

The relative efficiency estimates for Bank B are reported in Table 3. With regard to technical efficiency, the bank was during five occasions, under Model 1, fully technically efficient and under Model 2, on four occasions fully technically efficient. For the remainder of the sample period the technical efficiency estimate was in the range of 0.579 to 0.983 under Model 1 and between 0.569 and 0.992 under Model 2. The average technical efficiency estimate under Model 1 had a value of 0.844 and under Model 2 a value of 0.858. This indicate that the bank, on average, should be able to reduce its inputs, under Model 1 by 15.6% and under Model 2 by 14.2% without any reduction in its output.

The maximum allocative efficiency estimates reported in Table 3 suggest that at no time during the sample period was Bank B fully allocatively efficient under both models, suggesting that the bank was unable to attain an optimal input mix. The maximum allocative efficiency estimate had a value of 0.979 under Model 1 and a value of 0.986 under Model 2. The average allocative efficiency estimate under Model 1 was 0.765 and under Model 2, 0.822. This means that the

bank should, on average, be able to reduce its input costs by 23.5% under Model 1 and by 17.8% under Model 2 by altering its input mix.

      The bank was not once cost efficient during the sample period, despite being fully technically efficient, on five occasions under Model 1 and on four occasions under Model 2. The average cost efficiency estimate under Model 1 had a value of 0.639 and under Model 2 a value of 0.696. These values indicate that the bank should, on average, be able to reduce its input costs by 36.1% under Model 1 and by 30.4% under Model 2 if it were to become both fully technically and allocatively efficient.

Table 3: Relative efficiency estimates for Bank B

Year	Model 1					Model2				
	te	Ae	ce	Se	Return	te	ae	ce	Se	Return
1994	1.000	0.642	0.642	1.000	-	1.000	0.642	0.642	1.000	-
1995	1.000	0.592	0.592	0.773	irs	1.000	0.592	0.592	0.784	irs
1996	0.983	0.570	0.561	0.883	irs	0.983	0.570	0.561	0.878	irs
1997	1.000	0.519	0.519	1.000	-	1.000	0.519	0.519	1.000	-
1998	1.000	0.771	0.771	0.861	irs	0.817	0.640	0.522	0.476	irs
1999	1.000	0.979	0.979	0.976	irs	1.000	0.979	0.979	0.976	irs
2000	0.787	0.818	0.644	0.913	irs	0.786	**0.850**	**0.668**	0.914	irs
2001	0.785	0.797	0.626	0.918	irs	0.784	**0.893**	**0.700**	0.918	irs
2002	0.836	0.869	0.727	0.968	irs	0.974	**0.942**	**0.917**	0.937	irs
2003	0.901	0.870	0.784	0.981	irs	0.992	**0.954**	**0.946**	0.955	irs
2004	0.756	0.804	0.607	0.954	irs	0.818	**0.932**	**0.762**	0.945	irs
2005	0.825	0.774	0.639	0.968	irs	0.824	**0.851**	**0.701**	0.969	irs
2006	0.579	0.793	0.459	0.992	irs	0.569	**0.910**	**0.517**	0.964	irs
2007	0.598	0.797	0.477	0.992	irs	0.584	**0.902**	**0.527**	0.979	irs
2008	0.729	0.841	0.613	0.997	irs	0.804	**0.983**	**0.790**	0.996	drs
2009	0.732	0.798	0.584	0.993	irs	0.796	**0.986**	**0.785**	0.994	drs
Mean	0.844	0.765	0.639	0.948		**0.858**	**0.822**	**0.696**	0.918	
Min	0.579	0.519	0.459	0.773		0.569	0.519	0.517	0.476	
Max	1.000	0.979	0.979	1.000		1.000	0.986	0.979	1.000	

      Under Model 1 and Model 2, the bank was fully scale efficient on two occasions. This means that the bank was operating at the optimal scale during these years. For the remainder of the sample period the bank was, under Model 1, operating at decreasing returns to scale which means that the bank was operating at a scale that was too small. Under Model 2, a similar situation reveals itself, with the exception that during the last two years of the sample period, the bank operated at decreasing returns to scale meaning that the bank was operating at a scale that was too large.

      In comparing the efficiency results, moving from Model 1 to Model 2, Bank B experienced the following: On ten occasions there were improvements in both allocative and cost efficiency (printed in bold). On only one occasion there was deterioration in allocative and cost efficiency and for the remainder of the sample period the results remained unchanged.

      The relative efficiency estimates for Bank C are reported in Table 4. From this table it is clear that under Model 1, Bank C was fully technically efficient on seven occasions during the sample period. For the remainder of the sample period the technical efficiency was in the range of 0.807 to 0.986 with an average

technical efficiency value of 0.955. This means that the bank should, on average, be able to reduce its inputs by 4.5% without any reduction in outputs.

Table 4: Relative efficiency estimates for Bank C

Year	Model 1					Model 2				
	te	Ae	ce	se	return	te	ae	ce	Se	return
1994	1.000	1.000	1.000	0.797	irs	1.000	1.000	1.000	0.797	irs
1995	0.980	1.000	0.980	0.854	irs	**0.983**	1.000	**0.983**	0.852	irs
1996	0.973	0.997	0.971	0.902	irs	0.973	0.997	0.971	0.902	irs
1997	1.000	0.983	0.983	0.959	irs	1.000	0.983	0.983	0.959	irs
1998	1.000	0.987	0.987	0.996	drs	1.000	0.987	0.987	0.996	drs
1999	1.000	1.000	1.000	1.000	-	1.000	1.000	1.000	1.000	-
2000	1.000	1.000	1.000	0.976	irs	0.956	0.965	0.923	0.909	irs
2001	1.000	0.976	0.976	1.000	-	0.891	0.974	0.868	0.902	irs
2002	0.986	0.974	0.960	1.000	-	0.866	0.940	0.814	0.967	irs
2003	0.807	0.928	0.749	0.964	irs	0.791	0.918	0.726	0.968	irs
2004	0.831	0.893	0.742	1.000	-	0.804	**0.947**	**0.761**	0.938	irs
2005	0.876	0.879	0.770	1.000	-	**0.898**	**0.940**	**0.845**	0.948	irs
2006	0.945	0.872	0.823	0.999	drs	**0.958**	**0.940**	**0.901**	0.969	irs
2007	0.905	0.913	0.827	1.000	-	**0.912**	**0.960**	**0.876**	0.984	irs
2008	1.000	1.000	1.000	1.000	-	1.000	1.000	1.000	1.000	-
2009	0.970	0.929	0.901	0.999	drs	0.931	**0.970**	**0.904**	0.995	irs
Mean	0.955	0.958	0.917	0.965		0.935	**0.970**	0.909	0.943	
Min	0.807	0.872	0.742	0.797		0.791	0.918	0.726	0.797	
Max	1.000	1.000	1.000	1.000		1.000	1.000	1.000	1.000	

Under Model 2 the bank was fully technically efficient on five occasions. For the remainder of the sample period the technical efficiency estimate was in the range of 0.791 to 0.983 with an average value of 0.935, implying that the bank should, on average, be able to reduce its inputs by 6.5% without any reduction in outputs.

Bank C was, under Model 1, fully scale efficient on seven occasions and under Model 2, fully scale efficient on five occasions. This means that the bank was, on these occasions, able to operate at the optimal size. For the remainder of the sample period the bank was, under Model 1, operating at increasing returns to scale (being too small) on six occasions and at decreasing returns to scale (being too large) on three occasions. Under Model 2, the bank operated at decreasing returns to scale (being too large) on one occasion and at increasing returns to scale (being too small) on thirteen occasions.

Under Model 1, Bank C was fully allocatively efficient on five occasions. For the remainder of the period the allocative efficiency was in the range 0.872 to 0.997, with an average efficiency value of 0.958, implying that the bank should, on average, be able to reduce input costs by 4.2% by altering its input mix. The bank was also fully cost efficient on four occasions and for the remainder of the sample period the cost efficiency was in the range of 0.742 to 0.987 with an average cost efficiency value of 0.917. The average cost efficiency value indicates that the bank should, on average, be able to reduce input costs by 8.3% if it were to become both fully technically and allocatively efficient.

Under Model 2 the bank was fully allocatively efficient on four occasions and fully cost efficient on three occasions. For the remainder of the sample period

the allocative efficiency was in the range of 0.918 to 0.997 with an average allocative efficiency value of 0.970, implying that the bank should, on average, be able to reduce its input costs by 3.0% by altering its input mix. The cost efficiency for the remainder of the sample period was in the range of 0.726 to 0.987 with an average value of 0.909 implying that the bank should, on average, be able to reduce its input costs by 9.1% if it were to become both fully technically allocatively efficient.

Under Model 1, Bank C was, on seven occasions operating at the optimal scale, meaning that the bank was of the right size. For the remainder of the sample period the bank was operating at increasing returns to scale, meaning that it was too small, and on three occasions it was operating at decreasing return to scale, meaning that it was too large. Under Model 2 the bank was operating at the optimal scale on two occasions, at increasing returns to scale on thirteen occasions and at decreasing return to scale on only one occasion. The bank was fully technically, allocatively, cost and scale efficient during 1999 and 2008.

Moving from Model 1 to Model 2 in analysing the efficiency estimates for Bank C, the following is noted: On five occasions the bank experienced improvements in allocative efficiency and on six occasion improvement in cost efficiency (printed in bold), on four occasions deterioration in allocative efficiency and on five occasions deterioration in cost efficiency. For the remainder of the sample period the efficiency estimates remained unchanged.

The relative efficiency estimates for Bank D are reported in Table 5. The return to scale estimates for this bank indicate that, under both models, the bank operated at increasing returns to scale for twelve consecutive years, then at the optimal level for three years and then at decreasing returns to scale for one year. These results suggest that the bank operated at a scale that was too small and the efforts to increase the size of operations which resulted in the bank operating at the optimal level. Unfortunately the growth in size resulted in the bank being too large and operating at decreasing returns to scale. The bank was also fully technically efficient during the same period that it was fully scale efficient and this include one year that the bank was also fully allocative as well as fully cost efficient.

The average technical efficiency estimate of 0.864 (under model 1) implies that the bank can reduce its inputs by 13.6% without any reduction in outputs, while the average allocative efficiency estimate of 0.866 means that the bank should be able to reduce its input costs by 13.4% by altering its input mix. The average cost efficiency estimate of 0.751 implies that the bank can reduce its input costs by 24.9% if it were to become fully technically and fully allocatively efficient. Under Model 2 the average technical efficiency value is 0.866 which indicates that the bank should be able to reduce its inputs by 13.4% without any reduction in outputs. An average allocative efficiency estimate of 0.907 indicates that the bank should be able to reduce its input costs by altering its input mix.

The average cost efficiency estimates of 0.751 (under Model 1) and 0.786 (under Model 2) imply that the bank should be able to reduce its input costs by 24.9% and 21.4% respectively if it were to become fully technically as well as fully allocatively efficient.

Moving from Model 1 to Model 2, Bank D experienced, on eleven occasions, improvement in allocative efficiency and on six occasions, improvement in cost efficiency. On only one occasion there was deterioration in allocative

efficiency and four times deterioration in cost efficiency. For the remainder of the sample period the efficiency estimates remained unchanged.

Table 5: Relative efficiency estimates for Bank D

Year	Model 1					Model 2				
	te	Ae	ce	se	return	te	ae	ce	Se	Return
1994	0.882	0.900	0.794	0.765	irs	0.820	**0.926**	0.760	0.776	irs
1995	0.836	0.906	0.758	0.868	irs	0.833	**0.908**	0.757	0.871	irs
1996	0.853	0.930	0.793	0.913	irs	0.851	**0.932**	0.793	0.915	irs
1997	0.846	0.921	0.779	0.936	irs	0.845	**0.923**	0.779	0.938	irs
1998	0.859	0.912	0.784	0.954	irs	0.857	**0.915**	0.784	0.956	irs
1999	0.874	0.839	0.733	0.959	irs	0.874	0.839	0.733	0.959	irs
2000	0.759	0.827	0.628	0.930	irs	0.741	**0.853**	**0.632**	0.933	irs
2001	0.891	0.795	0.709	0.962	irs	0.867	**0.889**	**0.771**	0.952	irs
2002	0.817	0.765	0.625	0.974	irs	0.817	0.765	0.625	0.974	irs
2003	0.764	0.770	0.589	0.974	irs	**0.829**	**0.919**	**0.761**	0.975	irs
2004	0.732	0.783	0.573	0.984	irs	**0.847**	**0.909**	**0.770**	0.982	irs
2005	0.876	0.743	0.651	0.996	irs	**0.910**	**0.906**	**0.825**	0.985	irs
2006	1.000	0.864	0.864	1.000	-	1.000	**0.969**	**0.969**	1.000	-
2007	1.000	0.906	0.906	1.000	-	1.000	0.857	0.857	1.000	-
2008	1.000	1.000	1.000	1.000	-	1.000	1.000	1.000	1.000	-
2009	0.831	1.000	0.831	0.867	drs	0.760	1.000	0.760	0.964	drs
Mean	0.864	0.866	0.751	0.943		**0.866**	**0.907**	**0.786**	0.949	
Min	0.732	0.743	0.573	0.765		0.741	0.765	0.625	0.776	
Max	1.000	1.000	1.000	1.000		1.000	1.000	1.000	1.000	

5. Conclusions

It is clear that the four banks operated at increasing returns to scale for between 66% and 77% of the duration of the sample period, at decreasing return to scale for between 12.5% and 14% of the duration of the sample period, and at the optimal level for between 10.5% and 20% of the duration of the sample period. This means that for a long period of time they operated on a scale that was too small. Moving from Model 1 to Model 2, only Bank D experienced a marginal improvement in scale efficiency (0.006), while the other three banks experienced a marginal larger deterioration in scale efficiency, meaning that only Bank D was able to move closer to operating at the right size.

Moving from Model 1 to Model 2, Bank C experienced deterioration in average technical efficiency (0.020), while the other three banks experienced marginal improvement in average technical efficiency. This means that these three banks were able to marginally reduce the use of inputs without a reduction in outputs and moving closer to being fully technically efficient. The following improvements were recorded: Bank A (0.004), Bank B (0.014), and Bank D (0.002).

All the banks experienced improvements in average allocative efficiency, moving from Model 1 to Model 2. This means that all the banks were able to alter its input mix in order to move closer to being fully allocatively efficient.   The following improvements were recorded: Bank A (0.020), Bank B (0.057), Bank C (0.012), and Bank D (0.041).

Cost efficiency has to do with the input levels and the input mix required to produce a given set of outputs. Cost efficiency can be decomposed into technical and allocative components – technical efficiency has to do with determining appropriate input levels, while allocative efficiency has to do with determining the appropriate input mix. In this study, three banks experienced improvement in average cost efficiency, moving from Model 1 to Model 2. Bank C experienced deterioration in cost efficiency, despite an improvement in allocative efficiency, which may be driven by deterioration in technical efficiency. The following improvements in average cost efficiency were recorded: Bank A (0.021), Bank B (0.057), and Bank D (0.035).

From the results recorded, it is clear that there were improvements in technical, allocative and cost efficiency, moving from Model 1 to Model 2. Therefore this study concludes that, on average, banks were more efficient in managing the liability side of the balance sheet. This is especially clear in the improvements in allocative efficiency, where the banks were able to alter their input mix and improve the productivity of their inputs.

The practical implication of the findings in this study is, in formulating its objectives, bank management should take note of the fact that there is a difference in efficiency in managing the two sides of the balance sheet. The difference in efficiency may especially come to the fore in allocative efficiency, which deals with the optimal allocation of inputs for production purposes. An objective to grow the loans book (lending), creates a need for deposits and purchased funds (borrowings). It is clear that such an objective has an effect on the asset side (loans) as well as the liability side (deposits) of the balance sheet. In an effort to manage overall efficiency, bank management should be aware of which side of the balance sheet is more efficiently managed. However, it is important to note that these efficiencies may change over time, where managing the asset side may become more efficient.

REFERENCES

Berger A.N., Hanweck G.A., Humphrey D.B. (1987) Competitive Viability in Banking: Scale, scope and product mix economies, *Journal of Monetary Economics*, 20(3): 501-520.

Berger A.N. and Humphrey D.B. (1997) Efficiency of Financial Institutions: International Survey and Directions for Further Research, *European Journal of Operational Research*, 98(2): 175-212.

Bessis J. (2010) *Risk management in banking*, Wiley, Chichester.

Charnes A., Cooper W.W., Haung Z.M. (1990) Polyhedral cone-ratio DEA models with an illustrative application to large commercial banks, *Journal of Econometrics,* 46(1-2): 213-227.

Charnes A., Cooper W.W., Rhodes E. (1978) Measuring efficiency of decision-making units, *European Journal of Operations Research*, 2: 429-444.

Chen T. (1998) A study of bank efficiency and ownership in Taiwan, *Applied Economic Letters*, 5(10): 613-617.

Coelli T. (1996) A Guide to DEAP Version 2.1, A Data Envelopment Analysis (Computer) Program. *CEPA Working Paper 96/07,* Department of Econometrics, University of New England, Armidale.

Coelli T. J., Rao D.S.P., O'Donnell C.J., Battese G.E. (2005) *An Introduction to Efficiency and Productivity Analysis,* Springer, New York

Department of Bank Supervision (2009) BA 900 200 Reports, December, South African Reserve Bank, Pretoria.

Drake L. (2001) Efficiency and productivity change in UK banking, *Applied Financial Economics*, 11: 557-571

Devaney M., Weber W.L. (2000) Productivity growth, market structure, and technological change: evidence from the rural banking sector, *Applied Financial Economics*, 10: 587-595.

Falkena H.B., Kok W.J., Meijer J.H., *ed.* (1987) *The dynamics of the South African Financial System: Financial Risk Management*, Macmillan, Johannesburg.

Faure A.P. (1999) Elements of the South African Financial System. (*In* Fourie, L J, Falkena, H B and Kok, W J, eds. *Student Guide to South African Financial System*. Thomson Publishing, Johannesburg.

Favero C.A., Papi L. (1995) Technical Efficiency and Scale Efficiency in the Italian Banking Sector: a non-parametric approach, *Applied Economics*, 27(4): 385-395.

Halkos G.E., Salamouris D.S. (2004) Efficiency measurement of the Greek commercial banks with the use of financial ratios: a data envelopment analysis approach, *Management Accounting Research*, 15(2): 201-224.

Koch T.W., MacDonald S.S. (2003) *Bank Management,* South-Western, Singapore.

Luo X. (2003) Evaluating the profitability and marketability efficiency of large banks: An application of data envelopment analysis, *Journal of Business research*, 56(8): 627-635.

Mendes V., Rebelo J. (1999) Productive Efficiency, technological change and Productivity in Portuguese Banking, *Applied Financial Economics*, 9(5): 513-521.

Mitner M. (2011) Breaking the mould, http://www.fm.co.za/Article.aspx?id=133972, accessed 29 June, 2011.

Molyneux P., Altunbas Y., Gardener E. (1996) *Efficiency in European Banking,* Wiley, Chichester.

Oberholzer M., van der Westhuizen G. (2004) An empirical study on measuring profitability and efficiency of bank regions, *Meditari (Accounting Research)*. 12: 165-178.

O'Donnell C.J., van der Westhuizen G. (2002) Regional comparisons of banking performance in South Africa, *The South African Journal of Economics*, 70(3): 485-518.

Olivei G. (1992) Efficienca tecnica ed efficienca di scala nel settore Italiano: un approccio non-parametrico, *Quaderni del Centro Baffi di Economia Monetaria e Finanziaria*, pp. 67.

Oral M., Yolalan R. (1990) An Empirical Study on Measuring Operating Efficiency and Profitability of Bank Branches, *European Journal of Operational Research*, 46(3): 282-294.

Resti A. (1997) Evaluating the cost-efficiency of the Italian Banking System: What can be learned from joint application of parametric and non-parametric techniques, *Journal of Banking and Finance*, 21(2): 221-250.

Rose P.S., Hudgins S.C. (2005) *Bank Management and Financial Services*, Irwin, New York.

Sathye M. (2001) X-efficiency in Australian Banking: an empirical investigation, *Journal of Banking and Finance*, 25(3): 613-630.

Seiford L.M., Zhu J. (1999) Profitability and marketability of the top 55 U.S. commercial banks, *Management Science*, 45(9): 1270-1288.

Sherman H.D., Gold F. (1985) Bank Branch Operating Efficiency. Evaluation with Data Envelopment Analysis, *Journal of Banking and Finance*, 9(2): 297-315.

Sherman H.D. and Ladino G. (1995) Managing Bank Productivity Using Data Envelopment Analysis (DEA), *Interfaces*, Issue 25 : pp.60-73.

Stavarek D. (2002) Comparison of the relative efficiency of bank in European transition economies, *Proceedings of the D.A. Tsenov Academy of Economics 50th Anniversary Financial Conference, Svishtov, Bulgaria, April :* pp. 955-971.

Thanassoulis E. (1999) Data Envelopment analysis and its use in banking, *Interfaces*, 29(3): 1-13

Van der Westhuizen G. and Oberholzer M. (2003) A model to compare bank size and the performance of banks by using financial statement analysis and data envelopment analysis, *Management Dynamics: Contemporary Research,* 12(4): 18-26.

Van der Westhuizen G. (2004) Technical efficiency in bank lending and borrowing: a South African study. *Studies in Economics and Econometrics (SEE),* 28(1): 77-88.

Van der Westhuizen G. (2005) The relative efficiency of bank branches in lending and borrowing: An application of data envelopment analysis, *South African Journal of Economic and Management Science*, 8(3): 363-376.

Van der Westhuizen G. (2008) Estimating technical and scale efficiency and sources of efficiency change in banks using balance sheet data: A South African study, *Journal for studies in Economics and Econometrics*, 32(1): 23-45.

Van der Westhuizen G., Oberholzer M. (2009) The role of interest income and noninterest income on the performance of four large South African banks, *Studia Universitatis Babes Bolyai, Oeconomica*, 54(2): 100 -114.

Van der Westhuizen G. (2010) The role of interest income and non-interest income on the relative efficiency of bank regions: The case of a large South African bank, *Studia Universitatis Babes Bolyai, Oeconomica*, 55(2): 3 -23.

Vassiloglou M., Giokas D. (1990) A Study of the Relative Efficiency of Bank Branches: An Application of Data Envelopment Analysis, *Journal of the Operational Research Society*, 41(7): 591-597.

Yue P. (1992) Data Envelopment Analysis and Commercial Bank Performance: A Primer with applications to Missouri Banks, *Federal Reserve Bank of St. Louis*, January/February : 31-45.

ECONOMIC AND SOCIAL DIMENSIONS OF THE GLOBAL CRISIS: IMPLICATIONS ON INTERNATIONAL TRADE

Diana POPA [*]
Alexandru Ioan Cuza University of Iasi, Romania

Abstract. Like many researchers of the binomial: economic crisis – international trade, the purpose of this article is to answer the question: ,,How strong was the impact of the recent crisis on foreign trade", analyzing, briefly, each continent in part and consequences of so-called ,,tsunami on Wall Street". Moreover, one of the primary aims of the research is to identify the effects of the recession on developed countries and those developing as a result of participation in trade. To achieve the goals proposed, we have pointing to the most important scientific opinions in the field, according to which the current economic downturn has affected international trade in a different proportion from one country to another.

1. Introduction

The 21st century economy is like a world that is moving towards a more global economic system, which brings a number of risks, which we must accept them as such, because globalization is inevitable. It is appropriate to mention the financial crisis that has swept through South-East Asia in the late '90s and the recent economic crisis that began in the U.S. in 2008, and gradually moved around the world. Through its size and its context, this is historically unprecedented occurrence since 1945 and impugns the whole architecture of the banking system, of the markets and of the regulators.

To study accurately the effects of financial crisis on world trade is require a differentiation of a world in which there was no crisis and one in which there is. Certainly is that the international trading system, describing the fundamental exchange of goods and services, plays an important role in this context as one of the most important channels of interaction between states. Overall, this represents the substrate for spreading major crisis that shows how the economic turmoil,

---

[*] Corresponding author. Adress: Alexandru Ioan Cuza University, Faculty of Economics and Business Administration, Doctoral School of Economics, 22 Carol I Boulevard, 700505 Iași, Romania. E-mail: diana-popa@hotmail.com

originating of a single country, may globally spread. Also, trade flows are highly correlated with other economic interactions between countries (flows of services, financial assets, migration of workers), whose influence will be broached in this research. Both the causes of the crisis and policy responses have reshaped the level and the structure of the world trade. The objective of this study is to clarify the various direct and indirect effects of the crisis on international trade and how events might fix it.

2. Literature review

The global economic crisis and the ensuing effects represent one of the most controversial issues in literature and international press. More and more foreign researchers, such as Levchenko et al., Baldwin and Evenett, Chor, Fidrmuc, Lane, Lin and others, based on macroeconomic models, analyze the impact of economic downturn over each region embedded in the multilateral trading system.

Their opinions are very divided. Some suppose that the "tsunami on Wall Street" had a major negative impact on trade, the commerce decreased for the first time in 2009 since 1982 (Evenett et al., 2009, p. 119), in while others believe that the multilateral trading system has become a major victim of globalization, indifference of some countries in terms of international reform (Evenett and Baldwin, 2009, p.15). This dissatisfaction comes from the fact that investments on the one hand and foreign trade, on the other, have contributed significantly to world economic growth over the past decade, but, however, to update the multilateral trading system has made a low effort. In such a situation, it understand why was so affected the international trade by economic recession spread worldwide.

For years the trading system is continuously challenged on several fronts, starting with the launch failure of the Millennium Round in Seattle (1999) and continuing with the failure of the Doha Development Agenda and the unsuccessful negotiations from the Doha Round which started in 2001. The story of disrespecting deadlines, the repeated collapse of the talks, the modest results of the Ministerial Conference that followed are so well known that there is no need to be repeated here.

According to research conducted by Warwick McKibbin and Andrew Stoeckel, the composition and the level of world trade have been shaped before the crisis of 2007. The series of worldwide events such as the September 11 attacks and China's rapid growth as a result of WTO accession, reinforce the previous idea. Moreover, some of these phenomena, such as large differences between savings and investments in China (in the form of surplus) and the U.S. (in the form of deficit), led to large distinctions between exports and imports for each nation, in part, so that, China has accumulated large current account surpluses and the USA – large deficits (McKibbin and Stoeckel, 2009, pp. 7-10).

It is certain that the analysis and research of the literature didn't stop the idea set out above, even more than that, WTO critics and the relation: international trade – economic crisis, including Emlinger, Berthou, Baldwin, Evenett believe that the protectionism, embraced by the large commercial market actors (U.S. and EU, in particular) was the one who has contributed significantly to the reduction of international trade and not impulses of the crisis. Their statement is argued by the fact that although the WTO rules and principles point to the idea of free trade,

embodied by removing tariff barriers to trade and not just, in recent years, commercial tools such as anti-dumping measures, various rules and subsidies for production which were forbidden by WTO, have been used to raise the level of protectionism (Baldwin and Evenett, 2009; Berthou and Emlinger, 2009; Levchenko et al., 2010). More than that, these were increased from 2009 onwards, as a policy of protecting domestic production and increase its price for possible imports. The things took gradually a serious turn, so that the financial crisis spread to other systems, especially in Europe, but also Hong Kong, Russia, Brazil and even Congo.

From their point of view, the first channel through which the financial crisis, The study by Berkmen et al. offers one of the first attempts to explain differences in term of impact of the crisis on both developed and emerging markets. Thus, using the regression of opposite countries to explain the factors that led to the revision of growth forecasts after the outbreak of the global crisis, it was discovered that there is a small set of variables that explains a part from the variation of the revisions of growth. The countries with more systems of financial debt and with a rapid credit growth have undergone to several revisions in terms of their growth prospects. For the emerging markets, this financial channel fooled the commercial channel, an aspect that was translated through the fact that the exporting countries of advanced manufacturing goods were affected to a greater proportion than those who exported food (Berkmen et al., 2009, p.3). From analysis of these researchers, it can observe that the openness of trade is not static, making the conclusive difference is the composition of the trade. In particular, the share of manufacturing in total exports is correlated with a poor growth performance, both for developed countries and those developing. This is consistent with the idea that countries that export manufactured goods in developed countries appear to have been severely affected by falling demand in these markets, while food-exporting countries seem to have fared much better, despite the presence of the crisis worldwide since September 2008 (Naud, 2009; Berkmen et al., 2009, p. 13).

From their point of view, the first channel through which the financial crisis, started in the United States, had spread abroad , is represented by the commercial one because the global recession caused a sudden drop in demand came from the advanced economies and the side effects arising from the developing countries did not fail to occur as a result of the strong trade links between the latter and the advanced economies. Moreover, the exporting countries of advanced commodity appear to have suffered an immediate and pronounced decrease in demand for their exports compared with the exporters of primary products (Lin, 2008; IMF, 2009; Berkmen et al., 2009, p.5; Griffith-Jones, 2009).

The global recession stemming from the financial crisis of 2008 seriously affected the trade and all other aspects of the economy. According to Patrick Love and Ralph Lattimore, the trade isn't a cause of the crisis, but since it unites the economies between them, the commerce facilitates the spread of the conversion from one country to another, whether positive or negative (Love and Lattimore, 2009). Moreover, the two researchers stated in their paper the idea that international trade can contribute greatly to improving living standards worldwide, as long as the protectionist measures are kept at a distance. With this aspect, Pascal Lamy faced for several years and the failure to conclude the Doha Round is the best example in the statement that the protectionism will not soon disappear.

Two other researchers of the Centre for Future Studies and International Information (CEPI) in Paris try to give an explanation of the reduction of quantities traded due to the spread of recession in late 2008. Thus, according to them, the commercial loans (instruments used by the bank of the commercial partner to insure oneself of an eventual lack of payment of the customer) discontinued a number of commercial relations (A. Berthou, Ch. Emlinger, 2009, p. 1) because, in a context of global financial crisis, the inability of banks to provide such type of guarantee was likely to disrupt trade between states. Beyond the lack of commercial credit instruments, Berthou and Emlinger points out that the decrease of the volume of credit to the private sector also disturbed trade.

The trade decline could be observed more in value than in volume due to the lower prices: between April 2008 and April 2009, the import prices in most advanced economies have fallen by 20% in dollars. The lower commodity prices explains in a large measure this phenomenon. According to Berthou and Emlinger, the lowering of margins of the exporting firms could, also, help to reduce the prices of manufactured goods (Berthou and Emlinger, 2009, p. 2). Another argument regarding the price developments refers on the changing structure of the imports. Thus, if the income decreases automatically, the import demand will tend to move from high-quality products to those of lower quality, assuming through the composition effect, a diminution in the aggregate price of imports. In turn, the exporters are also affected differently by falling demand, acording to the specialization which they hold: on the product range of high quality or vice versa. The statistics show that this difference contributed to the decline in exports in developed countries and less in emerging ones (**Annex 1, Table 1**).

The current financial crisis took during a year a global dimension. If at the origin of losses and collapse of liquidity were been securities markets guaranteed by subprime loans, the generalized climate of uncertainty would cause an ”epidemic” widely to other market segments, exposing all financial institutions. In such circumstances, it can't be hidden idea shared by all those who have studied this phenomenon (and did not cease to do so), that the ”tsunami on Wall Street” as a whole, is remarkable through its size, speed of contagion in global financial sphere, but also length of time, because three years later, it continues still to produce victims. These factors make it one of the most impressive and undoubtedly unmatched in the recent financial history.

3. The economic crisis and advanced countries

The collapse of Lehman Brothers in September 2008, a midsize investment banker on Wall Street, sparked a wave of fear around the global financial markets. Basically, the banks have stopped lending to each other, the trade credits becoming, thus, difficult to obtain, and toghether with the falling demand for the investment goods and durables such as cars, the volume of trade fell dramatically in just a few months.

The current global crisis has embraced initially the developed economies, particularly the U.S., going then to European countries that were relatively well integrated in terms of financial, in international trade. So happened that in 2009, the most developed world economies were in a deep recession. The decline of global trade, both in terms of volume and pattern of trade was staggering. In such a situation, the internationally renowned organizations, like WTO, OECD, IMF,

World Bank predicted a decline in world trade volume by 13% in 2009 compared with 2008, a fact that has occured, unfortunately, for the vast majority of world countries (OECD, 2009).

3.1. The influence of the crisis on the international U.S. trade

Born in the United Stated as a "subprime crisis" in August 2007, for 13 months, it turned into a "global crisis" (Baldwin, 2009, p. 9), continuing with the series of negative effects brought by the recession that started after.

By mid 2007, the U.S. economy was the most powerful and prosperous from the contemporary era. But alongside the incidents from the financial sphere, the U.S. began to falter, until it lost totally the enviable equilibrium of old. Consequently, in 2008, the statistics showed a decrease in the flow of imports (-4%), although the exports maintained itself for the moment (6%) (Annex 1, Table 2). Moreover, the economic growth in the U.S. (in 2008) fell to – 0.1%, something that led to a substantial reduction in investment and private consumption, despite the favorable results achieved in export, which we have already mentioned. The year that followed was even more vague, because the exports would declined by 15.2% and the imports by 18.6% in the second quarter of 2009 compared to second quarter of 2008 (while the exports represented only 12% of GDP in 2008). The negative impulses already supported by the U.S. population, built the way towards other corner of the world, who would have entered in a very short time, in the dance of the crisis.

The U.S. recession that followed the subprime crisis, has two main effects on the modern economy. The first negative act refers to loss of the activity of economies dependent of U.S. market, being in fact, the most affected. But a second effect, contrary to the first, refers to the attracting of investments by other destinations, more competitive during the crisis as a result of the poor development prospects present in the U.S.. In other words, the money flows from the U.S. were directed towards Asia, in the most part, so that the "Chinese effect" (McKibbin and Stoeckel, 2009, pp. 22-24) became famous in literature in field, through the economic boom registered by this state, apparently centralized.

By the way, the global slowdown was due to the decrease in commodity prices, a phenomenon faced initially the U.S. and then, other states. The slow growth implies a less demand for oil, industrial metals, grains, the fact which was reflected in the significant decreases in commodity prices during the last months of 2009. For example, the international energy prices fell by over 20% in the third quarter of 2008, while the international prices for food, metals and minerals fell by more than 15%, respectively 10%.

According to Alan Greenspan, during this crisis that has attracted so much the world attention, in recent years, we have seen (with reference to the other states that would been attracted by the crisis) with concern, as gradually, every sector of the U.S. economy was affected by "the credit tsunami born once in a century" and then, we felt its effects on the incomes, prices, percentage of unemployment and number of fired and, finally, economic growth as a whole.

3.2. The influences of the crisis on EU-27

The general effects of the crisis were felt slowly, but surely throughout the world because it was the largest collapse of the global economic activity since the Great Depression. While China was a significant exception, the global financial

crisis and the recession stemming from it, has affected both industrialized economies and emerging ones. The European countries haven't been omitted from the path of the crisis, so in a few months, they experimented all the decline of former economic growth. As a result, the World Bank and OECD hastened to predict the future of the Union. According to them, the growth forecasts for Europe in the year 2009 was negative, between -0.1 and -1.2%, the figures which have come true. Even more than that, in the euro area, the decline in exports reached 17.1% in the second quarter of 2009, while that of imports to -14.4%. The decrease in trade was disastrous for Germany, with a contribution of net exports to cumulative GDP growth on a year, to -4.5% (due to the fact that the German economy is heavily dependent on foreign trade, with exports of goods and services which accounted for 52% of the German GDP, in 2008) (Bank of France, 2010, p.26). Less dependent on foreign trade compared with Germany, France was also affected by the sinking of international trade. Compared with the counterparts in the euro area, France hasn't lost the flow of FDI while the social costs have played a role of dampers, allowing for a better stabilization of revenues during the crisis.

Looking at Figure 1, it results the idea that the imports of high quality products were the most affected by crisis, and here we refer to spare parts and German cars, in particular. From the monthly data provided by Eurostat and from the distribution according to the range of products traded (assumed to be constant), we can calculate the trends in imports in the range of high and low quality of 15 European countries during the recent crisis. Starting from the period under consideration, the collapse of world trade was particularly strong, the reduction of the quantities of import was more noticeable for the range of high quality (-23%) compared with the range of lower quality products (-17%). The decline of premium products has been quite pronounced in the last quarter of 2008, the fact that leads us to conclude that the income elasticity of imports is higher for this category of products. Regarding this aspect, the microeconomic theory shows that an increase in income is always associated with an increased volume of goods consumed, an effect known as "Engel's curve". Moreover, the theory takes into account the possibility of a substitution between luxury goods and basic necessities, where there is a variation of income; an increase in income could lead to a higher proportion of luxury goods consumed by each individual (the fact which happened before the crisis) and vice versa, which can be detached in figure 1.

The literature is loaded with such theoretical models, from the traditional to the present and the conclusion that an increase in income leads to an augmentation of quantities of the premium goods is confirmed, naming the relation mentioned above as "the quality curve of Engel" (Berthou and Emlinger, 2009, p. 3). Another aspect to note is that once the income is reduced, the imports decreases much more than GDP. Being attached to the recession observed in the advanced economies, the idea stated above, helps to explain the recent collapse of world trade. Therefore, countries whose import demand is more elastic to variations of the income (industrialized countries, in particular) are equal to those who record a decline in GDP (with reference to emerging countries from the Community, but also China, India, Brazil etc.) (Annex 1, Table 1).

Figure 1: The evolution of the EU-15 imports, in quantity, depending on quality (March 2008 – March 2009)
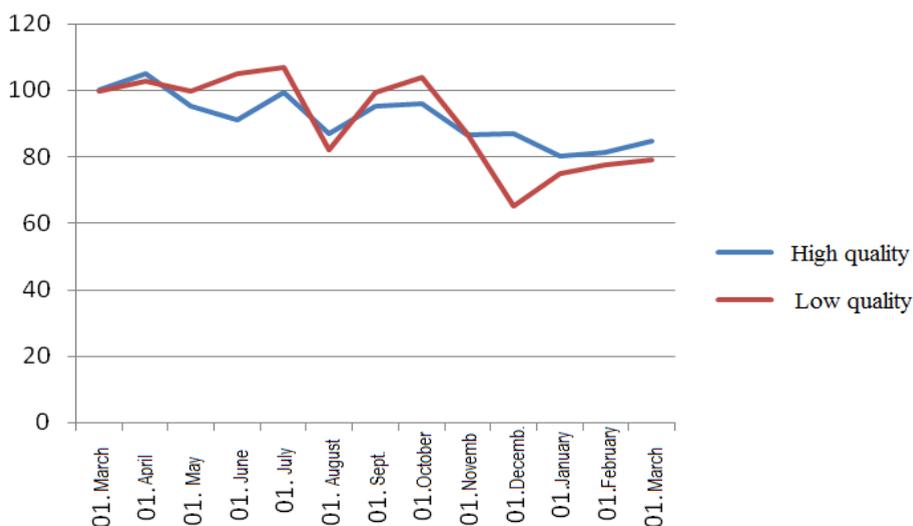
The countries in EU accession process (like Croatia, Turkey, Moldova, Serbia, Albania, Ukraine, Montenegro, Bosnia and Herzegovina, Kosovo) appear to have been affected very deeply by the consequences of economic crisis, and this is most likely due to the existence of strong trade and financial links with the EU Member States, which were like the U.S., in the epicenter of the recession (Berkmen et al., 2009, p. 10).

In conclusion, based on the results of figures, can be said that the exports of high-quality goods are more sensitive to changes of income and therefore, more sensitive, to economic cycles. The policies that encourage specialization on premium products can make, thus, the exports more volatile and a deficit of trade balance.

4. The crisis impact on emerging countries

Being a group, the developing countries require financial flows from all over the world to facilitate and accelerate the economic growth, trade and development. With the onset of the crisis in emerging countries, these flows (like development assistance, flows of investment, commercial loans etc.) decreased considerably due to the weakening of advanced economies and thus, the occurrence of disorders worldwide. Third, the international trade depends heavily of commercial loan, approximately 90% of these exchanges are funded by a short-term credit. How the credit crunch began to bite, the trade finance has also been reduced as a result of the banks' decision to limit the exposures to risk. These are just some of the negative effects felt by the BRIC countries, for example, during the crisis. Wim Naudé estimated the diminishing financial resources towards the emerging countries as around 300 billion dollars (Naudé, 2009, p.6), while other researchers pronounced for a higher value, more than 400 billion dollars

(Levchenko et al., 2010), but most likely, the truth was located somewhere in the middle.

The effects felt by developing countries are largely similar to those of advanced states, the difference is in their impact on the economic growth in each country and the period of recovery that will come. The safest effect refers to the substantial reduction in exports while the pace of expansion of the trade will experience a sharp slowdown. Statistics show a reduction in trading volume of this category of states of 4.1% in 2009 to 9.3% in 2006 (WTO, 2010). At a micro level, some exporters in developing countries faced with the difficulty of obtaining commercial loans, which finally, paralyzed the export of some sectors affected shortly by the decrease in external demand.

Referring to Latin America (as in the case of Africa), the studies show that their exports to the United States and European Union have declined significantly in recent years, while the trade with Asia have increased substantially as a result of the directed investment flows toward this region, even during the crisis.

In generally, the overall impact was undoubtedly negative. Some countries were more affected, especially those dependent by trade with the U.S., those with the difficulties in balance of payments, with the large fiscal deficits and with the financial sectors poorly regulated (Naudé, 2009, p.9).

4.1. The effects of economic downturn felt by Asian Countries

Considered a distant region in relation to the centre of manifestation of the crisis, the Asian countries were also shaken by the effects of so-called "tsunami on Wall Street". Compared with the other, these states can not boast with a spectacular growth to the early third Millennium, except China, India and Japan, which make the difference in the impact felt by every state in the region.

The statistical data of international organizations show that *Japan* is the most seriously affected country by the decrease of trade (Annex 1, Table 1 and Table 2). In addition to reducing external demand induced by crisis, the strong appreciation of the real value of yen, which began in late 2008, discouraged the exports, which fell by 29.3% in the second quarter of 2009 compared with the same period of the last year. The experts from the World Bank argued that the growth forecasts for Japan in the year 2009 were negative between -0.4 and -1.3% and were right.

Regarding *China* and *India*, the same data show positive values with respect to trade flows in the region and vice versa, when it were taken into discussion industrialized countries (U.S., EU, Japan) strongly affected by crisis.

Especially, after joining the WTO in November 2001, *China* witnessed a exorbitant growth in commerce. Between 2002-2008, the total value of Chinese imports and exports increased from 620.8 billion dollars to 2.56 trillion dollars, an annual rate of growth of 26.6%. The China's trade boom has surprised the entire world. However, the country's golden age in terms of the global trade was interrupted in the mid 2008 with the financial revolt initiated by the U.S. mortgage crisis. In a lesser extent, the economic crisis affected the Chinese economic growth, estimated at the end of 2008 for the following year with a percentage of 7.0 and 8.5% (down 9.8% in 2008 and 11.9% in 2007), although the country considered that has the sufficient substantial means to stimulate the domestic economy.

Moreover, there isn't a secret that the United States present itself as a major importer of China. As the U.S. imports have fallen, the exports of Chinese clashed of the same situation, with a percentage of 5% in the year 2009. Although the Chinese trade balance has worsened, the effect was quite small of 1% (McKibbin and Stoeckel, 2009, pp. 22-24). Also, it should be noted and the aspect referring to a small net effect on the real GDP of China (0.75%), although its exports hold much of the American GDP. The real investment from China provides the answer to this reality because, nowadays, there is a single recipient of money flows from other parts, namely China. Regarding this aspect, the World Bank believes in 2009 that the real investments in China could increase to 3.5% in 2011 and 2012. Therefore, it can be concluded that the Chinese advantages (resulted from gains obtained from FDI inflows into country) and that ensued from the U.S. suffering, compensated and exceed the negative effects arising from the loss of the flow of exports to the U.S., existing before crisis (McKibbin and Stoeckel, 2009, p.24).

The specialization in high or low quality goods affects the evolution of exports, as well as that of imports (Annex 1, *Table 1*) and in this region. Depending on the composition of product range, we tried to deduce the evolution of exports of the each partner in the year 2009. Thus, it is clear that the changes in GDP of importing countries have a slightly different effect over exporting countries based on the fact that these are specialized on the luxury goods category or normal. Take the example of *Japan*, in which the diminution of the demand by 6.2% in 2009 involved a reduction of approximately 17% in exports from Germany or France and only 14.7% in those from China. When the variation of demand becomes positive (the case of China and India in 2009), the exports from the luxury goods category are those that grow the most: on the Indian market, the German or French exports (6.2%) increased more than those of China (5.0%). However, on the Chinese market, it observes the growth of the India's export (9.2%) comparable to the countries considered exporting high quality products, such as Germany (9.1%), France (9.0%) and so on. This leads to the idea that on this market, the share of premium goods is approximately the same in the exports from India and Germany (Annex 1, *Table 1*).

Although, it is too early to estimate correctly the fully impact of the global economic crisis on labor migration in Asia, it is clear that the past trends will not be supported because of the deteriorating economic conditions in the major destination countries, affected by crisis. All indications lead to a deepening of the recession, which will reduce further, the international trade and the foreign investment, two major propeller of growth in region.

4.2. Latin America and global crisis

Triggered by the subprime lending excesses of the U.S. housing market, the actual economic crisis penetrated, initially, on other U.S. financial markets and then, expanded and abroad.

Latin America is another destination of the recession, which brought with itself two global shocks related to each other (the slowdown and decrease of the international relative prices), contributing significantly to the deterioration of the external environment. These shocks are spreading rapidly throughout the world, although their relative importance for different countries continues to evolve.

As in any region, the global crisis expanded worldwide through various channels of transmission, and for Latin America, they are: the financial contagion, foreign demand and changes in relative prices (World Bank, 2008, p. 2). Of these, the one that interests us the most, translates into the lower demand for Latin American exports worlwide, due to the stagnation of the growth in the rich countries and the sharp deceleration in the emerging Asian economies (World Bank, 2008, pp. 2-3). The drop in remittances, weakening of commodity prices, higher borrowing costs and stricter monetary policy impact for taming the inflationary pressures, will worsen the situation in region. In this circumstance, the cyclical downturn of Latin America was quite pronounced, leading to a number of obvious risks. Thus, the economic growth slowed from 5.6% in 2007 to a value of 4.6% in 2008 and 2.5% in 2009, a decrease greater than it previously expected, according to experts (World Bank, 2008). It is sure that all these developments are not amazing for the reason that the U.S. economy is close (because of the trade links and the remittances, among others) to that of Mexico, Central America, countries that have experienced among the first the impact of the crisis.

These effects were not more pronounced in Latin America compared with other countries. On the other hand, the countries that are relatively more linked to other regions such as Argentina, Peru, Brazil, showed a somewhat attenuated and delayed impact as a result of the robust growth of China, despite the current global recession. Another aspect to be mentioned is with reference to the changes in the commodity prices that had asymmetric effects between the Latin American countries. The decrease in commodity prices, which resulted from the slowing global economy has damaged trade in region as a whole. Because Latin America is a net exporter of products, over 90% of the region's GDP and the population that living in net exporting countries were adversely affected by the reduction of commodity prices. It is certain that this situation comes after a prolonged period, in which the same countries have experienced a period of boom in commodity prices (World Bank, 2008, p.3). Meanwhile, this fact had a different twist. Almost half of the region's countries, located mainly in Central America and the Caribbean, have become net importers of goods. For them, the crisis of the international prices of fuel, industrial metals, grains etc. was received as a consolation. Unfortunately, this has often led to a stagnation of the economic growth. At the same time, however, the reduction of the international prices for food and fuel helped to diminish inflationary pressures faced by Latin America, before the emergence of the crisis. Compared to the Asian crisis in 1997, this time, the region was much better positioned, due to the notable improvements in the macroeconomic and financial policies, and to the reduction of the dependence on external capital inflows (World Bank, 2008, pp. 3-4).

Although, there is a great uncertainty about the final consequences of global shocks that appeared together with onset of the crisis on Latin America region, it is sure that the risks have widened while the ability to manage the crisis differ from a country to other, from the examples of the U.S. and European Union.

5. The "tsunami on Wall Street" on African continent

Placed away from the centre of global crisis, the African countries were affected to a lesser extent by so-called "tsunami on Wall Street".However, there are some countries, members of the WTO, that embrace MFN clause and other

essential principles of the forum mentioned above are characterized by the economies highly vulnerable to exogenous shocks as a result of the participation in foreign trade. It is the case of the economy of *Democratic Republic of Congo* to whose openness is relatively high (142%), even if the connection to financial, trade and technology flows is very low, due to the embryonic nature of the financial system and the structure of public resources dominated by tax in respect of foreign trade on some basic goods (Samba, 2010). Moreover, the vulnerability is exacerbated as a result of the opening almost total of the capital account of balance of payments, since the liberalization measures taken through the programs imposed by the IMF. All they haven't done anything else but introduce many dollars in the Congolese economy and remove the FDI of this destination. On this basis, we can assess the impact of international crisis on the economy R. D. Congo, based on two levels of transmission, namely:

• The externally level through which the shocks are sent to the national economy through the main components of the balance of payments, acting as channels of contagion;

• The national level where we can assess the short and medium term impact of the external shocks on prices, access to goods and services, employment, economic growth and poverty.

Excluding the weak integration into the global economy and passing over foreign trade and international transactions, the Congolese economy was hit by the global financial crisis. Slowing economic growth in countries importing primary products led to reducing the production in many sectors of the Congolese economy in the last quarter of 2008. This continued with an accentuation of the reduction of commodity prices, which began long before the outbreak of the crisis, as can be seen in Table 1.

Table 1: Evolution of mining products prices for the export

Raw materials	Dec. 2007	July 2008	Nov. 2008	Dec. 2008	Jan. 2009	Feb. 2009
Crude oil ($/barrel)	95,0	147,0	50,0	38,9	41,6	44,1
Copper ($/t)	5.346,5	5.477,4	3.580,0	2.811,0	1.076,5	3.385,0
Cobalt ($/1b)	29,4	38,1	17,0	16,5	17,0	15,0
Gold (ounces)	693,6	940,0	815,7	869,7	928,7	939,8
Diamond (carat)	22,6	32,1	16,2	16,2	-	-

Source: Central Bank of Democratic Republic Of Congo, 2009

As can be seen in Table 1, except gold, whose prices have continued to increase on international market, despite a diminution in November 2008, the prices for other mining products for the exports from Congo collapsed, effectively, from last quarter of 2008.

The crisis has affected mainly the mining activity. Thus, the copper production decreased by 31% in the last quarter of 2008, while the production of diamonds has collapsed completely. Moreover, the mine from Bakwanga has ceased his activity at the end of that year, and oil production registered a growth rate of -4.4%, leading to a reduction in oil revenues of 2 million dollars in 2009 compared to a monthly average of 52 million dollars. The timber production was also affected due to the cancellation of orders for wood, furniture etc. coming from

Europe and Asia, following the global economic downturn. Combined with rising food prices, this evolution has affected pretty much balance of payments. Samba estimate that the effect of the crisis on trade balance in 2009 amounted to 1.320 million dollars, while the global balance to – 1.5 billion dollars (Samba, 2009). It can be said therefore that the economic recession decreased the ability of the country to import and of the Central Bank – to provide needed foreign currency.

Increasing public deficit, the over-liquidity of the commercial banks, reducing official reserves are only some issues that have exercised strong pressure on the Congolese franc's depreciation of 22% against the U.S. dollar between January and March 2009 (Samba, 2009, pp. 5-7). Ended up in a such situation, Democratic Republic of the Congo risked to disappear from the map, but the solution for economic recovery came in a short time. The international community (World Bank, IMF, African Development Bank, EU, Belgium) came with an urgent program to mitigate the effects of the financial crisis. Its purpose was to help maintain the Congolese economic and social stability. This budget support permitted, in addition to reconstituting the reserves and financing the imports of some basic goods, and the payment of outstanding invoices.

Although the effects of the global crisis on the Congolese economy were more negative than positive, the studies of the African researchers have identified a number of benefits, and among these, the most important was the decentralization, ie the weakening of the government influence in the Congolese economic life, protecting foreign investors and a greater emphasis on supporting national economic activity.

6. Conclusions

This paper uses detailed data on imports and exports flow, the level of economic growth, the trade balance of different countries for examine the anatomy of recent collapse of international trade, and other side effects experienced by the world regions. The statistical data of international organizations show that this collapse is exceptional in two respects: it is relatively higher for economic activities compared with those that have been observed in previous recessions and it is much larger than what predicted initially, the evolution of the internal absorption and the prices of the same period.

The literature sent us to the idea that there is some evidence that commercial ties have played a significant role in the transmission of current economic crisis on non-emerging markets of the developing countries as a result of increased globalization. However, the foreign trade is only one of channels through which economic difficulties of some developed countries were sent to others, particularly emerging countries. Linking financial markets also played an important role. These close connections between the economies are due to the importance of multinational firms in the global economy, implanted in many parts of the world and that adopt the global strategies.

It is also noted that the collapse of world trade that occurred in late 2008 and early 2009 affected in particular, high quality products as calculated over a period of ten years, the income elasticity of imports of these products is almost 60% higher than that of the imports of poor quality. Moreover, the tests performed during the research, estimated a decline in world trade volume in 2007 – early 2009 of 1.6% for low quality goods and 2% for luxury goods. These figures of a

much smaller amplitude compared with the estimated world trade in 2009, underline once again the exceptional nature of recent crisis and the global trade reaction.

In conclusion, we can say that the economic downturn affected trade results through the multiple channels, some obvious, others less. The most noticeable refers to slowing demand, both in the businesses and households. Once the households have started to spend less, the imports decreased, therefore, the exports to other countries will also reduce. Other effects, equally important, are presented in Annex 1, Figure 2 and their impact on countries of the world was surprised in this study.

General effects of the crisis were felt worldwide, because it was the largest collapse of global economic activity. While China was a significant exception, the global financial crisis and consequent recession have affected both advanced economies and developing countries. It is the case of United States, Japan and a number of European countries who in a few months only, have experienced the decline of the old economic growth. If the financial crisis that began in the U.S. had been limited to the territory of these states, there would have been no disastrous consequences to the global economy. But the real story is different from this scenario, and the decrease in trade flows, the collapse of global trade, in addition to financial consequences, affecting all of us, a greater or lesser extent, from one region to another.

REFERENCES

Baldwin R. (2009) *The Great Trade Collapse: Causes, Consequences and Prospects*, A VoxEU.org Publication, Centre for Economic Policy Research, London

Baldwin R., Evenett S. (edit.) (2009) *The collapse of global trade, murky protectionism, and the crisis: Recommendations for the G20*, VoxEU.org publication, Centre for Economic Policy Research, London

Berkmen P., Gelos G., Rennhack R., Walsh J. (2009) The Global Finacial Crisis: Explaining Cross-Country Differences in the Output Impact, *IMF Working Paper*, No. 280

Berthou A., Emlinger Ch. (2009) Crise et commerce: Les hauts et bas du haut de gamme, *La Lettre du CEPII*, Nr. 293, Octobre

Chor D., Manova K. (2010) Off the cliff and back? Credit conditions and international trade during the global financial crisis, *NBER Working Paper* 16174, July

Evenett S.J., Hoekman B.M., Cattaneo O. (edit.) (2009) *Effective Crisis Response and Openness: Implications for the Trading System*, Centre for Economic Policy Research, London

Fidrmuc J., Korhonen I. (2009) The Impact of the Global Financial Crisis on Business Cycles in Asian Emerging Economies, *CESifo Working Paper*, No. 2710

Gregory R., Henn Ch., McDonald B., Saito M. (2010) Trade and the Crisis: Protect or Recover, *IMF Working Paper*

Griffith–Jones S., Ocampo J.A. (2009) The Financial crisis and its impact on developing countries, *International Policy Centre for Inclusive Growth, Working Paper,* No. 53, April

Lane Ph.R., Milesi-Ferretti G.M. (2010) *The Cross-Country Incidence of the Global Crisis*. Available at: http://siteresources.worldbank.org/BRAZILINPOREXTN/Resources/3817166-1271 175469758/Milesi_Ferreti%5B1%5D.pdf, accessed on 15.04.2011

Levchenko A. A., Lewis L.T., Tesar L.L. (2010) The Collapse of International Trade During the 2008-2009 Crisis : In Search of the Smoking Gun, *NBER Working Paper*

Liu W., Pannell C. W., Liu H. (2009) The Global Economic Crisis and China's Foreign Trade, *Eurasian Geography and Economics*, 50(5): 497-512

Love P., Lattimore R. (2009) International Trade: Free, Fair and Open?, *OECD Insights*

McKibbin W.J., Stoeckel A. (2009) The Potential Impact of the Global Financial Crisis on World Trade, *Brookings*

Naudé W. (2009) The Financial Crisis of 2008 and the Developing Countries, Discussion Paper No. 01, *UNU – WIDER*, Helsinki, Finland

Ocampo J.A. (2009) Latin America and the global financial crisis, *Cambridge Journal of Economics*, 33(4): 703-724

Samba D.M. (2010) Economie congolaise et crise financière internationale, *Journées Sociales du CEPAS*, Nr.439: 653-664

Sen A. (2009) Capitalism Beyond the Crisis, *The New York Review of Books*, 56(5), March

*** Banque de France (2010) *De la crise financière à la crise économique*, Documents et débats, Nr. 3, Janvier

 *** *OECD* (2009) *World trade set to fall 13 percent, OECD urges governments to avoid protectionism*. Available at: http://www.oecd.org/document/12/0,3343, fr_2649_37431_4278 8172_1_1_1_1,00.html, accessed on 16.05.2011

*** OMC (2010) *Rapport sur le commerce mondial*. Available at: http://www.wto. org/french/res_f/booksp_f/anrep_f/world_trade_report10_f.pdf, accessed on 25.04.2011

*** World Bank (2008) *Latin America and The Gobal Crisis*, Office of Regional Chief Economist, Octobre

*** WTO (2010) *International Trade Statistics*. Available at: http://www.wto.org/english/res_ e/statis_e /its2010_e/its2010_e.pdf, accessed on 16.05.2011

Acknowledgements

Table 1: Variation of traded quantities corresponding to changes in GDP in 2009 (annual rate %)

		IMPORTERS							
		USA	Germany	France	UK	Brazil	Japan	China	India
EXPORTERS	USA	-	- 14,5	-8,1	-10,8	-1,7	-16,7	8,5	6,1
	Germany	-7,7	-	-8,0	-11,0	-1,7	-16,9	9,1	6,2
	France	-7,5	- 14,6	-	-10,4	-1,7	-17,0	9,0	6,2
	UK	-7,8	-14,9	-7,8	-	-1,8	-16,7	8,8	6,4
	Brazil	-7,1	-14,2	-7,2	-10,1	-	-15,7	9,3	6,3
	Japan	-7,6	-14,8	-8,1	-10,6	-1,8	-	8,3	6,2
	China	-6,5	-13,1	-7,0	-9,5	-1,5	-14,7	-	5,0
	India	-7,1	-13,7	-7,3	-9,8	-1,6	-16,0	9,2	-
	GDP forecasts	-2,8	-5,6	-3,0	-4,1	-1,3	-6,2	6,5	4,5

Note: Countries are grouped by geographical area, emphasizing emerging and indrustrialized countries. *Source:* Berthou and Emlinger, 2009, p. 4

Figure 1: Evolution of the World Trade: the exports and the imports of goods and services of the large geographical areas (volume, billion dollars)
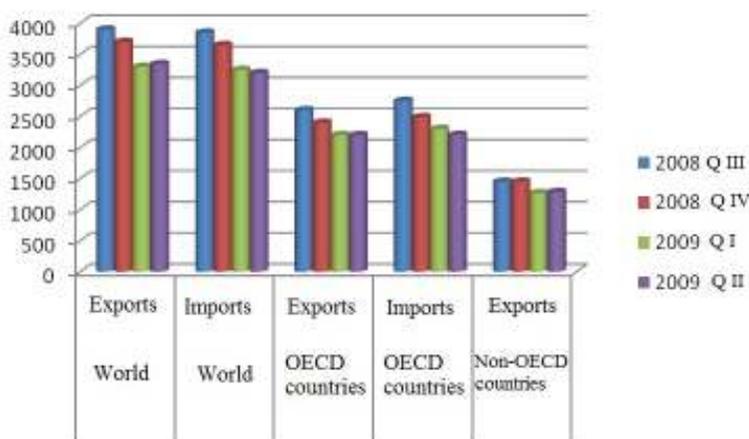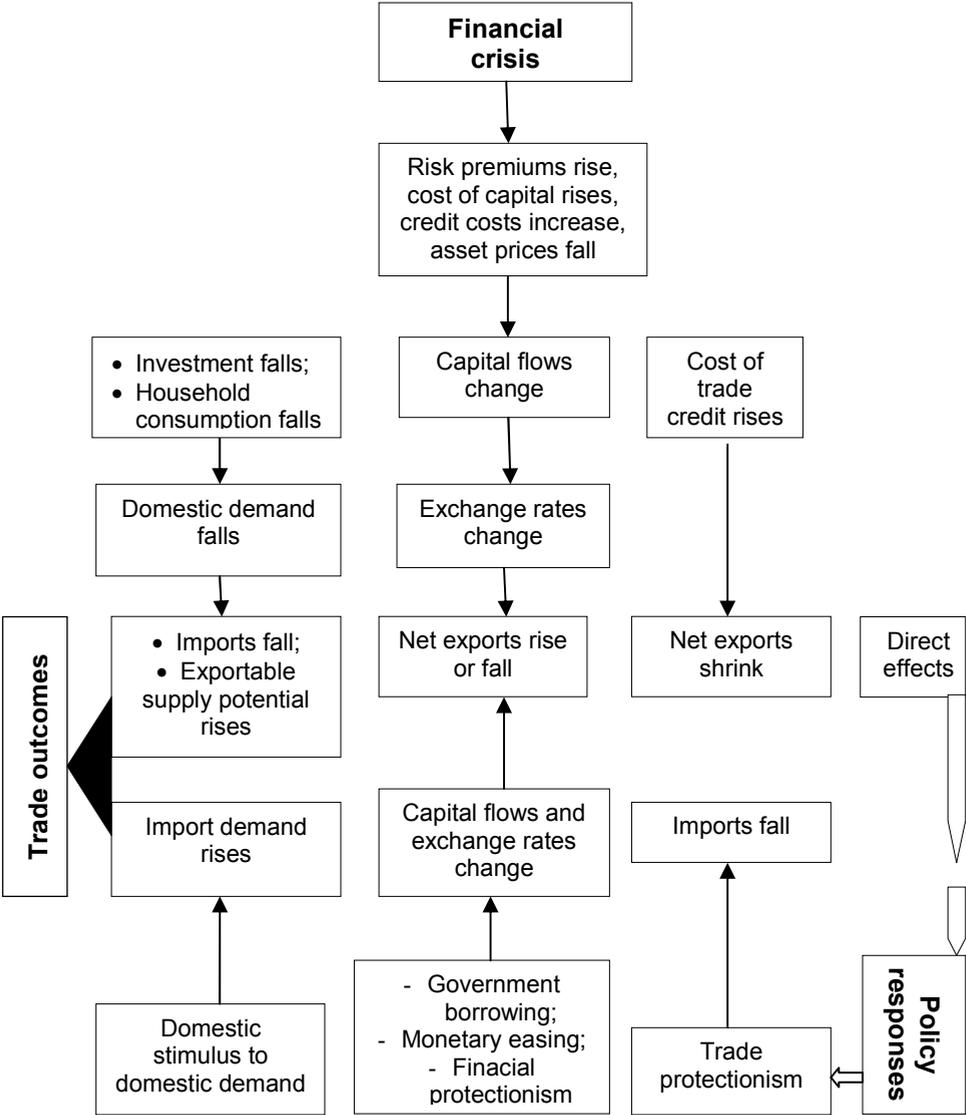

Source: Date processed, WTO, 2009

Table 2: Increase the volume of world merchandise trade depending on region (2000-2009) (annual percentage)

COUNTRIES	EXPORTS			IMPORTS		
	2000-2009	2008	2009	2000-2009	2008	2009
United States	2	6	-14	1	-4	-17
Central and South America	4	1	-8	6	13	-17
European Union (27)	2	0	-15	1	-1	-15
China	17	9	-11	15	4	3
India	12	15	-3	13	18	-3
Japan	2	3	-25	1	-1	-13

Source: Date processed, WTO, 2010

Figure 2: The main mechanisms affecting trade outcomes


```
                         ┌─────────────────┐
                         │    Financial    │
                         │      crisis     │
                         └─────────────────┘
                                  │
                                  ▼
                         ┌─────────────────┐
                         │ Risk premiums rise, │
                         │ cost of capital rises, │
                         │ credit costs increase, │
                         │  asset prices fall │
                         └─────────────────┘
```

Financial crisis

Risk premiums rise, cost of capital rises, credit costs increase, asset prices fall

- Investment falls;
- Household consumption falls

Capital flows change

Cost of trade credit rises

Domestic demand falls

Exchange rates change

Trade outcomes

- Imports fall;
- Exportable supply potential rises

Net exports rise or fall

Net exports shrink

Direct effects

Import demand rises

Capital flows and exchange rates change

Imports fall

Domestic stimulus to domestic demand

- Government borrowing;
- Monetary easing;
- Finacial protectionism

Trade protectionism

Policy responses

BRICS CURRENCY VOLATILITY: CONFUSION OR INDECISION ?

Andre MELLET [*]
North-West University, South Africa

Abstract. The year 2008 will be remembered when the world experienced the biggest financial crisis since the depression of the 1930's. The years that followed 2008 will be remembered as the years of uncertainty about sustainable recovery and governments' trouble to manage their enormous fiscal debt. The consequence of these developments was currency volatility. International investors adjusted their risk profiles regarding BRICS countries since the crisis and these countries received billions of new investments. The question arises what these countries can do to stop this appreciation of their exchange rates which influences their exports and therefore their recovery negatively. On the one extreme China continued to manage their exchange rate regardless of heavy international criticism whilst on the other extreme taxes are levied by Brazil on capital inflows. This paper will analyse various tactics available to authorities in BRICS countries to reduce volatility of their currencies and the proposal for a new international reserve currency.

1. Introduction

The year 2008 will be remembered when the world experienced the biggest financial crisis since the depression of the 1930's. The years that followed will be known for uncertainty regarding sustainable recovery. Various governments experienced escalating debt because of stimulatory policies and a reduction in income. The consequence of these developments was currency volatility. International investors adjusted their risk profiles regarding BRICS countries since the crisis and these countries received billions of new investments. Various emerging countries' exchange rates appreciated accordingly relative to the USA $ which was to their detriment.

Exchange rates however fluctuated widely since the collapse of the Bretton Woods system of fixed exchange rates. During the past two decades the world

---

[*] Corresponding author. Adress: North West University, Van Eck Boulevard, Vanderbijlpark, 1900 South Africa, Tel :0721334638, 016 – 9103362, E-mail: andre.mellet@nwu.ac.za

witnessed two waves of capital flows that influenced specifically emerging economies. The first wave was in the 1990s which culminated in the Asian crisis in 1998. The second wave began in 2003 and culminated during the global financial crisis of 2008. These two periods of large inflows to emerging countries mirrored each other due to the availability of external capital and risk adjustments of investors towards emerging countries. These big inflows to emerging countries created important policy challenges in response to the surge of international capital.

This abundant liquidity available in the international market poses various challenges for the policy makers of BRICS countries because of currency appreciation pressures. These capital flows may increase financial integration in the world, but it challenges policy makers to address the impact of these inflows in the different domestic economies. Various challenges exist, namely how to address the over-heating of the economy and inflated asset values, the loss of competitiveness in exports, vulnerability to capital inflows and possible reversal of these abrupt inflows, the impact on domestic interest rates because of a changed liquidity scenario and policy measures regarding official reserve accumulation.

The G20 finance ministers stated after their meeting in February 2011 the need to combat exchange rate volatility and misalignment of exchange rates amongst countries. The G20 countries are dedicated towards greater exchange rate flexibility and reiterated the importance of improvements in the international monetary system to be implemented in order to avert unexpected shifts in capital flows and exchange rate fluctuations. The Chinese government officials and the USA government officials disagreed about the method and timeline of the measures to eliminate misalignment of exchange rates amongst countries. Governments in the world reacted differently to mitigate the risks in emerging markets. The France minister of finance called for a seminar in Shenzhen countries end of March 2011 regarding the reform of the dollar-dominated global monetary order. China continues to manage their exchange rate regardless of heavy international criticism whilst on the other extreme taxes are levied by Brazil on capital inflows. The South African Central Bank (SARB) relaxes foreign exchange controls and continuous to increase foreign reserves.

Volatility creates uncertainty regarding international trade and uncertainty regarding the risk profile to invest in BRICS countries. The question remains how to address these waves of capital inflows that pose macroeconomic challenges for policy makers in BRICS economies. The Bank of International Settlements established the Committee on the Global Financial System (CGFS) in November 2009 to examine macroprudential policy issues that face central banks after the 2008 financial crisis. The International Monetary Fund also established research groups to assess the new risks that face BRICS countries. Aspects that are researched are for example policy options available to address capital inflows, the benefits of different policy responses and new macroprudential measures.

In this research the reasons for volatility and the macroprudential measures available to monetary authorities are analysed. Firstly, the determinants that influence exchange rates will be briefly referred to. Secondly, a brief referral to the main economic theories in foreign exchange will follow. Thirdly, policies available for emerging countries will be analysed. Fourthly, the BRICS countries will be individually analyzed with specific referral to monetary policies of individual

countries. In conclusion, available policies of BRICS countries will be summarised and new challenges will be addressed.

2. Determinants influencing exchange rates

Various participants in the economy, for example importers, exporters, investors and policy makers are all concerned with the behavior of exchange rates according to (Takaendesa, 2006).Two general approaches can be identified to measure currency exposure according to (Scott, 2004). Accounting exposure is the first approach that is concerned with the proposition of specific accounting rules that deal with the handling of accounting items which are denominated in foreign currency. Economic exposure is a broader concept that measures the degree to which the current value of the balance of payments will change if the exchange rate changes. Various determinants influence the exchange rate value and each will be briefly discussed.

Inflation

Inflation is the rate of change in prices of goods and services, where the price level is the cumulative figure of past inflations. One of the biggest consequences of inflation can be seen as a constant increase in the money growth, whilst a reduction in the money growth will lead to lower inflation rates (Mohr and Fourie, 2004). Various countries in the world adopted the inflation targeting method which relies on a systematic assessment of future inflation. If domestic expectations increase, the domestic currency loses purchasing power which relates to a depreciation because the inhabitants of a country increases their purchasing of goods and services at the current lower price levels.

According to (Dornbush, 2009) the exchange rate can be seen as the price for a foreign currency which can be determined through the demand for money. The relationship between exchange rates and inflation rates is negative according to (Mishkin, 2001). A negative relationship occurs due to depreciation in the exchange rate, which will increase the cost of imports and therefore the rate of inflation. The inflation rate is also counteracted by an appreciation in the exchange rate. Exchange rates must be exogenous to have direct effects on inflation. According to (Walsh, 2003) a domestic monetary expansion causes the exchange rate to depreciate which causes the inflation rate to increase.

Interest Rates

Interest rates are the cost of money or it is the yearly price received by an investor from the investment house for the amount invested. Ultimately, according to (Dornbush, 2009), the interest rate influence the growth potential of a country. Policy makers have also the ability to manage the real exchange rate level which will have a direct impact on the current account balance.

Central banks steer inflation towards the target range through different monetary tools of which the interest rate level is the main tool. (Akinboade 2001) states that in order to reduce inflation, interest rates are manipulated by central banks. This strategy is costly in terms of output and employment creation. As central banks manipulate the interest rate level to reduce the rate of inflation, the higher interest rate level attracts foreign capital flows. Foreign investors compare

interest rates amongst countries which is an exogenous factor for the domestic economy.

Exports and Imports

The current account balance, which is part of the balance of payments for any given country, is the difference between exports of goods and services (and other income received from abroad for example dividends) and imports of goods and services (and other income transferred abroad). According to (Mohr, 2005) a current account deficit is often regarded as an indication that a country is living beyond its means. Countries with large current account deficits in the long run experience exchange rate depreciation which could correct the deficit over time.

The current account balance serves as the basis for equilibrium exchange rate analysis and is an internationally accepted indicator which is calculated as the current account ratio relative to the GDP ratio (Xiaolian, 2010). The IMF uses this approach to access member countries' exchange rates. The size of the gap between the current account balance and the current account norm indicates the degree of undervaluation or overvaluation. The current account balance is also determined by changes in price competitiveness, economic growth of trading partners and income growth in the domestic country.

Exchange rate policy

The exchange rate policy pursued by a country can be classified in three broad categories. When making a regime decision, all countries integrated in the financial system must choose upon a fundamental basis (Hishamh, 2009). It is a choice between more or less control over domestic monetary conditions.

The first category is a floating regime which is applicable for more developed countries combined with well rooted financial markets. It implies less control over external prices and greater volatility in the exchange rate is experienced. Secondly, a fixed regime which is more advantageous for a less developed country, especially if the capital account is relatively closed and if trade is dominated by other countries. It implies less control over interest rates and money supply (which affects inflation and growth). Thirdly, an intermediate regime that allows some degree of control over both domestic monetary conditions and external prices.

The regime choices according to literature are based on various factors, for example the size of the country, openness of trade, the size of the tradable sector, the structure and amounts involved of trade partners, capital account openness, the development of the domestic financial markets, etc. Various advantages are achieved under a flexible or managed regime relative to a fixed regime according to (Salvatore, 2001). Firstly, a country does not need to concern itself with external balances and is thus free to utilize all policies at its disposal to achieve domestic goals. Secondly, both monetary and fiscal policy can be applied to achieve the same goals. Thirdly, monetary policy can also be used to achieve other internal balances, for example higher growth. Fourthly, flexible exchange rates enhance the effectiveness of monetary policy. Fifthly, each country is allowed to pursue domestic policies aimed at reaching its own desired inflation-unemployment trade-off. Lastly, a flexible exchange rate regime imposes minimal government interventions (interventions occur only in the short-run) with maximum freedom in the financial markets

If countries decide to employ a fixed regime it may be for several reasons, but it is normally mainly for purposes of export and trade (Salvatore, 2001). If a country like China controls its domestic currency, they keep it normally low and do not allow appreciation. This help to support the competitiveness of its goods as these goods are sold abroad. Secondly, a low exchange rate is to the advantage for the country with low costs of production like China relative to a country like the USA with a stronger comparative currency. Thirdly, these higher earnings support a higher standard of living for the inhabitants of the country and a higher economic growth. Fourthly, countries like China also protect their economies against adverse exchange rate swings and reduce the impacts of any currency crisis abroad.

Productivity growth

The remuneration of labour is a significant element of the cost of production where the actual impact on costs depends on the correlation between the remuneration of labour and workers' contribution to production and hence productivity (Mohr, 2005). The production function provides a quantitive link between inputs and outputs and productivity is the ratio which measures the amount of output that is produced with a given amount of factor inputs.

Fazeer (2007) states that there is a negative relationship between productivity and a floating exchange rate which can be rationalized by the fact that firms in open economies face two types of shocks. The first shock is a financial shock, namely when wages paid to workers are preset and cannot be adjusted to financial shocks. An appreciation will reduce the profits of companies. The second shock is a real shock. This shock is regarded as a benefit that flexible exchange rates deliver, namely the currency will adjust to changes in the terms of trade. A negative real shock (which reduces exports) can be offset by the depreciation of the currency.

Unemployment

Unemployment is relatively easy to define but difficult to measure, especially in developing countries. Two definitions are used regarding the unemployment rate of a country (Mohr, 2005). The strict definition as formulated by the International Labour Organization is generally used in international comparisons in developed countries. The expanded definition is more suitable to developing countries. Although the causality is from exports to an adjustment in employment, it is important to note that if unemployment continuous to increase in a country because of exchange rate adjustments, a scenario of economic and political instability will develop which will cause a depreciation of the domestic currency.

Monetary policy

Monetary policy refers to a government's regulation of money supply and interest rates. It is typically executed by a country's central bank to achieve certain macroeconomic goals of which a stable inflation rate is the most important. According to (Scott, 2004) there are various measures to consider by monetary policy authorities, namely the inflation rate, the direction of the inflation rate, the ability to change interest rates and monetary stability.

The International Trade Institute of Southern Africa (ITRISA, 2009) states that central banks has long held the view that low inflation and exchange rate

stability will do more to enhance long-term economic growth than an easing of credit conditions would. Easing of credit conditions does alleviate the problems of low growth and unemployment in the short-term, but in the longer-term will only lead to higher inflation and higher production costs. Exchange rate fluctuations tend to reduce the flow of international trade and investments. (Salvatore, 2001) states that monetary authorities may intervene in the foreign exchange market, but if a freely floating exchange rate regime is implemented, historical data indicates that the currency fluctuated a lot over time.

Fiscal policy

Fiscal policy refers to the taxation and expenditure policies of the central government of a country. Fiscal policy includes various goals, for example to maintain macroeconomic stability, to promote growth and to attain a fairer distribution of wealth. In practice, fiscal policy affects a number of macroeconomic variables such as aggregate demand, income distribution, resource allocation and economic activity as a whole.

The effect of monetary policy under flexible exchange rates is qualitatively the same as the effect of fiscal policy under fixed exchange rates (Salvatore, 2001). Fiscal policy impacts both directly and indirectly on a number of monetary transmission channels and thereby has implications for the implementations of monetary policy. Various channels exist whereby fiscal policy affects monetary policy, for example domestic demand, interest rates and the inflation rate. (Salvatore, 2001) states that under a fixed exchange regime and elastic short-term international flows, fiscal policy is effective whereas monetary is ineffective. If flexible exchange rates exist, the opposite is true. A close relationship exists between monetary and fiscal policy to influence macroeconomic variables. If no coordination exists, then these two policies neutralize each other.

Foreign direct investment

Countries that experience sustained capital inflows have a history of higher economic growth. Foreign direct investment (FDI) is a component of the balance of payments. It represents the investment of foreign assets into domestic structure, equipment and organizations. It does not include foreign investment into the stock markets. From a macroeconomic perspective, FDI is more stable than portfolio investment and is the preferred type of investment. Equity and bond investments tend to be highly volatile and speculative. FDI's relative stability and long-term character make it the preferred source of foreign capital for emerging economies. Historical data indicates that host countries with a high component of FDI experienced less overall volatility in investment flows and also a more stable exchange rate.

Volatility

Given the persistent effects that changes in the exchange rate can have on economic conditions, policymakers naturally want to understand what can plausibly be done to limit exchange rate variability. Volatility refers to the spread of all likely outcomes of an uncertain variable. Changes in the exchange rate and its volatility affect export earnings in a negative direction. The exchange rate regime that a country chooses to adopt depends on the degree of financial development (Fazeer, 2007). In countries with underdeveloped financial sectors, the volatility of

exchange rates induced by a flexible exchange rate regime reduces economic growth.

Other determinants

The abovementioned determinants by no means constitute all the determinants that influence the exchange rate of a country. There are other determinants that also influence exchange rate changes, for example movements amongst major currencies, political or economic instability, changing prices of commodities and risk profiles of investors that change towards countries with financial problems (PIGS countries and negative capital flows) and emerging countries (BRICS countries and positive capital flows).

Movements amongst major currencies cause changes in BRICS countries' exchange rates which is an exogenous change. If the PIGS countries for example experience financial problems, the Euro depreciates against the USA $. BRICS countries' exchange rates adjust towards the USA $ and the Euro without any domestic cause or policy change by their own monetary of fiscal authority. If the USA $ depreciates because of escalating debt, BRICS currencies appreciate against the USA $. This appreciation put strain on their trade balance and their output growth. This appreciation may however reduce their inflationary pressures.

Political and economic instability is another cause that can change capital flows. If instability prevails, investors withdraw their capital and the currency depreciates. Perceptions and sentiment, for example the reduction in the USA credit rating during August 2011, also influence investors' decisions to move capital. Lastly, risk profiles that changed positive towards emerging countries and BRICS countries in particular, created an exogenous inflow of capital and thus an appreciation of the domestic currency if a floating regime exists. This exogenous behavioral change is not necessarily what the host country needs and what the monetary and fiscal authority policies intend to achieve.

3. Keynesian and other theoretical views regarding exchange rates for BRICS countries

Keynesian views

The exchange rate regime that most economists and the International Monetary Fund consider as ideal for emerging countries is one with a largely unregulated capital market, where capital mobility is absolutely unrestricted and where a flexible exchange rate exists (IMF, 2002). Keynesian economists believe that capital management techniques must be introduced together with an exchange rate system that prevents excessive exchange rate fluctuations in order to create macroeconomic stability.

This is easier said than done. The type of exchange rate regime and the relaxing of capital controls in emerging countries is again an important debate after the 2008 world financial crisis. The world experienced various capital instability scenarios since the 1990s where various emerging economies lost capital. Examples where the Mexico crisis (1994-95), East Asia (1997-98), Russia (1998), Brazil (1998-99) and the Argentina crisis in (2002). The question is if capital account liberalization and financial integration have brought risks (for example contagion) to emerging countries creating a more unstable environment? Another

question arises, namely which exchange rate regime and capital account convertibility is appropriate for emerging countries to reduce volatility?

Keynes' theory related to the monetary system is the creation of an environment to maintain full employment and price stability. Keynes stated that the creation of an international liquidity currency was an essential condition to assure the adequate elasticity of the money supply to increase the demand for investment (Ferrari-Filho, 2008). Keynes arguments about an exchange rate regime are that it must create price stability. Secondly, he recommended a fixed but adjustable exchange rate regime to reduce uncertainties in the market place and thirdly, he recommended a fixed but adjustable exchange rate regime for a world of open capital movements (Ferrari-Filho, 2008).

Post Keynesian analysis, therefore in a post-Bretton Woods world, argues that international capital movements occur because of a combination of volatile exchange rates and financial liberalization. According to this viewpoint, capital mobility is more unstable than stable as it increases the likelihood of financial and currency crisis which make it difficult for any domestic authority to manage their different economic policies. Financial instability and speculative attacks on various domestic currencies must therefore be expected. This economic school argues that the flow of international capital must be controlled and that complimentary policies must be implemented. The question that arises is how can this be done?

According to Tobin (1978) the main macroeconomic issue is not the choice of a specific exchange rate regime, but the excessive short-run capital mobility that reduces the autonomy of monetary authorities world wide to manage domestic employment, output and inflation goals. He stated that "*the mobility of financial capital limits viable differences among national interest rates and thus severely restricts the ability of central banks and governments to pursue monetary and fiscal policies appropriate to their internal economies*".

Purchasing power parity

A concept which is often used to explain and predict movements in the exchange rates is the purchasing power parity (PPP). According to Mohr (2005) the PPP between two countries is the amount of units of the one country's currency which provides the holder the same purchasing power as one unit of the other country's currency. PPP can refer either to parity between two countries (a bilateral comparison) or to parity between the country and a group of trading countries (a multilateral comparison).

Two types of PPP can be distinguished, namely absolute and relative PPP. In the first instance, the equilibrium exchange rate between two countries is set by the ratio between the price levels in these countries. The latter example is about changes in exchange rates that reflect differences in relative inflation rates. Analysis of the absolute PPP helps to forecast changes in the exchange rate.

There are however numerous arguments against the PPP because of the fact that a range of economic forces can cause great and long-lasting fluctuations in the real exchange rate over time. The validity of the long-run PPP may depend according to (Scott, 2004) if the price index includes both tradable and non-tradable goods which can create a bias into the calculation if there are productivity differences between countries. (Copeland, 1989) however states that whether true or not, PPP is an important benchmark for the analysis of exchange rate movements particularly concerning international competitiveness. If the level of

prices is a reasonable accurate index of the cost of production in a country, then the ratio of price levels for any two countries will serve as a measure of relative competiveness.

4. Policies available for emerging countries

The impossible trinity paradigm exists for any open economy all the time, namely the inability to target the exchange rate, to manage an independent monetary policy and to allow full capital mobility simultaneously. BRICS economies experience exogenous capital surges which make the management of their domestic macro economy more cumbersome. These surges in capital may complicate their macroeconomic management as their economies are not always able to adjust to the exchange rate volatility or appreciation that is generally experienced.

Various policy options are available to BRICS countries authorities' in response to the liquidity expansion and capital inflows that they experienced since the early 2000s. The policy responses to reduce the risks of a continuation of capital inflows depend on the specific conditions in each emerging country. A brief summary of options available follows which are available to emerging economies (IMF, 2010).

Exchange rate adjustment

The monetary authorities of emerging countries can use the exchange rate as an automatic stabilizer if an undervalued exchange rate exists. The exchange rate can be allowed to adjust towards equilibrium to reduce the risks of the capital inflows. If the exchange rate is not misaligned, the appreciation of the currency has a serious negative repercussion because the country looses its competitiveness in its tradable sector. In countries with a fixed exchange rate regime, the need to preserve the credibility of the peg excludes the option of any temporary changes in the exchange rate level.

Intervention

Monetary authorities may intervene to slow an appreciation of the exchange rate. Sterilization is the option through which a rise in net foreign assets is offset by a decrease in net domestic assets to keep the monetary base constant. The sterilization of liquidity injected by intervention when reserves are increased may cause inflation pressures and must be addressed. Risks regarding sterilization may also cause further inflows if the differential between domestic and foreign rates is maintained. Other measures of sterilization may be done through open market operations to reduce the monetary impact.

Monetary policy

The monetary authority may narrow the interest rate differential between foreign and domestic interest rates to reduce the carry trade potential. This policy measure is limited if the domestic inflation rate is in a rising cycle. The support of restrictive fiscal policy is required in countries where inflation is high. Monetary policy may also increase the reserve requirements of financial institutions. If the remuneration of reserves is close to market rates, the cost of sterilization will increase which can limit the ability of this policy measure for central banks.

Fiscal policy

Restrictive fiscal policy can support monetary policy by reducing the budget's financing needs. A restrictive fiscal policy can also reduce the creation of asset bubbles by lowering aggregate demand. A restrictive fiscal policy adjustment is not always feasible, especially if the domestic real growth rate is low. The lag time of fiscal policy must also be considered. In a country with a fixed exchange regime, fiscal policy may be an effective tool.

Prudential regulation and supervision

Prudential ratios together with conventional policy measures for example liquidity ratios which differentiate according to currencies or reserve requirements with different maturity dates, is useful to reduce the impact of capital surges. Adequate supervision of such regulations also helps to reduce systematic risk in the financial sector. The ability of such supervision is often limited by capacity constraints. Measures to reduce the external borrowing of banks can also be used to reduce capital inflows from abroad. These measures can help to reduce rapid credit growth in the financial sector or to prevent the dollarization of the bank sector's balance sheets.

Liberalization of capital outflows

Countries that experience big capital inflows may liberalize existing restrictions on capital outflows. Such a relaxation of capital controls on residents' outward investment help to alleviate appreciation pressures without adversely affecting financial integration of the economy. Adequate prudential regulation and risk management procedures should be in place for institutional investors' outward investment. The liberalization of outward investment should be based on longer-term expected flows and not only on short-term surges in capital flows.

Capital controls on inflows

If the available policy options are not sufficient to reduce capital surges, capital controls may be an option. If the capital inflows is however of a more fundamental nature, the adjustment of other macroeconomic policies is a better option. These controls are rarely successful to reduce capital surges, but it can alter the composition of inflows toward longer-term maturities.

There are two main groups of capital controls, namely market-based and administrative controls. Various factors influence the decision, for example the aim of the controls to lengthen the maturity structure, the type of flows involved and the experience of the authorities to manage these controls. Firstly, market-based controls increase the cost of the capital transaction. These controls are generally transparent and do not prohibit transactions, but only discourage capital flows by increasing the cost. These controls can become very complex to administer as the number of rates, withholding periods and exemptions increase.

Secondly, administrative controls are normally less transparent. These controls restrict capital transactions and transfers of funds through outright prohibitions or explicit quantitative limits. A transaction normally involves the approval of the central bank personnel and occurs often on a discretionary basis. These controls impose administrative obligations on the banking system and require adequate trained people in the central bank.

### Conclusion on policy mix available to BRICS countries

The appropriate policy response to a capital surge depends on a variety of specific circumstances in various countries. The stage of the business cycle and the prevailing fiscal policy as well as the persistency of the capital surge all play a role when policy measures are analyzed for implementation. Certain general conclusions can be drawn after empirical studies were done in emerging countries. Firstly, according to (Claessens, 2006) countries with relative high current account deficits are more vulnerable to a sharp reversal of capital surges because they were particularly affected by the increase in aggregate demand and the real appreciation of their currencies. Secondly, a public expenditure restraint during such periods of capital inflows contributes to a lower real exchange rate appreciation as well as a better GDP growth after the surge. Thirdly, a policy of resistance to nominal exchange rate appreciation is in general not effective to prevent a real appreciation and has often been followed by a sharp reversal of capital inflows. Fourthly, restrictions on capital inflows in general have not been associated with lower real exchange rate appreciation.

5. BRICS exchange rate examples

Brazil
Since the 1999 Brazilian currency crisis the currency depreciated for a couple of years before it stabilized and continued to appreciate to the USA $ except for the 2008 USA financial crisis.

Figure 1: Brazil Exchange Rate and Stock Market
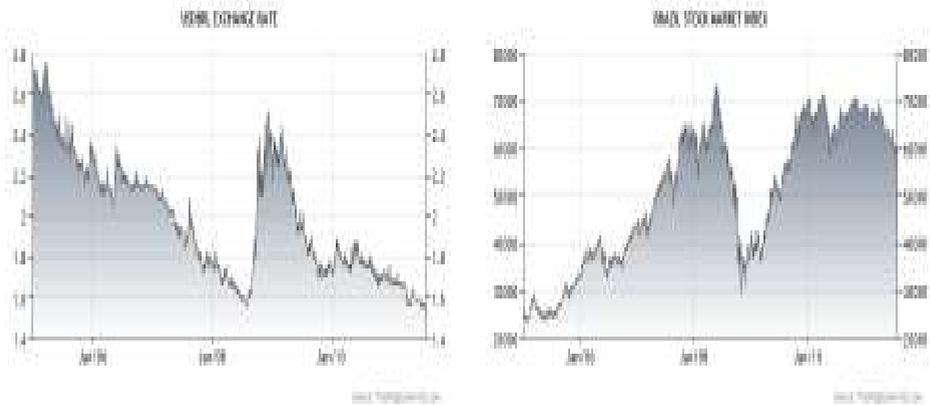
Since early 1990s the Brazilian economy had a low and volatile growth history. Various factors influenced this low growth, for example high inflation in the early 1990s, external vulnerability caused by financing needs of the balance of payments until early 2000s and high real interest rates in the early 2000s. After decades of high inflation, investment was low but it changed with the implementation of the Real Plan in the 1990s. The result of the Real Plan was a tight monetary policy to bring inflation down (Mallick, 2009) but these measures caused the nominal exchange rate to appreciate. After the 1999 Brazilian currency crisis the monetary authorities implemented various new norms that resulted in

financial liberalization, for example reduction of both the minimum average maturity for external loans and the financial tax on capital inflows, the elimination of the restrictions on investments in securities by foreign investors and the simplification of the procedures related to capital remittance to other countries (De Paula, 2007). Since then Brazil experienced a more stable economic development scenario.

Empirical results suggest that these changes resulted in greater exchange volatility and higher interest rates, probable as a result of the reduction in barriers to capital outflows. The reasons for their exchange rate vulnerability are not clear, but the fact is Brazil experienced exchange rate volatility since the 1990s and especially after 1999 whilst they were dependent on foreign capital to achieve balance of payments equilibrium.

Russia
Since the East Asian and 1998 Russian crisis the Russian currency depreciated for a couple of years before it stabilized and continued to appreciate to the USA $ except for the 2008 USA financial crisis.

Figure 2: Russia Exchange Rate and Stock Market
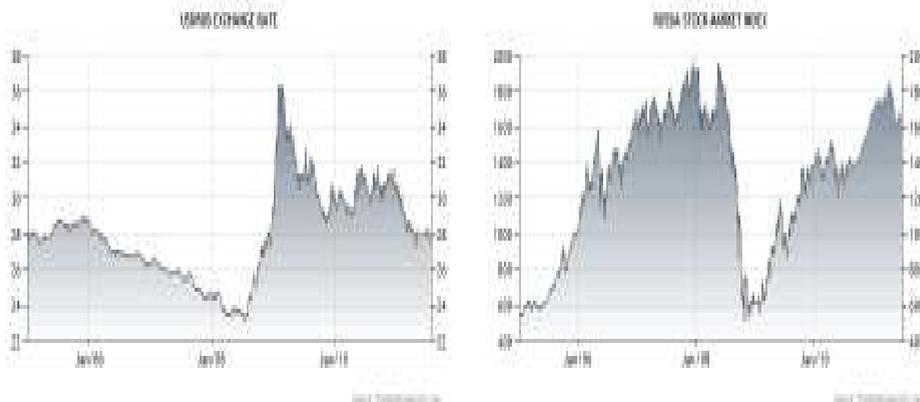
The main reason why the Russian economy performed badly in the early 1990s was related to the transition period from a centralized economy to a market economy. This political change did not lead to a true independent Russian monetary authority. Some of the independent republics kept on using the Ruble and central banks of those republics conducted their own credit policies (Mallick et al, 2009). In 1995 the Russian economy began to stabilize, and a new law of the Bank of Russia provided a degree of legal independence. This law allowed the monetary authority to introduce a pegged exchange regime with a crawling band against the US dollar.

Various other factors also contributed towards that weak performance of the Russian economy during the period of transition. The Russian economy experienced large budget deficits because of government's inability to collect taxes and to contain expenditure. The negative market reaction against fiscal instability continued to put pressure on the exchange rate in the band and the monetary authorities decided in 1998 to allow the currency to float. Since 2000 the Bank of Russia's main goal was to reduce inflation and to achieve a positive real growth. The monetary authorities tried to "froze" the budget revenues from oil and gas

85

production in order to sterilize the expansion of the money supply. This sterilization policy had however negative consequences, because investments in infrastructure, high technology and manufacturing was underfunded. Since the adaptation of a floating exchange rate regime, the CBR pursued multiple economic objectives. The Russian government makes use of different capital controls on capital inflows and outflows from time to time, for example a requirement of permission to raise capital abroad. The government also established the Oil Stabilization Fund in 2004 to absorb the extra fiscal revenue – high revenues from oil, gas and oil products are therefore sterilized.

India

Since the East Asian crisis the India currency depreciated for a couple of years before it stabilized and continued to appreciate to the USA $ except for the 2008 USA financial crisis.

Figure 3: India Exchange rate and Stock Market
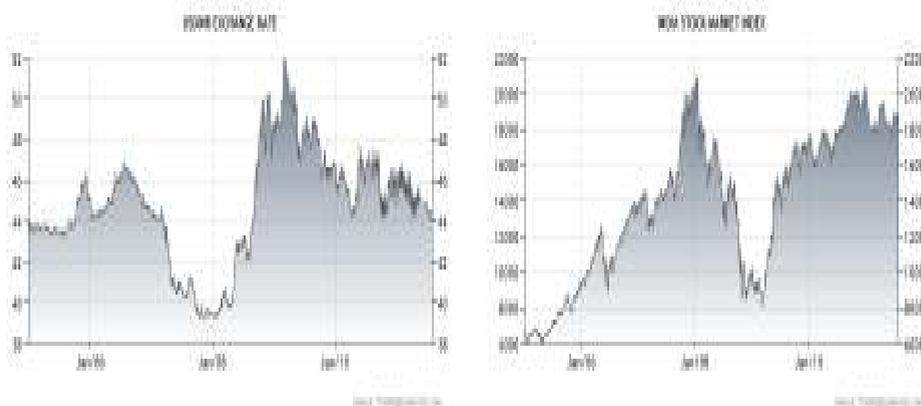
The basic objectives of the Reserve Bank of India during the recent two decades were to maintain reasonable price stability and to ensure an adequate expansion of credit to assist economic growth. During these two decades the monetary authority also maintained conditions to curb destabilizing and speculative activities against their currency. Since the mid eighties the broad money supply, M_3, emerged as the nominal anchor relative to output and prices (Mallick et al, 2009). During 1998 the Reserve Bank of India formally adopted a multiple indicator approach. The authority used different interest rates, capital flows, the exchange rate, credit supply, the fiscal position, inflation rate and output in the policy applications.

India experienced an improvement in their economic growth after their external debt crisis of 1991. After years of fairly low growth a dramatic change occurred after 1991 when the real growth rate increased to an average rate of 6.5% for the period 1990 – 2006 (De Paula, 2007). The economic improvement is a result of various factors, namely the improvement in consumer spending, strong productivity growth, the management of a well coordinated economic policy and the implementation of various reforms. Capital account liberalization occurred as part of broad based economic reforms. The exchange rate regime also changed

from a pegged exchange rate to a managed floating regime. The capital controls in India are more quantitive controls rather than market based controls. It also demarcates a clear distinction between residents and non-residents. The nature and pace of India's liberalization had an influence on the dimension and composition of the private capital inflows and outflows. The nature of their liberalization into the international financial markets caused a slow investment from abroad if India is compared to the other leading emerging economies.

China
The Chinese currency was very stable during the recent decade because of their managed currency regime.

Figure 4: China Exchange Rate and Stock Market

The monetary policy of China appears to be more complicated than advanced economies because the monetary authority applies both quantitive and price instruments in view of their imperfect monetary transmission mechanism. The law that governs the People's Bank of China states that the objective of monetary policy is to maintain price stability and the promotion of economic growth (Mallick et al, 2009). The People's Bank of China does not have an operational target as their main indicator of monetary policy. They use short-term interest rates as well as reserve requirements for banks to influence credit lending by banks and therefore the inflation rate. Since the end of the 1970s the exchange rate regime changed. Initially it was centralized and fixed. During the latter half of the 1980s the exchange rate was duel. There existed an official rate which the monetary authority adjusted on a periodic basis and a market determined rate which existed on a relatively depreciated level compared to the official rate.

In 1994 the official rate devaluated and unified with the exchange rate and a managed float exchange regime was adopted. The exchange rate in recent years is considered to be devaluated. China experienced an accumulation of reserves since the beginning of the 1990s as a result of a deliberate foreign reserves accumulation policy of the central bank, a continuation of a current account surplus and an increasing capital inflow, mainly FDI.

Economic reforms began in the late 1970s but were very slow. Changes began in some provinces before some measures were also implemented on a national basis. The growth rate of the Chinese economy was impressive for many

years. The average real GDP was 9.8% from 1990 to 2006 (De Paula, 2007). Investment in their real sector and a continuous growth in their exports is the driving force of this spectacular growth. China's expansion in international trade escalated after 2000 to such an extent that China became the biggest exporter in the world. The increase in their exports came as a result of further liberalization of their export licensing system, the increasing productivity in their industry and low wages.

South Africa

The South African currency depreciated to its lowest level during the 2001 currency crisis and continued to appreciate to the USA $ except for the 2008 USA financial crisis.

Figure 5: South Africa Exchange Rate and Stock Market
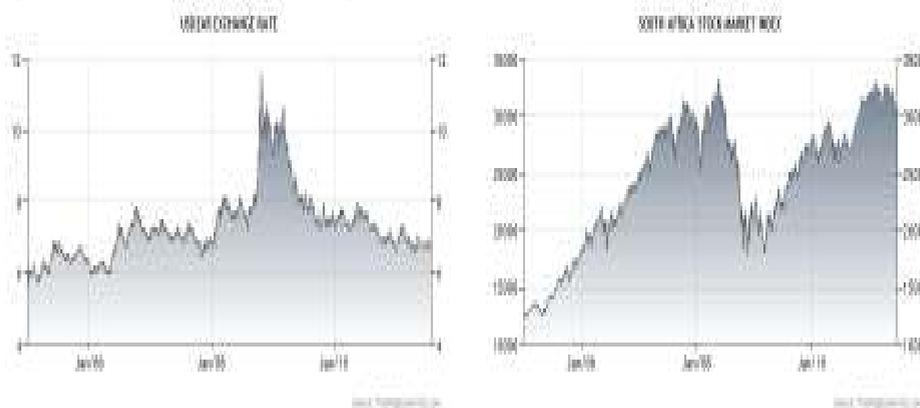
The growth rate for South Africa was low and erratic in the 1980s and 1990s. A high growth rate is one of the goals of the growth employment and redistribution (GEAR) policy implemented in 1996. Growth again was a main priority in the accelerated growth initiative (ASGISA) in 2006. In the new growth plan of 2010 the sustainability of growth is again questioned and addressed. After democratic elections in 1994 the authorities announced a policy of gradual abolishment of exchange controls. In 1995 the Financial Rand, an investment currency for non-residents, was abolished. The gradual relaxation of exchange control for domestic juristic persons and residents followed as the Minister of Finance announced some adjustments almost every year. The South African economy experienced a currency crisis in 2001 and the currency depreciated to the lowest level ever in December 2001. The floating exchange rate system experienced a relatively strong appreciation since 2001 as well as volatility in relation to other currencies. In recent years the central bank are involved in the purchasing of foreign exchange to increase foreign reserves and to manage the international liquidity in the market. The exchange rate is not an objective or target of SARB.

South Africa had different monetary policy regimes before 2000. The first regime was a liquid asset ratio-based system with quantitive controls on interest rates and the second regime was a cash reserves-based system with pre-announced monetary targets (Rossouw, 2009). These targets came under severe pressure during the period of financial liberalization since 1994. As a result, these

targets had to be supplemented by a diverse set of indicators, for example asset prices, credit growth fiscal stance, exchange rate, output gap and wage settlements (Mallick et al, 2009). The third regime was an inflation targeting system that came into being in 2000 which the aim to enhance accountability, predictability and transparency and also the adoption of a floating exchange rate system.

Summary of BRICS

If the graphs of the five BRICS countries are compared, the similarity is obvious (China is different because of their managed exchange rate regime). Most of the countries experienced an appreciation of their currencies until the 2008 international financial crisis. During the financial crisis the currencies depreciated and recovered again as risk profiles improved to continue their appreciation towards the USA dollar. If the indices of the various stock markets are compared, there is also similarity amongst the BRICS countries. All the indices imcreased until the financial crisis to decline substantially because of uncertainty in the international investment arena. All the indices began within a year after the crisis with a slow recovery phase to enter into another declining phase during August 2011 because of uncertainty in the USA regarding fiscal debt.

Although there are vast political and economic differences amongst the BRICS countries, there are also various similarities. Almost all of these countries had a financial crisis in the 1990s and went trough a process of political transformation. China, India, Russia and South Africa have been in more or less degree successful to manage their exchange rate regimes with restrictive capital account convertibility. They managed their macroeconomic policy in conjunction with an exchange rate regime to reduce instability. These experiences proved that capital control measures to protect the domestic economy against the destabilizing effects of international capital flows were to some degree a success.

Russia went through an unstable political transformation process with a very bad performance in their macroeconomics to a fast growing market economy. The process of change in China was less chaotic because the authority's relaxation of restrictions was very well managed. South Africa also went through a process of political change but this political transformation was fairly smooth. Brazil on the other hand adopted a more liberal economic approach which included a less interventionist approach. The result was high exchange rate volatility, higher interest rates and a poor economic performance.

The various experiences of the BRICS can be summarized as follows:

- Firstly, all five countries experienced a process of gradual capital account liberalization.
- Secondly, policy makers applied a variety of capital management techniques in relation to the overall aim of their economic policy regime.
- Thirdly, most of the BRICS experienced a surplus on their current account.
- Fourthly, the central banks accumulated foreign reserves to reduce speculative attacks on their domestic currency. This tactic enhanced the monetary policy makers' capability to influence the effective real exchange rate and to reduce volatility.
- Fifthly, most of the BRICS has some kind of a managed float exchange regime with the aim to preserve a stable effective exchange rate as an intermediate target as part of other macroeconomic policies geared towards employment and growth.

Table 1: Exchange rate regimes of BRICS

Country	Exchange regime	Monetary policy framework	Indicator exchange rate	Capital account convertibility	Exchange rate volatility
Brazil	Floating with dirty floating	Inflation targeting	Nominal bilateral	High	High
Russia	Managed floating	Multiple indicators	Nominal bilateral	Partial with restrictions	Low
India	Managed floating	Multiple indicators	Nominal bilateral & real effective	Partial with many restrictions	Very low
China	Semi-fixed	Various indicators	Real effective	Partial with many restrictions	Very low
South Africa	Floating	Inflation targeting	None	Partial with restrictions	High

Source: De Paula, 2007 and author's own research

6. Conclusion

Central banks in the BRICS countries reacted differently to mitigate the risks in financial markets. The appropriate mix of tools applied by central banks is influenced by the state of their financial markets and domestic economy, for example how close the economy is to full capacity, what is the level of official reserves available to intervene, the quality of existing prudential regulation and the scope for the currency to appreciate further without damaging the domestic economy. There exists no one strategy for all countries to reduce the destabilization of short-term capital surges (Ostry, 2010). From any individual country point of view, polices applied are normally some kind of mix between reserves accumulation, adjustments in either the fiscal and monetary stance as well as the strengthening of the prudential framework. In some countries it was necessary to implement capital controls as a legitimate component of the policy mix to reduce the impact of capital surges.

Keynes however stated that the creation of an international liquidity currency was an essential condition to assure the adequate elasticity of the money supply to increase the demand for investment. The different post Keynesian viewpoints are against the background of financial globalization. Conditions for greater economic interdependence must be created by the different authorities in order for their national economic policies to operate autonomously. Authorities in BRICS economies are challenged to introduce exchange rate management to assure domestic policy objectives and to promote a more predictable environment for domestic investment. Monetary authorities should implement capital controls to preserve the independence of their monetary policy, therefore countries should not have a fixed exchange rate regime. Capital controls to support macroeconomic stability should be added as and when necessary.

The growing economic power of the BRICS created a new international environment where it becomes impossible for the United States to resist a reshaping of the international monetary system. The Framework of the G20 leaders towards a process of mutual assessment of each other's policies is also step in the right direction. The creation of a new international reserve currency which is not connected to domestic deficiencies of individual countries for example high debt is a step in the right direction. A solution is to enhance the role of the Special Drawing Rights (SDR) of the IMF in international trade and finance.

The BRICS are likely to support reforms that should create a more stable international environment, based on a stable currency not linked to deficiencies of debt or any kind of historical perceptions. A new currency of some kind can help to improve international currency stability. This step in conjunction with better coordinated monetary policies in the G20 countries, improved financial regulation and coordinated G20 intervention can reduce future international instability and volatility in exchange rates and stock markets.

REFERENCES

Akinboade O.A., Niedermeier E.W., Siebrits F.K. (2001) South Africa's inflation dynamics: Implications for policy. Available:http://www.essa.org.za/papers. Date of access: 15 May 2011

Anderson A. (2011) SA spends R50 billion to stabilize currency. Business Day: 1, 28 March

Claessens S., Schmukler S. (2006) International financial integration through equity markets: Which firms from which countries go global? *Technical report, World Bank*

Copeland L.S. (1989) *Exchange rates and international finance*, Addison-Wesley Publishers, Chatlam Great Brittan

De Paula L.F. (2007) Financial liberalization, exchange rate regime and economic performance in BRICs countries. *Paper by ANPEC* (Brazilian Association of Graduate Programs in Economics) at the 35th Brazilian Economic Meeting

Dornbush R., Fischer S., Startz R. (2009) 10th ed. *Macro Economics*, Mcgraw-Hill Co, New York

Fazeer M. (2007) One Economics, Many Exchange Rate Policies. Available at : http://fazeer.wordpress.com/one-economics-many-exchange-rate- policies. Date of access:15 April 2011

Ferrari-Filho F., De Paula L.F. (2008) Exchange rate regime proposal for emerging countries: a Keynesian perspective. Journal of Post Keynesian Economics, 31(2) : 227-248

Hishamh H. (2009) Exchange rate Concepts IV: Forex Regimes, Economics Malaysia. Available at: http://econsmalaysia.blogspot.com/archive. Date of access: 10 March 2011

International Monetary Fund (2002) *World Economic Outlook*. Washington, DC, September

International Monetary Fund. (2010) Global Liquidity Expansion: effects on receiving economies and policy response options, *Global Financial Report*. Washington, DC, April

ITRISA (2009) International Trade Finance & Payment Institute of Southern Africa, Itrisia, Sandton

Mallick S.K., Sousa R.M. (2009) Monetary Policy and Economic Activity in the BRICS. *NIPE Working Paper 27/2009*. Available:http://eeg.uminho.pt/economic/nipe. Date of access:10 May 2011

Mishkin F.S. (2001) Inflation Targeting. Graduate School of Business, *Columbia University and National Bureau of Economic Research*. Available:http://budgetspeechcompetition.co.za. Date of access:12 June 2011

Mohr P., Fourie L. (2004) 3rd ed. *Economics for South African Students*, Van Schaik Publishers, Pretoria

Ostry J.D., Ghosh A.R., Habermeier K., Chamon M., Qureshi M.S., Reinhardt D.B.S. (2010) *Capital Inflows: The role of Controls*. IMF Research Department. Washington, DC, Feb.

Rossouw J. (2009) *South African Reserve Bank: History, Functions and Institutional Structure*, Publishing section SARB, Pretoria

Salvatore D. (2001) 7th ed. International Economics, John Wiley & Sons, New York

Scott J. (2004) *Exchange rate volatility: An analytical model*, Platinum Press, Vanderbijlpark.

Takaendesa P. (2006) *The Behaviour and Fundamental Determinants of the Real Exchange Rate in South Africa*. Fort Hare: Rhodes University. Dissertation - M Com.

Tobin J. (1978) A Proposal for International Monetary Reform, *Eastern Economic Journal*, 4(3-4): 153-159

Walsh C.E. (2003) 2nd ed. *Monetary theory and policy*, MIT Press, Cambridge USA

Xiaolian H. (2010) *Three characteristics of the managed floating exchange rate regime*. The people's bank of China, Beijing. Available: http://bis.org/review. Date of access: 21 June 2011

CREATION DE RICHESSE DANS LE SECTEUR FORMEL AU SENEGAL: QUELS PRINCIPAUX DETERMINANTS

Latif DRAMANI [*]
University of Thiès, Senegal

Resumé. Ce papier s'attache à appréhender les déterminants de la création de la richesse du secteur moderne au Sénégal. La méthodologie utilisée est inspirée de la théorie de la croissance endogène et plus spécifiquement de la méthode dite de « décomposition de la croissance ». Les résultats de l'étude mettent en évidence trois déterminants majeurs : le facteur travail mesuré par la rémunération des salariés, le facteur capital mesuré par la CCF et la productivité multifactorielle capital-travail. Une analyse plus fine des résultats obtenus montre une dominance des salaires dans la création de valeur ajoutée. Ce dernier résultat ne néglige pas pour autant la CCF et le progrès technique à travers la productivité multifactorielle, qui restent aussi des déterminants importants.

Classification JEL: C32, O17, O47

Mots-clé: secteur formel, productivité, capital, travail, croissance, progrès technique, productivité multifactorielle

1.1. Analyse du contexte national et problématique

La présente étude concerne uniquement le secteur moderne du Sénégal au cours de la période 1990-2007. Le choix de cette période se justifie par le fait qu'elle se situe après et durant une époque où il y a eu de grandes mutations économiques notamment :

- La crise économique des années 1980 caractérisée par une récession économique, une baisse de la croissance consécutive à une crise de liquidité et une aggravation de la pauvreté.
- La dévaluation de 50% du FCFA le 10 janvier 1994 pour ajustement structurel après la crise des années 1980.
- L'arrivée de l'Euro en monnaie scripturale en 1999 et en monnaie fiduciaire en 2002 : arrimage du FCFA à l'Euro.

Le Sénégal, situé en Afrique l'Ouest, compte 11 millions d'habitant avec une espérance de vie de 56 ans. Plus de la moitié représente des femmes (52%) et

---

[*] Corresponding author. Adress: UFR des Sciences Economiques et Sociales**,** Site VCN Thies None BP 967 Thiès, Senegal. Tél : (221) 33 952-21-21 Fax : (221) 33 952-21-21, Email : dramaniarmel@yahoo.fr

43% de la population ont moins de 15 ans (2004). Le Sénégal à pris son indépendance depuis 1960 et bénéficie d'une relative stabilité politique. L'économie du pays, qui reposée sur un tissu industriel d'huileries d'arachide, de phosphate, de la pêche et du coton s'est dégradée avec la baisse des cours mondiaux, la grande sécheresse des années 70 et le manque d'anticipation des pouvoirs publics.

Malgré leur bon suivi, les programmes d'ajustement structurel (PAS) ont fragilisé le tissu social. Le Sénégal fait parti des pays les plus pauvres, il occupe le 156ème rang sur 177 pays en 2006 au classement mondial. Le PIB/habitant est de 634 US $. Près de 54% de la population vit en dessous du seuil de la pauvreté selon le DSRP (Document de Stratégie de Réduction de la Pauvreté). La croissance économique, très faible dans les années qui ont précédé la dévaluation du franc CFA le 12 janvier 1994, a depuis lors repris sa progression.

Le taux de croissance du PIB de 4,7% l'an sur la période 2001-2005 reste toutefois insuffisant pour réduire rapidement la pauvreté. De surcroît, l'année 2006 s'est caractérisée par une dégradation marquée du cadrage macroéconomique national imputable, certes, au choc pétrolier externe, mais également à la chute drastique des activités des Industries chimiques du Sénégal (ICS) et aux importantes coupures récurrentes d'électricité touchant autant le secteur formel que l'informel. Par ailleurs, l'année 2007 est marquée par une forte inflation qui perdure. Ces cinq dernières années, le secteur moderne a contribué en moyenne à 47% du PIB national. Cette part, bien qu'étant inférieure à celle du secteur informel qui domine l'activité économique sénégalaise, tient toujours une place importante dans les comptes de la nation et constitue un indicateur essentiel de la croissance économique, d'où l'intérêt d'étudier ses déterminants afin de déceler les défaillances du secteur formel.

Dans le contexte de crise économique actuelle, les instruments de politiques économiques constituent les leviers sur lesquels le gouvernement peut agir pour changer le cours de l'économie. Les entreprises du secteur moderne, quant à elle, peuvent esquisser des stratégies susceptibles d'impulser une croissance forte et durable. Le Sénégal n'ayant pas une politique monétaire indépendante du fait de son appartenance à l'UEMOA, ne dispose alors que de sa politique budgétaire comme instrument (subventions, recettes fiscales). Sa « politique monétaire reste donc du ressort de la Banque Centrale des États de l'Afrique de l'Ouest (BCEAO) dont la monnaie, le franc CFA, commune aux pays membres, est rattachée à l'euro par un système de parité fixe. Le taux de change du franc CFA suit automatiquement les fluctuations de l'euro par rapport au dollar »[1]. La variation du PIB d'une année sur l'autre est l'indicateur officiel de la croissance après correction de l'inflation.

1.2. Objectifs

L'objectif principal de cette étude est de mettre en exergue les facteurs susceptibles d'agir sur l'évolution de la valeur ajoutée du secteur formel.
Les objectifs spécifiques sont les suivants :

---

[1] http://www.africaneconomicoutlook.org/fr/countries/west-africa/senegal/#statistics_table

- Explorer les déterminants de la valeur ajoutée selon les études théoriques et empiriques,
- Spécifier et estimer les fonctions de valeur ajoutée pour chaque macro-secteur
- Formuler des recommandations qui pourraient permettre au secteur moderne de créer davantage de richesse pour promouvoir la croissance économique du Sénégal.

1.3. Analyse et traitement des données

Les données qui vont servir à l'étude sont issues de la comptabilité nationale sénégalaise. Elles proviennent des comptes de production du secteur moderne par activité économique et sont exprimées en millions de francs CFA courants. Ces données sont annuelles et disponibles de 1980 à 2007, mais suite à une première analyse graphique de quelques indicateurs calculés à partir de ces dernières nous avons constaté entre 1980 et 1990 une évolution de la valeur ajoutée alors que la productivité du travail et celle du capital étaient stables. Et donc pour éviter ce problème qui pourrait être de nature structurelle ou dû par les consommations intermédiaires, nous avons préféré limiter notre étude sur la période 1990-2007, ce qui nous fait, au final, un échantillon de 18 observations.

Pour rendre compte à l'échelle économique de l'évolution de la valeur ajoutée ainsi que de celle des facteurs de production et des indicateurs; il a fallu déflater nos données puisqu'elles étaient enregistrées en valeurs dans les comptes nationaux. L'une des difficultés majeures dans cette étape a été le choix et le calcul des déflateurs pour la valeur ajoutée du secteur moderne et pour la consommation en capital fixe (CCF) car la comptabilité nationale sénégalaise n'en dispose pas à l'exception des indices prix à la consommation sur la période et les indices prix au logement de 1998 à 2007.

Pour faire face à cette préoccupation, nous avons émis certaines hypothèses en admettant comme déflateur de la valeur ajoutée du secteur moderne et des différents macro-secteurs, celui de la valeur ajoutée totale des secteurs formel et informel. C'est l'indice obtenu par le rapport valeur ajoutée totale secteur formel et informel compris (en milliards de francs CFA courants) sur valeur ajoutée totale secteur formel et informel compris (en milliards de francs CFA aux prix constants de 1999). Une autre hypothèse a été d'utiliser comme déflateur pour la CCF l'indice des prix FBCF des entreprises modernes. Pour obtenir cet indice, nous avons d'abord calculé les indices de prix « élémentaires » de la FBCF (base 1999) pour les produits les plus significatifs puis calculé la moyenne pondéré de ces indices « élémentaires » à l'aide des poids respectifs des produits significatifs qui sont calculés sur la période 2001-2003.

Les données de cette étude ont fait l'objet d'une analyse statistique descriptive et d'une analyse économétrique. Le logiciel économétrique Eviews a été utilisé pour les estimations économétriques.

1.4. Définition de quelques concepts

La richesse crée par l'entreprise

C'est en produisant des biens et services à partir d'autres ressources que chaque entreprise contribue à la production nationale de richesses. La richesse

ainsi créée est une richesse ajoutée. On raisonne en nature dans ce contexte, et donc le terme « ajoutée » n'est pas à prendre au sens arithmétique.

Les ressources nécessaires à la production de la richesse ajoutée d'une entreprise sont au nombre de trois :

- Le travail fourni par les acteurs de cette entreprise
- L'équipement productif, ou capital technique, à la disposition de l'entreprise
- Le capital financier, engagé dans le secteur par la société

L'ensemble des deux derniers est appelé capital de façon usuelle.

Il existe un quatrième facteur à prendre en compte : la consommation intermédiaire. La richesse créée par l'entreprise, qui s'ajoute à la production nationale s'entend nous l'avons dit en nature. Nous disposons maintenant des éléments permettant de déterminer la « dimension économique » correspondante : la valeur ajoutée.

La valeur ajoutée

Il existe une valeur marchande pour chacun des biens et services produits ou consommés par l'entreprise. Une évaluation respective de la valeur totale des uns et des autres aux prix du marché, c'est-à-dire au prix facturés, permet de déterminer la production et la consommation intermédiaire utilisée. A l'échelle de l'entreprise la valeur ajoutée se définit comme l'écart entre ces deux valeurs. A l'échelle d'un secteur, la valeur ajoutée correspond à la somme des valeurs ajoutées des entreprises qui le composent. « La valeur ajoutée est utile pour caricaturer un secteur et constitue une mesure de l'intégration de l'entreprise dans son secteur ».

Le secteur moderne ou formel

Le secteur moderne ou formel d'une économie est constitué des entreprises qui pratiquent une ou plusieurs activités officielles conformément aux lois et règlements, et qui payent leurs impôts. A l'opposé, on trouve le secteur informel qui regroupe une ou plusieurs activités souterraines ou clandestines que l'on pratique aux mépris de la loi, donc sans paiement d'impôts. Il faut rappeler que le secteur informel représente environ la moitié de la valeur ajouté créée dans le pays et emploi plus de 70% de la population active.
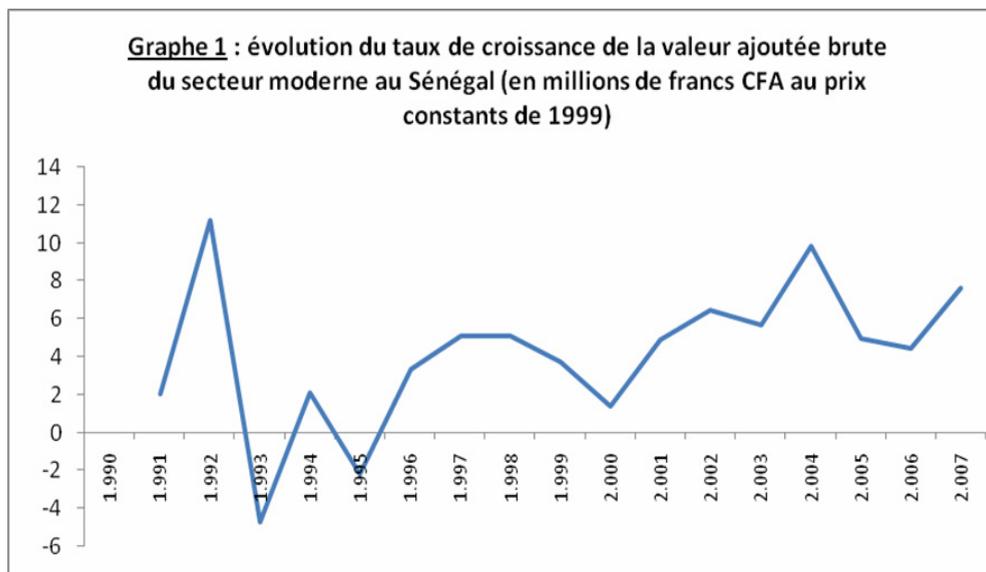
Dans le cadre de notre étude, le secteur formel du Sénégal est décomposé en 4 macro-secteurs : le secteur du commerce, le secteur des BTP et Annexes, le secteur de l'industrie et le secteur des services.

2. Faits stylisés : évolution de quelques ratios de gestion et de structure financière du secteur moderne sénégalais sur la période 1990-2007

2.1. La croissance de la valeur ajoutée et sa répartition par macro-secteur

Le taux de croissance de la valeur ajoutée illustré au graphe 1 a connu, sur la période, d'importantes fluctuations. A la suite d'une forte croissance de 11,2% entre 1991 et 1992, La valeur ajoutée du secteur moderne a enregistré une baisse de 4,71% entre 1992 et 1993 puis de 2,16% entre 1994 et 1995. A partir de 1995, elle n'a cessé de croitre ; cependant on note une légère croissance (1,37%) entre 1999 et 2000. Cette situation est a priori due à l'accroissement de la

valeur ajoutée dans l'ensemble des secteurs, singulièrement le commerce et l'industrie.

Graphe 1 : évolution du taux de croissance de la valeur ajoutée brute du secteur moderne au Sénégal (en millions de francs CFA au prix constants de 1999)

Source : Calculs de l'auteur à partir de données de l'ANSD

L'analyse par macro-secteur du graphe 2 met en exergue un accroissement dans tous les secteurs à l'exception des BTP, avec toutefois une importante progression dans le commerce où le taux de valeur ajoutée est ressorti à 32,4% en 2007 contre 29,1% en 2006. Comparé aux autres secteurs, le commerce affiche un meilleur ratio « valeur ajoutée/production » sur toute la période revue. Cette situation résulte de la maitrise relative des consommations intermédiaires. Le graphe 2 nous montre que la contribution de chaque macro-secteur à la valeur ajoutée brute du secteur moderne varie peu au fil des années. En moyenne, la contribution des différents macro-secteurs à la valeur ajoutée brute du secteur moderne au cours de la période d'étude est de 23,16% pour l'industrie, de 4,73% pour les BTP, de 16,43% pour le commerce et de 55,56% pour les services. Les services constituent donc le macro-secteur qui contribue le plus à la création de valeur ajoutée du secteur moderne.

Graphe 2 : Evolution du taux de valeur ajoutée par macro secteur (aux prix constants de 1999)
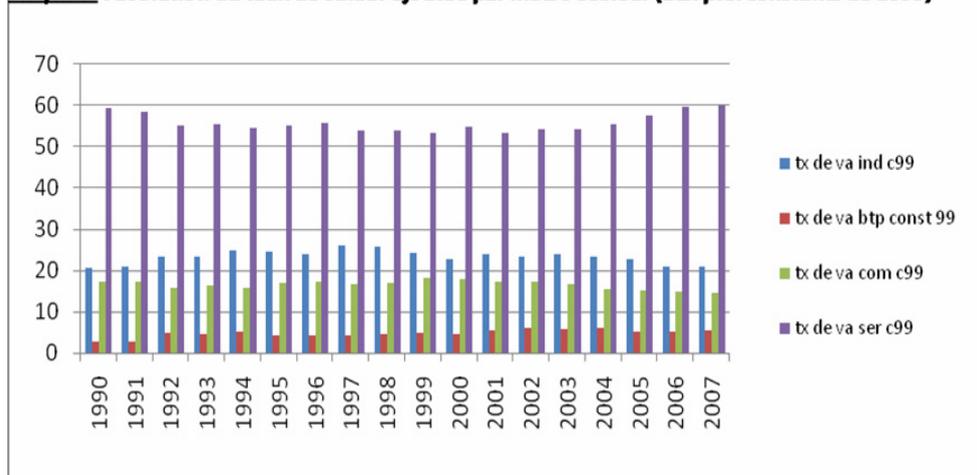
Source : Calcul de l'auteur à partir de données de l'ANSD

A la vue du graphe 3 ci-dessous, les services restent les principaux contributeurs à la création de valeur en 2007 avec 60% suivi de l'industrie 21% et du commerce 14%. On assiste donc sur la période à une contribution à la valeur ajoutée très inégale. Une comparaison de ces résultats à la contribution moyenne des différents macro-secteurs à la valeur ajoutée du secteur moderne sur la période 1990-2007 (dernier paragraphe de la page précédente) laisse paraitre une hausse pour les services et BTP et une baisse pour l'industrie et le commerce. Le comportement des services pourrait en effet s'expliquer par la bonne santé des Télécom. Quant à l'industrie, l'explication pourrait reposer sur les investissements réalisés pour renouveler l'équipement productif, l'acquisition de brevets et de nouvelles technologies, etc.

Graphe 3 : Répartition de la valeur ajoutée par macro secteur en 2007 (en million de FCFA aux prix constants de 1999)
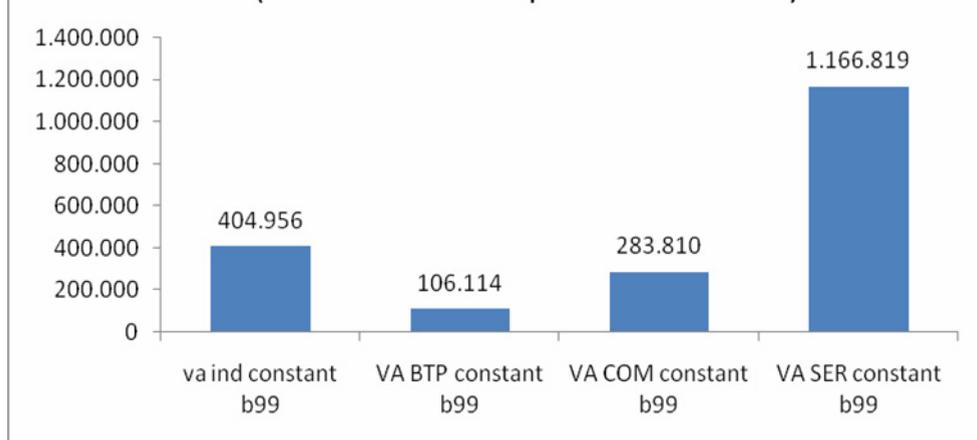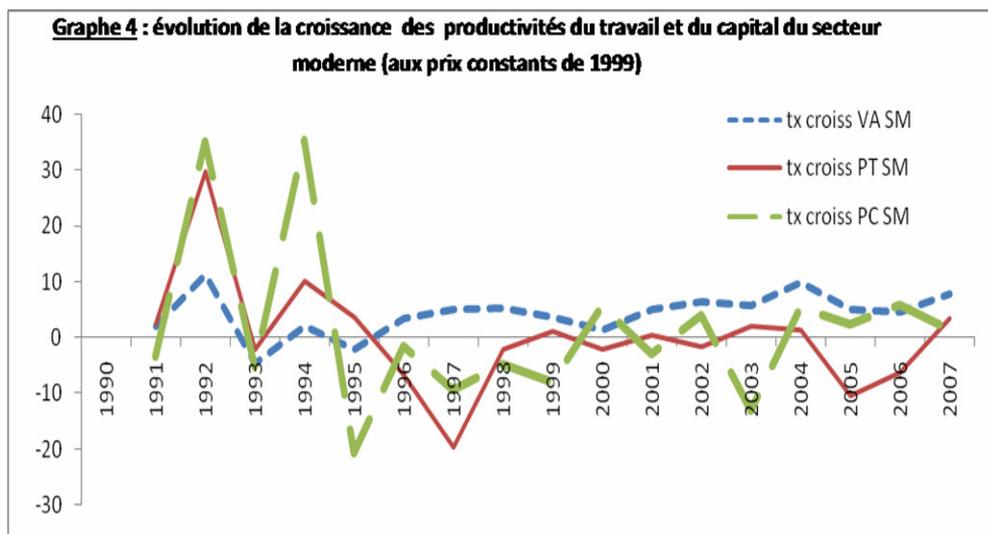
Source : Calcul de l'auteur à partir de données de l'ANSD

2.2. La productivité du travail et du capital

On observe sur le graphe 4 une instabilité de la croissance annuelle des productivités du travail et du capital (mesurées respectivement par les ratios « valeur ajoutée sur salaires » et « valeur ajoutée sur consommation en capital fixe ») du secteur formel qui en retour se traduit par une croissance mouvementée de la valeur ajoutée parfois non synchrone à l'évolution de la productivité des facteurs surtout celle du capital. Ces points atypiques se manifestent en 1997, en 1999 et en 2003. On notera a priori que le facteur travail impact le plus sur l'accroissement de la valeur ajoutée dans le secteur moderne.

Au niveau des services qui contribuent à 60% de la valeur ajoutée du secteur formel, on obtient la même tendance que précédemment concernant l'évolution des facteurs et celui de la valeur ajoutée excepté pour l'année 1997 où l'on assiste à une hausse de la valeur ajoutée suite à une décroissance de la productivité de chaque facteur (voir graphe 8).

Une analyse des résultats pour l'industrie (graphe 5) a montré qu'au cours des années, la plus importante contribution à la croissance (création de valeur ajoutée) pourrait provenir de la contribution quantitative de la main d'œuvre, suivie des services du capital sauf entre 1995 et 1998 où l'on a un point atypique. La croissance de la valeur ajoutée du secteur des BTP et celle du commerce semble être dépendante de la productivité des deux facteurs à l'exception de l'année 1997. Ces résultats sont illustrés par les graphes 6 et 7.
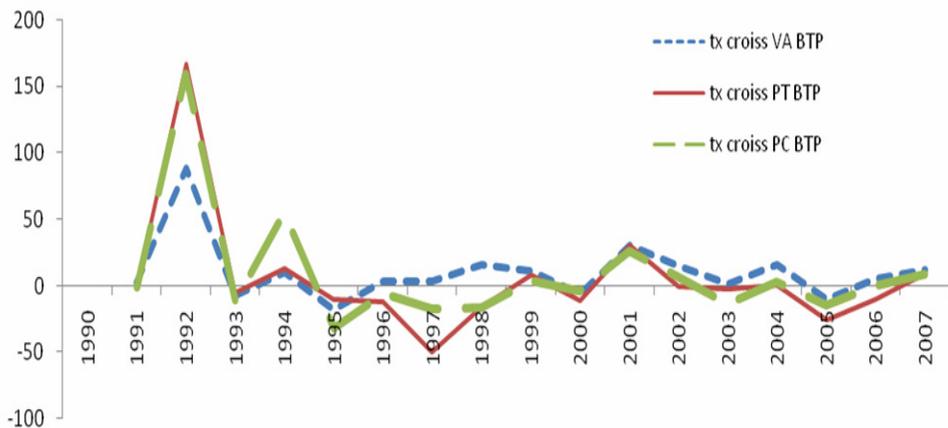

Graphe 4 : évolution de la croissance des productivités du travail et du capital du secteur moderne (aux prix constants de 1999)

Source : Calculs de l'auteur

Graphe 5 : évolution de la croissance des productivités du travail et du capital de l'industrie (aux prix constants de 1999)
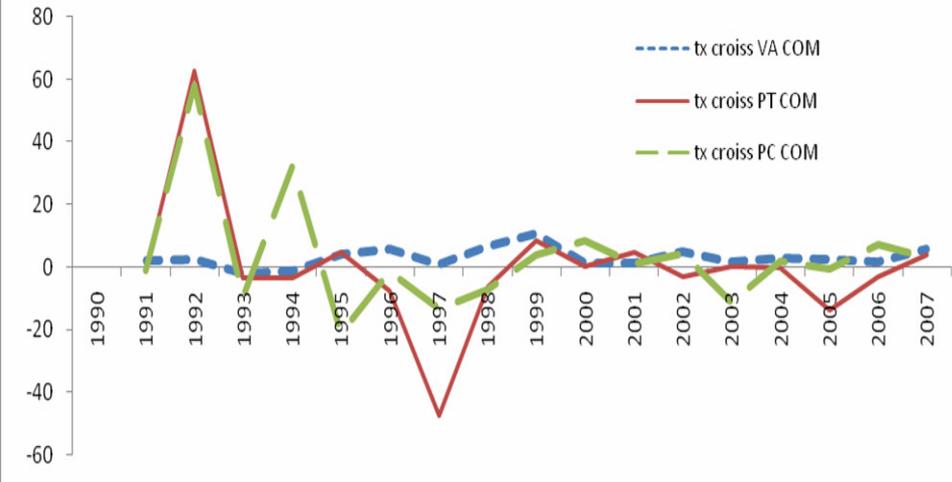
- - - - tx croiss VA ind
——— tx croiss PT ind
- - - - tx croiss Pc ind
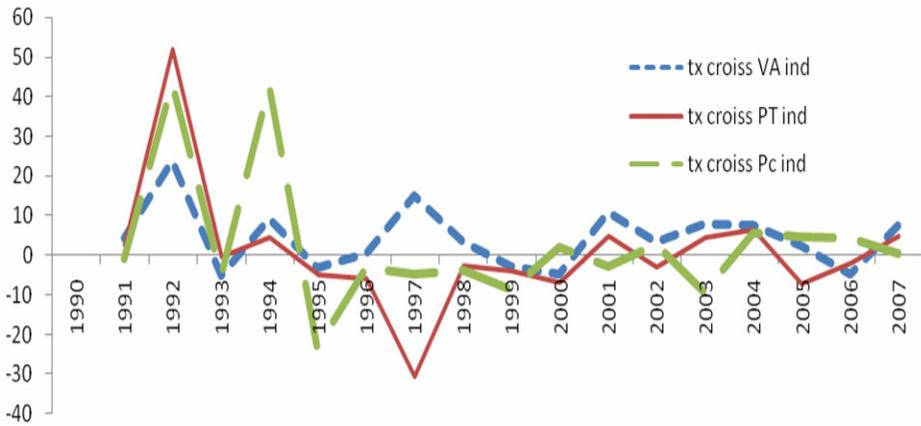
Source : Calculs de l'auteur

**Graphe 6 : évolution de la croissance des productivités du travail et du capital des BTP (aux prix constants de 1999)**

- - - - tx croiss VA BTP
——— tx croiss PT BTP
- - - - tx croiss PC BTP

Source : Calculs de l'auteur

100

Graphe 7 : évolution de la croissance des productivités du travail et du capital du commerce (aux prix constants de 1999)
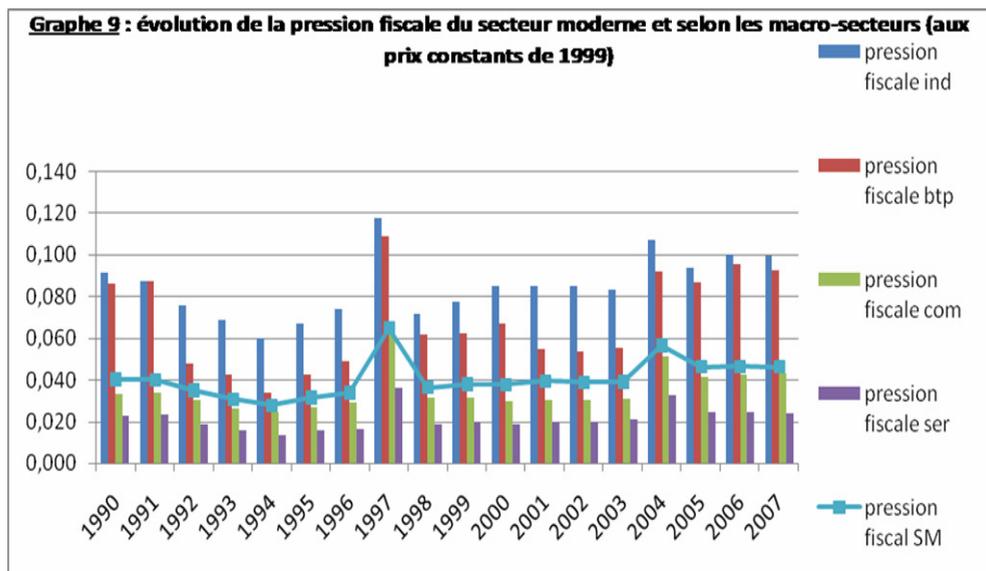
Source : Calculs de l'auteur

Graphe 8 : évolution de la croissance des productivités du travail et du capital des services(aux prix constants de 1999)
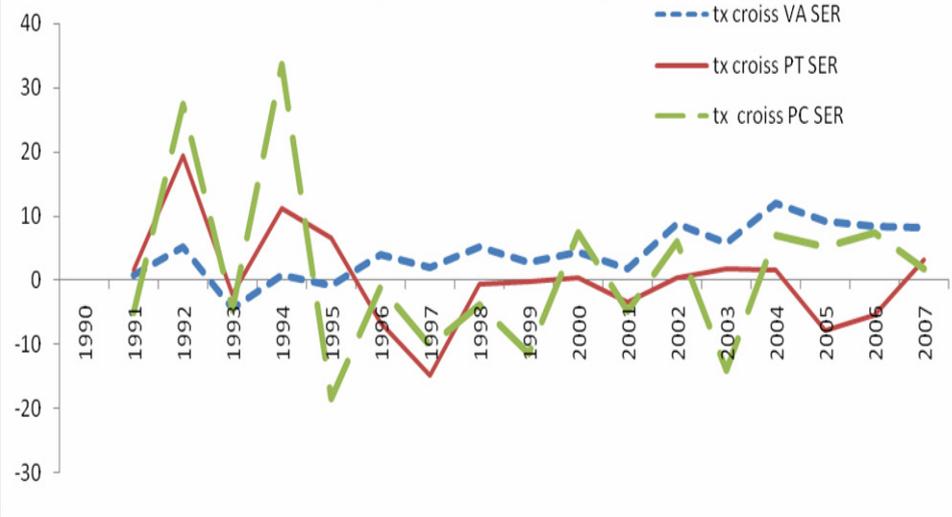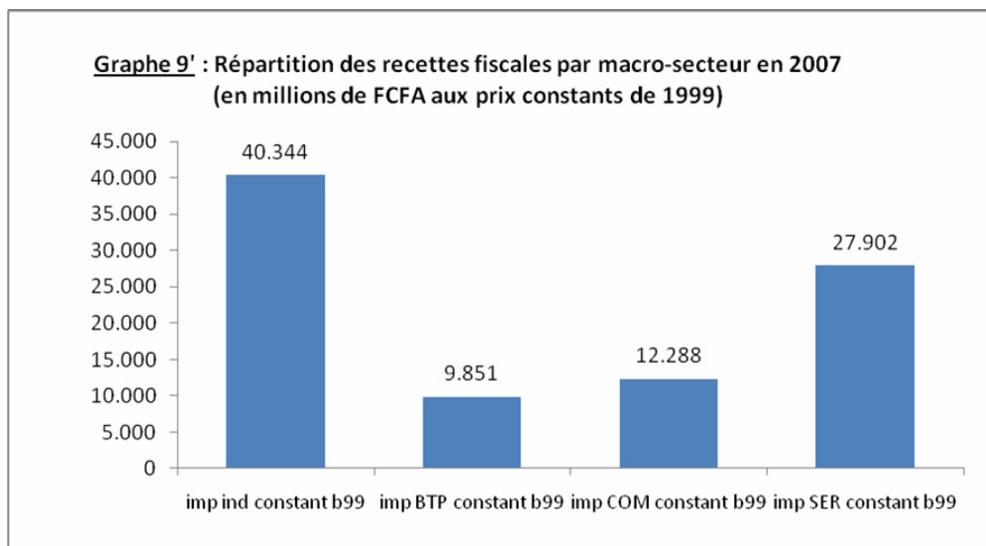
Source : Calculs de l'auteur

2.3. La fiscalité du secteur moderne

Depuis 2002, la pression fiscale du secteur moderne, mesurée par le ratio « impôt sur valeur ajoutée », a entamé un mouvement à la baisse. Entre 2006 et 2007, elle est passée de 4,61% à 4,04%. Cette baisse s'explique en effet par une croissance de la valeur ajoutée de 7,63% contre 6,99% pour les impôts collectés. En dépit de ce repli de la pression fiscale en 2007, les impôts collectés ont connu un relèvement pour atteindre 90,3 milliards de FCFA contre 84,4 milliards en 2006.

Graphe 9 : évolution de la pression fiscale du secteur moderne et selon les macro-secteurs (aux prix constants de 1999)

Source : Calculs de l'auteur

La répartition des recettes fiscales selon le secteur d'activité (graphe 5'), laisse apparaitre des disparités assez importantes. En effet, l'industrie reste la principale source de recette en 2007 avec 45% des impôts collectés, suivi du secteur des services (31%), du commerce (13%) et des BTP (11%). Cependant une analyse du ratio « impôt sur valeur ajoutée » illustrée au graphe 5 nous révèle qu'en moyenne la pression fiscale du secteur moderne est de 4% sur la période. Elle est à peu prés stable entre 1990 et 1991 puis atteint un minimum de 2,77% en 1994 et un maximum de 6,48% en 1997. Enfin, en 2004, on note une pression fiscale assez élevée de 5,65%.

Graphe 9' : Répartition des recettes fiscales par macro-secteur en 2007 (en millions de FCFA aux prix constants de 1999)

Source : Calculs de l'auteur

Une analyse macro-sectorielle laisse apparaitre que l'industrie demeure le secteur le plus fiscalisé avec un taux de 10% en 2007 contre 9,28% pour les BTP, 4,32% pour le commerce et 2,39% pour les services. Le léger affaiblissement de la pression fiscale en 2007 a contribué à l'amélioration des résultats de l'ensemble des secteurs.

3. La revue sélective de la littérature

De nombreux travaux théoriques et empiriques ont été consacrés aux déterminants de la valeur ajoutée. Deux cadres théoriques majeurs sont proposés par les économistes pour comprendre le processus de croissance, les approches traditionnelle et moderne de la croissance. Le cœur de l'approche traditionnelle est constitué par le modèle de Solow, pour lequel le taux de croissance d'une économie est égal à la somme de ses taux de croissance démographique et de progrès technique, tous deux exogènes, hors du champ d'analyse de l'économiste. C'est en partie l'insatisfaction ressentie face à cette éxogénéité des déterminants de la croissance qui a suscité l'apparition de l'approche moderne. Nous montrons comment cette dernière, en enrichissant la description de l'économie, peut rendre endogène son taux de croissance.

3.1. Les fondamentaux de la création de valeur ajoutée selon la théorie économique

Les études théoriques sur la mesure de la productivité ont commencé avec les travaux de Jan Tinbergen (1942) et ceux de Robert Solow (1957). Ils ont relié à l'analyse de la croissance économique, la productivité du travail exprimée dans le cadre d'une fonction de production. D'autres auteurs tels que Rebelo (1991), Lucas (1988), Romer (1990), Robert Barro (1990), Aghion et Howitt (1992), Harrod-Domar (1939-1946), ont eux aussi travaillé sur ce sujet.

3.1.1. Le modèle de Solow

Le modèle décrit comment un accroissement du stock de capital, de la quantité de travail (ou de la population) et le progrès technique interagissent et affectent la production au sein de l'économie. À long terme, il montre que l'économie tend vers un état stationnaire. Cette situation d'équilibre est déterminée par le taux d'épargne, le progrès technique et la croissance démographique. Le taux d'épargne et le progrès technique étant des données dans le modèle, la croissance économique dépend, à long terme, de celle de la population.

Selon Solow il faut isoler les contributions des différents facteurs de production à la croissance de la production. Lorsque la production Q s'obtient par déflation de la valeur ajoutée et que seuls le travail et le capital existent comme facteurs de production l'équation comptable de la croissance se formule comme suit :

$$\frac{dlnQ}{dt} = S_L \frac{dlnL}{dt} + S_K \frac{dlnK}{dt} + \frac{dlnA}{dt} \qquad (1)$$

Dans cette équation, le travail et le capital contribuent à la croissance de la valeur ajoutée. Le produit du taux de variation du facteur considéré par sa part relative dans les coûts totaux donne sa contribution respective. La variation de la

valeur ajoutée qui n'est pas expliquée par ces contributions est attribuée à la croissance de la productivité multifactorielle, incorporée dans la variable *A*. Et donc, le taux de variation de *A* s'obtient en retranchant les contributions des facteurs travail et capital du taux de croissance de la production. En faisant la différence entre le taux de variation de la croissance de la production et le taux de variation de la croissance du facteur travail utilisé, soit :

$$\frac{dlnQ}{dt} - \frac{dlnL}{dt} \quad (2)$$

On obtient la croissance de la productivité du travail. En recombinant l'équation ci-dessus, on obtient une décomposition de la variation de la productivité du travail en deux éléments. La première composante retrace la variation de la productivité du travail liée à un accroissement du capital (la productivité du travail augmente lorsqu'une quantité plus importante de capital est utilisée par chaque travailleur ou lorsqu'on licencie). La seconde composante retrace les effets de la croissance de la PMF :

$$\frac{dlnQ}{dt} - \frac{dlnL}{dt} = (1 - S_L)\frac{dlnK}{dt} - \frac{dlnL}{dt} + \frac{dlnA}{dt} \quad (3)$$

Mesurer la PMF aide à démêler les contributions directes du travail, du capital, des facteurs intermédiaires et de la technologie à la croissance. C'est donc un outil important pour examiner les profils de croissance passés et pour évaluer le potentiel de croissance économique à venir. Le modèle de SOLOW retient un progrès technique neutre au sens d' HARROD, c'est-à-dire qui augmente l'efficacité du facteur travail. La technologie est ainsi représentée par :

$$y(t) = F\big(K(t), A(t)N(t)\big) = F\big(K(t), e^{\gamma t}N(t)\big) = F\big(K(t), E(t)\big) \quad (4)$$

Où γ est le taux, exogène, du progrès technique et $E(t) = e^{\gamma t}N(t)$ le service effectif du travail (ou travail en unités efficaces), compte tenu du progrès technique.

La neutralité au sens de Solow correspond au cas symétrique d'Harrod : le progrès technique porte sur le capital et, au cours du processus de croissance, la production par travailleur reste inchangée pour un salaire inchangé, tandis que le rendement du capital augmente au rythme du progrès technique.

3.1.2. L'approche moderne: la croissance comme processus auto-entretenu

3.1.2.1. Le modèle « AK »
En 1991, Sergio Rebelo publie un article dans lequel il soutient que la technologie agrégée est décrite par une fonction linéaire unifactorielle, le stock de capital :

$$Y = AK \quad (5)$$

Ce modèle simple favorise une croissance endogène dans le sens où les politiques influencent les taux de croissance, et se dérive très facilement de celui

de Solow sans progrès technique. Cette équation sous entend que la production est proportionnelle au stock de capital.

Encadré 1[2] : L'accumulation du capital s'illustre comme suit :

$$\dot{K} = sY - (n + \delta)K \qquad (6)$$

Supposons que n = 0 pour simplifier (K devient donc aussi le capital/tête en normalisant la population à $N = 1$). Nous pouvons donc considérer le diagramme de Solow qui se construit comme suit :
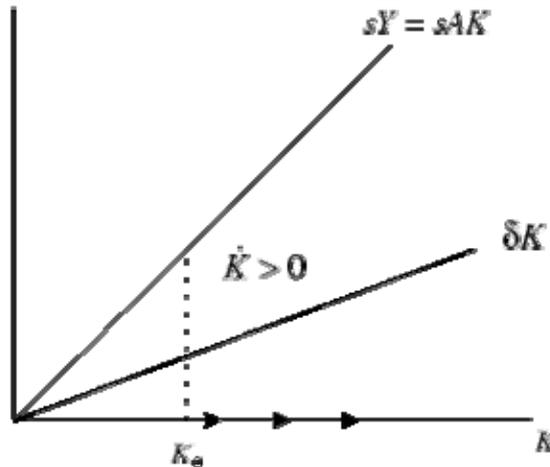

Figure 8.1: Diagramme de Solow dans le modèle AK

Si au moment de démarrage de l'économie, on a $sY > \delta K$, le stock de capital croît dans le temps. En effet, l'investissement total est constamment supérieur à la dépréciation, la croissance ne s'arrête donc jamais. Comment cela est-il possible? Dans le modèle de Solow, chaque unité de capital ajoutée grâce à l'épargne contribue de moins en moins à la production du fait des rendements décroissants ($\alpha<1$). Dans ce modèle, nous avons des rendements constants ($\alpha=1$): le produit marginal de chaque unité de capital supplémentaire est toujours A. On peut clairement voir cela en réécrivant l'équation (6) :

$$\gamma_K = \frac{\dot{K}}{K} = \frac{sY}{K} - \delta = sA - \delta = Cste \quad \forall K.$$

$$(7)$$

Et, avec la dérivée logarithmique de la production, on obtient

$$\gamma_Y = \gamma_K = sA - \delta.$$

$$(8)$$

La corrélation entre le taux de croissance du PIB et le taux d'investissement est positive. Ainsi, le taux de croissance du PIB augmente de manière permanente si les politiques publiques augmentent ce taux d'investissement. Le modèle *AK*

---

[2] «Croissance économique» Yildizoglu Murat 2001-12-15 Université Montesquieu Bordeaux IV - FRANCE

génère une source endogène de croissance, même si la population ou le niveau technologique n'évolue pas dans le modèle.

Dans le modèle AK, « tout est capital », et il n'existe donc plus le facteur primaire travail. C'est ainsi que Robert Lucas (1988) utilise l'idée de désagréger de façon explicite le stock de capital total au sein d'une représentation bisectorielle dans laquelle le stock de capital physique garde sa signification habituelle et le stock de capital humain possède sa propre loi d'accumulation. La fonction de production agrégée du secteur est une Cobb-Douglas à rendements d'échelle constants :

$$Y(t) = K(t)^\alpha \left[(1-u)H(t)\right]^{1-\alpha} \qquad (9)$$

Dans cette équation, K(t) est le stock de capital physique, homogène au bien, H(t) est le stock agrégé de capital humain, et u (0 ≤ u ≤ 1) est une variable ayant la dimension d'un temps. $1-u$ indique la proportion de capital humain consacré à la production.

Le capital physique s'accumule de la même manière que dans le modèle de Solow et le taux d'épargne s est constant.

Le capital humain est accumulé à travers la formation et on a :

$$\dot{H}(t) = BuH(t) - \delta_H H(t) \qquad (10)$$

B est défini en tant que facteur d'échelle positif représentant la productivité de l'éducation et δ_H est le taux de dépréciation du capital humain.

Ce modèle est donc proche du celui de Solow avec progrès technique neutre au sens d' Harrod. Il met en évidence un mécanisme important totalement absent du modèle de Solow habituel : « il existe dans l'économie un arbitrage entre taux de croissance et niveau de produit. Se former davantage (augmenter *u*) augmente le taux de croissance (*Bu*) mais diminue le produit Y qui dépend du temps travaillé ».

3.1.2.2. Le progrès technique sous-produit de l'investissement

L'idée selon laquelle le progrès technique découle de l'apprentissage (learning by doing), avancé par Arrow dans les années soixante, a été repris en 1986 par Romer. Selon lui, l'amélioration de l'expérience des salariés et donc de leur productivité réside dans le fait même de produire, ce qui en retour leur permet de produire plus. Ces bénéfices seront au profit de l'économie. Il en résulte une externalité technologique.

M entreprises identiques (indicées par i) représentent l'économie et chacune d'entre elles a accès à une technologie privée néoclassique :

$$Y_i(t) = K_i(t)^{1-\beta} (A(t) N_i(t))^\beta, \qquad i = 1,\dots, M \qquad (11)$$

A(t) est le progrès technique portant sur le facteur travail et son niveau est considéré comme donné par chaque firme. Le marché est concurrentiel et les entreprises adoptent leur fonction de production en vue de maximiser leurs profits. La notion « *learning by doing* », revient à poser que le niveau de développement technologique, commun à toutes les entreprises, est directement proportionnel à $K(t) = \sum_{i=1}^{M} K_i(t)$ (stock de capital agrégé). En effet, ce dernier rend compte de l'expérience acquise par l'économie dans la production. On a ainsi :

$$A(t) = A^{\frac{1}{\beta}} \sum_{i=1}^{M} K_i(t) \qquad (12)$$

Le stock de capital macroéconomique crée ainsi au niveau microéconomique une externalité positive sous forme de « supplément » commun à toutes les firmes. Cette externalité interprétée comme un stock commun de connaissances, dérivé de l'investissement, est sans coût pour ces entreprises qui en profitent. La fonction de production sociale, obtenue par l'agrégation de fonctions privées néoclassiques est linéaire par rapport au facteur accumulable capital et présente des rendements d'échelle croissants par rapport au capital t au travail, elle s'écrit :

$$Y(t) = MY_i(t) = MK_i(t)^{1-\beta} AK(t)^{\beta} N_i(t)^{\beta} \qquad (13)$$

$$= M \left(\frac{K(t)}{M}\right)^{1-\beta} AK(t)^{\beta} \left(\frac{N(t)}{M}\right)^{\beta} = AK(t) N(t)^{\beta} \qquad (14)$$

Ce modèle assure une croissance auto-entretenue s'il n'y a ni croissance démographique, ni progrès technique exogène.

L'accumulation génère un surplus dont une partie ne revient pas aux investisseurs. Ainsi surviennent des phénomènes de sous-investissements dus à l'insuffisance des incitations à l'accumulation, que l'Etat peut éviter en subventionnant l'investissement des entrepreneurs, de façon à rapprocher ses productivités privée et sociale.

3.1.2.3. Modèle de croissance de Barro : rôles des dépenses publiques

Une autre source de croissance endogène réside dans le cas où l'Etat crée une externalité par sa politique économique en fournissant des infrastructures qui soutiennent la productivité marginale du capital privée. Barro (1990) publie un article dans lequel il introduit comme facteur de production le *flux* de dépenses associé G qu'il suppose être un investissement en un bien *pur*. On a ainsi pour l'entreprise i :

$$Y_i = AK_i^{\alpha} N_i^{1-\alpha} G^{1-\alpha}, \quad \alpha \in \,]0,1[\qquad (15)$$

Où Y_i, N_i et K_i sont respectivement la production, le travail et le stock de capital privé de l'entreprise i, *G* la dépense totale de l'Etat en infrastructures et *A* le niveau d'avancement technologique constant dans le temps. Si les entreprises sont toutes identiques, on obtient une fonction de production sociale à rendements constants dans les facteurs de production privés *K* et *N* qui s'écrit :

$$Y = AK^{\alpha} N^{1-\alpha} G^{1-\alpha} \qquad (16)$$

La productivité marginale du capital privé est décroissante et tend à s'annuler quand *K* s'accroit. Mais au cours de l'accumulation, elle sera maintenue à ce niveau à l'aide d'infrastructure ou capital public.

Encadré 2[3] :

Les dépenses publiques sont financées par un impôt proportionnel au taux т (constant dans le temps) sur tous les revenus : ***T = тY***. L'équilibre budgétaire est assuré à chaque instant : ***T = G***. la dépense publique est constituée de bien final de sorte que т est la fraction du produit final absorbée par l'Etat. Les ménages consacrent alors une fraction *s* du revenu à l'épargne de sorte que la dynamique d'accumulation du capital prend la forme :

$$\dot{K} = s\,(1\text{-}т)\,Y - \delta K \qquad (17)$$

De plus, la fonction de production sociale est déterminée en remplaçant *G* par *тY* :

---

[3] ANALYSE MACRO ECONOMIQUE 1 de Jean-Olivier HAIRAULT

> **Y = $AK^\alpha N^{1-\alpha} (\tau Y)^{1-\alpha}$ soit :**
>
> $$Y = \tau^{\frac{1-\alpha}{\alpha}} A^{\frac{1}{\alpha}} N^{\frac{1-\alpha}{\alpha}} K \quad (18)$$
>
> Puisque *A*, *N* et *τ* sont constants, on se ramène ainsi au modèle AK. Ce résultat dépend crucialement du fait que l'élasticité du produit par rapport à l'infrastructure vaut **1-α**.
> En l'absence de croissances démographiques, 28 et 29 permettent d'exprimer le taux de croissance du stock de capital :
>
> $$g_K = \frac{\dot{K}}{K} = s(1-\tau)\frac{Y}{K} - \delta = s(1-\tau)\tau^{\frac{1-\alpha}{\alpha}} A^{\frac{1}{\alpha}} N^{\frac{1-\alpha}{\alpha}} - \delta$$

Ce taux est constant : la croissance est auto-entretenue et son taux dépend de manière non monotone du taux d'imposition choisi par l'Etat. Il existe un niveau de taxe optimal qui assure un juste équilibre entre les effets négatifs de diminution du revenu et positif par le biais d'un soutien à la productivité privée.

3.1.2.4. Endogénéisation du progrès technique

« Conformément à la logique schumpétérienne, le progrès technique résulte maintenant de la volonté délibérée d'une catégorie particulière d'agents que nous appellerons les « entrepreneurs-chercheurs » dont le rôle est de produire des innovations à, l'aide de capital, de travail mais aussi de stock existant de connaissances qui résulte des innovations passées. En effet, chaque innovation produite augmente le stock de connaissances de l'économie et devient ainsi source d'externalités positives.

Ces innovations leur octroient une rente sur un marché par le biais de brevets qu'ils déposent afin de se protéger contre l'imitation, alors que la connaissance est un bien public pur. « Et c'est cette protection qui permet à l'innovateur de s'approprier le surplus engendré par l'innovation en ayant l'exclusivité de la production du bien ou de l'utilisation du procédé correspondant à l'innovation ».

Romer (1990) et Aghion et Howitt (1992) ont développé deux modèles canoniques de croissance avec endogénéisation du progrès technique. Ces modèles sont caractérisés par la nature des innovations. Ainsi, Aghion et Howitt soutiennent le fait que les innovations chassent les anciennes, entrainant ainsi l'économie dans un mouvement de destruction créatrice. Le progrès technique n'est plus conçu comme un état mais comme un processus de « destruction créatrice ».

A l'opposé, Romer soutient que les innovations s'accumulent et que c'est leur diversité qui génère de la richesse pour l'économie. La nature de la concurrence joue un rôle majeur dans les deux cas puisque c'est d'elle que dépendra le montant des rentes allouées à l'innovateur, et donc l'incitation à l'innovation et finalement le rythme de croissance des économies.

L'économie de Romer comporte trois secteurs, notamment le secteur de production du bien final.
La fonction de production s'écrit :

$$Y = N_Y^{1-\alpha} \int_0^A x_i^\alpha \, d_{i,} \quad \alpha \in]0,1[\qquad (19)$$

On note trois propriétés technologiques :
- une préférence pour la diversité est vérifiée, ainsi Le capital technologique est source de richesse.

- Les rendements d'échelles sont croissants si l'on assimile le capital technologique à un input.
- L'introduction d'un nouvel input – une innovation technologique – n'exerce pas d'effet direct sur la demande des autres inputs.

3.1.2.5. Le modèle de croissance d'Harrod- Domar

Au XXe siècle le modèle post keynésien d'Harrod-Domar (1939-1946) a surtout mis l'accent sur l'instabilité de la croissance.

Ce modèle de croissance est l'œuvre de deux économistes anglo-saxons l'anglais Harrod et l'américain Domar. Il suppose une fonction de production à coefficients fixes, et la croissance ne découle que de l'augmentation des facteurs de production en faisant pour l'instant abstraction du progrès technique et de l'enseignement.

Le modèle établi par Harrod et Domar est :

$$Y[t] = \min\left\{ \frac{K[t]}{v} ; \frac{L[t]}{u} \right\}$$

(20)

Le minimum des deux termes entre accolades donne la production. En d'autres termes, on peut écrire que :

Si $\frac{K[t]}{L[t]} < \frac{v}{u}$ alors la production est déterminée par **Y[t] =** $\frac{K[t]}{v}$

Dans ce cas, la production est contrainte par le manque de capital physique. En effet, si $K[t]/L[t]$ (capital par travailleur) est faible (inférieur à u/v) la production ne dépendra que de la quantité de capital disponible dans l'économie.

Si $\frac{K[t]}{L[t]} > \frac{v}{u}$ alors la production est déterminée par **Y[t] =** $\frac{L[t]}{u}$.

Dans ce cas, la production est contrainte par le manque de travail.

3.1.2.6. Le modèle de comptabilité de la croissance

La méthode de la comptabilité de croissance permet de décomposer la croissance économique pour en identifier les déterminants fondamentaux. Elle permet de mesurer la contribution respective des facteurs travail et capital à la croissance. Son origine remonte aux travaux de Tinbergen (1942) et Solow (1957) dans le cadre de la théorie néoclassique de la production, développés ensuite par Griliches (1992), Diewert (1990) et Jorgenson (1995a, 1996) en particulier. Elle a été développée ensuite pour intégrer les enseignements des nouvelles théories de la croissance (Barro, 1998).

Les travaux théoriques de Solow ont permis de mettre en évidence une part inexpliquée, appelée depuis « résidu Solow ». Cette part correspond à l'amélioration de l'efficacité des facteurs de production », en d'autres termes au progrès technique. Carre, Dubois et Malinvaud ont montré dans leurs travaux que ce facteur résiduel explique la moitié de la croissance totale. Le modèle standard de comptabilité de la croissance se fonde sur la théorie micro-économique de la production et sur un certain nombre d'hypothèses :

- Il existe une technologie de production que l'on peut représenter par une fonction de production, qui relie la production brute, Q, aux facteurs primaires travail L et services du capital K, ainsi qu'à des facteurs intermédiaires, tels que le matériel, les services ou l'énergie (M).

- La fonction de production présente des rendements d'échelle constants.
- Ni le facteur travail ni le facteur capital ne sont nécessairement homogènes. Il existe N types (qualités) différents de travail, L_1, L_2,...L_N, M types différents de services du capital K_1,K_2,...K_M, et R types différents de facteurs intermédiaires M_1,M_2,...M_R :

$$Q = H(L_1, L_2, ...L_N, K_1, K_2, ...K_M, M_1, M_2, ...M_R, t)$$

- Les variations de productivité sont neutres par rapport au modèle de Hicks, c'est-à-dire qu'elles correspondent à un déplacement vers l'extérieur de la fonction de production, exprimé par un paramètre A, (A.1) devient donc :

$$Q = A.F(L_1, L_2, ...L_N, K_1, K_2, ...K_M, M_1, M_2, ...M_R)$$

- Pour tout niveau de production souhaité, l'entreprise minimise le coût des facteurs, en fonction de la technologie de production présentée ci-dessus. Les marchés des facteurs de production sont concurrentiels, de manière que l'entreprise considère le prix des facteurs comme donné et ajuste les quantités de facteurs afin de minimiser les coûts.
- Le travail et les facteurs intermédiaires peuvent être loués à n'importe quel moment aux prix du marché w_i (i = 1, 2,...N) pour le travail et pm_i (i = 1,2, ..., R) pour les facteurs intermédiaires.
- La fourniture de services du capital nécessite d'investir dans les différents types de capital ou de louer un bien de capital pendant une période donnée. Tout investissement accroît le stock de capital productif d'où sont tirés les services du capital. Étant donné que les services du capital fournis par un bien d'équipement déclinent à mesure que celui-ci vieillit, ou disparaissent complètement lorsqu'il est retiré du service, il convient de tenir compte de ces pertes d'efficience ou de cette dégradation. La dégradation, le taux de rendement net requis et les pertes ou les gains provenant d'une variation du prix du marché des biens de capital constituent ensemble le coût d'utilisation du capital (voir l'annexe 4 pour plus de détails). Ce coût d'utilisation du capital (μ) est le prix des services du capital qui émanent du stock de capital productif de chaque catégorie de bien de capital.
- Aucun coût d'ajustement n'est associé à l'investissement. Ou, alternativement, tous les coûts d'ajustement sont strictement proportionnels au volume d'investissement.

3.1.3. Mesure de la productivité selon le manuel de l'OCDE

Le Manuel de la productivité de l'OCDE (Organisation de Coopération et de Développement Economiques) est un guide des différentes mesures de productivité. Ce Manuel présente entre autres les fondements théoriques de la mesure de la productivité fondée sur la valeur ajoutée. D'après ce manuel, il existe plusieurs méthodes pour mesurer la croissance de la productivité. Le choix à faire dépend du but qu'on se fixe en mesurant la productivité et, dans bien des cas, de la disponibilité des données. Une classification simple des mesures de la productivité en deux catégories donne les mesures de la productivité unifactorielle (elles rapportent une mesure de la production à celle d'un seul facteur de production) et les mesures de la productivité multifactorielle (rapportant une

mesure de la production à un ensemble de facteurs de production). On distingue aussi au niveau du secteur ou de l'entreprise d'une part, les mesures qui rapportent la production brute à un ou plusieurs facteurs de production et, d'autre, part celles qui recourent à un concept fondé sur la valeur ajoutée pour saisir les évolutions de la production. Notre étude, elle, s'intéresse aux mesures de la productivité en termes de valeur ajoutée. Ces mesures sont résumées dans le tableau 1.

Tableau 1. Vue d'ensemble des principales méthodes de mesure de la productivité fondées sur la valeur ajoutée

Type de facteur de production estimé			
Travail	Capital	Travail et Capital	Travail, Capital et facteurs de production intermédiaires
Productivité du travail (fondée sur la valeur ajoutée)	Productivité du capital (fondée sur la valeur ajoutée)	PMF capital-travail (fondée sur la valeur ajoutée)	–
Méthode de mesure de la productivité fondée sur un seul facteur		*Méthode de mesure de la productivité fondée sur plusieurs facteurs (PMF)*	

Source : synthèse de l'auteur

Ce tableau est incomplet, car les mesures de productivité unifactorielle peuvent aussi être définies par rapport aux facteurs intermédiaires. Le tableau n'illustre que les méthodes de mesure de la productivité, fondée sur la valeur ajoutée, les plus répandues notamment : la mesure de la productivité du travail, la mesure de la productivité du capital et la mesure de la productivité multifactorielle (PMF). La productivité du travail fondée sur le concept de la valeur ajoutée est la statistique la plus fréquemment évaluée parmi ces différentes méthodes de mesure, suivie de la PMF capital-travail.

3.1.3.1. La productivité du travail en termes de valeur ajoutée

Elle se définit comme étant le rapport entre l'indice de quantité de la valeur ajoutée et l'indice de quantité du facteur travail. Cette mesure renseigne sur le profil temporel de l'utilisation productive du travail en vue de générer une valeur ajoutée. L'évolution de la productivité du travail fais ressortir l'influence conjointe de variations du capital et des facteurs intermédiaires, ainsi que les changements touchant la technique, l'organisation et l'efficience à l'intérieur des entreprises et entre elles et, enfin, l'influence des économies d'échelle, de la variation des taux d'utilisation des capacités et des erreurs de mesure.

La productivité exprimée en termes de capacités personnelles des travailleurs ou d'intensité des efforts accomplis par ces derniers n'est reflétée que partiellement par la productivité du travail. Comme il est indiqué plus haut, le rapport entre la production et le facteur travail dépend fortement de la présence d'autres facteurs.

Par comparaison à la productivité du travail en production brute, le taux de croissance de la productivité en valeur ajoutée dépend moins d'un changement quelconque du rapport entre facteurs intermédiaires et facteur travail, ou du degré d'intégration verticale. Ainsi, le recours à la sous-traitance revient à substituer des facteurs intermédiaires à la main-d'œuvre, ce qui fait baisser à la fois la valeur ajoutée et le facteur travail. Le premier de ces effets entraine une hausse de la productivité mesurée du travail, tandis que le second la réduit. Les mesures de la productivité du travail en valeur ajoutée ont tendance donc à être moins sensibles que celles en production brute aux processus de substitution entre matières et services, d'une part, et main-d'œuvre, d'autre part.

Les mesures de la productivité du travail laissent apparaitre les effets combinés des évolutions concernant le facteur capital, les facteurs intermédiaires et la productivité dans son ensemble. Elles ne négligent donc aucun des impacts directs de l'évolution technique, qu'ils soient corporels ou incorporels. Ces derniers (incorporels) se manifestent par l'intermédiaire des biens d'équipement et des facteurs intermédiaires. Les premiers (corporels) augmentent en général les possibilités de production pour un ensemble de facteurs donné. Les uns comme les autres affectent donc la productivité du travail.

Cette mesure de la productivité du travail en terme de valeur ajoutée à pour finalité l'analyse des liens micro-macro à savoir la contribution d'une branche d'activité à la productivité du travail et la croissance de l'économie dans son ensemble. L'avantage de cette mesure est qu'elle est aisée et lisible. Cependant elle présente des limites en étant une mesure partielle qui reflète l'influence conjointe de plusieurs facteurs. On a tôt fait de la confondre avec l'évolution technique ou avec la productivité des individus appartenant à la population active. Par ailleurs, les mesures de la valeur ajoutée fondées sur une procédure de double déflation et ayant recours à des indices de Laspeyres à pondération fixe présentent de nombreux inconvénients théoriques et pratiques.

3.1.3.2. La productivité du capital en termes de valeur ajoutée

Elle se définit comme étant le rapport entre l'indice de quantité de la valeur ajoutée et l'indice de quantité du facteur capital. L'indice de productivité du capital renseigne sur le profil temporel de l'utilisation productive du capital en vue de générer une valeur ajoutée. La productivité du capital reflète l'influence conjointe du travail, des facteurs intermédiaires, des évolutions touchant la technique, l'organisation et l'efficience, ainsi que les économies d'échelle, les taux d'utilisation des capacités et les erreurs de mesure.

Comme pour la productivité du travail, les mesures de la productivité du capital peuvent s'appuyer sur la production brute ou sur la valeur ajoutée. Le raisonnement est le même que pour la productivité du travail concernant la sous-traitance et le degré d'intégration verticale : les mesures de la productivité du capital en valeur ajoutée ont tendance à être moins sensibles que celles en production brute aux processus de substitution entre facteurs intermédiaires et capital. Lorsque le facteur capital est mesuré sous sa forme théoriquement la plus appropriée, c'est-à-dire en tant que flux de services, avec correction des variations qui affectent la qualité des biens d'équipement, il traduit l'évolution technique corporelle (hausse ou baisse de qualité des biens d'équipement) en une augmentation ou une réduction du flux de services du capital exprimés en qualité constante. Une amélioration de qualité des biens d'équipement débouche ainsi sur

une plus grande quantité de services du capital. A taux de croissance de la production constant, ce phénomène implique une diminution de la productivité du capital. Il ne faut pas confondre productivité du capital et taux de rendement du capital. La première est une mesure partielle et matérielle de la productivité. Le second mesure le revenu, qui établit un lien entre revenu du capital et valeur du stock de capital.

Les variations de la productivité du capital indiquent à quel point il est possible d'accroître la production en réduisant les coûts de bien-être, coûts prenant la forme de consommation non réalisée. L'avantage de cette mesure se trouve dans sa grande lisibilité. L'inconvénient est que la productivité du capital est une mesure partielle de la productivité, qui reflète l'influence conjointe d'une grande variété d'éléments. Taux de rendement et productivité du capital font parfois l'objet de confusion.

3.1.3.3. La productivité multifactorielle capital-travail en termes de valeur *ajoutée*

Elle se calcule en faisant le rapport indice de quantité de la valeur ajoutée sur indice de quantité des facteurs travail et capital combinés. L'indice de quantité des facteurs travail et capital combinés correspond à l'indice de quantité de (différentes catégories de) travail et de capital, pondérées chacune par sa part dans la valeur ajoutée totale, à prix courants.

La PMF capital-travail renseigne sur le profil temporel de l'utilisation productive des facteurs capital et travail combinés en vue de créer une valeur ajoutée. Sur le plan conceptuel, la productivité capital-travail ne correspond généralement pas à une fidèle mesure de l'évolution technique. Cependant, elle constitue un indicateur de la capacité d'une branche à contribuer à la croissance du revenu de l'ensemble de l'économie par unité de facteur primaire. En pratique, cette mesure reflète les effets combinés des évolutions techniques incorporelles, des économies d'échelle, des évolutions de l'efficience, des variations d'utilisation des capacités, des externalités générées par certains inputs, de l'évolution de la qualité des facteurs de production5, des coûts d'ajustement, les effets de cycle, des changements institutionnels et sociaux, des variations dans les parts de rémunérations factorielles, des variables omises comme la contribution des ressources naturelles à la croissance les externalités générées par certains inputs, de l'évolution de la qualité des facteurs de production5, des coûts d'ajustement, des effets de cycle, des changements institutionnels et sociaux, des variations dans les parts de rémunérations factorielles, des variables omises – comme la contribution des ressources naturelles à la croissance et des erreurs de mesure. Il convient donc d'être particulièrement prudent dans l'interprétation de la notion de PMF en gardant à l'esprit de la multitude de facteurs qui en déterminent la mesure.

Lorsque la mesure du facteur capital agrège des catégories détaillées d'actifs, pondérées chacune par son coût de l'utilisateur, et fondées sur des prix des biens d'équipement reflétant les variations de qualité, les effets de l'évolution technique corporelle sont incorporés au terme représentant le facteur capital, et seule l'évolution technique incorporelle affecte la PMF.

Harberger (1998) a le mérite de rendre le concept de la PMF plus concret en l'assimilant à une réduction des coûts de production. En effet, un gain de PMF reflète de manière générale une augmentation de l'efficience productive et par conséquent une diminution des coûts de production. Comme l'expliquent Bourgain

et Pieretti (1999), puisque « la hausse de la PMF permet l'augmentation de la production sans accroissement du volume des facteurs, il s'ensuit que, pour un même niveau de production, le coût total en facteur diminue ».

Cette mesure de la productivité multifactorielle capital-travail en termes de valeur ajoutée à pour finalité l'analyse des liens micro-macro sur la contribution d'une branche d'activité à la croissance de la PMF et du niveau de vie de l'ensemble de l'économie; analyse des évolutions structurelles.

Elle présente certains avantages notamment l'agrégation aisée des différentes branches, l'existence d'un lien conceptuel simple entre croissance des PMF au niveau des branches d'activité et au niveau agrégé. Les données sont directement disponibles dans les comptes nationaux. Cependant elle ne constitue pas une mesure appropriée des changements technologiques à l'échelon de la branche ou de l'entreprise, ce qui est une limite. Par ailleurs, lorsqu'elle se fonde sur une procédure de double déflation et utilise un indice de Laspeyres à pondération fixe, cette mesure souffre des inconvénients conceptuels et empiriques de ce concept.

3.2. Etudes empiriques

A partir de ces théories, il est possible d'examiner empiriquement les facteurs favorables à la création de valeur et donc à la croissance. Cependant, il n'existe pas d'études empiriques concernant le secteur moderne sénégalais publiées. Le peu d'études empiriques sur ce sujet réalisées concernent notamment l'Afrique en général ou bien les pays occidentaux et ne sont pas focalisées que sur le secteur moderne mais sur l'ensemble de l'économie. Parmi ces dernières on note celle de Barro (1991) dans son article « Economic growth in a cross-section of countries », celle d'autres auteurs tels que Bean (1989), Gali et Hammour (1991), Saint-Paul (1993), Nickell, Wadhani et Wall (1993), Malley et Muscatelli (1996).

II-2-1 L'analyse empirique de Barro

Barro, dans son article, se place dans la perspective d'une comparaison entre pays (voir aussi Levine et Renelt (1992) et Barro et Sala-i-Martin (1992)). Il trouve comme résultats principaux :

- Que le niveau d'éducation a le pouvoir explicatif le plus important sur la croissance à long terme. Ce niveau d'éducation est mesuré par la proportion de la population qui participe à l'enseignement secondaire. On note encore d'autres facteurs importants dans ces travaux, tels que la stabilité politique, le taux d'investissement et le développement du secteur financier.
- Que le taux de croissance de long terme, pour un pays donné, se détermine par le niveau de ces variables. « Barro et Sala-i-Martin montrent alors qu'il y a convergence des pays vers ce sentier de croissance. Un pays pauvre rattrapera donc son retard par rapport à un pays riche s'il a le même niveau d'éducation, le même degré de stabilité politique, etc. »[4].

Ces résultats ne vérifient pas certaines des nouvelles théories de la croissance qui soutiennent qu'une nation peut ne jamais rattraper le retard de développement provenant d'un choc transitoire comme une guerre. En effet, Barro

---

[4] Gilles Saint-Paul « Les nouvelles théories de la croissance et leurs implications pour la politique économique et l'analyse de la concurrence internationale ».

et Sala-i-Martin montre aussi que ce retard est rattrapable à 2% par an si les résultats de convergence conditionnelle font que le pays détient de bonnes stratégies de politique économique.

« On peut également se demander dans quelle mesure le décollage spectaculaire de certains pays (l'Asie du sud-est dans les années soixante-dix et quatre-vingt, l'Amérique latine et la Chine dans les années quatre-vingt-dix) est un simple phénomène de rattrapage, ou si ces pays sont en train de converger vers un sentier de croissance à taux plus élevé, auquel cas ils finiront par dépasser les pays de l'O.C.D.E. Pour Young (1994), la réponse est claire : la croissance exceptionnelle des pays du sud-est asiatique devrait se tarir à brève échéance, car elle a reposé essentiellement sur une forte accumulation de capital physique ».

II-2-2 L'effet des récessions sur la productivité

De nombreuses études empiriques corroborent l'idée que les récessions peuvent avoir un impact positif sur la productivité. Bean (1989), Gali, Hammour (1991) et Saint-Paul (1993) trouvent ainsi qu'un choc négatif de demande augmente la productivité à long terme. Nickell, Wadhwani et Wall (1993) montrent que les entreprises fortement endettées ont une croissance de productivité plus élevée que les autres, en accord avec les effets de discipline.

Cependant, les analyses empiriques mettent en évidence que l'investissement constitue un déterminant majeur de la croissance à long terme (Delong et Summers, 1991, 1993). De plus, le progrès technique ne peut être exogène car il semble provenir d'un effort explicite (en matière de R&D ou de formation). De nouveaux modèles de croissance, dans la lignée des théories de la croissance endogène, vont prendre en compte le rôle des investissements en capital physique (Romer, 1986), en capital humain (Lucas, 1988 ; Ben Mimoun et Raies, 2008) et dans la R&D (Romer 1990; Jones 1995 ; Koleda 2004). En outre, les investissements en infrastructures sont également fondamentaux dans le processus de croissance (Barro, 1990).

3.2.3. Analyse de l'expérience individuelle de croissance des pays d'Afrique subsaharienne

O'Connell et Ndulu (2000) ont examiné la littérature empirique de la croissance et ont développé un ensemble d'approches à localiser l'expérience de croissance spécifique à chaque pays dans le « crossregional » et la perspective transnationale. L'accumulation lente du capital, la croissance lente de la productivité, et une transition démographique retardée contribuent chacune de manière importante à la performance relative de l'Afrique. La politique, les établissements, et la stabilité politique sont covariants avec la croissance comme l'indique la théorie.

4. Méthodologie

4.1. Spécification du modèle théorique: les variables supposées explicatives et leurs effets attendus

Compte tenue de l'objectif du papier, la méthode utilisée s'appuie sur la spécification du modèle de comptabilité de la croissance dont les mérites sont indiqués plus haut. En effet, La comptabilité de croissance est une méthode de calcul souvent utilisée dans les études empiriques. Rappelons que l'approche en termes de comptabilité de la croissance repose sur une fonction de production

agrégée au niveau de l'économie et sur des hypothèses théoriques fortes (concurrence pure et parfaite, rendements d'échelle constants, minimisation des coûts…). Dans ce cadre, la contribution d'un facteur (utilisation du capital, par exemple) est évaluée par le logarithme de son volume (ou de la croissance de son volume) multipliée par la part de sa rémunération dans la valeur ajoutée.

Sous ces hypothèses et d'après notre revue sélective de la littérature, il nous est possible de distinguer deux sources de la croissance économique : l'accumulation des facteurs primaires (travail et capital), l'amélioration de l'efficience productive globale de ces facteurs (également appelée productivité multifactorielle). Concrètement, l'équation extensive de la comptabilité de croissance utilisée dans cette étude permet de décomposer la croissance de la valeur ajoutée réelle (*VA*) en 3 termes selon les contributions du travail (L), du capital (*K*) et enfin selon le taux de croissance de la productivité multifactorielle (*PMF*). A long terme, cela donne pour chaque macro-secteur :

$$\dot{VA}^{i,t} = c + \alpha S_{VA,L}^{i,t} \dot{L}^{i,t} + \beta S_{VA,K}^{i,t} \dot{K}^{i,t} + \gamma \dot{PMF}^{i,t} + \varepsilon^{i,t} \qquad (21)$$

Comme on peut le constater, l'équation ne contient pas textuellement toutes les variables proposées par la littérature. Par exemples le taux d'investissement, le niveau d'éducation, la démographie. Cependant, la spécification du modèle de la comptabilité de croissance donne la possibilité d'inclure des facteurs pertinents que l'on retrouve dans la revue théorique tels que les consommations intermédiaires et les impôts nets. On obtient ainsi un modèle de comptabilité de croissance augmenté :

$$\dot{VA}^{i,t} = c + \alpha_1 S_{VA,L}^{i,t} \dot{L}^{i,t} + \beta_1 S_{VA,K}^{i,t} \dot{K}^{i,t} + \gamma_1 \dot{PMF}^{i,t} + \delta_1 S_{VA,CI}^{i,t} \dot{CI}^{i,t}$$
$$+ \theta_1 S_{VA,I}^{i,t} \dot{I}^{i,t} + \varepsilon_2^{i,t} \qquad (22)$$

Le point placé au-dessus d'une variable indique que celle-ci est mesurée en taux de croissance et $S_{VA,L}$, $S_{VA,K}$, $S_{VA,CI}$ et $S_{VA,I}$ représentent respectivement la part, dans la valeur ajoutée du macro-secteur *i au temps t*, de la rémunération attribuée aux facteurs travail, capital, consommations intermédiaires et impôts nets.

Les paramètres α, β, γ, δ et θ représentent les estimateurs des variables explicatives et ρ le paramètre des résidus $\varepsilon^{i,t-1}$. En effet, on s'attend d'une part à ce qu'une hausse du facteur capital ou du facteur travail ou de la productivité multifactorielle entraine un accroissement de la valeur ajoutée, et d'autre part à ce qu'une hausse des impôts nets ou des consommations intermédiaires diminue la valeur ajoutée.

4.2. Méthode d'analyse empirique

Dans l'estimation des régressions, nous étudions d'abord les caractéristiques des séries temporelles de toutes les variables à l'aide des tests de racine unitaire plus particulièrement celui du Dickey Fuller Augmenté (1981). Ceci pour savoir si les variables sont stationnaires ou non stationnaires. Les variables non stationnaires peuvent conduire à des régressions fallacieuses. Dans ce cas, les résultats peuvent suggérer des relations significatives entre les variables du

modèle alors qu'en réalité ce n'est qu'une indication qu'il existe une corrélation entre les variables.

Si les variables sont non stationnaires, nous examinons la présence de la cointégration par la méthode d'Engle et Granger. Ceci parce que dans une régression avec les variables non stationnaires, les résultats sont valables si et seulement si ces variables sont cointégrées. Pour tester l'existence de la cointégration dans cette étude, nous effectuons nos régressions en faisant usage du test ADF pour examiner la stationnarité des résidus de ces régressions. Si les résidus sont stationnaires, nous concluons que les séries temporelles utilisées dans le modèle sont cointégrées. Si les variables ne sont pas cointégrées, alors nous prenons leurs différences jusqu'au degré où ils deviennent stationnaires avant d'effectuer nos régressions par la méthode des moindres carrés ordinaires. Cette méthode revient encore à spécifier éventuellement les mécanismes d'ajustement de court terme en vue d'atteindre l'équilibre stable de long terme :

$$dVA^{i,t} = c + \alpha' d(S^{i,t}_{VA,L} L^{i,t}) + \beta' d(S^{i,t}_{VA,K} K^{i,t}) + \gamma' d(\dot{PMF}^{i,t}) + \rho' \varepsilon^{i,t-1} + \varepsilon^{i,t}_1 \quad (23)$$

et à analyser l'estimateur ρ' des résidus $\varepsilon^{i,t-1}$, qui sont les résidus de la relation de long terme retardés d'une période. Si l'estimateur de ces résidus est significatif et inférieur à zéro, la conclusion serait l'existence d'une et d'une seule relation de cointégration. Cette relation est illustrée par la dynamique de court terme (Engle et Granger). La dynamique de court terme pour le modèle augmenté s'écrit :

$$dVA^{i,t} = c + \alpha'_1 d(S^{i,t}_{VA,L} L^{i,t}) + \beta'_1 d(S^{i,t}_{VA,K} K^{i,t}) + \gamma'_1 d(\dot{PMF}^{i,t})$$
$$+ \delta'_1 d(S^{i,t}_{VA,CI} CI^{i,t}) + \theta'_1 d(S^{i,t}_{VA,l} l^{i,t}) + \rho'_1 \varepsilon^{i,t-1}_2$$
$$+ \varepsilon^{i,t}_3 \quad (24)$$

Une des principales limites de l'approche d'Engle et Granger est qu'elle s'applique lorsqu'une seule relation de longue période existe entre les variables non stationnaires. Or, si le modèle de base contient N séries, il peut y avoir jusqu'à N - 1 relations cointégrées entre les variables. Dans le cas où plusieurs relations de longue période sont possibles (selon la théorie économique), il existe une méthode proposée par Johansen qui permet de déterminer statistiquement le nombre de relations cointégrées. Sa méthode comprend deux tests :

- Test de la trace : il teste l'hypothèse nulle que le rang de cointégration est de r, r= 0,1,…, p-1 contre l'hypothèse alternative que le rang de cointégration est de p.
- Test de la valeur propre maximale : il teste la même hypothèse nulle quecelle de la trace par contre l'hypothèse alternative est que le rang de cointégration est de r+1.

D'une part, la présence préalable de relation de cointégration autorise le recours aux modèles à correction d'erreur *(VECM)* en vue de spécifier la dynamique d'ajustement de court terme des indices en présence. D'après Engle et Granger, si des variables sont cointégrées, alors la représentation *VECM* suivante existe :

$$\Delta X_t = \delta_0 + \Pi X_{t-1} + \delta_1 \Delta X_{t-1} + \lambda \mu_{t-1} + v_t \qquad \textbf{(25)}$$

Le coefficient (λ) représente la vitesse d'ajustement en vue d'atteindre l'équilibre stable de long terme. Econométriquement, ce coefficient devrait être significativement négatif pour que le VECM soit valide. D'autre part, cette présence engendre l'existence d'une relation causale entre les variables dans au moins une direction. Cette relation causale peut-être analysée grâce au test de causalité de Granger qui s'appuie sur le modèle vectoriel à correction d'erreurs (VECM). Le sens de la causalité économique est un élément essentiel pour élaborer une politique économique ou pour effectuer des prévisions. De manière pratique, « the causal knowledge » est nécessaire à une formulation correcte de la politique économique (Bourbonnais, 2003).

5. Estimations et commentaires des résultats

Avant de procéder à l'estimation des modèles, il est nécessaire de déterminer le niveau de stationnarité des séries afin de savoir s'il existe une cointégration entre les variables.

5.1. Stationnarité et ordre d'intégration des séries
Pour déterminer le niveau de stationnarité des séries, nous utilisons le test de Dickey Fuller Augmenté (1981) (ADF). Le tableau 2 présente un résumé des résultats obtenus de ce test.

Tableau 2. Résultats du test de racine unitaire (test ADF, seuil 5%)

Variables Secteurs	VA^{it}	$S_{VAL}^{it} L^{it}$	$S_{VAL}^{it} R^{it}$	PMP^{it}	$S_{VACI}^{it} CI^{it}$	$S_{VAI}^{it} I^{it}$
Secteurs modernes	I(0) avec trend, sans constante	I(1) sans trend et constante	I(1) sans trend et constante	I(0) sans trend et constante	I(1) sans trend et constante	I(0) sans trend et constante
Industrie	I(0) sans trend, avec constante	I(0) sans trend et constante	I(1) sans trend et constante	I(0) sans trend et constante	I(0) sans trend, avec constante	I(0) sans trend et constante
BTP	I(0) sans trend et constante	I(0) sans trend et constante	I(0) sans trend et constante	I(0) sans trend et constante	I(0) sans trend et constante	I(0) sans trend et constante
Commerce	I(0) sans trend, avec constante	I(0) sans trend et constante	I(0) sans trend et constante	I(0) sans trend et constante	I(0) sans trend et constante	I(0) sans trend et constante
Services	I(1) sans trend et constante	I(1) sans trend et constante	I(1) avec trend et constante	I(0) sans trend et constante	I(1) sans trend et constante	I(0) sans trend et constante

Après avoir comparé les statistiques ADF, pour les différentes variables, aux valeurs critiques de Mackinnon fournies par le logiciel économétrique Eviews, nous avons su qu'il existait parmi celles ci certaines qui n'étaient pas stationnaires en niveau. Il a fallu les différencier une seule fois pour les rendre stationnaire. Maintenant qu'on sait que parmi les variables y'en a qui sont intégrées d'ordre 1, on peut étudier s'il existe une ou plusieurs relations stables de long terme entre elles appelées relations de cointégration.

5.2. Test de cointégration sur les séries

L'application de la méthode d'Engle et Granger a donné comme résultat l'existence d'une relation de cointégration entre les variables intra-sectorielles. En effet, l'estimateur ρ' des résidus $\varepsilon^{i,t-1}$ (voir annexe 3) est significatif et inférieur à zéro pour chaque relation de court terme. Cependant les résultats du test de Johansen diffèrent selon le critère d'information choisi (Akaike ou Schwarz) et selon le test choisi (celui de la trace ou celui de la valeur propre maximale). Le critère d'information de Schwarz sera retenu dans notre étude.

➢ Le secteur moderne

Le critère d'information de Schwarz ainsi que le test de la trace au seuil de 5% nous révèlent qu'il n'existe qu'une seule relation de cointégration entre la valeur ajoutée du secteur moderne, les salaires, la consommation en capital fixe et la productivité multifactorielle. Par contre le test de la valeur propre maximale nous indique qu'il n'existe aucune relation de cointégration. Toutefois, avec l'approche d'Engle et Granger nous avions obtenu une relation de cointégration et donc on valide le test de la trace qui vérifie les résultats de cette approche.

➢ Les macro-secteurs

D'après les résultats du test de Johansen pour chaque macro-secteur (voir annexe 2), on est en présence d'une seule relation stable de long terme liant les variables de chaque macro-secteur ; ceci est conforme avec les résultats obtenus avec la méthode d'Engle et Granger

5.2.2. Estimations de la valeur ajoutée par la méthode des moindres carrés ordinaires

➢ Modèle du secteur moderne :

L'estimation du modèle pour le secteur moderne à donné les résultats suivantes :

Relation de long terme

$$VA^{i,t} = 0.017 + 1.194\ S_{VAL}^{i,t} L^{i,t} + 0.908\ S_{VAK}^{i,t} K^{i,t} + 0.299\ P\dot{M}F^{i,t} \quad (26)$$
$$\quad\ (0.02) \quad\ (6.00) \qquad\qquad (3.12) \qquad\qquad\ (6.48)$$

Les résultats de ces estimations sont particulièrement bons. Statistiquement, tous les coefficients sont significatifs au seuil de 1%, à l'exception de la constante. Le modèle explique 78% de la variance de la valeur ajoutée. Les valeurs entre parenthèse sont les statistiques de Student. Sur le plan économique, tous les paramètres ont le signe prédit par la théorie. En effet, une hausse de 1% des salaires ou de la consommation en capital fixe ou de la productivité multifactorielle, toute chose égale par ailleurs, entrainerait une hausse respective de 1.19%, 0.90%, 0.29% de la valeur ajoutée. Le facteur travail est donc, à long terme, la principale source de création de valeur ajoutée dans le secteur moderne sénégalais suivi du capital et enfin de la productivité multifactorielle. La dynamique de court terme est la suivante :

Relation de court terme

$$dVA^{i,t} = 0.049 + 0.948\, d\!\left(S_{VAL}^{i,t} L^{i,t}\right) + 0.589\, d\!\left(S_{VAR}^{i,t} K^{i,t}\right)$$
$$+ 0.271\, d\!\left(PMF^{i,t}\right) - 0.758\varepsilon^{i,t-1} \quad \textbf{(27)}$$

(0.10)   (5.55)   (3.11)   (9.56)   (-2.50)

Cette dynamique d'ajustement de court terme est valide puisque le coefficient de $\varepsilon^{i,t-1}$ (-0,758) est significativement négatif. Ces variables ont plus d'impact à long terme qu'à court terme. Nous constatons qu'au seuil de 5%, le test de Granger (annexe 3) laisse présager d'un lien de causalité bidirectionnelle entre la valeur ajoutée et la productivité multifactorielle (salaires, consommation en capital fixe) et des liens de causalité unidirectionnelle entre d'une part les salaires et la CCF et d'autre part entre les salaires et la PMF. Autrement dit, la CCF influe sur les salaires qui à leur tour influent sur la productivité multifactorielle. Cette dernière quant à elle est source de croissance de la valeur ajoutée ; l'inverse est valable. En outre, l'estimation par les MCO du modèle augmenté (voir annexe 4) nous montre qu'à court et à long terme les impôts nets ont un impact négatif (plus accentué à long terme) sur la croissance de la valeur ajoutée du secteur moderne. Les consommations intermédiaires, quant à elles, n'ont aucun impact significatif sur la croissance de la valeur ajoutée du secteur moderne sénégalais.

➢ Modèle de l'industrie :

Relation de long terme

$$VA^{i,t} = -0.121 + 1.029\, S_{VAL}^{i,t} L^{i,t} + 1.476\, S_{VAR}^{i,t} K^{i,t} + 0.288\, PMF^{i,t} \quad \textbf{(28)}$$

(-0.19   (7.76)   (5.85)   (13.53)

Les valeurs absolues des coefficients sont deux fois supérieures à leurs écart-types, (voir annexe 3), ils sont donc significatifs à l'exception de la constante. En effet la statistique F de Fisher est à 66,29 avec une probabilité de 0%, et le modèle explique 93% de la variance de la valeur ajoutée du secteur Industrie. Nous avons là un bon modèle, d'un point de vue statistique. Qu'en est-il de la validité du modèle d'un point de vue économique ? Les signes des coefficients sont conformes aux hypothèses précitées et nous renvoie à la théorie économique. Dans le macro-secteur Industrie, la consommation en capital fixe est le principal déterminant de la valeur ajoutée, suivi des salaires puis de la productivité multifactorielle. Une hausse de 1% de la consommation en capital fixe, toute chose égale par ailleurs, entraine une hausse de 1,5% de la valeur ajoutée industrielle. Par ailleurs, la consommation en capital fixe reste le principal déterminant de la valeur ajoutée à court terme :

Relation de court terme

$$dVA^{i,t} = -0.053 + 1.033\, d\!\left(S_{VAL}^{i,t} L^{i,t}\right) + 1.420\, d\!\left(S_{VAR}^{i,t} K^{i,t}\right)$$
$$+ 0.296\, d\!\left(PMF^{i,t}\right) - 0.870\varepsilon^{i,t-1} \quad \textbf{(29)}$$

(-0.09)   (11.46)   (8.87)   (21.30)   (-2.88)

Cependant les salaires ainsi que la productivité multifactorielle ont beaucoup plus d'impact (positif) sur la valeur ajoutée à court terme qu'à long terme. Le coefficient d'ajustement -0.87 est significativement négatif, ce qui rend valide l'équation (27). Le test de causalité de granger (voir annexe 3) n'indique aucune relation causale entre les variables au seuil de 5% et donc ne confirme pas, par rapport au test de la cointégration de Johansen, une causalité entre ces variables. Cependant

à 10% on a la CCF qui influe sur les salaires et non pas l'inverse. L'analyse du modèle augmenté (annexe 4) montre qu'à la longue, comme à court terme, ni les impôts nets ni les consommations intermédiaires n'ont d'impact significatif sur la création de valeur ajoutée.

➢ Modèle des BTP :

Relation de long terme

$$V\!A^{i,t} = 1.713 + 0.194\, S_{VAL}^{i,t} L^{i,t} + 1.294\, S_{VAK}^{i,t} K^{i,t} + 0.166\, P\!M\!F^{i,t} \qquad (30)$$
$$\phantom{V\!A^{i,t} = }(0.57)\quad (0.70)\qquad\qquad (1.33)\qquad\qquad (8.78)$$

Les salaires et la CCF, à elles seules, n'ont pas eu d'effets significatifs dans le modèle. Toutefois, leur combinaison impacte de manière positive sur la croissance de la valeur ajoutée. En effet, une hausse de 1% de la PMF entraine un accroissement de 0,16% de la valeur ajoutée. 87% de la variance de la valeur ajoutée est expliqué par ce modèle et nous obtenons une Durbin-Watson égale à 2,2 : notre modèle est donc bon. La productivité multifactorielle capital-travail est donc le principal déterminant de la valeur ajoutée du secteur moderne à long terme. Nous obtenons à peu près les mêmes résultats à court terme où encore seule la PMF est source de création de la valeur ajoutée du secteur des BTP.

Relation de court terme

$$dV\!A^{i,t} = 0.011 + 0.135\, d\big(S_{VAL}^{i,t} L^{i,t}\big) + 0.855\, d\big(S_{VAK}^{i,t} K^{i,t}\big)$$
$$+ 0.168\, d\big(P\!M\!F^{i,t}\big) - 1.104\, s^{i,t-1} \qquad (31)$$
$$(0.00)\quad (0.66)\qquad (1.22)\qquad\quad (12.86)\qquad (-3.79)$$

Cette dynamique de court terme explique 95% de la variance de la valeur ajoutée et nous relevons la présence d'un coefficient d'ajustement négatif et statistiquement significatif ce qui témoigne de la validité statistique du modèle *VECM*. Selon les résultats du test de causalité de GRANGER (annexe 3), il n'existe pas une relation causale entre la croissance de la PMF et celle de la valeur ajoutée. Par ailleurs, les salaires engendrent de la consommation en capital fixe au seuil de 5%. L'inverse est valable au seuil de 10%. A court et long terme, dans le modèle augmenté, les consommations intermédiaires ainsi que les impôts nets n'ont aucun effet significatif sur la création de valeur ajoutée des BTP.

➢ Modèle du commerce :

Relation de long terme

$$V\!A^{i,t} = 2.635 - 0.063\, S_{VAL}^{i,t} L^{i,t} + 2.619\, S_{VAK}^{i,t} K^{i,t} + 0.033\, P\!M\!F^{i,t} \qquad (32)$$
$$\phantom{V\!A^{i,t} = }(2.83)\quad (-0.18)\qquad\qquad (1.75)\qquad\qquad (1.12)$$

Aucun des estimateurs des variables n'est significatif à l'exception du coefficient de la CCF qui lui est significatif mais au seuil de 10%. D'un point de vue statistique et économique, Notre modèle n'est pas bon car seule 20% de la variance de la valeur ajoutée est expliqué par le modèle de long terme et que le sens de l'impact de la main d'œuvre sur la valeur ajoutée, bien que n'étant pas significatif, n'est aucunement conforme à ce que dit la théorie économique. De plus la statistique F de Fisher est de 1,08 avec une probabilité de 39%.

Relation de court terme

$$dV\!A^{i,t} = 0.086 - 0.201\, d\big(S_{VAL}^{i,t} L^{i,t}\big) + 1.716\, d\big(S_{VAK}^{i,t} K^{i,t}\big) + 0.036\, d\big(P\!M\!F^{i,t}\big)$$
$$- 0.853\, s^{i,t-1} \qquad (33)$$
$$(0.11)\qquad (-0.87)\qquad (1.92)\qquad (1.93)\qquad (-3.11)$$

A court terme, la CCF n'est pas la seule source de création de valeur ajoutée dans le secteur du commerce au seuil de 10%; à elle s'y ajoute la PMF malgré son faible impact. La dynamique de court terme est valide car le coefficient d'ajustement est négatif et significatif. Le modèle explique 65% de la variance à court terme de la valeur ajoutée du secteur Commerce et présente un Durbin-Watson égale à 1,85. D'après une analyse de la causalité des variables à la Granger (annexe 3), les relations entre les variables sont unidirectionnelles au seuil de 5%. En effet, la CCF, les salaires ainsi que la PMF engendrent de la valeur ajoutée. Les salaires sont eux aussi engendrés par la CCF. Les résultats du modèle augmenté (annexe 4) à long terme pour le secteur du commerce n'indiquent aucun impact significatif de la part des consommations intermédiaires et des impôts nets sur la croissance de la valeur ajoutée. Cependant à court terme toutes les coefficients des variables sont tous significatifs sauf la constante et ont le sens prédit par la théorie économique (sauf pour les consommations intermédiaires qui elles devraient faire baisser la valeur ajoutée). Le coefficient de détermination est de 77% et le coefficient d'ajustement est significativement négatif ; ce qui nous confère un bon et valide modèle. La CCF reste la principale source de création de la valeur ajoutée du secteur du Commerce suivi des salaires, puis des consommations intermédiaires. Les impôts nets ralentissent la création de valeur ajoutée.

> Modèle des services :

Relation de long terme

$$VA^{i,t} = -1.032 + 1.332\, S_{VAL}^{i,t} L^{i,t} + 0.806\, S_{VAK}^{i,t} K^{i,t} + 0.410\, P\dot{M}F^{i,t} \qquad (34)$$

(-1.41)   (9.58)   (4.08)   (7.75)

Relation de court terme

$$dVA^{i,t} = -0.021 + 1.162\, d\left(S_{VAL}^{i,t} L^{i,t}\right) + 0.538\, d\left(S_{VAK}^{i,t} K^{i,t}\right)$$
$$+ 0.358\, d\left(P\dot{M}F^{i,t}\right) - 1.297 s^{i,t-1} \qquad (35)$$

(-0.05)   (6.09)   (3.00)   (7.49)   (-4.53)

A long terme, aussi bien qu'à court terme, les coefficients sont tous significatifs au seuil de 1% et ont le sens prédit par la théorie économique. Les modèles expliquent, à long terme et à court terme, respectivement 87% et 92% de la variance de la valeur ajoutée du secteur des services. Dans les deux cas, le travail est le principal déterminant de la valeur ajoutée des services suivi de la CCF et enfin de la PMF. La dynamique de court terme est validée par la présence d'un coefficient d'ajustement significativement négatif (-1, 3). Le test de causalité de Granger, nous révèle, au seuil de 5%, l'existence d'une relation bidirectionnelle entre la CCF et la valeur ajoutée et de relations unidirectionnelles entre d'une part la valeur ajoutée des services et la PMF, et d'autre part la CCF et les salaires. Autrement dit, la CCF dans les services engendre de la valeur ajoutée et vice versa. La CCF engendre aussi les salaires. La croissance de la valeur ajoutée des services engendrerait aussi la croissance de la PMF.

L'analyse du modèle augmenté ne laisse apparaitre à long terme aucun impact significatif sur la valeur ajoutée ni de la part des consommations intermédiaires ni de celle des impôts nets. Cependant à court terme nous obtenons un impact significatif, suivant le sens prédit par la théorie, de la part des impôts nets. Le modèle explique 94% de la variance observée à court terme sur la

valeur ajoutée des services et est validé par un coefficient d'ajustement significatif et inférieur à zéro (-1,39).

5.2.3. Interprétation des résultats

En résumé, la valeur ajoutée du secteur moderne du Sénégal à pour principal déterminant le facteur travail mesuré dans notre étude par la rémunération des salariés, suivi du facteur capital mesuré par la CCF et enfin la PMF capital-travail. En outre, les résultats des régressions nous montrent que les principaux déterminants de la valeur ajoutée diffèrent selon les macro-secteurs. En effet, les services ont pour principal déterminant de leur valeur ajoutée le facteur travail. Pour la valeur ajoutée de l'industrie et celle du commerce, c'est le facteur capital qui est le principal déterminant. Enfin la PMF est le principal générateur de valeur ajoutée dans le secteur des BTP.

Si l'on remonte aux faits stylisés, les services contribuent le plus à la création de valeur ajoutée du secteur moderne (55,56% en moyenne sur la période) suivi de l'industrie, puis du commerce. A partir de ces résultats, il devient clair que le facteur travail soit le principal déterminant de la création de la valeur ajoutée du secteur formel vu que cette dernière dépend à 60% de la valeur ajoutée du secteur des services qui a aussi comme déterminant principal le facteur travail. Il s'en suit le facteur capital, puis la PMF.

Le niveau des salaires soutient de manière prépondérante la performance des services à la création de valeur ajoutée et handicap la création de valeur ajoutée dans les secteurs du commerce et des BTP et Annexes. L'amélioration des salaires dans le secteur du commerce à tendance à freiner la croissance de la valeur ajoutée. La productivité du travail étant un déterminant important de la formation des salaires, on peut avancer l'idée selon laquelle dans le secteur des services, la productivité du travail en termes de valeur ajoutée est élevée contrairement aux secteurs du commerce et des BTP et Annexes. Le problème observé dans les secteurs des BTP et du commerce pourrait aussi découler du nombre de personne employé.

Le fort impact de la CCF à la croissance de la valeur ajoutée dans le secteur de l'industrie et dans le secteur du commerce pourrait s'expliquer par la nature des immobilisations de ces secteurs. En effet la rémunération de ce facteur est importante dans ces macro-secteurs, ce qui est à l'origine de sa grande contribution à la croissance. La décision d'investir étant étroitement liée aux rendements attendus, l'investissement en capital physique pourrait donc être supérieur à l'investissement en capital humain. Exemple des marchandises pour le commerce et des machines pour les industries. Ainsi, La productivité du capital est supérieure à celle du travail dans ces secteurs

Dans le secteur des BTP, des services et celui de l'industrie, le progrès technique constitue une force motrice de la création de valeur ajoutée. En effet l'efficience productive de la PMF ou encore progrès technique s'expliquerais par la structure de production dans ces secteurs. On peut penser aussi au plein essor de la R&D financé par les dépenses publiques dans ces secteurs. En outre si l'on assimile comme Harberger (1998) la PMF à une réduction des coûts de production, on peut dire que la croissance de la valeur ajoutée dans le secteur BTP et Annexes est imputable à la réduction des coûts de production. Par ailleurs, un choc de dépenses publiques serait favorable à la création de valeur ajoutée

dans les services et le secteur du commerce car leurs valeurs ajoutées ont tendance à baisser lorsqu'ils subissent une pression fiscale forte.

6. Conclusion et recommandations de politiques économiques

Le cadre macroéconomique au sein duquel opèrent les entreprises au Sénégal est assez bon. La croissance a été soutenue ces dernières années. Elle est en moyenne de 4,7% sur la période 1994-2003, au-dessus de la moyenne pour l'Afrique sub-saharienne. En outre, les principaux paramètres macroéconomiques sont relativement corrects. Cette croissance économique depuis 1994 s'est traduite par un développement non négligeable du secteur manufacturier et des services.

Les estimations de fonction de production suggèrent que la productivité totale des facteurs au Sénégal demeure significativement supérieure à celle de pays comme l'Ethiopie, le Mozambique et la plupart des pays de l'UEMOA. Cependant, malgré l'existence d'un bon cadre macroéconomique, la mise en place de nombre de réformes économiques significatives reste difficile. Ainsi les diverses privatisations, l'amélioration du code du travail et une réforme tarifaire généralisée tardent à s'opérer. De même, le maintien de la productivité des entreprises à un niveau très correct ainsi que les divers problèmes structurels perdurent.

C'est dans ce contexte que ce papier s'est attaché à analyser les déterminants de la valeur ajoutée du secteur moderne au Sénégal. A terme, l'étude a révélé trois déterminants majeurs qui entre eux même subissent des interactions à savoir le facteur travail mesuré par la rémunération des salariés, le facteur capital mesuré par la CCF et la productivité multifactorielle capital-travail.

Les résultats empiriques mettent en exergue la dominance des salaires dans la création de valeur ajoutée. Ce fait ne néglige pas pour autant la CCF qui reste un déterminant clé de la valeur ajoutée. On note aussi la l'importance du progrès technique à travers la productivité multifactorielle.

Plus de la moitié de la valeur ajoutée créée dans le secteur moderne provient des services. Ils sont donc le moteur de la création de richesse dans le secteur formel au Sénégal. Après les services viennent l'industrie en deuxième position et le commerce en troisième.

Toutefois, des freins importants minent ces secteurs. En effet, les flux d'IDE sont relativement faibles au Sénégal, inférieurs à la moyenne pour l'Afrique subsaharienne et l'UEMOA. En outre, les divers classements internationaux disponibles indiquent une attractivité modérée du Sénégal pour les investisseurs, notamment étrangers (Doing Business, Africa competitiveness, World Economic forum). Ceci suggère d'une part que les réformes déjà entreprises n'ont pas assez amélioré le climat des investissements et donc changées significativement la perception des investisseurs quant à l'attractivité du Sénégal et d'autre part que des mesures additionnelles sont nécessaires.

L'étendue de la corruption constitue un motif sérieux d'inquiétude pour les entreprises du secteur manufacturier. Elle est citée par environ 40 pourcent des chefs d'entreprise du secteur manufacturier et environ 39 pourcent de ceux opérant dans les services comme un problème critique ou majeur. Le Sénégal n'est pas très bien placé à ce niveau en termes de comparaisons internationales. En pratique, le phénomène a un coût non négligeable. En moyenne, environ 6,5

pourcent de la valeur des contrats avec l'administration est perdue". Néanmoins, cette étude présente certaines limites qui s'articulent autour des points suivants :

- ❖ La période d'étude et la fréquence des données collectées ; ce qui peut affecter certains de nos résultats.
- ❖ Certaines variables déterminantes de la revue de la littérature n'ont pas été pris en compte et ont été remplacé par d'autres mesures pour la simple raison qu'elles ne sont pas faciles à mesurer dans une économie comme celle du Sénégal.
- ❖ Le manque d'études empiriques relatives à la création de valeur ajoutée dans les secteurs modernes, en particulier celui du Sénégal.
- ❖ Cette étude n'a cerné que quelques déterminants de la valeur ajoutée avec l'approche de la comptabilité de la croissance. En effet, cette approche ne vient pas expliquer les causes profondes de la croissance mais indique l'importance relative des différents sources immédiates de la croissance. Des études institutionnelle et chronologique doivent aussi être effectuées si l'on veut analyser les causes profondes de la croissance.

Au vue de cette étude, les recommandations de politiques économiques vont être différentes selon les macro-secteurs du fait qu'ils n'ont pas toujours les mêmes déterminants de leurs valeurs ajoutées. En général les politiques macroéconomiques qui pourraient à terme permettre au secteur formel de créer davantage de richesse pour promouvoir une croissance soutenue de l'économie sénégalaise sont :

- ❖ La mise en place d'une stratégie commerciale s'appuyant sur l'exploitation des opportunités d'accès aux marchés offertes par les pays développés.
- ❖ La rémunération des salariés fondée sur le salaire d'efficience afin d'augmenter la productivité du travail dans le secteur des BTP, celui du commerce et celui de l'industrie.
- ❖ Davantage investir en capital physique dans les services.
- ❖ Investir plus en capital humain dans le commerce et l'industrie.
- ❖ La revalorisation du secteur des BTP.
- ❖ Favoriser la R&D dans les secteurs de l'industrie, du commerce et des services pour qu'il ait plus d'innovations
- ❖ Minimiser les coûts surtout dans le secteur du commerce.
- ❖ La conduite des gros acteurs du secteur informel vers le secteur formel afin de lutter contre leur non imposition qui est un manque à gagner pour l'Etat au détriment du secteur formel.
- ❖ L'assainissement du cadre réglementaire et l'éradication progressive de la corruption rampante.

Glossaire

C99 ou B99 : Base 100 en 1999
CCF : Consommation en Capital Fixe
COM : Commerce
CROISS : Croissance
ICS : Industries Chimiques du Sénégal
IMP : Impôt
IND : Industrie

PC : Productivité du Capital
PMF : Productivité multifactorielle
PT : Productivité du Travail
SER : Services
SM : Secteur Moderne
TX : Taux

Bibliographie

Agence Nationale de la Statistique et de la Démographie du Sénégal, *Banques de données économiques et financières*, décembre 2008.

Aghion P., Howitt P. (1992) A Model of Growth through Creative Destruction" Econometrica, 60(2): 323-351.

Akaike H. (1969) Fitting Autoregressive Models for Prediction, *Annals of International Statistics and Mathematics,* 21: 243-247.

Akaike H. (1994) A New Look at the Statistical Model Identification, *Automatic Control, IEEE*, 19 (6): 716-723.

Barro R.J. (1990) Government Spending in a Simple model of Endogenous Growth, Journal of Political Economy, 98(5): 5103-5125.

Barro R. (1991) Economic Growth in a Cross-Section of Countries, *Quarterly Journal of Economics*, 106(2): 407-444.

Barro R., Sala-I-Martin X. (1992) Convergence, *Journal of PoliticalEconomy,* 100(2): 223-251.

Barro R. (1998) Human Capital and Growth in Cross-Country Regressions. Harvard University.

Bean C (1989) Endogenous Growth and the Pro-cyclical Behavior of Productivity, European Economic Review, 37: 861-890

Ben Mimoun M., Raies M. (2008) Human Capital Investment and Growth: A Dynamic Education Model, *Journal of Business and Public Affairs*, 2(1): 1-22

Bourghain A., Pieretti P. (1999) Analyse de la productivité totale des facteurs dans l'industrie luxembourgeoise, *Cahiers d'économie du Centre universitaire de Luxembourg*, 14: 9 – 27.

Domar H. (2002) *Growth Model* in Brian Snowdon and Howard R. Vane (dir.), *An Encyclopedia of Macroeconomics*, p. 316.

Griliches Z. (1992) *Output Measurement in the Service Sectors*, Chicago: University of Chicago Press.

Jorgenson D.W (1995) *Productivity and Economic Growth*, In Dale W. Jorgenson, *International Comparisons of Economic Growth*, Chapter 1, Cambridge, The MIT Press, 1-88

DeLong B.J., Summers L.H. (1991) Equipment Investment and Economic Growth, *Quarterly Journal of Economics*, 106(2): 445-502.

DeLong, Bradford J., Summers, Lawrence H. (1993), « How Strongly Do Developing Countries Benefit from Equipment Investment? », Journal of Monetary Economics, 32, p. 395-415.

Engle R.F., Granger C.W.J. (1987) Co-integration and Error Correction. Representation, Estimation, and Testing, *Econometrica*, 55(2): 251-76.

Fuller W.A. (1976) *Introduction to Statistical Time Series*, New York: Wiley.

Granger C. (1988) Some Recent Developments in a Concept of Causality, *Journal of Econometrics*, 39: 199-211.

Greene W. (2006) Econométrie, 5ème edition

Gali J., Hammour M. (1991) Longrun Effects of Business Cycles, Univ. of Columbia.

Hairault J.O. (2000) Analyse macroéconomique, Paris: La Découverte

Harberger A.C. (1998) A Vision of the Growth Process, *American Economic Review,* 88(1): 1-32.

Johansen S. (1988) Statistical Analysis of Cointegration Vectors, *Journal of Economic Dynamics and Control*, 12(2-3): 231-54.

Jones C.I. (1995) R&D-Based Models of Economic Growth, *Journal of Political Economy*, 103(4): 759-784.

Koléda G. (2004) Innovations horizontales et verticales, croissance et régimes technologiques, Revue économique, 55(6): 1171-1190.

Levine R., Renelt D. (1992) A sensitivity analysis of cross-country growth regressions. *American Economic Review*, 82(4): 942–963.

Lucas R.E. Jr. (1988) On the Mechanics of Economic Development, *Journal of Monetary Economics*, 22(1): 3-42.

Malley J., Muscatelli V.A. (1996) *Business Cycles and Productivity Growth: are Temporary Downturns Productive or Wasteful*, Univ. of Glasgow.

Mbaye A.A. (2002) *An Industry Level Analysis of Manufacturing Productivity in Senegal*, December

Ndjieunde G. (2005) *Performances économiques des pays africains de la zone franc*, décembre

Nickell S., Wadhwani S., Wall M. (1992) Productivity growth in UK companies, 1975-86', European Economic Review, 36(5): 1086-1091.

O'Connell S., Ndulu B, J.(2000) *Africa's growth experience*, A Focus on Sources of Growth, April.

Saint-Paul G. (1993) Productivity Growth and the Structure of the Business Cycle, European Economic Review, 37: 861-890.

Rebelo S.T. (1991) Long-Run Policy Analysis and Long-Run Growth, *Journal of Political Economy*, 99(3): 500-521.

Solow R.M. (1956) A contribution to the Theory of Economic Growth, *Quarterly Journal of Economics*, 70(1): 65-94

Romer P. (1986) Increasing Returns and Long-Run growth, *Journal of Political Economy*, 94(5): 1002-1037

Romer P. (1990) Endogenous Technological change, *Journal of Political Economy*, 98(5): 71-102.

Saint-Paul G. (1996) Les nouvelles théories de la croissance et leurs implications pour la politique économique et l'analyse de la concurrence internationale, *Revue francaise d'economie*, 11(3): 3-20

Schwartz G. (1978) Estimating the Dimension of a Model, *Annals of Statistics*, 6(2): 461-464.

Tinbergen J. (1942) Zur Theorie der Langfristigen Wirtschaftsentwicklung, On the Theory of Long-Term Economic Growth), *Weltwirtschaftliches Archiv*, 55: 511-549.

Yildizoglu M. (2010) *Croissance économique*, Université Montesquieu Bordeaux IV – France

Young A. (1991) Lessons from the East Asian NICs: A Contrarian View, *European Economic Review*, 38(3-4): 964-973

Guide for authors

The articles can be written in **English, French or German.**
Before being accepted for publication, the articles must be sent in two copies printed on paper and on a CD (Word only) on the address:

Studia UBB, Oeconomica
58-60 Teodor Mihali street, room 231
400591 Cluj-Napoca, Romania

In the first stage, **before being accepted for publication**, the articles will be presented in the following way:

(1) The text: between 10 and 20 printed pages, numbered, recto only, A4 format, all margins 2 cm, characters Arial 11, and spacing 1.5.

(2) The first page (which will be eliminated in order to make the evaluation, by one of the Advisory Board members, anonymous) must contain the title of the article, the author's name, his/her complete coordinates (professional address, phone, e-mail) and potential thanks for the technical and/or the financial help. The title must be precise, clear and in agreement with the main theme of the text. The authors must make sure that they cannot be identified when reading the manuscript.

(3) The second page will contain the title of the article and an abstract (in English) of 5-10 lines, that should present the main results of the article. The summary must inform the reader about the content of the article. The summary must be followed by the JEL Classification and by 3-6 keywords in English which define best the article.

(4) The text will start properly on page 3.

(5) In the introduction, the author must present the relevance of the article for the respective field and must quote the main results obtained by other authors concerning the subject. The conclusions must summarize clearly the results and the consequences.

(6) The presentation of the bibliographical references:
- In the text the references quotes will appear between brackets, with the name and the publication date, e.g.: (Denicolo, 2000).
- For two co-authors they will use for example (Dixit and Stiglitz, 1977).
- In the case of three or more than three authors, only the first will be mentioned, under the form (Brooks et al, 1998).
- If two references have the same author and the same publication year, they will be differentiated through letters (McFadden, 1984a). These letters will also appear in the bibliography.

At the end of the article the references will be presented as follows:

Periodicals:

Wojcik C. (2000) Alternative Models of Demand for Automobiles, *Economics Letters*, 68(2) : 113-118.

Books:

Biswas T. (1997) *Decision-making under Uncertainty,* Macmillan Press, London.

Working papers:

Musu I. (1995) Transitional Dynamics to Optimal Sustainable Growth, *Fondazione ENI Enrico Mattei Working Paper no. 5095*.

Paper presented at conferences:

Nainggolan K. (1996) Indonesian Agriculture under a Free Trade Regime, *ASAE Conference, Bali Indonesia, 6 - 9 August*, 18p.

Quotes of personal works:
If the author wants to make reference to one or several personal works, it is essential that the used formulation preserve his anonymity. In the first sent version, before being accepted for publication, if the quotation of a personal work is absolutely necessary, the author may use the formulation (author, 2001) both in the text and in the bibliography. The bibliographical references will be completed after the article is accepted for publication.

(7) After the article is accepted for publication, the final and complete version of the article must be sent on a CD or by e-mail. The article will be written in Microsoft Word.

(8) *Studia UBB, Oeconomica* requires the exclusivity of the article. The same article mustn't be proposed simultaneously to other journals.