MONEY, CREDIT AND INTEREST: SEARCHING FOR A CREDIT CHANNEL IN SOUTH AFRICA

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0. INTRODUCTION

- Is there evidence of a credit channel, i.e. both the bank-lending and the balance-sheet channels, in South Africa?
- Bernanke and Gertler (1995:28) warn that the credit channel is not really a separate channel,
- Rather the amplification of the existing interest rate and money channel of monetary policy.
- Thus models credit channel within a broader model of monetary transmission mechanism that models the money channel in the form of the money demand and its determinants.

1. LITERATURE ON THE CREDIT CHANNEL

- Bernanke and Blinder (1988)
- Bernanke and Blinder (1992), Gertler and Gilchrist (1993), Bernanke and Gertler (1995); Iacoviello and Minetti (2008), Garretsen and Swank (2003); Fountas and Papagapitos (2001), Tang (2001). Southern Africa: Lungu (2007)
- Bernanke and Blinder (1988): Basic general equilibrium model; extends the IS-LM model.
- Textbook IS-LM model: money market, bond market and goods market.
- IS-LM model accepts the perfect substitutability of bonds and bank loans.
- Bernanke and Blinder drop this assumption: allows them to model the supply and demand for bank loans separately from that of bonds.
    - Model: Money supply and demand, loans supply and demand, goods market equilibrium
    - Through substitution derive a CC curve:

$$Y = Y(i, \phi(i, Y, R)) \qquad (9)$$

- Regress money and credit each on interest rate and income – call these money demand and credit demand
- Subsequent literature disagrees: $L = C(\rho, i, D)$ not a credit demand relationship
    - Textbook example of a supply and demand identification problem.
- Addressing this problem in the literature gave rise to different approaches in establishing the presence of the credit channel (cf. Iacoviello and Minetti 2008, Garretsen and Swank 2003; Fountas and Papagapitos 2001, Kashyap, Stein and Wilcox 1993).
    1. Distinguish between either small and large borrowers or lenders (Garretsen and Swank 2003; Kashyap, Stein and Wilcox 1993).
    2. This approach also allows for the distinction between the bank-lending channel (loan demand phenomenon) and the balance-sheet channel (a loan supply phenomenon, first suggested by Bernanke and Gertler 1995).
- Follow the second option in this paper

- Eq 9 is augmented by introducing the quality spread or external finance premium (EFP), s, that represents the balance-sheet channel:

$$Y = Y(i, \phi(i, s, Y, R)) \qquad (9')$$

- The EFP is levied by lenders and results from:
  - A combination of information asymmetries, moral hazard and adverse selection.
- Bernanke and Gertler (1995:34-7) argue that as interest rates increase, balance sheets weaken,
- As a result moral hazard and adverse selection problems might also increase.
- Might cause external finance premium to increase when interest rates increase.
- Banks will then lend less

- Variation of Equation (9') can also be specified with prices/inflation as dependent variable
  - Equation (9') substituted into a Phillips curve. Can thus be used to derive excess demand for output (i.e. a disequilibrium).
- Serves as indicator of how monetary policy impacts inflation (ultimate objective of monetary policy in many countries) when transmitted through the credit channel.

$$P = P(i, \phi(i, s, Y, R)) \qquad (9'')$$

- Consider the size and significance of i and s as indications of the presence and significance of the bank-lending and balance-sheet channels of the credit channel
  - cf. Iacoviello and Minetti 2008, Fountas and Papagapitos 2001

2) LITERATURE ON MONEY DEMAND

- In terms of the sheer number of articles, the literature on money demand might be one of the largest within the economics discipline (see Sriram (2000) for international literature covering most of the 1990s).
- The form in which authors estimate money demand functions has become highly standardised
- This contrasts with the literature on the credit channel.
- Include Moll (2000), Jonsson (2001), Wesso (2002), Tlelima and Turner (2004), Ziramba (2007), Hall, Hondroyiannis, Swamy and Tavlas (2007) and Todani (2007),
    - Moll provides an overview of earlier literature.

3) MONEY, CREDIT AND INTEREST IN SOUTH AFRICA

- Model credit channel within a broader model of monetary transmission mechanism that models the money channel in the form of the money demand and its determinants.

$$M^D = D(Y, i)$$

$$P = P(i, \phi(i, s, Y, R))$$

- Distinguish between two sub-channels of the credit channel: The bank-lending channel and the balance-sheet channel.

- Therefore, the variables used in the analysis below are:
  - *m3* = the log of real M3,
  - *GDP* = the log of real GDP,
  - *DCPI* = the quarterly inflation rate annualised so as to match the interest rates that are calculated on an annual basis,
  - *TB rate* = the Treasury bill rate (for own rate and monetary policy rate),
  - *Bond rate* = the 10-year government bond rate (for opportunity cost and indicator of expected inflation),
  - *EFP* = the external finance premium defined as the spread between the mortgage rate and the 10-year government bond rate (following Iacoviello and Minetti (2008:4)),
  - *Credit* = the log of real private sector credit extension (following Garretsen and Swank (2003))

- Unlike other studies that include data as far back as 1970, the sample period in this study is 1982:1 to 2007:3.
    - Limit the sample to the period characterized by financial market liberalisation (the 1980s) and financial market deepening (the period since the mid 1990s).
- The analysis uses the by now standard Johansen cointegration technique, which is suitable for use when time-series data are non-stationary.
    - The technique also allows for the use of weak exogeneity tests, as well as impulse-response and variance decomposition analyses.
- To test for the stationary of variables the analysis uses the KPSS test, which, unlike the often-used ADF test, does not suffer from small sample problems.

Table 2 - KPSS Stationarity test

	Quarterly data		
	t-values		I(*)
	Level	First dif	
m3*	0.31	0.09	**I(1)**
GDP*	0.30	0.08	**I(1)**
Credit*	0.27	0.09	**I(1)**
DCPI**	1.04	0.03	**I(1)**
EFP**	0.15		**I(0)**
TB rate**	0.50	0.14	**I(1)**
Bond rate**	0.93	0.37	**I(1)**

Null hypothesis: Variable is stationary
* Intercept and trend: Critical t (5%): 0.15
** Intercept: Critical t (5%): 0.46

- The vector error-correction model estimated below using the Johansen procedure is:

$$\Delta X_t = \Pi X_{t-1} + \sum_{t=i}^{k} \Gamma_i \Delta X_{t-i} + \varepsilon_{kt} \qquad (10)$$

- where X_t = (m3, GDP, DCPI, TB rate, Bond rate, EFP, Credit)
- The trace test is used to determine the number of cointegrated vectors. It indicates the presence of two cointegrating vectors:

$m3 = -\beta_1 DCPI + \beta_2 GDP + \beta_3 TB\ rate - \beta_4 Bond\ rate + \beta_5 Credit + \varepsilon_1$

$DCPI = \beta_6 GDP - \beta_7 EFP - \beta_8 TB\ rate + \beta_9 Bond\ rate + \beta_{10} Credit + \varepsilon_2$

Table 3 – Money demand, inflation and the interest and credit channels of monetary policy

	Model 2		Model 3	
Cointegrating Eq:	**Coint Eq 1**	**Coint Eq 2**	**Coint Eq 1**	**Coint Eq 2**
m3	1	0	1	0
DCPI	0.22 [1.51]	1	*0.75 [7.08]*	1
GDP	*-1.87 [-9.42]*	*0.45 [2.76]*	*-1.90 [-9.16]*	*0.43 [2.91]*
EFP	0	-1.59 [-4.57]	0	*-1.59 [-4.38]*
TB rate	*-0.95 [-5.80]*	*1.73 [6.50]*	*-0.75 [-7.08]*	*1.72 [6.31]*
Bond rate	*1.27 [4.76]*	*-1.72 [-5.67]*	*0.75 [7.08]*	*-1.72 [-6.31]*
Credit	*-0.40 [-5.34]*	*-0.27 [-4.29]*	*-0.47 [-5.76]*	*-0.26 [-4.28]*
Trend	*0.00 [3.67]*	0.00 [1.50]	*0.00 [4.62]*	*0.00* [1.55]
C	17.43	-2.72	18.65	-2.60
Error Correction:	**M3**	**DCPI**	**M3**	**DCPI**
EC 1	-0.23 [-3.85]	-0.14 [-1.05]	-0.17 [-3.38]	-0.16 [-1.48]
EC 2	-0.13 [-1.97]	-0.54 [-3.66]	-0.05 [-0.74]	-0.49 [-3.51]
Adj. R-sq	0.53	0.46	0.51	0.47
Weak ex χ^2 prob	0.00	0.00	0.03	0.01
Autocor LM(2) prob	0.44		0.52	
Autocor LM(4) prob	0.81		0.77	

Weakly exogenous χ^2 (prob):
Model 2: GDP (0.00), EFP (0.27), TB rate (0.01), Bond rate (0.25), Priv sector credit (0.77)
Model 3: GDP (0.00), EFP (0.37), TB rate (0.03), Bond rate (0.16), Priv sector credit (0.84)

Notes:
t-values in square brackets, statistically significant values (at a 5% level) in the cointegrating relationships are in italics.
Dummies included: 1984:3 (instability caused by first election and introduction of tri-cameral parliament), 1985:4 (instability following Rubicon speech), 1993:3 (instability just prior to acceptance of interim constitution and following Hani assassination), 1990:1-1994:1 = 1 (period of political transition), 1990:1-2007:3 = 1(Stals and Mboweni anti-inflationary regime), and 1998:3 = 1, 1998:4 = -1 (transitory dummy for exchange rate instability in 1998).
All cointegrating relationships were estimated with a constant and trend.

- According to the theory on the balance-sheet channel: tighter monetary policy causes a deterioration in balance sheets, that, in turn, causes EFP to increase.
    - Increase in EFP associated with weaker aggregate demand and decrease in inflation.
- The positive sign may indicate: As balance sheets weaken when risk and EFP increase, the weaker balance sheets may render the central bank relatively reluctant to combat inflation.
    - At prevailing nominal interest rate and in the face of higher risk, CB tolerates higher inflation rates because dealing with inflation through higher interest rates might further weaken balance sheets.
- Also notable: The weak exogeneity test indicates that EFP is weakly exogenous.

- Testing for addition restrictions on the parameter values of Model 2.
  - Table 4 reports the probabilities of the χ^2 values of the LR test for binding restrictions.
- Restrictions are first each tested separately within the context of Model 2, before they are tested jointly. Tests indicate:
  - Parameters of inflation and long and short-term interest rates in vector 1 are equal, with long and short-term interest rate parameters having opposite signs.
  - The parameters of long and short-term interest rates in vector 2 are also equal, but opposite in sign.
  - The χ^2 probability of the final model (with the joint hypothesis that all the above restrictions jointly hold) is 0.66, clearly indicating that the model can be accepted.
  - As a separate hypothesis, parameter of GDP in vector 1 of Model 2 was set equal to 1 to test old (i.e. pre-Friedman) quantity theory notion that velocity is stable. This hypothesis is clearly rejected with a χ^2 probability of 0.00.

- Use Model 3 to conduct an impulse-response analysis and to examine the variance decomposition of money demand, inflation and GDP (the three variables that consistently came out as endogenous in the weak exogeneity tests).
- The impulse-response analysis is done for one standard deviation increase in the TB rate, which serves as indicator of tighter monetary policy.
- It indicates that money demand, inflation and GDP act as expected on *a priori* grounds to the increase in the TB rate.
    - Money demand increases in response to increase in TB rate (recall that TB rate is used as indicator of own rate of money; expect money demand to increase),
    - GDP and inflation decreases (tighter monetary policy leads to a contraction in output and a decrease in inflation).
- These effects peak at about seven to eight quarters
- Complies with conventional wisdom and experience in monetary and financial circles.

Figure 1 – Impulse-response functions of M3, DCPI and GDP to a change in the TB rate

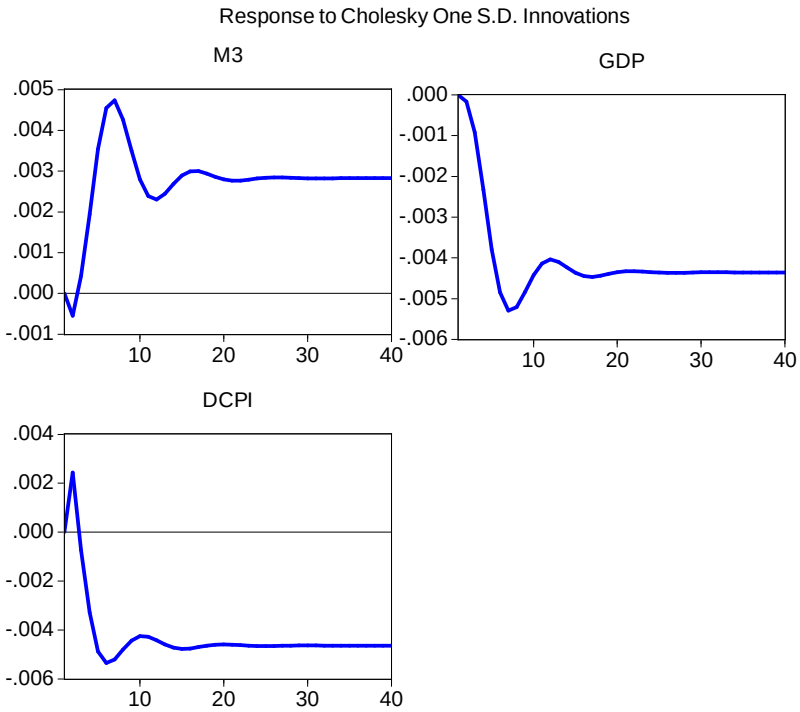
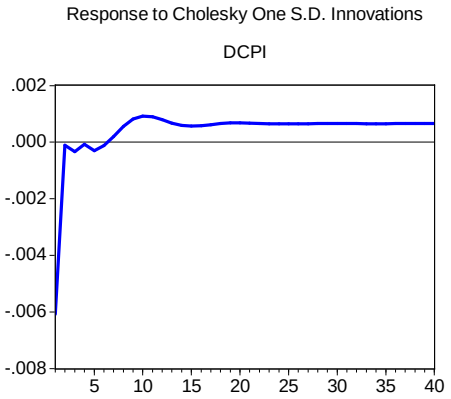


Figure 2 – Impulse-response functions of DCPI to a change in GDP



❒ The variance decomposition yields both expected and unexpected results.

Table 5 – Variance decomposition – 20 quarters

		Variance explained by:						
		m3	**DCPI**	**GDP**	**EFP**	**TB rate**	**Bond rate**	**Credit**
Variance explained	**m3**	11.50	19.95	11.23	11.21	0.77	2.69	42.66
	DCPI	3.36	34.29	1.40	2.70	10.80	33.24	14.20
	GDP	3.92	16.40	35.56	7.31	22.08	3.78	10.96

Cholesky Ordering: TB rate, Credit, EFP, Bond rate, GDP, DCPI, M3.
The policy variable is placed first, with the most endogenous variables, M3 and DCPI, placed last.

❒ It shows that inflation explains 34% of its own variation, while the TB rate and the bond rate explain a further 11% and 33%.

❒ GDP explains 36% of own variance, DCPI and TB rate explaining a further 16% and 22%.

❒ Credit explains 43% of money demand, 14% and 11% of inflation and GDP.

❒ Similarly, EFP contributes very little to any of the variances explained (explain 11% of money demand.

- VEC Granger causality tests. At a 5% level of significance:
  - Changes in all variables jointly Granger cause changes in DCPI,
  - Changes in the TB rate and EFP individually and jointly Granger causes changes in GDP,
  - TB rate individually and jointly Granger causes changes in EFP,
  - Change in GDP individually and jointly Granger causes changes in the TB rate.

Conclusion

- The statistically significant parameters of the TB rate and credit in Model 3 as well as their role in explaining variances of DCPI and GDP together with
- the positive sign of EFP in Model 3 and its very small role of EFP in explaining the variances of DCPI and GDP,
- serves as evidence in support of the existence of the bank-lending channel and the use of non-price mechanisms to affect the supply of credit, but not for the existence of the balance-sheet channel.