A COMPARATIVE ANALYSIS OF THE DIVISIA INDEX AND THE SIMPLE SUM MONETARY AGGREGATES FOR SOUTH AFRICA.

By

Meshach Aziakpono,
Department of Economics, Rhodes University, P.O. 94, Grahamstown, South Africa, Tel: +27 (046) 603 8684, E-mail: m.aziakpono@ru.ac.za

Solomon Moyo
The IQ Business Group (Pty) Ltd, South Africa, Tel: E-mail:
and
Hugo Nel
Department of Economics, Rhodes University, P.O. 94, Grahamstown, South Africa, Tel: +27 (046) 603 8301, E-mail: h.nel@ru.ac.za

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Outline of Presentation

- Motivation
- Objectives of the study
- Divisia Monetary Aggregates
- Performance of Divisia and Simple Sum Monetary Aggregates
- Conclusion

1. Motivation

- Measuring money is important for several reasons, e.g.:
  - Use as instrument of monetary policy (monetary targeting)
  - Use for forecasting of economic activities (e.g. output and inflation)
  - Use as leading economic indicator
- Traditional approach – Simple Sum Aggregates (SM): $M = \sum_{i=1}^{n} x_i$
  - Advantage – very simple to measure and has accounting interpretation
  - Problems:
    - Assumes monetary assets are perfect substitutes (hence equal weighting across assets and over time). But:
      - Monetary assets are not perfect substitutes across assets
      - Financial innovation affects the moneyness of monetary assets over
    - The case of missing money
- Alternative approaches:
  - Variable Elasticity of Substitution (VES), Divisia Index and Currency Equivalent

Table 1: Evolution of South Africa's Monetary Policy Frameworks

YEARS	MONETARY POLICY
1960-1981	Liquid asset ratio-based system with quantitative controls over interest rates and credit
1981-1985	Mixed system during transition
1986-1998	Cost of cash reserves-based system with pre-announced monetary targets (M3)
1998-1999	Daily tenders of liquidity through repurchase transactions (repo system), plus pre-announced M3 targets and informal targets for core inflation
2000-present	Formal inflation targeting

Objectives of the Study

- To construct a Divisia index for South Africa
- To evaluate the relative performance of DM and SM in terms of:
  - Predictive ability of inflation and national income
  - Controllability
  - Information content
- To make some recommendation based on the findings

2. Divisia Monetary Aggregates

- DM places emphasis on medium of exchange function of money
- DM is calculated as weighted average of the growth rate of N different component money holdings:
  - Following Barnett (1980), Barnett *et al.* (1984), Anderson *et al.* (1997), Dahalan *et al.* (2005) we use the Tornquist-Theil discrete time approximation as follows:

$$DM_t = DM_{t-1} \prod_{i=1}^{N} \left(\frac{M_{it}}{M_{it-1}}\right)^{s_{it}^*} \quad [1]$$

where: DM_t = Divisia index,
S_{it}^* = the average of S_{it} and S_{it-1},
S_{it} = expenditure share of the monetary assets *i* at time *t,*
M_{it} = the balance of asset *i* at time *t,*
N= monetary component and Π= product sign

2. Divisia Monetary Aggregates –2.

- Step 1: Determining the expenditure share:
  Following Dahalan *et al.* (2005) we use:

$$S_{it} = \frac{\pi_{it} M_{it}}{\sum_{j=1}^{N} \pi_{jt} M_{jt}} \quad [2]$$

  where: π_{it} = is the user cost of each asset at time *t,*

- *Step 2: Determine the user cost:*
  - *Following* Barnett (1980) and Dahalan *et al.* (2005) we use:

$$\pi_{it} = \frac{P_t (R_t - r_{it})}{1 + R_t} \quad [3]$$

where: R_t = is the benchmark rate, r_{it} = is asset *i*'s rate of return, *and* P_t = is the consumer price index

2. Divisia Monetary Aggregates –3.

- Following Ishida (1984:77), Eq.[3] is simplified as:

$$\pi_{it} = R_t - r_{it} \quad [4]$$

- Next we determine the benchmark rate, R_t following Dahalan *et al*. (2005) and Hancock (2005) as the maximum rate of return over a large class of assets plus a constant, thus:

$$R_t^* = \max\{RODD_t, RSTD_t, RMTD_t, RLTD_t, GB_t\} + c \quad [5]$$

where: R^*_t = benchmark asset,
RODD= rate of return on other dd,
RSTD= rate of return on short term deposits,
RMTD= rate of return on medium term deposits,
RLTD = rate of return on long term deposits,
GB = government 10 year bond, and
c = constant

Table 2: Data used in computing DM aggregate

MONETARY AGGR COMPONENTS	DEFINITION	COMPOSITION	RATES	ASSUMPTIONS
Coins and notes in circulation	Currency in circulation	Notes and coins	zero	No interest rates
Cheque and transmission deposits	Non-cash currency	Cheques	zero	No interest rate
Other demand deposits	Other demand deposits with banking institutions	Deposits	Calculated	Implicit interest rates
Other short- and medium-term deposits	All savings deposits of the domestic private sector with monetary institutions including savings deposits with and savings bank certificates issued by the postbank	Short-term deposits Medium-term deposits	NCD 6 Month NCD 12 Month	The NCD rates are representative of the short- and medium-term deposits
Long-term deposits	Long-term deposits of the domestic private sector with monetary institutions, including national saving certificates issued by the postbank	Long-term deposits	NCD 36 Month	The NCD rate is a good representative of the long-term deposits

Notes: NCD Negotiable certificate of deposit, Benchmark asset option: Envelope method (maximum of selected financial and non-financial asset returns) plus a constant.

Figure1: Annual average Divisia index and simple sum (1986:01-2006:12)

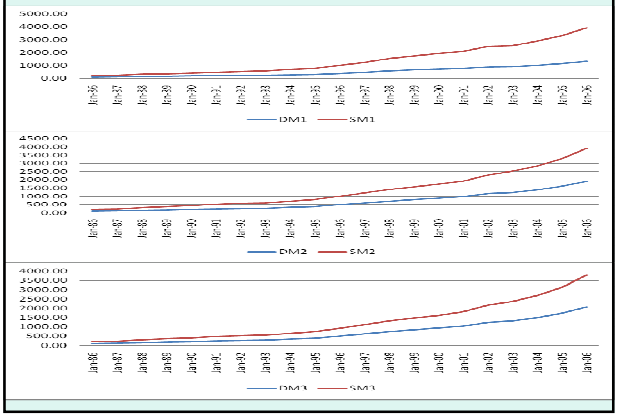


Figure 2: Annual average Growth rate of SM, DM and Macroeconomic variables (1986:01-2006:12)

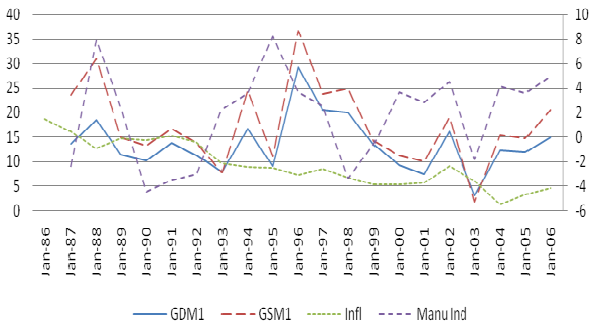


Figure 3: Annual average Growth rate of SM, DM and Macroeconomic variables (1986:01-2006:12)

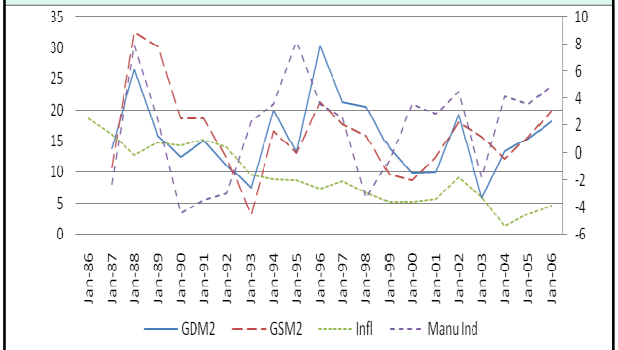
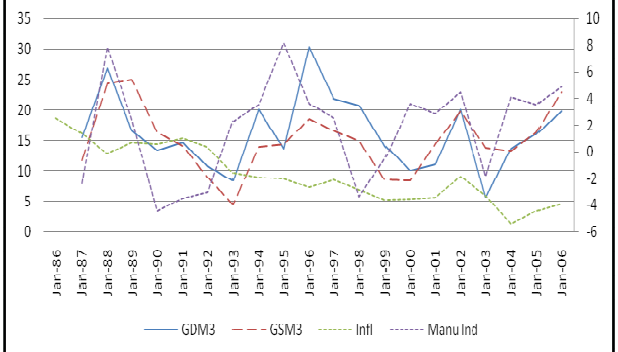


Figure 4: Annual average Growth rate of SM, DM and Macroeconomic variables (1986:01-2006:12)



3. Performance of DMs and SMs

- *Econometric Technique: Polynomial Distributed Lag (PDL) Model:*
  - The PDL reduces multicollinearity which is common in economic data, thereby increasing precision of the estimation
- Predictive power: $MEV\ c\ ar(1)\ pdl(MA,k,r)$ [6]
- Controllability: $MA\ c\ ar(1)\ pdl(gmb,k,r)$ [7]

where: *MEV* = dependent variable,
MA = monetary aggregates,
gmb = growth rate of monetary base,
c = constant,
ar = autoregressor of order 1,
k = lag length and
r = degree of polynomial

3. Performance of DMs and SMs -2

- Information content:
  - Following Acharya and Kamaiah (2001):

$$I = -0.5\log\left[\frac{1-R^{*2}}{1-R^{2}}\right] \quad [8]$$

where: I = Information content, R^{*2} and R^2 are from:

$$G = A_g(L)G + B_q(L)M + u \quad [9]$$

$$G = A_q(L)G + v \quad [10]$$

where: A_p and B_q are polynomials in L associated with G and M respectively, L is lag operator and u and v are error terms.

- Data: Monthly series 1986:01 to 2006:12

Results - Predictive power:

Table: 1 PDL Regression of Inflation on Money Growth

Money	DM1	SM1	DM2	SM2	DM3	SM3
SUM LAGS	3.57	2.72	3.02	1.39	3.33	3.30
T-STAT	4.59*	4.68*	3.99*	1.67***	4.27*	2.89*
SE	0.78	0.58	0.76	0.84	0.78	1.15
AR(1)	0.98	0.98	0.98	0.98	0.98	0.98
AdjR²	0.98	0.98	0.98	0.98	0.98	0.98
D-W	1.84	1.76	1.82	1.81	1.74	1.96

*Note: *, **,*** denotes significance at the 1%, 5%,10% level, respectively, SE (standard error) D-W (Durban Watson).*

Results - Predictive power:

Table 2: PDL Regression of Man. Index on Money Growth

Money	DM1	SM1	DM2	SM2	DM3	SM3
SUM LAGS	0.116	0.178	0.192	0.014	0.201	0.071
T-STAT	0.491	1.032	0.848	0.07	0.88	0.275
SE	0.237	0.173	0.227	0.207	0.228	0.259
AR(1)	-0.43	-0.429	-0.431	-0.425	-0.43	-0.426
AdjR²	0.171	0.172	0.172	0.165	0.171	0.167
D-W	2.052	2.053	2.054	2.039	2.054	2.048

Note: See note on Table 1 above for a description of the terms used in the table above.

Results – Controllability:

Table 3: PDL Regressions of growth rates of monetary aggregates on monetary base

Money	DM1	SM1	DM2	SM2	DM3	SM3
SUM LAGS	0.046	0.072	0.107	0.354	0.117	0.266
T-STAT	0.240	0.278	0.581	2.380**	0.649	2.319**
SE	0.190	0.257	0.185	0.149	0.181	0.115
AR(1)	-0.369	-0.296	-0.363	-0.110	-0.376	-0.169
AdjR²	0.199	0.135	0.205	0.095	0.212	0.094
D-W	2.174	2.109	2.158	2.002	2.180	2.030

Note: See note on Table 1 above for a description of the terms used in the table above.

Results:
Table 4: Information Content

	Inflation	M. Index	M.Base
SM1	2.070	1.238	0.313
SM2	2.061	1.010	0.311
SM3	2.192	1.204	0.311
DM1	2.203	1.395	0.321
DM2	2.649	1.106	0.319
DM3	2.158	1.074	0.320
	RANKING		
1	DM2	DM1	DM1
2	DM1	SM1	DM3
3	SM3	SM3	DM2
4	DM3	DM2	SM1
5	SM1	DM3	SM3
6	SM2	SM2	SM2

Note: M. index (manufacturing index), M. base(monetary base)

4. Conclusion

- Predictive power:
  - Any of the monetary aggregates can be used to predict inflation:
    - The Divisia aggregates have stronger predictive power than their simple sum counterparts.
    - The predictive power of the Divisia was strongest for the M1 followed by the M3
  - An insignificant relationship between monetary aggregates and manufacturing index
- Controllability:
  - A weak link between the monetary aggregates and monetary base
    - This suggests that the move away from monetary targeting by the SARB is a move in the right direction
- Information content:
  - High information content for inflation but not for the other variables used
    - Again the Divisia aggregates is superior to the simple sum