Monetary Policy and the predictive power of the yield spread in South Africa

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Outline of Presentation

- Motivation
- South African Business Cycle since 1980s
- The Model, Estimation methods and Data
- Empirical Results
- Conclusion

1. Motivation

- Several empirical studies have shown that the yield spread can be used to predict the probability of a country entering a recession (e.g. Estrella and Hardouvelis, 1991; Estrella and Mishkin, 1996; Haubrich and Dombrosky, 1996; Dueker 1997; Stojanovic and Vaughan, 1997; Dotsey, 1998; Estrella and Mishkin, 1998; Moneta, 2003)
- For South Africa:
  - **Moolman (2002) shows** that the yield curve successfully predicts turning points of the business cycle two quarters ahead
  - **Khomo and Aziakpono (2007)** found that the yield spread produce recession forecasts up to 18 months, although its best predictive power is seen at two quarters (5 months).
    - Compared with other indicators, the yield curve outperforms better especially in longer horizons
- But why does the yield curve help to predict recession?

1. Motivation -2

- One of the possible explanations often cited for the relationship btw the yield curve and recession is the monetary policy stance of the central bank (Estrella and Mishkin, 1998)
- Empirical studies on this subject remain inconclusive (Estrella and Hardouvelis,1991 (*no effect*); Wu, 2001 (*strong correlation*); Estrella, 2005 (*found effect*); Estrella and Trubin, 2006 (*some effect*); Wright,2007 (*some effect*)
- To what extent is monetary policy responsible for the yield curve's predictive power in South Africa?
- Answering this question is the focus of this study

Figure 1: The yield spread and the business cycle in RSA since 1980s

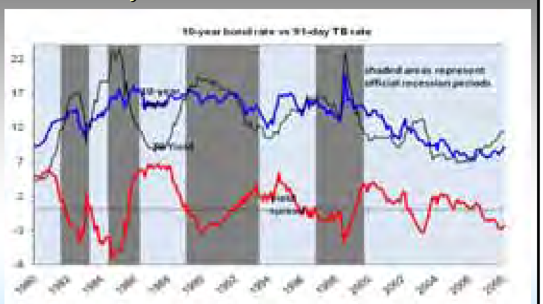
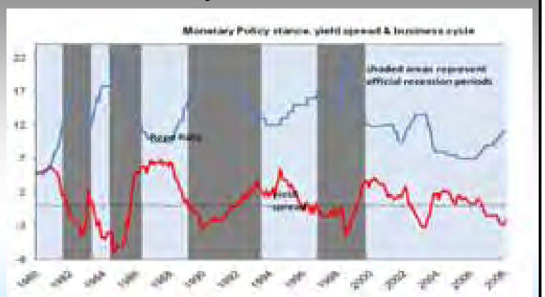


Figure 2: repo rate vs. yield spread & business cycle in RSA



What does the graph tell us?

- Since 1980 the yield curve becomes inverted prior to all four downswings.
- An increase in the spread normally indicates an increase in the likelihood of the economy changing into an upswing, whilst a decline in the spread increases the likelihood of a downswing. The only exception was in 2002, when a decline in the yield curve was not followed by a downswing in the economy.
- The yield curve has become inverted prior to all downswing phases of the business cycle and recessions observed in South Africa, although the timing between the inversion of the curve, and the recession dates has varied from two to four quarters.
- This suggests that the slope of the yield curve is a valuable leading economic indicator and as such correctly predicts future economic conditions.
- A monetary policy tightening proceeded or occur during all the recession

3. The Model, Estimation methods and Data

- **Estrella and Hardouvelis (1991) model:**

  Rt = α + βXt-k + εt *(1)*

  where *Rt* indicates the presence (*Rt* = 1) or absence (*Rt* = 0) of a recession at time *t* and *Xt-k* is the explanatory variable(s), lagged at time *t-k.*

- The probit model:

  Pr(Rt = 1) = F(α + βX t-k), *(2)*

  where *Pr* denotes the probability that a recession will occur, conditional upon the observed value of the explanatory variable *X* lagged *k* quarters (months). *F* is the cumulative normal distribution while α and β are parameters.

Model: Contd.

- Dueker (1997) Model: added a lag of *Rt* to the probit model (2) to remove the serial correlation in the error term thus:

  Pr (Rt = 1) = F(α + β1X t-k + β2R t-k) ***(3)***

- The measure of the goodness of fit is probit model - *pseudo R²* statistic:

  Pseudo R² = 1 - (Lu/Lc) –(2/N) Lc ***(4)***

  where *Lu* is the value of the log-likelihood of the estimated model (unrestricted) and *Lc* is the value of a constrained model containing only the constant term (all coefficients are zero except constant). *N* is the number of observations.

- The *pseudo R2* is used together with *t (z)* statistics from the estimated regressions to find the lags that give the best fit for all the variables studied.
- Lastly, it is necessary to measure the predictive accuracy of the models estimated. We use the RMSE and variance proportion (VP), to evaluate the forecasting accuracy of the model.

Indicators and data sources

- *The Yield Spread*: yield spread is calculated as the difference in yields between the 10-year government bond and the 91-day Treasury bill in South Africa.
- Data on the business cycle and repo rate were obtained from the SARB. The period covered in the study is January 1980 to June 2004.

Empirical Results:
Table 1: *simple probit Model- yield spread only*

Months Ahead	***k=3***	***k=6***	***k=9***	***k=12***	***k=15***	***k=18***	***k=24***
Beta	-0.273	-0.293	-0.250	-0.187	-0.116	-0.062	-0.004
Z-statistic	-8.629	-8.930	-8.391	-7.046	-4.763	-2.652	-0.165
Prob	0.000	0.000	0.000	0.000	0.000	0.008	0.869
Pseudo R²	0.274	0.305	0.250	0.163	0.070	0.022	0.0001
RMSE	0.417	0.409	0.420	0.441	0.466	0.479	0.484
VP	0.321	0.302	0.352	0.444	0.591	0.749	0.982

*Figure 3: R*ecession probabilities estimates

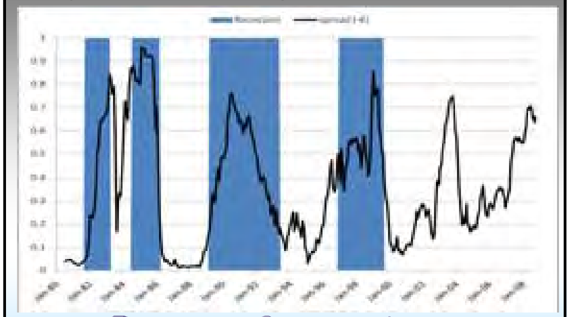


Table 2: Results from Modified Probit Model

Variables	k=3	k=6	k=9	k=12	k=15	k=18	k=24
SPREAD							
Z-stat	-4.948	-5.848	-5.584	-4.743	-3.296	-1.991	-351
Prob	0.000	0.000	0.000	0.000	0.0010	0.047	0.726
R $_{t-k}$							
Z-stat	11.80	9.788	6.862	4.225	2.122	0.740	-0.422
Prob	0.000	0.000	0.000	0.000	0.034	0.460	0.673
Pseudo R^2	0.097	0.121	0.103	0.071	0.034	0.012	0.001
RMSE	0.420	0.408	0.432	0.451	0.471	0.481	0.483
VP	0.083	0.265	0.399	0.523	0.653	0.775	0.960

*Figure 4: R*ecession probabilities estimates with alternative models

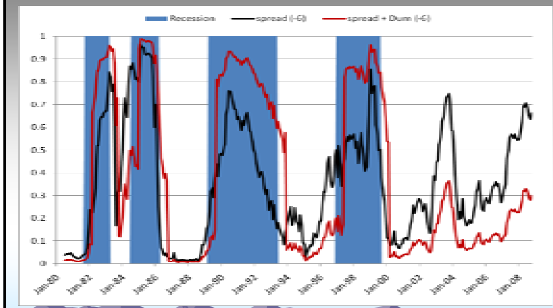


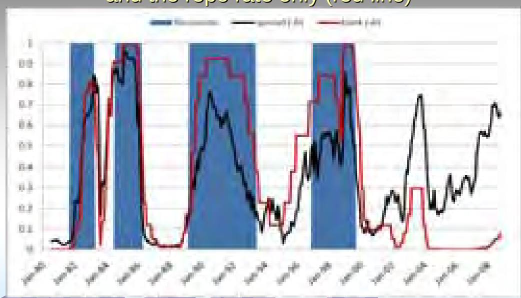
Table 4: ***Results from Combination of Repo Rate and Yield Spread***

$Prob(R_t = 1) = \Phi(c_0 + c_1X_{t-k} + c_2Repo_{t-k})$

Variables	k=3	k=6	k=9	k=12	k=15	k=18	k=24
SPREAD							
Z-stat	2.087	0.626	0.177	0.032	0.515	1.101	1.953
Prob	0.037	0.531	0.860	0.975	0.607	0.271	0.051
Repo Rate							
Z-stat	8.307	8.124	7.647	6.362	4.855	3.766	2.699
Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.007
RMSE	0.286	0.289	0.337	0.395	0.444	0.468	0.479
VP	0.112	0.160	0.236	0.348	0.479	0.603	0.731

__ indicates model is not statistically significant even at 10%

Figure 5: estimated recession probabilities based on a model containing the spread alone (dark line) and the repo rate only (red line)



Conclusion

- Empirical results presented in this paper provide further evidence that the yield curve, as represented by the yield spread between 3-month and 10-year government paper can be used to estimate the likelihood of recessions in South Africa.
- The yield spread produce recession forecasts up to 18 months, although its best predictive power is seen at two quarters (6 months).
- Results from the standard probit model proposed by Estrella and Hardouvelis (1991) and the modified probit model with a lagged dependent variable are somewhat similar, although the latter model improves forecasts at a shorter horizon up to 3 months.
- The yield spread loses its explanatory power when combined with a variable representing the monetary policy stance of the central bank
- Although the yield spread correctly predicts business cycle phases, most of its predictive power comes from monetary policy