

South African Economy

Analysis and Application

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Micro Principles Used in Macro

1 Facts, 2 Theory, 3 Applications

- Economy consists of producers and consumers in market places
- A market for goods defined as selling and buying by firms and consumers over a particular time period and at certain average price
- Econometrics 'facts': supply and demand for a certain good at particular prices over a period of time (long enough data)
- Market price and quantity depends on market's Industrial Organization (IO)
- Microeconomic Theory: equilibrium price and quantity in a market
- IO: perfect competition, monopoly, oligopoly, monopsony,...(Prices, Costs, Quantities, Profits)
- Micro to Macro: Production (PPC), Indifference curve (Utility) and Equilibrium at tangency for prices and quantities
- Utility maximization and profit maximization gives rise to demand and supply of goods and services - Comparative Statics

South African Economy

Historical background and Economic Performance

- Accession to democratic state in 1994
- Since 1994; social welfare, education, health facilities, housing, public services, ...
- Sound macro policies: stable inflation and public debt
- Low growth-high unemployment (huge inequalities) scenario: an unfortunate reality
- Structural transformation: declining manufacturing sector, capital deepening and service sector emphasis

South African Economy

An Economy, National Output

- The SA economy is an aggregate of all industries within its area: national economy
- It engages in trade (*small open economy*) and a net importer over past few years (value of imports greater than value of exports)
- National output: GDP, GDI, GNP
- GDP: Four main kinds of expenditure within GDP
- Problem with national output measure at market prices
- Since tech drives down costs, while increasing quality of good “quality and index number problem”
- Quality-constant basis of goods is not accounted

Gross Domestic Product by Category of Expenditure

Constant 2010 prices, seasonally adjusted and annualised (R million)

	2016	2017	2018
GDP	3 079 145	3 122 426	3 144 223
Personal consump exp	1 864 436	1 902 851	1 937 396
Gross private dom. investment	602 458	621 705	604 174
Net Exports	-16184	-31842	-38859
Exports	912 546	905 898	929 792
Imports	928 730	937 740	968 651
Govt consump exp + inv	628 434	629 712	641 512

Gross Domestic Product by Category of Industry Value Added

Constant 2010 prices, seasonally adjusted and annualised (R million)

	Agric	Mining	Manu	Finance	Govt	The rest	GDP
2016	64 305	225 035	383 903	616 301	471 158	...	3 076 466
2017	77 857	234 522	383 189	628 972	472 497	...	3 119 983
2018	74 157	230 514	386 884	640 368	478 693	...	3 144 539

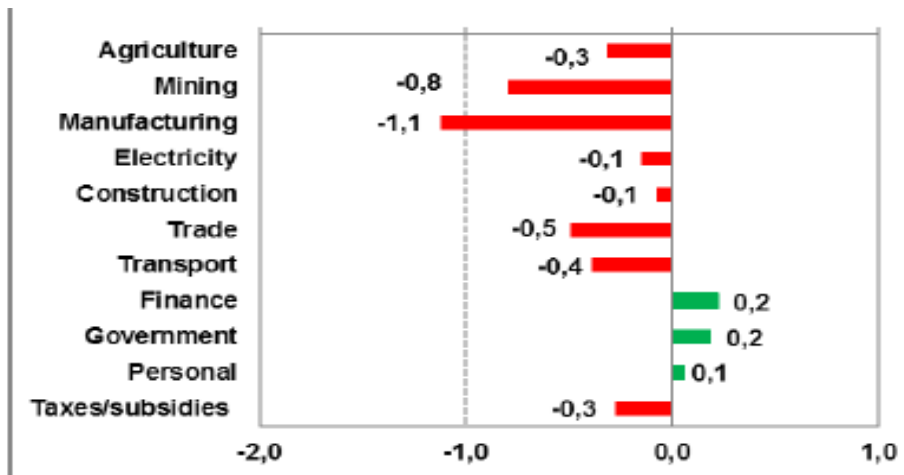
Sector growth trends

Contribution to growth in annual percentage

Percentage change	2013	2014	2015	2016	2017	2018 ¹
Agriculture, forestry and fishing	4.5	6.8	-6.4	-10.2	17.7	-3.2
Mining and quarrying	4.0	-1.7	3.1	-4.2	4.6	-1.4
Manufacturing	1.0	0.3	-0.4	0.9	-0.2	0.9
Electricity, gas and water	-0.6	-1.0	-1.7	-2.3	0.2	0.9
Construction	4.6	3.5	1.8	1.1	-0.3	-1.2
Trade, catering and accommodation	2.0	1.4	1.9	1.7	-0.6	0.4
Transport, storage and communication	2.9	3.5	1.4	0.8	1.5	0.9
Finance, real estate and business services	2.6	2.7	2.6	2.3	1.9	2.2
General government services	3.2	3.2	1.0	1.4	0.3	0.8
Personal services	2.6	1.8	1.0	1.5	1.2	1.0
GDP	2.5	1.8	1.3	0.6	1.3	0.8

Sector growth in 2019

Contributions to growth in GDP, Q1 2019



Economic Growth in Selected Countries

World, Advanced, Developing, Sub-Saharan countries

Region/country	2010-2017	2018	2019	2020	2021-2023
Percentage	Post-crisis	Average GDP forecast			
World	3.8	3.7	3.5	3.6	3.6
Advanced economies	2.0	2.3	2.0	1.7	1.6
United States	2.2	2.9	2.5	1.8	1.5
Euro area	1.3	1.8	1.6	1.7	1.5
United Kingdom	2.0	1.4	1.5	1.6	1.6
Japan	1.5	0.9	1.1	0.5	0.5
Developing countries	5.3	4.6	4.5	4.9	4.9
China	8.0	6.6	6.2	6.2	5.8
India	7.3	7.3	7.5	7.7	7.7
Brazil	1.4	1.3	2.5	2.2	2.2
Russia	1.8	1.7	1.6	1.7	1.4
Mexico	3.1	2.1	2.1	2.2	2.9
Sub-Saharan Africa	4.3	2.9	3.5	3.6	4.0
South Africa ¹	2.0	0.7	1.5	1.7	2.4

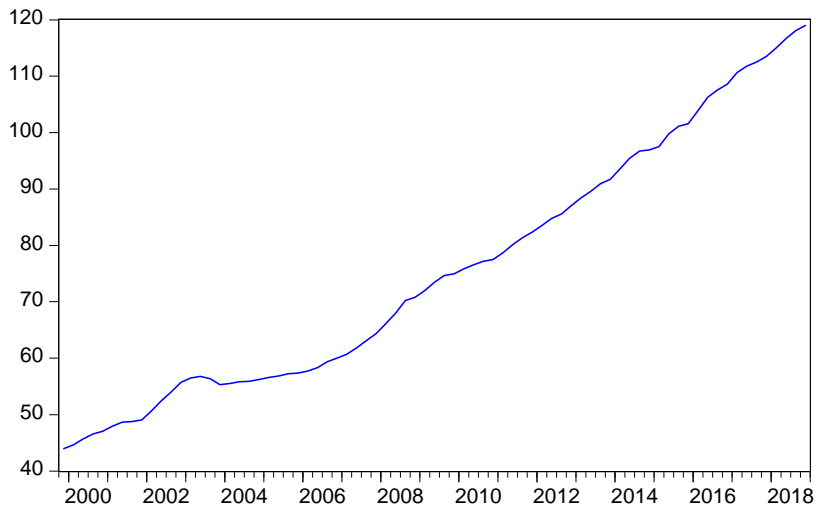
South African Economy

Nominal Versus Real: Inflation & Price Indices

- Economists speak in terms of "nominal" (current Rand (Brazilian Real) value) or "real" (value of currency unit) values
- Inflation defined as rate of change of aggregate price level (measured by a price index; CPI)
- Inflation as caused by monetary factors
- Prices fall due to Asset value crashes or increases in technology which decreases relative prices "index number problem"

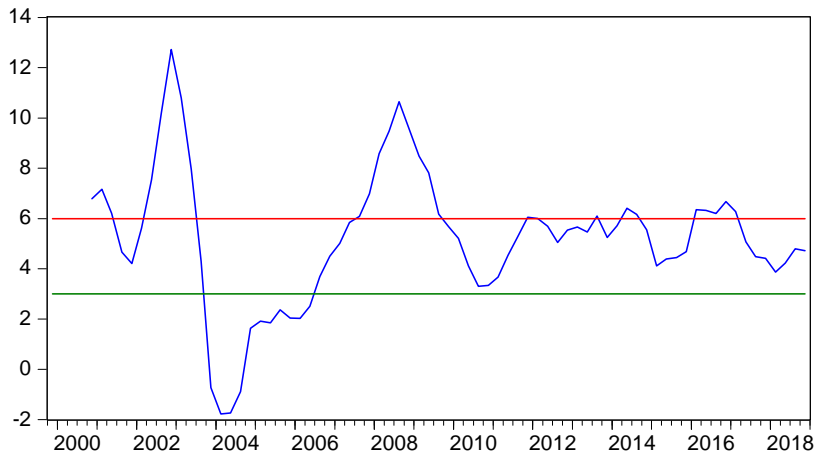
Consumer Price Index, Quaterly, 1999-2018

All items



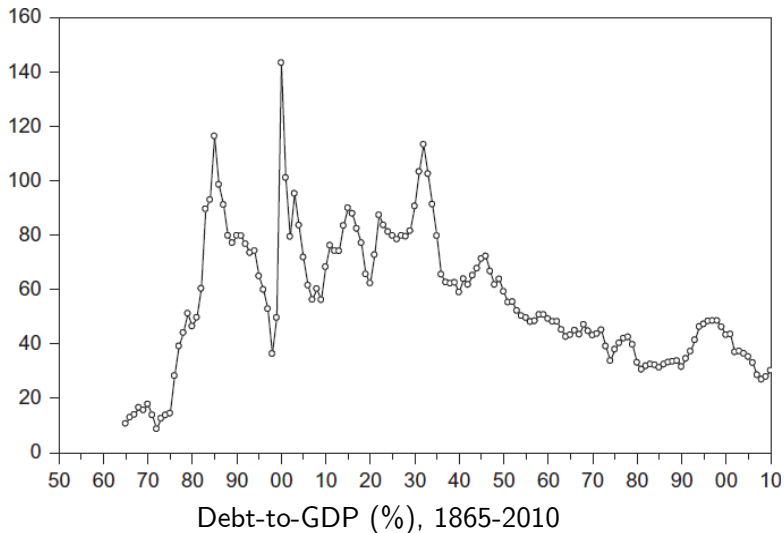
Percentage Change in Consumer Price Index 1999-2018

Macroeconomic policies - inflation and inflation targeting since 2000



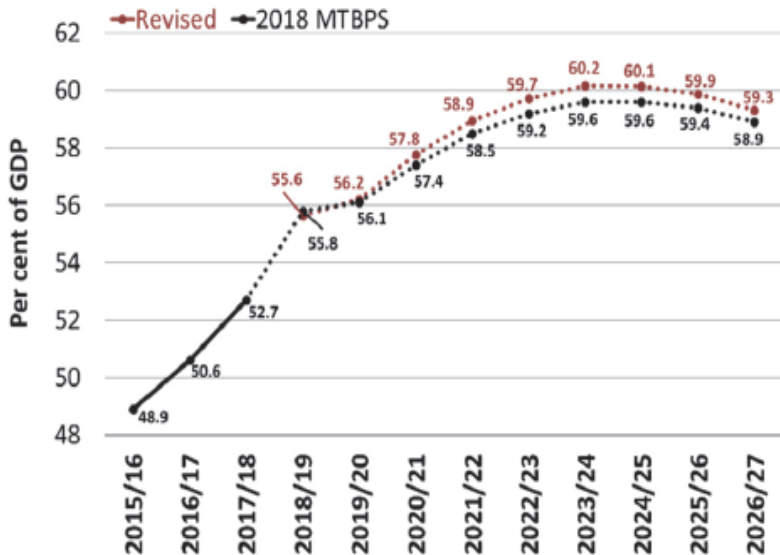
Fiscus - Historical Debt-to-GDP

Past 150 years



Fiscus - Debt-to-GDP outlook

Increasing debt burden



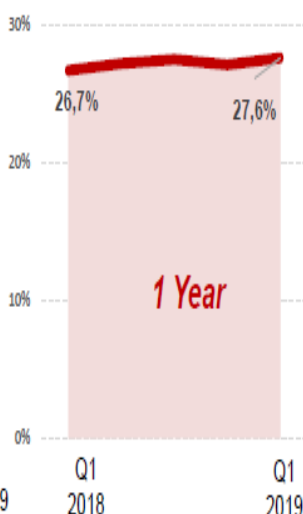
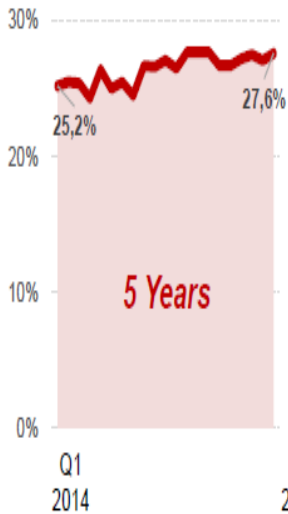
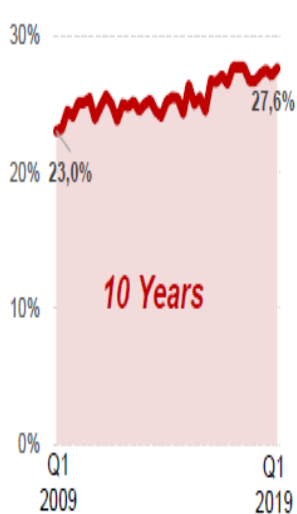
Labour market statistics

Some Key Facts in 2019

- Working age population (15-64 years old): 39 million
- Labour force participation rate at 60%
$$= \frac{\text{labour force (empl + unempl)}}{\text{adult population}} = \frac{23.4 \text{ million}}{39 \text{ million}}$$
- Not economically active (over 12 million) and discouraged workers (over 3 million)
- Official unemployment rate is around (6.8 million) $29\% \left(\frac{\text{unempl}}{\text{labour force}} \right)$;
broad measure at $38.5\% \left(\frac{\text{unempl} + \text{discouraged}}{\text{labour force}} \right)$
- Unemployment concentrated among low-education/unskilled and young people (youth unempl at 56.4%; graduate unempl at over 30%)
- Mining and manufacturing sectors have had decreasing employment share over the past few years
- Labour market regulations still rigid and not conducive - cost of hiring, income grants and other benefits

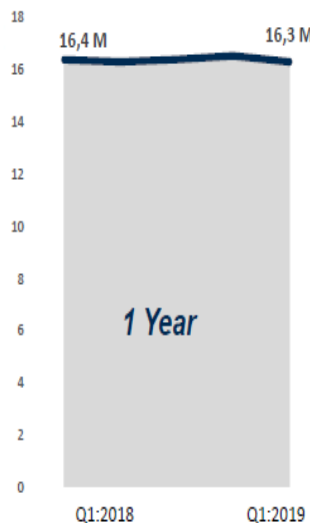
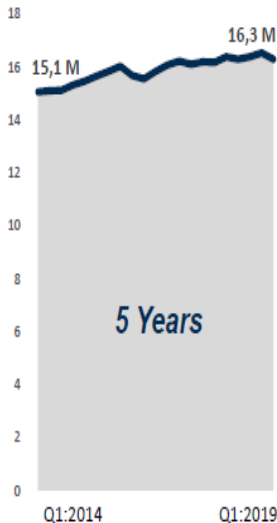
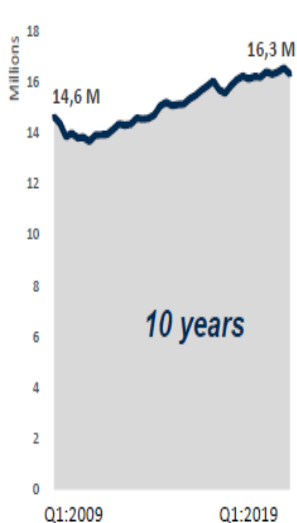
Labour market statistics

Unemployment rate persistently high



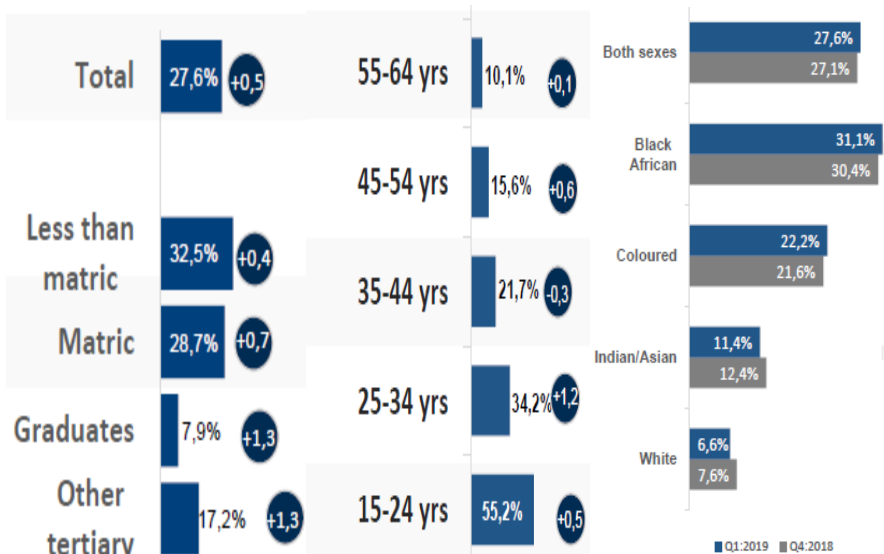
Labour market statistics

Number of employed persons declined by 237 000 to 16,3 million in 2018-2019



Labour market statistics

Unemployment rate by categories; educational level, age group and population group



■ Q1-2019 ■ Q4-2018

August 2019



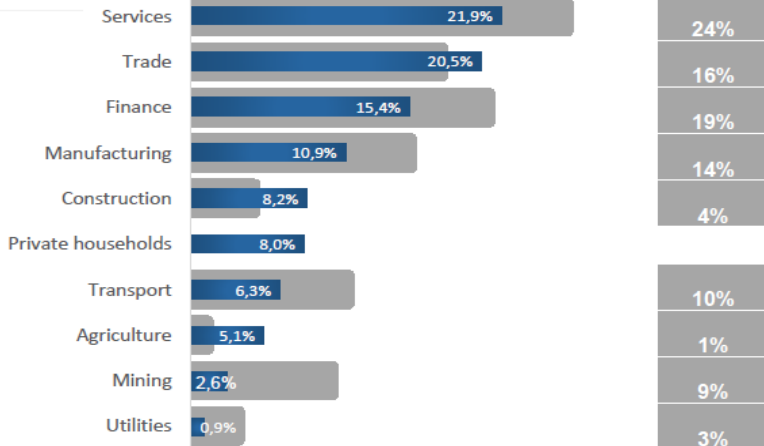
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Labour market statistics

Increasing service sector and declining low skill manufacturing sectors

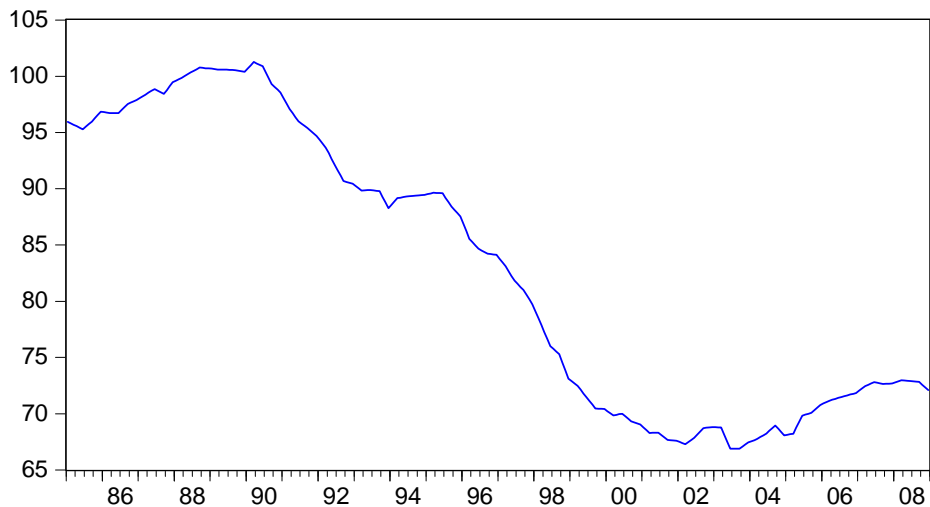
Employment and GDP share per industry

Employment shares, Q1:2019



Labour market statistics

Decreasing manufacturing and mining employment index (1986-2008)



Economic Performance

Some explanations

- A declining manufacturing sector at the expense of low/semi-skills employment
- Declining tradable prices and appreciation of real exchange rate
- Public debt and credit rating - state-owned enterprises in dilemma
- Private-public coordination to re-invent manufacturing sectors - mortar cars, fruits and nuts, oil, mining, fisheries, export processing zones
- Investment pledges of R500 billion in SA
- Monetary policy and real exchange rate
- Public governance and accountability

Representative Agent Economy

Aggregate Production Function, Utility Function and General Equilibrium

- Representative agent economy: single production function and single utility function (Indifference Curve)
- Acting as Representative Firm in economy that supplies output
- Acting as Representative consumer with a utility function over output
- Representative agent economy: "Robinson Crusoe" economy after novel
- Representative agent economy: unique equilibrium on firm side & consumer side
- Useful, simple, workhorse, model of entire economy - market economy with firms and consumers (same equilibrium)

Monetary policy in a model with commodity and financial markets

A model for Small Open Economy commodity exporters - Applications for South Africa

- Joint work with Vo Phuong Mai Le at Cardiff University
- Commodity price shocks and business cycles
- Key channels of commodity price shock to macroeconomy
- Extension to dual sector economy with differential access to finance
- Real exchange rate appreciation and deflation
- Monetary policy that targets inflation vs price-level

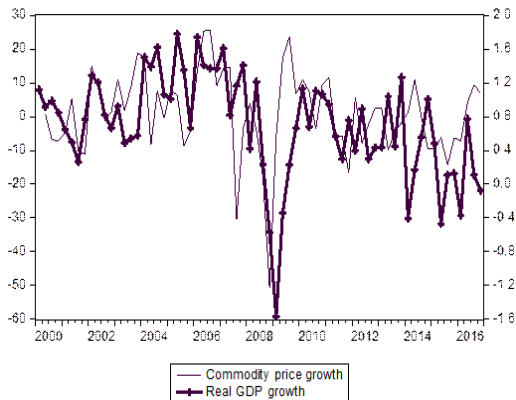
South African economy

Some Key Facts

- Commodities - 60% of country's exports, 25% of world's platinum, 23% of world's supply of diamonds, gold about 5% of global production, sixth largest exporter of coal, half of world's chromium
- IMF report - 10 % decline in export commodity prices leads to 0.2 % GDP growth decline - US interest rate up by 100 basis points would increase South African long-term rates by 73 basis points
- Financial markets access - global leading miners such as Rio Tinto, Xtrata, Anglo American, BHP Biliton with shares quoted on world market and manufacturing sector dominated by SMEs with 50% access to micro finance
- Adopted monetary regime - Inflation targeting since 2000

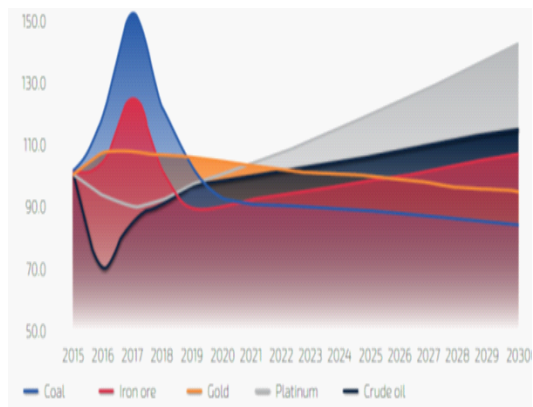
Introduction - An Overview of Evidence

Key Stylized facts - Commodity price and real GDP



Introduction - An Overview of Evidence

Commodity price forecasts - index 2015 = 100



Introduction - An Overview of Evidence

Key Stylized facts - Country risk premia and commodity price

Table 2. Regression results

RHS variable	Real spread (3-mth TB real rate)
Commodity price	-0.0148** (.007)
Output growth	0.168 (0.243)
Trade balance	0.0000 (0.001)
Debt-to-GDP ratio	-0.017 (0.011)
Constant	0.69*** (0.232)
Observations	68

Introduction - An Overview of Evidence

Key Stylized facts - Domestic loan premia and commodity price

Table 3. Regression results

LHS variable	Real spread (loan premia)
Commodity price	-0.017** (0.014)
Output growth	-0.243 (0.240)
Trade balance	0.0000 (0.001)
Debt-to-GDP ratio	-0.018* (0.014)
Constant	0.658*** (0.293)
Observations	68

Introduction - An Overview of Evidence

Key Stylized facts - correlations

Table 1: Business Cycles Correlations in South Africa

	P^{X^*}	Y	C	I	TB	R
P^{X^*}	1.00	0.54	0.57	0.18	-0.10	-0.027
Y	0.54	1.00	0.89	0.71	-0.10	0.09
C	0.57	0.89	1.00	0.59	-0.15	-0.095
I	0.18	0.71	0.59	1.00	-0.07	0.27
TB	-0.10	-0.10	-0.15	-0.07	1.00	0.81
R	-0.027	0.09	-0.095	0.27	0.81	1.00

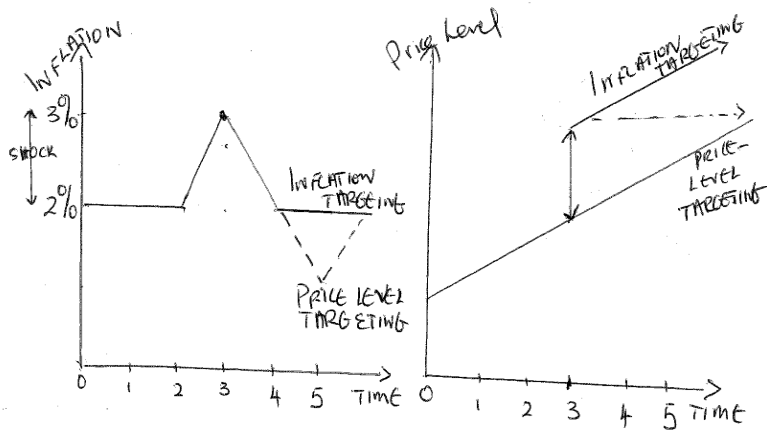
Monetary policy in a model with commodity and financial markets

A model for Small Open Economy commodity exporters - Case for South Africa

- Monetary Economics: its many approaches and the New Keynesian paradigm
- Inflation targeting (IT) and price level targeting (PLT)
- Price level stability, welfare improvements, less deflation (prevent zero bound on interest rates during recent financial crisis)

Introduction - Inflation Targeting vs Price Level Targeting

Shocks and expectations



- Automatic adjustment in inflation (work via New Keynesian Phillips Curve)

$$\pi_t = \beta E_t \pi_{t+1} + \kappa \tilde{y}_t$$

Introduction - Contribution

Contribution and main results

- Two-sector SoE stretched with financial frictions and nominal rigidities
- Commodity producers face country risk premia and non-commodity producers face extra domestic loan premia
- Commodity price shock: third channel as 'financial market' effect on top of 'competitiveness' and 'borrowing cost term' effects - financial accelerator exacerbates business cycle
- Role for stabilization and comparison of three types of monetary regimes; inflation-targeting (IT), price-level targeting (PLT) and nominal GDP targeting (NGDPT)

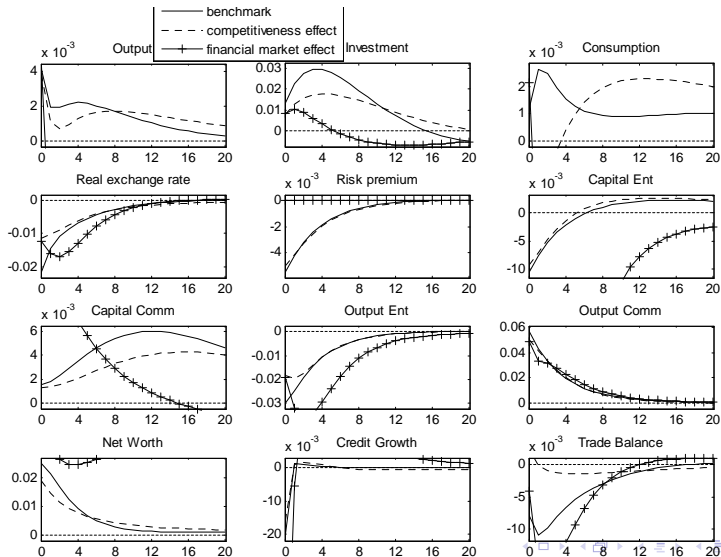
SoE, Commodity, Financial Sector and Monetary Policy

Model setup - key features

- HH - consumption, labour in commodity and final-good sectors and deposits in banks and international bonds
- Commodity production is exported and used as factor inputs for wholesale sector
- Principal-Agent problem of Wholesaler/Bank: asymmetric information and financial friction
- Calvo price setting for intermediate domestically produced and imported goods
- Final good combines intermediate local and imported goods
- Calibration and estimation - main macro shocks implications
- Commodity shock and comparison of three monetary regimes: IT, PLT and NGDPT

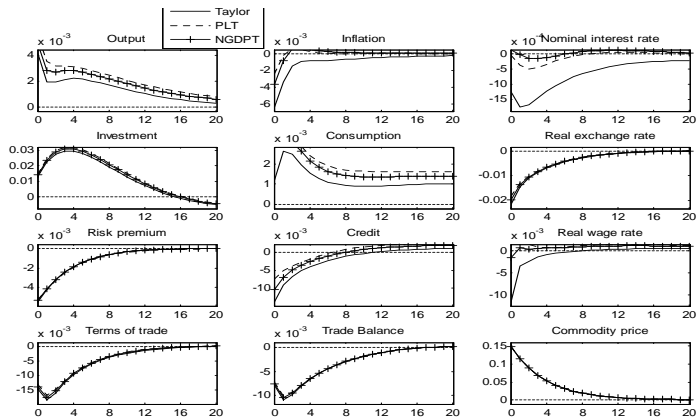
Estimated Commodity Price Shock

Benchmark vs Competitiveness effect and Financial effect



Estimated Commodity shock

Monetary regimes



Theoretical variance

Lower inflation variance and financial market stability

Table 6: Theoretical Variances from Different Monetary Regimes

	IT	PLT	NGDPT
<i>var</i> (output gap)	0.1393	0.1816	0.1718
<i>var</i> (inflation)	0.1290	0.0006	0.0024
<i>var</i> (nominal interest rate)	0.1191	0.0005	0.0004
<i>var</i> (consumption)	0.3063	0.3896	0.3719
<i>var</i> (investment)	0.3816	0.4246	0.4059
<i>var</i> (real exchange rate)	0.0465	0.0470	0.0477
<i>var</i> (real wage)	1.7918	2.0166	1.9740
<i>var</i> (risk premium)	0.0024	0.0020	0.0021
<i>var</i> (credit growth)	0.2394	0.1249	0.1148

Conclusion

Remarks and Way Forward

- Commodity price shock outline the three effects in the paper; two already coined and a third one - Financial market effect
- Stabilization policies following Dutch-disease problem
- Demarcate study in terms of monetary policy regimes, viz., IT, PLT and NGDPT
- PLT vs IT provides lower inflation variance and financial market stability - adjustment of expectations
- PLT: prevents deflation, stronger output boom and lower trend price level
- Possible extensions: capital control

References

Books, journal articles, codes (dynare),...

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- Book (used to be available online): Open Economy Macroeconomics by Martin Uribe and Stephanie Schmitt-Grohe

Unemployment and Search-Theoretic DSGE Models

Background and main issues

- Central question for labour and macro: what determines the level of employment and unemployment in the economy?
- Textbook answer: labor supply, labour demand, and unemployment as “leisure” - Classical (Walrasian) labour market
- Labour market frictions as core framework - Diamond-Mortensen-Pissarides
- Labour market regulations
- Unemployment Benefit (Insurance)
- Financial and labour markets interactions

Unemployment and Search-Theoretic DSGE Models

A Basic Real Business Cycle Model with Search Unemployment (possible extensions)

- Objective: work conceptually (and computationally) with search-theoretic DSGE models of unemployment - recently a very popular class of models
- Labour market flows and matching function
- Infinitely-lived representative households in economy, each with an infinite number of family members (normalised to 1), all members participate in labour force (n_t and $(1 - n_t)$)
- Firms have a profit-maximization problem; employ n_t employees, rent capital, cost of posting vacancies
- Wage Bargaining between worker-firm pair reflecting power of individuals
- Aggregation and Functional forms
- Extension to include emerging market economies features: dual sector with commodity market, small open economy with country premia, monetary policy, capital control

TECHNICAL APPENDIX

Labour market flows

Matching function and definitions

- All agents in economy either employed (n_t) or unemployed ($u_t = 1 - n_t$)
- Matching technology with constant returns to scale :

$$m_t = \chi v_t^\psi u_t^{1-\psi}$$

- Employment evolves as:

$$n_{t+1} = (1 - \rho) n_t + m_t$$

- Job finding rate, Ψ_t be given by:

$$\Psi_t = \frac{m_t}{1 - n_t}$$

- Vacancy filling rate, Φ_t as follows:

$$\Phi_t = \frac{m_t}{v_t}$$

Household problem

- The representative household maximizes

$$\text{Max}_{c_t^n, c_t^u, k_{t+1}} E_0 \sum_{t=0}^{\infty} \beta^t [n_t U(c_t^n, 1 - h_t) + (1 - n_t) U(c_t^u, 1 - e)]$$

$$\text{s.t. } n_t c_t^n + (1 - n_t) c_t^u + (k_{t+1} - (1 - \delta) k_t) + T_t = n_t w_t h_t + r_t^k k_t + (1 - n_t) b^u + \pi_t$$

$$n_{t+1} = (1 - \rho) n_t + \Psi_t (1 - n_t)$$

- Value function (Bellman equation) ($V(\Omega_t^H) = V(k_t, n_t)$)

$$V(k_t, n_t) = \text{Max}_{c_t^n, c_t^u, k_{t+1}} \left\{ \begin{array}{l} [n_t U(c_t^n, 1 - h_t) + (1 - n_t) U(c_t^u, 1 - e)] \\ + \beta E_t [V(k_{t+1}, n_{t+1})] \end{array} \right\}$$

$$\text{s.t. } n_t c_t^n + (1 - n_t) c_t^u + (k_{t+1} - (1 - \delta) k_t) + T_t = n_t w_t h_t + r_t^k k_t + (1 - n_t) b^u + \pi_t$$

$$n_{t+1} = (1 - \rho) n_t + \Psi_t (1 - n_t)$$

- Apply standard method on Bellman equation (as an exception)

$$V(\Omega_t^H) = \max_{c_t^z, k_{t+1}} \left\{ \begin{array}{l} [n_t U(c_t^n, 1 - h_t) + (1 - n_t) U(c_t^u, 1 - e)] \\ + \beta E_t [V(\Omega_{t+1}^H)] \\ + \lambda_t \left(\begin{array}{l} n_t w_t h_t + r_t^k k_t + (1 - n_t) b^u + \pi_t - n_t c_t^n \\ - (1 - n_t) c_t^u - (k_{t+1} - (1 - \delta) k_t) - T_t \end{array} \right) \\ + H_t ((1 - \rho) n_t + \Psi_t (1 - n_t) - n_{t+1}) \end{array} \right.$$

- First order equilibrium conditions:

$$(c_t^z) : U_{c^z}(c_t^z, \cdot) = \lambda_t \text{ for } z = n, u$$

$$(k_{t+1}) : \lambda_t = \beta (1 + r_t^k - \delta) E_t \lambda_{t+1}$$

$$(n_{t+1}) : \frac{\partial V(\Omega_t^H)}{\partial n_t} = U(c_t^n, 1 - h_t) - U(c_t^u, 1 - e) +$$

$$\lambda_t [w_t h_t - b^u - (c_t^n - c_t^u)] + (1 - \rho - \Psi_t) \beta \frac{\partial E_t V(\Omega_{t+1}^H)}{\partial n_{t+1}}$$

Firm problem

- A representative firm solves the profit-maximization problem

$$\max_{v_t, k_t} \pi_t = y_t - w_t h_t n_t - r_t^k k_t - \omega v_t$$

$$\text{s.t. } n_{t+1} = (1 - \rho) n_t + v_t \Phi_t \text{ and } y_t = a_t k_t^\alpha (n_t h_t)^{1-\alpha_1}$$

- Apply standard method on Bellman equation (as an exception)

$$V(\Omega_t^F) = \max_{v_t, k_t} \left\{ a_t k_t^\alpha (n_t h_t)^{1-\alpha_1} - w_t h_t n_t - r_t^k k_t - \omega v_t \right. \\ \left. + J_t [(1 - \rho) n_t + v_t \Phi_t - n_{t+1}] + \beta E_t \left[\frac{\lambda_{t+1}}{\lambda_t} V(\Omega_{t+1}^F) \right] \right\}.$$

- First order equilibrium conditions w.r.t k_t , v_t and n_{t+1} :

$$(k_t) : r_t^k = \alpha \frac{y_t}{k_t} \quad ; \quad (v_t) : \Phi_t J_t = \omega$$

$$\frac{\partial V(\Omega_t^F)}{\partial n_t} = \left((1 - \alpha) \frac{y_t}{n_t} - w_t h_t \right) + (1 - \rho) \beta E_t \left[\frac{\lambda_{t+1}}{\lambda_t} \frac{\partial V(\Omega_{t+1}^F)}{\partial n_{t+1}} \right]$$

Wage bargaining

- For the household, the value (measured in terms of goods) in period t of the marginal employed individual

$$\frac{\partial V(\Omega_t^H)}{\partial n_t} / \lambda_t$$

- For the firm, the value (again measured in terms of goods) in period t of having a marginal employee enter into production

$$\frac{\partial V(\Omega_t^F)}{\partial n_t}$$

- Sharing rule based on Nash bargaining power of individuals (HH power: $\xi \in (0, 1)$)

$$\frac{\partial V(\Omega_t^H)}{\partial n_t} = \frac{\xi}{1 - \xi} \lambda_t \frac{\partial V(\Omega_t^F)}{\partial n_t}$$

References

Books, Journal articles and Codes

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- Dynare codes on basic RBC model above (Andolfatto, 1996) available at 'Andolfatto_1996-master.zip'
- Dynare codes on Diamond-Mortensen-Pissarides - 'DMP.zip'
- Dynare Codes on search and matching models available at: *Macroeconomic Model Data Base 2.1 - User Guide* - see NK_CKL09 and EA_CKL09: Christoffel et al. (2009)