RESEARCH REPORT ESCOR #7911:

"Governance and Inflation Targeting in South Africa for Sustainable Growth."

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I.   Background and Objectives

Monetary policy in South Africa's transition economy has recently undergone an important regime change. Given capital account liberalisation and medium-term constraints on fiscal policy, monetary policy has the major responsibility for curbing inflation and currency instability, and yet trying to ensure sufficient growth for longer-term political stability.

The move to inflation targeting from 2000 aimed to enhance policy transparency and accountability and thereby to decrease inflationary expectations. By contrast with targeting the exchange rate directly, the exchange rate is viewed as only one factor influencing inflation, and should result in less interest rate volatility, with less detrimental effects on growth. Successful inflation targeting demands good forecasting models of inflation, clarity on the mechanisms of monetary transmission, an institutional design that guarantees the transparency and accountability of policy, and a shared understanding with the private sector of the effectiveness of monetary policy for inflation. There has been little research on the adoption of inflation targeting in South Africa (S.A.). We aim to provide an original, comprehensive and sophisticated analysis to evaluate the design and operation of the new monetary policy regime and its implications for sustainable growth, currently the subject of considerable domestic policy debate.

Moreover, while the need for good econometric modelling in S.A. has never been greater, the South Africa Reserve Bank (SARB) lacks capacity in this area. The SARB's quarterly econometric macro-model has not been opened to outside scrutiny (unlike in the U.K.). The SARB's models omit important interest rate transmission channels (e.g. they omit wealth effects, see our previous DFID research) which makes it difficult to take a well-informed view of the size and dynamics of the effects of monetary policy. In the past the models have given insufficient attention to the consequences of regime shifts and, more generally, to the influential Lucas Critique of the use of policy modelling.

In the light of these observations, our clear objectives are the following:

1. To clarify the detailed institutional design and mode of operation of the new regime in a comparative light, to assess the accountability and transparency of the system.
2. To contribute to an understanding of the detailed channels of transmission from interest rates to inflation.
3. To contribute to the development of sound forecasting models for inflation needed to make inflation targeting operative, using far more sophisticated models than hitherto.
4. To develop empirical models to evaluate the practical operation of inflation targeting over the first 3 years, and to compare alternative policy rules.
5. To draw comprehensive policy lessons from this research in an accessible way, evaluating such policy in the light of wider macroeconomic concerns.

In Section VI below, we present our research output from the project. In Section III below, we discuss key findings from these papers. The first objective is addressed in Paper 1. The second objective is addressed by Papers 3, 4, 5 and 6. The third objective is addressed by Papers 7, 8 and 9. The fourth objective is addressed in part by Paper 2. This policy-relevant paper was not originally envisaged by the project, and has cost a great deal of time, see below. The time frame for part of the fourth objective has altered. A new follow-up project has been funded by DFID (R8311) from October, 2003, with the specific aim of developing our empirical work further in the context of a small structural model of about 16 equations (see our website). Comparing alternative monetary policy rules makes more sense in the context of this small macro-model, and we postpone this aspect to project R8311. Project R8311 also aims to translate our S.A. research in a practical manner in S.A., and in other African countries through the establishment of our *African Central Banking Network* (see website). Interactions with our central bank visitors has brought forward two papers which are formally part of project R8311: Paper 11 on adding S.A. wealth estimates to the SARB database; and Paper 9 on inflation modelling and forecasting in Uganda. These two papers were not originally envisaged as part of project R7911, and will be completed under project R8311. There is obviously considerable synergy across all three of our DFID-funded projects. Objective 5 will be addressed in Paper 14.

II.   Methods

The method used in Paper 1 with Prof. Kahn was a detailed analysis of nine central bank websites, statutes, inflation reports, research papers and other documents, to derive objective assessments of transparency across political, economic, procedural, policy and operational aspects of central banking (see Geraats, 2002)[1].

The other papers required a large number of different data series at various frequencies. Our study mainly utilised the SARB's data base, supplemented by some data from *Statistics SA*. We had frequent and detailed discussions on data quality and construction with the SARB, and were provided with various unpublished data series.

We encountered major problems with the consumer price data-base available from the SARB and *Statistics SA*. There is no technical handbook from *Statistics SA* on the construction of the headline consumer price index (CPI) and the targeted index, which is the headline index minus mortgage interest costs (CPIX). We had to undertake some detective work in index number methodology (Paper 2) to uncover how *Statistics SA* constructs CPI and CPIX. We give a clear and critical account of the methods, and produce a long time series for CPIX on a consistent methodology for modelling and forecasting purposes. We also uncovered serious errors in the ten components of the CPI on the SARB website, which may, in turn, have caused distortions in the constant price national accounts (Paper 7). These problems, and their resolution, consumed a disproportionate

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amount of our time, but our work should have very considerable policy benefits.

The S.A. economy has suffered many political shocks and discontinuities, as well as terms of trade shocks. International trade and financial sanctions, foreign disinvestment, capital flight and emigration during the Apartheid era, and their subsequent reversal (to some extent) during the 1990s, have greatly influenced macroeconomic outcomes and policy. There have also been important changes in domestic regimes, notably in trade policy, exchange rate and monetary policy, and in financial regulation.

Such shifts have required creative modelling of regime breaks. For instance, we created a proxy for the evolving openness to foreign competition in S.A., which involved modelling unobservable factors such as sanctions and quotas, using a stochastic trend model for the import share of home demand. This openness indicator plays a crucial role in our modelling of the inflation process.

The Lucas critique of econometric modelling of policy has had a huge influence on econometric methodology, and with concerns about endogeneity issues, has led to the de-emphasis on large econometric models, and a shift to vector autoregressions (VARs) – see Sims (1980, 1996). In the research reported here we have not followed recent fashions in the use of "structural VARs", where minimal restrictions are imposed on VARs. Instead we have emphasised a structural approach to specific equations, handling expectations through multi-step forecasting models, carefully constructed to deal with regime breaks, and thoroughly tested for stability. We use systems estimation methods to check on and improve the single equation specifications, and use principal components of additional variables to check the Sims critique that 'structural models' impose incredible restrictions. Our models could never have been uncovered using conventional VARs since we find longer lags than ever checked, find significant non-linearities, incorporate important regime shifts, and work with richer sets of variables than typically considered in VARs. Indeed, our models suggest that typical VARs impose 'incredible restrictions'.

Our methodology is discussed in detail in Paper 4 (with seven different price equations and three forecast equations) and Paper 7 (with ten different sub-component equations and one forecast equation). The discussion of how to reduce dynamic terms in general equations to more parsimonious equations attracted particular interest from modelers at our SARB seminars.

III. Findings

We elaborate our findings under different headings associated with different papers (see research output in Section VI) which cover various areas of the economic literature.

1. Measuring Central Bank Transparency in Newly Inflation Targeting Countries

The last decade has seen a trend towards governments granting independence to central banks, while requiring a greater accountability for their actions. Improved accountability has been facilitated by a parallel trend towards greater transparency (and this can also serve to protect independence). But apart from such institutional safeguards, recent economic thinking suggests that greater transparency of policy may influence the effectiveness of monetary policy. Geraats (2002) provides a framework for assessing different channels of transparency, organised by political, economic, procedural, policy and operational aspects of central banking. Objective information disclosure by central banks is used to score the five channels, creating a weighted total transparency index, and is applied to 9 OECD countries.[2]

Central bank transparency in developing and emerging market countries has never been explored in this manner. In this paper, we apply the approach to a new set of 9 countries - those that began targeting inflation from 1999 onwards[3], extending the analysis to derive broader indexes,

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[2] Geraats, Petra and Sylvester Eijffinger. 2002. "How Transparent are Central Banks?" CEPR Working Paper 3188. London: Centre for Economic Policy Research.

[3] The countries with first date of targeting in parenthesis are: Brazil (1999), Hungary (2001), Iceland (2001),

addressing aspects of transparency that are perhaps less relevant for OECD economies (e.g. escape clauses).

We find S.A. has one of the lower scores, especially for economic and procedural transparency, though scores improve markedly from the preceding monetary policy regime. Transparency can be improved by: publishing the macro-econometric model; publishing more detailed economic forecasts; publishing regular evaluations of forecast errors; publishing minutes of Monetary Policy Committee (MPC) meetings; and assessing future economic conditions and indicating future policy inclination in Monetary Policy Committee statements. The paper is of considerable interest to the SARB; it is co-authored by the head of the research division who is one of the MPC members.

This research is also a pilot study for the first year of the *African Central Banking Network* (project R8311)*,* when participants explore the "The Governance Environment of Monetary Policy", examining central bank transparency, amongst other issues.

2. *Construction of CPIX Data for Forecasting and Modelling in South Africa.*

This paper is concerned with the lack of a clear technical account of the methodology of construction of both CPI and the targeted index, CPIX by the official statistical agency, *Statistics SA* - by contrast with reputable official statistical agencies in other countries.[4] The issuance of index-linked bonds in principle legally requires such transparency. The recent debacle on the rent index, which caused a major revision in inflation data back to January 2002, may have been partly attributable to the lack of a proper handbook.

- We have enhanced transparency by explaining the detailed CPI methodology as we understand it. This has not been a straightforward exercise. We call for *Statistics SA* to produce a handbook of CPI methodology, to which we believe our paper makes a constructive beginning.
- Given our interpretation of CPI methodology, we subtract the mortgage bond component from the headline CPI, using correct weighting and rebasing, in order to produce the first consistent historical series of CPIX back to 1970 for modelling and forecasting inflation in South Africa.
- These data are used in our subsequent papers for modelling and forecasting inflation.
- While the CPIX measure was introduced in 2000, and is published monthly only from 1997, a far longer time series is required for the forecasting and modelling exercises of the South African Reserve Bank (SARB) and others. Our historical measure differs from internal SARB quarterly estimates of historical CPIX data: model builders at the Reserve Bank have been working with poor historical approximations to CPIX. We understand that the SARB plans to use our consistent methodology and historical data in their inflation modelling. We will shortly provide the consistent series on our website, back to 1970 in some cases.
- Apart from greater transparency, we call for a substantial increase in resources to *Statistics SA,* to improve index number methods and provide improved access to historical data for users such as the Reserve Bank, as well as the private sector and universities, whose research efforts could be harnessed constructively in better measuring and understanding the inflation process in S.A..
- Detailed suggestions for improvements, some of which we regard as urgent, are given in the conclusion to <u>Paper</u> 2.

3. *Understanding the Inflation Process in South Africa.*

In this paper (<u>Paper</u> 3, below), we develop a 7 equation model of the inflation process in S.A. (which has recently adopted inflation targeting), including the exchange rate, consumer prices, producer

Mexico (1999), Norway (2001), Peru (2002), Philippines (2002), South Africa (2000) and Thailand (2000).
[4] No technical bulletin corresponding to the *Handbook of Methods*, Chapter 17 *(*Bureau of Labor Statistics, U.S., April 1997) is produced by *Statistics SA*, or otherwise obtainable from other government agencies. The only publicly available information on methodology is the descriptive (non-technical) account contained within the monthly bulletins (in the explanatory notes).

price, import prices, wages, food prices and house prices. This provides useful information on the speed and extent of exchange rate pass-through, and illuminates the various channels through which monetary policy influences inflation. The model is in the tradition of central bank models of the inflation process, but carefully tests for asymmetries, structural breaks and expectations effects, and applies a range of econometric tests and methods to refute the charge that such models necessarily impose 'incredible' restrictions, Sims (1980).

The first four equations mentioned above break into a simultaneous system, estimated using maximum likelihood methods, providing an important econometric check on the individual equation specifications (now revised as a separate paper, Paper 4, below). A number of fascinating and policy relevant findings are suggested by our paper.

- One of the most important concerns the central question of monetary policy transmission onto inflation. We find evidence for the "cost channel" by which higher interest rates *increase* CPIX inflation (e.g. Barth and Ramey, 2001[5]), but an effect that has declined with the opening of the economy, as domestic interest rates have been less of a constraint on the cost of capital and on investment. The CPIX equation suggests a more conventional negative effect of interest rates on inflation in recent years.
- Our exchange rate equation also has important implications for monetary transmission. We find a positive effect on the exchange rate and therefore disinflationary effect on prices from a higher interest rate differential and an indirect effect in the same direction via the trade surplus to GDP ratio. However, the growth rate of the economy relative to its trading partners over the previous three years has a very significant effect on the exchange rate. Since we find important interest rate effects on output in Paper 15, the short run disinflationary benefits of higher interest rates are, in part cancelled by a medium-term weakening of the exchange rate, illustrating the dangers of 'overkill'.
- The producer price equation has a significant output gap effect, giving another channel through which interest rates affect inflation.
- The evidence from our house price model (being developed as a separate paper, Paper 5, below) is also for negative large interest rate effects and we have evidence that house price changes feed into wages. The wage model (being developed as a separate paper, Paper 6, below) also provides evidence of another interest rate effect in the opposite, 'perverse' direction. There is evidence of a direct positive effect on wages of higher interest rates in addition to their effect on headline CPI, which incorporates a mortgage cost component.
- Our producer and import price equations and our wage equation reveal important negative effects of increased openness on inflation, and these in turn feed into CPIX. This implies that increased openness, lower world inflation and tight monetary policy were the major forces bringing down S.A. consumer price inflation since 1990.
- The wage equation has its own interesting story. First, apart from lagged wages, no economic variable affects inflation with a lag shorter than two quarters, implying this is an important source of persistence of inflation. This is consistent with contracts made in quarter t, on the basis of information from the previous quarter, with little attempt to be forward looking, and implemented in quarter t+1. Secondly, the variables that raise wages are those relevant to workers – consumer prices, house prices and borrowing costs. Research for other economies often finds that prices received by *firms* are as or more relevant for wage determination. Our findings, from a completely open-minded starting point, appear to be consistent with strong union power in S.A..
- Insights into exchange rate pass through are also important. The exchange rate has a direct role to play in import prices, producer prices and CPIX, and in that order for the size of effect and speed of transmission. The models suggest substantially less than 100 percent pass-through even in the import price equation, less for producer prices and least of all for CPIX.
- In future work, we plan to complete the system of equations to endogenise all the important

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[5] Barth, M. and V. Ramey. 2001. "The Cost Channel of Monetary Transmission." *NBER Macroeconomics Annual 16*: 199-240.

variables so we can study the full general equilibrium effects of exchange rate shocks, including those through the output gap and the trade surplus to GDP ratio (project R8311). This is expected to yield strong policy implications on monetary transmission and pass-through.

4. Forecasting Inflation in South Africa: both the Aggregate Index and Components of the Consumer Price Index

Inflation is a far from homogeneous phenomenon, but this fact is ignored in most work on consumer price inflation. Using a novel methodology grounded in theory, the ten sub-components of the consumer price index (excluding mortgage interest rates) are modeled separately, four quarters ahead. The method combines equilibrium correction models in a rich multivariate form with the use of stochastic trends estimated by the Kalman filter to capture structural breaks and institutional change. Our paper cites just two other sources for such research, both of which use far simpler models than ours. Our methodological framework thus makes a real contribution to this under-researched area.

- As well as serving as a prelude to designing practical forecasting models for overall inflation, this research is of considerable practical use for monetary policy, allowing sectoral sources of inflation to be identified. The models cast important light on the complex forces acting on the relative prices and inflation rates of the different goods and services, explaining higher inflation rates in some sectors and the persistence of the residual disturbances.
- We find evidence for the influence of the increasing degree of openness, which has brought down relative prices and inflation rates of the more tradable goods and of those goods where the pressure of international competition has contributed to higher productivity growth. Conversely, the relative prices of goods and services more sheltered from these international competitive pressures have tended to rise.
- Other important factors with differential impacts on prices of different goods and services include the exchange rate, oil prices and other terms of trade shocks. Changes in institutions, such as marketing boards and tariffs and quotas, including local content restrictions on foreign vehicle manufacturers, have also had their impact on prices of particular goods and services. The evidence from some goods is for important fiscal effects on prices, as indirect tax rates on, for example, alcohol and tobacco, have risen.
- The more sophisticated approach is likely to be used to improve the current informal monthly sectoral model of the SARB, which is a key input into the MPC deliberations (run by our co-author, Dr. Pretorius).
- An improved understanding of inflationary pressures for particular components of the basket of consumer spending could potentially help target micro-economic policy interventions, perhaps involving deregulation or the competition authorities, and the phasing of taxation.
- Aggregating the forecasts of the components with appropriate weights from the overall index, potentially indicates the gains to be made in forecasting the idiosyncratic sectoral behaviour of prices, over forecasting the overall consumer price index. This is beyond the scope of the current paper (see discussion in paper) and will be investigated in a follow-up paper.
- Our paper raises questions about whether some of the price indices incorporate adequate quality corrections (issues of great concern currently in the U.S. [6] and elsewhere).
- Long-standing errors in the SARB data base on the CPIX components were uncovered and (largely) remedied as a result of our intervention (see <u>Section</u> II).
- The paper incorporates a new four-quarter-ahead model for CPIX (<u>Paper</u> 8), with economic implications broadly consistent with those of the CPIX equation in <u>Paper</u> 4, discussed above. We have considerable evidence from our aggregate CPIX forecasting equation that the inflation process in South Africa has not been stable over the last quarter of a century. In particular, increased openness has not merely affected the overall inflation rate but seems to have altered the

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[6] Boskin, M.J., E. Dulberger, R. Gordon, Z.Griliches and D. Jorgenson. 1996. "Toward a more accurate measure of the cost of living." Final Report to the Senate Finance Committee, December 4.

role of both the terms of trade and interest rates in explaining inflation. The inflationary roles of terms of trade shocks and of the "cost channel" of monetary policy appear to have declined, altering the monetary policy transmission.

5. *Inflation Modelling and Forecasting for Uganda*

Our S.A. inflation research is being adapted to develop models to help understand the monetary transmission mechanism and to forecast inflation in Uganda. Our work includes a detailed data appendix, exploring data availability and quality, and constructing the proxies for theoretical variables that we used in our S.A. models of inflation, as well as new variables (e.g. a comprehensive rainfall index). The paper details structural breaks and regime shifts, essential for sensible modelling of inflation. Estimation of one-quarter-ahead and four-quarter-ahead multi-step forecasting models of food price inflation, total inflation and non-food inflation is in progress. This work is of great interest to the Bank of Uganda (it is co-authored with the person responsible for monetary policy information to the MPC). Apart from the forecasting aspect, it will help understanding the key determinants of inflation, essential for informed monetary policy. This work is well in advance of any yet on Ugandan inflation, as the detailed literature survey in the paper can testify. The only other inflation models available are VAR models, with limited lags and variables, and no treatment of structural breaks.

This work is also the pilot study for the second year of the *African Central Banking Network,* when participants from other countries will examine data quality of price indices and forecast inflation in their countries using small models or (multi-step) single equations in our workshops.

6. *New wealth estimates and use of estimates in papers on money demand and consumption*

Without information on the market values of the main components of household wealth, it is difficult to understand the behaviour of aggregate consumer spending and hence of private saving, and of the broad money holdings of households. Neither the SARB nor other government statistical agencies publish balance sheet wealth estimates on a market value basis, of the type produced by U.S. Federal Reserve Board, the Bank of England and the Office of National Statistics in the U.K., and comparable organisations in Japan and elsewhere.

- We have constructed the first set of estimates at market values of aggregate personal sector wealth holdings in S.A.. Since 1970, the SARB has published flow of funds data and information on households' holdings of local authority and public enterprise bonds, unit trusts, pension and long-term insurance funds, using a mix of book values and market values; and since 1990 publishes household debt data (unpublished data from 1970). From these data and other sources, it has been possible, with some difficulty, to assemble a profile back to 1970 of the main components of personal sector wealth.
- Our revised estimates respond to constructive comments from the referees and editor of the *Review of Income and Wealth*. They embody improved bond price indices and other improvements such as improved benchmarks and better data from the Reserve Bank on liquid assets and debt, as well as robustness checks on the implications of alternative assumptions.
- We have previously examined private sector demand for broad money using error correction models. Our model is the first for S.A. to employ measures of assets; expectations; volatility, turnover and uncertainty measures; and a financial liberalisation indicator. We expect shortly to re-estimate the model with the revised wealth estimates.
- We have previously modelled private consumption in S.A., in a joint model with household debt. This is the most comprehensive S.A. consumption function to date, by contrast with the SARB model, from which relative prices, assets and debt, proxies for expectations and measures of financial liberalisation have been omitted. We expect shortly to re-estimate the model with the revised wealth estimates.

7. *The Feasibility of Compiling Wealth Estimates for South Africa.*

Our initiative with Johan Prinsloo, formerly head of national accounts at the SARB (now consultant in the SARB) has the objective of adding balance sheet data to the flow of funds and other national accounts data produced by the SARB (and linking with our historical estimates from Paper 10). This will have major benefits in improving the understanding and modelling of saving, demand for money and monetary transmission in S.A. (as our past DFID-funded work has shown). The initiative flows directly from our existing DFID work on wealth estimates, and the endeavour to improve SARB statistics on wealth will be furthered as part of the new project (R8311). There are four main limitations of our own wealth estimates: benchmarks for personal sector ownership of directly held equities; personal sector ownership of foreign assets; the assets of unincorporated enterprises, part of the personal sector; and personal sector ownership of corporations not quoted on the stock market. We have been exploring progress on these questions with Johan Prinsloo (SARB) in Paper 11, consulting with the UK Office of National Statistics. There are possibilities that existing data sources would, in some cases, at least provide orders of magnitude of the missing data. However, it seems likely that new surveys, for example of share registers and of households, as carried out in other countries, will be required to fill these gaps.

IV.   Dissemination

Our principal means of dissemination has been via conferences, seminars and workshops, in S.A., the U.K., and abroad. Attachment 1 contains a list of these presentations.

Prompted by requests from S.A. economists and policy makers (especially the SARB), we put a lot of effort into creating a detailed website to publicise our research: http://www.csae.ox.ac.uk/ and follow links to *"The South African Macroeconomic Research Programme"*. Though not originally promised by the project, this has proved an invaluable means of dissemination. It provides details of our DFID-funded projects, publications, work-in-progress, and conference and seminar presentations. We provide some unique data arising from the research. We also give details of capacity-building links with S.A. institutions; and explain the policy importance of our research, using downloadable non-technical summaries of the papers.

We submit our papers to the CSAE working paper series. This website is the main avenue to reach African economists and Africanists. We also publish many of the papers in the widely circulated working paper series of the Centre for Economic Policy Research (CEPR). There has been a wide circulation of our draft papers by post and electronic mail to academics, policy-makers and the private sector in S.A., academics elsewhere, and international institutions (e.g. The World Bank and International Monetary Fund), and our papers have benefited from their comments.

We have been invited to write an overview piece on our S.A. research by the *Royal Institute of International Affairs*. We intend to prepare newspaper articles for *Business Day* in S.A. and the *Financial Times* in the U.K.. Finally, we have recently been invited by the *National Institute for Economic Policy* (NIEP) to write a chapter assessing S.A. monetary and exchange rate policy since 1994, for what will be a widely-publicised book examining S.A. policies under the ANC government. NIEP is a prominent trade union think-tank in Johannesburg. Trade union cooperation in moderating wage agreements plays a key role in reducing inflationary expectations under transparent inflation targeting regimes.

V.   Capacity-building and collaboration

The capacity-building element of the project, which has involved visits to the CSAE from senior members of the National Treasury and the SARB, and senior visitors from the Research Department, Bank of Uganda, has been hugely successful and appreciated by the participants. (Quarterly reports to DFID have regularly attached letters of appreciation and the programmes followed.) Attachment 2 contains a list of capacity-building and collaborative research visits.

We have regularly held well-attended workshops and seminars in S.A., with participation from the SARB, the National Treasury, academia and the private sector, discussing research findings and emphasising new modelling issues (Attachment 1).

This project has produced five co-authored papers with senior policy figures, in the BER, the SARB and the Bank of Uganda. These are: Prof. Ben Smit (Director, Bureau of Economic Research, Stellenbosch University, senior consultant on the macro-model for the National Treasury); Prof. Brian Kahn (Head of Research and MPC member, SARB); Dr. Coen Pretorius (Senior Economist, Macro Models Unit, SARB); Johan Prinsloo (Senior Economist, Research Department, SARB); and Rachel Sebudde (Senior Economist, Research Department, Bank of Uganda).

The close involvement of policy-makers in this work helps ensure the policy-relevance of the work, and we give just a few examples. Dr. Pretorius produces informal monthly forecasting models of sectoral price components that are heavily relied on by the MPC at its policy meetings. Our joint paper (Paper 7) with improved methods will be adapted by him, and introduced at the monthly level (we are discussing a possible further joint paper in this context). Prof. Kahn is an MPC member and sees our transparency work (Paper 1) as bolstering his endeavours to enhance transparency, through using objective comparative indicators. Our research with Prof. Smit is regularly relayed by him to the National Treasury modellers; and we recently provided detailed comments on the National Treasury's macro-model. Many of the SARB's own serious concerns with *Statistics SA* data have been addressed in our Paper 2.

VI. Research Output and Appended Papers

The project output has appeared in the following mimeos, papers, journal articles and book chapters, exceeding the original promises of the project. Some of these papers were reviewed in 2003 by DFID referees for a follow-up project grant (the application was successful). Peer-review was required for several of the conference presentations (see Attachment 1). The following papers below will in due course also be submitted to the CEPR working paper series: 5, 6, 8, 10, 12, 13 (our author "id" is 131312). Two papers in the research output (papers 15 and 16) were extensively revised in the period of the project, and the final publications are thus included as output.

Papers 4 and 7 are appended to this report.

1. Aron, J. and B. Kahn (S.A. Reserve Bank). "Measuring Central Bank Transparency in Newly Inflation Targeting Countries." *CSAE Working Paper Series* (forthcoming April, 2004).

2. Aron, J. and J. Muellbauer. 2004. "Construction of CPIX Data for Forecasting and Modelling in South Africa." *CSAE Working Paper Series* 2004-09. Submitted to the CEPR working paper series. We have been invited to submit this paper to the *Journal of Economics and Econometrics* (South Africa).

3. Aron, J., J. Muellbauer and B. Smit (Bureau for Economic Research). "Understanding the Inflation Process in South Africa." Keynote Address, *Eight Annual Conference on Econometric Modelling for Africa*, Stellenbosch University, South Africa, 1-4th July, 2003. (see conference paper on our website). This paper has been revised and divided into the following three papers.

4. Aron, J., J. Muellbauer and B. Smit (Bureau for Economic Research). 2004. "A Structural Model of the Inflation Process in South Africa." *CSAE Working Paper Series* 2004-08. Submitted to the CEPR working paper series. Accepted by *peer-review* for discussion at the 59th *European Econometric Society Meeting* in Madrid, August, 2004.

5. Aron, J. and J. Muellbauer. "Interest rate effects on house prices: evidence from South Africa." Mimeo.

6. Aron, J. and J. Muellbauer. "Are wage-setters forward-looking? Evidence from South Africa." Mimeo.

7. Aron, J., J. Muellbauer and C. Pretorius (S.A. Reserve Bank). 2004. "A Framework for Forecasting the Components of the Consumer Price Index: application to South Africa." *CSAE Working Paper Series* 2004-07. Submitted to the CEPR working paper series. Accepted by *peer-review* for discussion at the CSAE Conference, Oxford University, March, 2004. We plan shortly to submit this paper to the *Oxford Bulletin of Economics and Statistics*.

8. Aron, J. and J. Muellbauer. " Multi-Step Inflation Forecasting Models: an Application to South Africa." *CSAE Working Paper Series* (forthcoming April, 2004). We plan to submit this paper to the *Review of Economics and Statistics*.

9. Aron, J. and Sebudde, R. (Bank of Uganda). "Inflation Modelling and Forecasting for Uganda". (Work in progress, mimeo). Submitted for *peer-review* for the International Research Project on "Macroeconomic Policy Challenges Of Low Income countries" (funded by the Governments of the UK and the Netherlands, the International Monetary Fund, and the World Bank), conference at the IMF/World Bank, Washington DC, January 2005.

10. Aron, J. and J. Muellbauer, "Revised Estimates of Personal Sector Wealth for South Africa." *CSAE Working Paper Series* (forthcoming April, 2004). Final revised submission for the journal *Review of Income and Wealth* (U.S.A.).

11. Aron, J., J. Muellbauer and J. Prinsloo (S.A. Reserve Bank). "The Feasibility of Compiling Wealth Estimates for South Africa." (Work in progress, mimeo). Will be completed on his visit to Oxford in September, 2004. Expected to be published as a *South African Reserve Bank Discussion Paper*.

12. Aron, J. and J. Muellbauer, " Consumption, Financial Liberalisation, and Housing Wealth." Mimeo. We plan to submit this revised paper based on our new wealth estimates (see Paper 10) to the *Journal of Political Economy*.

13. Aron, J. and J. Muellbauer. "Wealth, Financial Liberalisation and the Demand for Broad Money". Mimeo. We plan to submit this revised paper based on our new wealth estimates (see Paper 10) to the *Journal of Money, Credit and Banking*.

14. Aron, J., and J. Muellbauer, "Synthesis and Policy Overview", in progress, awaiting final drafts of Papers 5 and 6. We plan to submit this synthesis paper to the *South African Journal of Economics,* to advertise the constituent papers within South Africa.

15. Aron, J. and J. Muellbauer, 'Interest rate effects on output: Evidence from a GDP forecasting model for South Africa', *IMF Staff Papers* 49 (November, *IMF Annual Research Conference*): 185-213, 2002, (also http://www.cepr.org/pubs/new-dps/dplist.asp?authorid=131312)

16. Aron, J. and J. Muellbauer, 'Estimating monetary policy rules for South Africa', in N. Loayza and K. Schmidt-Hebbel (eds) 'Monetary Policy: Rules and Transmission Mechanisms', *Series on Central Banking, Analysis and Economic Policies*, Volume 4, Central Bank of Chile, pages 427-475, 2002, *(*also http://www.bcentral.cl/books/v4/v4.htm)

Attachment 1: Dissemination of Results

1. Our New Website:

Our new website on the CSAE homepage, provides details of publications, work-in-progress, and conference and seminar presentations arising out of our DFID-funded projects. We provide some unique data arising from the research. We also give details of capacity-building links with South African institutions; and explain the policy importance of our research, using non-technical summaries of the papers.

http://www.csae.ox.ac.uk/
and follow links to *"The South African Macroeconomic Research Programme"*

2. Workshops and seminars in South Africa and abroad

"A Structural Model of the Inflation Process in South Africa." Accepted for the Econometrics and Empirical Economics Programme of the *59th European Meeting of the Econometric Society* (ESEM) 2004, Madrid, August 20-24. (*peer-reviewed*).

"Modelling and Forecasting Inflation in South Africa." Seminar, Research Department, South African Reserve Bank, Conference Centre, 4th December, 2003 (*presented with Dr. Coen Pretorius*).

"Forecasting the Sub-components of the CPI in South Africa." Staff Seminar, Department of Economics, University of Pretoria, South Africa, 3rd December, 2003.

"Determinants of Personal and Corporate Saving in South Africa", Invited Address, National Treasury Saving Policy Round Table, CSIR Conference Centre, Pretoria, South Africa, 2nd December, 2003.

"Understanding the Inflation Process in South Africa." Invited Seminar, Research Division, International Monetary Fund, Washington DC, 8th October, 2003.

"Measuring and Forecasting Consumer Price Indices in South Africa." Staff Seminar, Department of Economics, Stellenbosch University, South Africa, 8th August, 2003.

Forum on the IMF paper on the real exchange rate of the rand, Invited participant, Investec Securities and the *Economics Association of South Africa*, Cape Town, August 7th, 2003.

"Measuring and Forecasting Consumer Price Indices in South Africa." Staff Seminar, School of Economics, University of Cape Town, South Africa, 7th August, 2003.

"Measuring and Forecasting Consumer Price Indices in South Africa." Joint seminar of the *Economics Association of South Africa* and the Department of Economics, University of the Witwatersrand, South Africa, 5th August, 2003.

"Understanding the Inflation Process in South Africa." Invited Keynote Address, *Eight Annual Conference on Econometric Modelling for Africa*, Stellenbosch University, South Africa, 1-4th July, 2003.

Retreat for the Monetary Policy Committee, senior SARB staff and invited senior Bank of England members, South Africa, June, 2003: the non-technical summaries on our new website on the CSAE homepage, were a requested resource for this retreat.

"Modelling the Inflation Process in South Africa." Seminar, Research Department, South African Reserve Bank, 5th April, 2003.

"A Multi-Step GDP Forecasting Model for South Africa." *57th Econometric Society European Meeting*, Venice, 25-28 August, 2002 (*peer-reviewed*).

"A Multi-Step GDP Forecasting Model for South Africa." Seminar, Research Department, South African Reserve Bank, 11th April, 2002.

"Forecasting components of the CPI in South Africa." Seminar, Research Department, South African Reserve Bank, 11th April, 2002.

"Interest Rate Effects on Output: Evidence from a GDP Forecasting Model for South Africa." *Second Annual IMF Research Conference*, Washington DC, 30 November, 2001 (*peer-reviewed*).

"Inflation and Output Forecasts for South Africa: Monetary Transmission Implications", *Econometric Society European Meeting*, Lausanne, 30 August-2 September, 2001 (*peer-reviewed*).

3. Dissemination in the U.K.

"Inflation Targeting and the Relevance of Modelling Inflation in African Countries." Invited Seminar, Macroeconomics, Policy Division, Department for International Development (DFID), scheduled for 29 April, 2004.

"Forecasting the Sub-Components of the Consumer Price Index in South Africa." in "Growth, Poverty Reduction and Human Development in Africa." CSAE Conference, St. Catherine's College, Oxford University, 21-22 March, 2004 (*peer-reviewed*).

"The Governance Environment of Monetary Policy." 1st *African Central Banking Network* Workshop, Department of Economics, Oxford University, 24-26th November, 2003.

"Modelling and Forecasting Inflation in South Africa." Staff Seminar, Department of Economics, Oxford University, 13th November, 2003.

"Modelling the Inflation Process in South Africa." Seminar in Econometric Theory and Econometrics, Nuffield College, 16th May, 2003.

"Interest Rate Effects on Output: Evidence from a GDP Forecasting Model for South Africa." in "Understanding Poverty and Growth in Sub-Saharan Africa." *CSAE Conference*, St. Catherine's College, Oxford University, 18-19th March, 2002 (*peer-reviewed*).

"Interest Rate Effects on Output: Evidence from a GDP Forecasting Model for South Africa." CSAE Seminar Series, CSAE, Oxford University, 5th February, 2002.

Four papers on DFID research findings, presented jointly with John Muellbauer, at a day-long workshop (participants from the media, business and financial sectors, and U.K. government and policy bodies): "Macroeconomic Policy in South Africa: Recent Findings on Capital Flows and Monetary Policy", Centre for the Study of Economics and Finance in South Africa (CREFSA), London School of Economics, 23rd November, 2001.

Attachment 2: Capacity-Building and Collaborative Research Visits

The following visits have taken place to Oxford:

Two week visit from Bank of Uganda: January/February, 2001
Dr. Polycarp Musinguzi (Executive Director, Research Department, Bank of Uganda)
Mrs. Rachel Sebudde   (Senior Economist, Research Department, Bank of Uganda)

Two week visit from the S.A. Reserve Bank: March, 2001
Dr. Coen Pretorius   (Senior Economist, Macro-Models Unit, S.A. Reserve Bank)

Two week visit from the S.A. Reserve Bank: December, 2001
Prof. Brian Kahn   (Head, Monetary Research Unit, S.A. Reserve Bank)

Two week visit from the S.A. National Treasury: August/September, 2002
Mr. Elias Masilela   (Head, Macro-Policy Unit, National Treasury)

African Central Banking Network Preliminary Workshop, Oxford: September, 2002
Participants from the Centre for Policy Studies, South Africa; and from Research Departments of the Bank of Mozambique, Bank of Tanzania, Bank of Uganda, National Bank of Ethiopia and South African Reserve Bank.

Two week visit from the S.A. Reserve Bank: October, 2002
Dr. Daleen Smal   (prev. Deputy Head, Research Department, S.A. Reserve Bank)

One week visit from the Bureau for Economic Research: November, 2002
Prof. Ben Smit   (Director, BER, Stellenbosch University)

One week visit from the S.A. Reserve Bank: February, 2003
Prof. Brian Kahn   (Senior Deputy Head, Research Department, S.A. Reserve Bank)

Two week visit from Bank of Uganda: June, 2003
Mrs. Rachel Sebudde   (Senior Economist, Research Department, Bank of Uganda)

One week visit from the S.A. Reserve Bank: September, 2003
Mr. Johan Prinsloo   (Senior Economist, Research Department, S.A. Reserve Bank)

Visit to Nuffield by Dr. Johan Van den Heever, head of the Quarterly Bulletin at the SARB and member of the MPC, 24th September, 2003.

One week visit from the S.A. Reserve Bank: October, 2003
Prof. Brian Kahn   (Senior Deputy Head, Research Department, S.A. Reserve Bank)

Two week visit from Bank of Uganda: November, 2003
Mrs. Rachel Sebudde   (Senior Economist, Research Department, Bank of Uganda)

African Central Banking Network First Workshop for 2003/2004, Oxford: November, 2003
Participants from the Centre for Policy Studies, South Africa; and from Research Departments of the Bank of Mozambique, Bank of Tanzania, Bank of Uganda, National Bank of Ethiopia and South African Reserve Bank.

One week visit from the S.A. Reserve Bank: January, 2004
Prof. Brian Kahn   (Senior Deputy Head, Research Department, S.A. Reserve Bank)

HIGHLIGHTS: IMPROVED INFLATION MODELS AND FORECASTS, BETTER DATA AND TRANSPARENCY SHOULD FACILITATE MONETARY POLICY

South Africa (S.A.) adopted inflation targeting in 2000, which requires good forecasting models of inflation, clarity on monetary transmission mechanisms, and transparent policy. There has been little research on inflation targeting in SA. This research has resulted in eight papers. First, we construct a new central bank transparency index for nine newly targeting countries, thus evaluating S.A.'s transparency in a comparative light. Second, we explain index number methodology for constructing historical CPIX data. Third, we develop a seven-equation model of the inflation process, providing insights into exchange rate pass-through, and monetary policy transmission channels (now developed into three separate papers). Fourth, we use new multi-step forecasting methods to forecast CPIX inflation. Fifth, using a novel methodology we forecast the ten sub-components of CPIX, illuminating sectoral behaviour, and potentially improving aggregate forecasts. An overview paper synthesises the research, and discusses policy implications.

The key research findings:

- Indexes of transparency score political, economic, procedural, policy and operational aspects of central banking. S.A. has one of the lower scores, especially for economic and procedural transparency, though scores have improved markedly from the preceding monetary policy regime.

- In the absence of an official handbook on CPI construction, we explain the methodology, and use it to provide the first consistent historical data to 1970 on CPIX for modelling and forecasting inflation. We uncovered a range of data problems, from the lack of detailed price data before 1997, to neglect of issues widely debated and researched elsewhere, such as the measurement of homeowners' costs and the treatment of quality change and new goods in the CPI.

- We model economy wide linkages to CPIX inflation from the exchange rate, import prices, producer prices, wages, food and house prices. This illuminates key questions of how interest rates influence inflation, exchange rate pass-through into inflation and the role of trade openness in reducing inflation since 1990. Methodologically, our findings – for example of asymmetries and parameter shifts with increased openness - could never have been uncovered using standard VAR methods.

- Price movements for different components of CPIX are not homogeneous. We show detailed evidence of the role of openness, the output gap, the exchange rate, interest rates and other factors in explaining price movements for different groups of goods and services. Understanding and forecasting these sectoral movements leads to a better understanding and forecasting of overall inflation. In general, our rich equilibrium correction models and stochastic trends represent an important methodological advance in this globally under-researched area.

- Our sophisticated one-year ahead forecasting model for CPIX finds evidence of changing terms of trade, exchange rate and interest rate effects at the four-quarter horizon. For example, the "cost channel" of monetary transmission - higher interest rates *increase* inflation - has weakened so that monetary policy currently appears more likely to achieve its conventionally understood disinflationary effects.

- Few developing countries have models of inflation. Yet such models are prerequisites to more developed monetary policy regimes. We are translating our S.A. techniques, drawing on a rich theoretical framework, to Uganda and other African economies in ongoing work.

Some policy recommendations:

- Greater transparency raises credibility and helps reduce inflationary expectations. Improvements include: publishing the macro-econometric model; publishing more detailed economic forecasts; publishing regular evaluations of forecast errors; publishing minutes of Monetary Policy Committee (MPC) meetings; and assessing future conditions and indicating future policy inclination in Monetary Policy Committee statements.

- *Statistics SA* should publish a technical handbook of CPI methodology (as do reputable agencies in other countries e.g. the US). Investment in a high-capacity statistical agency to resolve various data problems we have raised will yield huge benefits in relation to the costs, including growth benefits.
- Our seven-equation model of the inflation process has several policy implications. It makes clear that interest rates affect inflation through complex and sometimes countervailing channels, highlighting the risks of interest rate 'overkill'. Demonstrating the important effects of exchange rate shocks suggests scope for stabilising foreign exchange interventions, necessitating a substantial increase in foreign exchange reserves.
- Our sectoral CPIX forecast methods greatly improve on existing informal 'bottom up' methods of component forecasting used by the S.A. Reserve Bank, and are expected to develop such methods. Our sectoral approach also suggests a role for complementary policy interventions on pricing by other agencies e.g., those concerned with regulation of telecoms.

Contributors:
John Muellbauer, Oxford University; Janine Aron, Oxford University; Ben Smit, Bureau of Economic Research, University of Stellenbosch; Brian Kahn, South African Reserve Bank; Coen Pretorius, South African Reserve Bank.

Four of the key papers are:
Aron, J. and J. Muellbauer. "Construction of CPIX Data for Forecasting and Modelling in South Africa." *CSAE Working Paper Series* 2004-09.

Aron, J., J. Muellbauer and B. Smit (Bureau for Economic Research). 2004. "A Structural Model of the Inflation Process in South Africa." *CSAE Working Paper Series* 2004-08.

Aron, J., J. Muellbauer and C. Pretorius (S.A. Reserve Bank). 2004. "A Framework for Forecasting the Components of the Consumer Price Index: application to South Africa." *CSAE Working Paper Series* 2004-07.

Aron, J. and B. Kahn (S.A. Reserve Bank). "Measuring Central Bank Transparency in Newly Inflation Targeting Countries." CSAE Working Paper Series (forthcoming, April, 2004).

Further information:
http://www.csae.ox.ac.uk/
and follow links to "*The South African Macroeconomic Research Programme*"

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South Africa, monetary transmission, central bank transparency, inflation modelling + forecasting
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