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Does Commodity price impact monetary policy? Evidence from Australia

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and

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The aim of this paper is to examine whether the commodity prices predicting inflation, unemployment and short term interest rate in Australia. Time series econometrics such as vector autoregressive model, cointegration and granger causality are used for this purpose. The empirical shows that three commodity prices (COMRL, COMNRL and COMBSMTL) precede inflation. However, no evidence of reverse causation is found. These finding have important implication for monetary authority. Inflation targeting experience has so far been hit by positive supply shocks. In case of negative supply shock, commodity price may be useful in singling out the likely direction of inflation.

Keywords: Commodity price; monetary policy; Cointegration; Error correction model; Granger causality test

JEL classifications: Q43, Q48 and C32

Introduction

There have been a good number of studies pondering over the role of commodity price in formulating or at least in conducting monetary policy. In other words, role of commodity price has been examined as a monetary policy

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target variable as well as an information variable. The discussion of commodity price in connection with monetary policy surfaced in the 1980s when the growth of monetary aggregates as an intermediate target variable became less dependable. Commodity price is thought to be a significant variable in conducting monetary policy because of the belief that it conveys information about the future movements in general price level. There are mainly two arguments that are forwarded to support this belief: first, because primary commodities are used as important inputs into production of manufactured goods, any change in commodity price directly affects production cost and the general price level [Garner, 1989; Kugler, 1991]. Bloch *et al* [2007] find that increase in primary commodity prices on world markets increases costs for manufacturers in all countries that lead to increased finished goods prices. So any movement in commodity price may signal the probable direction of the future price level. Second, as commodities are traded in continuous auction market, they provide instantaneous information about the state of the economy [Cody and Mills, 1991] and they are more responsive to the demand and supply shocks in the economy than most consumer goods and services [Garner, 1989; Kugler, 1991]. These features of commodity price have stimulated researchers to examine its suitability as an information or indicator variable in the conduct of monetary policy.

Primary commodities play very significant role in Australian economy. Its role in the economy has given a special name to its currency, *commodity currency*. Australia's terms of trade is largely affected by the commodity prices as export of commodity constitutes the largest single share in total export, it accounts for over half of goods exports [IMF, 2006]. An increase in commodity price implies improvement in terms of trade, which is equivalent to the transfer of income from the rest of the world. For example, the projected increase in terms of trade because of increase in commodity prices was equivalent to an increase in Australia's real income of around 2 per cent of GDP [RBA, 2005]. Thus commodity prices play an important role in affecting income, employment and

production. Despite such important role commodity price plays in Australian economy, it is surprising to note that so far no attention has been given to examine its role in operating monetary policy. Although commodity price has been subjected to research in a number of studies in the context of Australian economy, such as Sapsford [1990], Fisher [1996], Bloch *et al* [2006] and so on, its role in the operation of monetary policy has not yet been examined. The present paper attempts to utilize this research gap and investigate if commodity price can be of any use in the conduct of monetary policy in Australia.

Review of Literature

Frankly speaking, relationship between commodity price and monetary policy is not new. In gold standard, monetary policy was tied with a single commodity, gold. However, in recent history, as mentioned in Boughton and Branson [1988], the proposal to base the US monetary policy on a commodity standard, with commodities chosen based on their closeness with inflation, comes from Hall [1982]. Having experienced high and volatile inflation in the 1970s, policymakers in the US get concerned about reforming monetary policy. One set of reform proposal forwarded, among others, was to set commodity price as policy target. Since then a number of studies have examined the suitability of commodity prices as an instrument of monetary policy. However, most of the studies are related to the US economy. For example, Garner's [1985] analysis of the advantages and disadvantages of using commodity prices as target variable suggest that commodity prices are not feasible policy target, as they cannot be adequately controlled by the central bank, rather, at best, it can be used as one of several information variables in designing and conducting monetary policy. Garner's [1989] econometric study concludes the same, that is, controlling commodity price index will not guarantee stable price level, as they are not cointegrated. However, an index of industrial commodity prices may provide useful information to the policymakers but cannot constitute a target variable. Furlong's [1989], based on VAR model that includes quarterly data on monetary aggregate, commodity price index, consumer price index and

an indicator of the strength of economic activities relative to potential over the period 1965:1 to 1987:4 on US economy, arrives at a different result and concludes that commodity prices can be used as a guide for monetary policy and it will improve inflation forecast. Cody and Miller's [1991] study, build on Furlong [1989], also finds that use of commodity prices in formulating monetary policy would improve the performance of the US economy.

Some studies find changing relationship between commodity prices and inflation and inappropriateness of commodity prices in conducting monetary policy. Blomberg and Harris [1995] find that commodity price index performed well in predicting inflation in the 1970s and early 1980s in the US, however, after early 1980s commodity price index loses this power. They argue that this poor performance is primarily due to the declining importance of commodities, both as a share of final output and as a source of exogenous shocks to the economy. Furlong and Ingenito [1996] also come to the same conclusion that commodity prices were relatively strong and statistically robust leading indicator of inflation in the 1970s and early 1980s. Evidence showing redundancy of commodity prices as an indicator of inflation keeps coming. For example Polley and Lombra [1999] conclude that commodity price along with two other information variables, namely interest rate spread and exchange rate does not provide the kind of useful information required to improve the policymakers' economic forecast.

The role of commodity prices in the conduct of monetary policy fell out of favor in the late 1980s and 1990s. However, recently commodity prices have been "re-surfaced in discussions of inflationary outlook for western economies, with oil price developments, in particular, being seen as a source of current inflationary pressures" [Brown and Cronin, 2007:7]. Findings of recent empirical studies show that commodity prices provide information useful for the monetary policymakers. Awokuse and Yang's [2003] five variables VAR (money stock, federal fund rate, consumer price index, industrial production index and

commodity price index) estimation on US economy with monthly data from 1975:1 to 2001:12 indicate that commodity prices are useful in predicting future inflation rate.

Studies that looked into the issue in the context of countries other than the US include Boughton and Branson [1988], Hamori [2007] and Ocran and Biekpe [2007]. Boughton and Branson [1988] investigate if commodity price indexes contain information about the future movements in consumer price inflation in G-7 industrial countries. However, they do not find any support in favor of the notion that there is a long run equilibrium relationship between commodity prices and consumer price inflation. Their study fails to accept the hypothesis that these two variables are cointegrated. Bank of Japan (BOJ) introduced zero interest rate policy in February 1999. This policy exerted significant impact on the link between commodity price and inflation. Hamori [2007] estimates a six variable VAR that includes BOJ commodity price index, consumer price index, industrial production index, money supply, interest rate, and exchange rate. He splits the sample period into two parts; before (January 1990 – January 1999) and after (February 1999 – December 2005) zero interest rate policy is introduced. The study finds that the commodity price index performs fairly well in predicting inflation before zero interest rate policy is introduced, however, this connection ceases to exist thereafter. Failure of the commodity price index as a leading indicator of inflation after the introduction of zero interest rate policy is natural. The BOJ introduced zero interest rate policy when the Japanese economy was in severe depression. In the face of strong deflationary pressure, the responsiveness of inflation to the movement in commodity prices is impaired and the result is break down of the link.

South Africa is one of the major commodity exporting countries. It is the world's largest producer of the platinum group of metal and gold. Therefore, it is obvious that prices of these commodities will have significant impact on its overall economic performance. Ocran and Biekpe [2007] examine this issue in VAR framework over the period 1965:1 to 2004:4. Their causality test suggests

that average gold price and metal price index contain valuable information about interest rate, money, exchange rate, and inflation and therefore, it would be helpful for the monetary authority to use these commodity prices in formulating monetary policy. Despite the close link between commodity and the performance of Australian economy, no attempt has so far been made to evaluate its usefulness in the operation or formulation of monetary policy. Commodity prices in Australia have mainly been brought into analysis due to their shares in export and thereby their influences on terms of trade. For example, Gillitzer and Kearns [2005] examines the long term pattern of Australia's terms of trade over a period of 135 years (1870-2004) to see if the long term terms of trade trend can be explained by Prebisch-Singer hypothesis, which states that the countries that primarily export commodities and import manufactures experience decline in terms of trade. However, they find that Australia's terms of trade declined by less than the decline in the ratio of world commodity prices to world manufactures prices, which was mainly caused by faster price growth of Australia's commodity export and also by the diversification of export base toward commodities that experienced relatively faster price growth.

A study close to the present one is Bloch *el al* [2006]. In this study impact on domestic inflation of world commodity prices are examined in the context of Australia and Canada, two major commodity exporting countries. They find that commodity prices have positive impact on aggregate price level that comes from the use of commodities in the production of industrial goods. In this paper, they do not cover the issue of causality between inflation and commodity prices, which is necessary to comment on the usefulness of commodity prices in the conduct of monetary policy. Moreover, the impact on inflation of commodity prices for a major commodity exporting country should come through the income channel, because higher commodity prices increase real income, which put upward pressure on aggregate demand, price level, production, and employment. As barely there has been any study on the role of commodity

prices in monetary policy, it remains a prospective area of research and thus it provides the motivation for this paper.

Given the satisfactory performance of inflation targeting in Australia, one may question the relevance of this research, because policymakers and researchers generally look for alternative tools for the operation of monetary policy when the existing mechanism does not yield desired results. The objective of this paper is not to suggest any alternative to the existing inflation targeting. Under the current arrangement, the Reserve Bank of Australia (RBA) announces a numerical value of inflation to be achieved or maintained during a certain periods to come. In order to steer the inflation in the desired path RBA uses 'cash rate' as its monetary policy instrument. The aim of this paper is to examine if the commodity price can act as an additional indicator of inflation. The relevance of this research lies in the potential challenge of dealing with adverse supply shocks that RBA may face in the future. Inflation targeting has generally been coincided with favourable supply shocks, that is, positive surprise on productivity, which has pushed output up and price level down. Stevens [2003] describes it as 'a very benign environment in which to operate monetary policy', which may not always be the case. However, commodity price may well be useful for the monetary authority faced with adverse supply shocks if there is a casual relationship between commodity price and other target variables like inflation, output, and unemployment, provided commodity prices precede the target variables.

Methodology

In order for commodity price to be a useful variable in the conduct of monetary policy, it should have significant relationship with the variables that are monitored or controlled by the monetary authority, such as, inflation,

unemployment and economic growth [Furlong, 1989]. Moreover, commodity price will have to contain information about the future movements of those variables. Commodity price with these features will be able to signal the monetary authority about the potential effects on the ultimate target variables of their policy stances. To test if the commodity price possesses these features, this paper examines the causal relationship between commodity price and three macroeconomic variables, namely, inflation, economic growth, and unemployment.

Commodity prices have significant impact on Australia's macroeconomic performance. Commodity exports constitutes around half of Australia's total export. Therefore, any change in export income caused by change in commodity prices affects its national income. Change in national income changes aggregate demand and employment, that is, increase in commodity prices increases income, which in turn, increases aggregate demand. Higher aggregate demand boosts production and employment, which also pushes up the price level. Thus, commodity prices should contain information about the future movements of these key macroeconomic indicators. To examine this information content of commodity price this paper makes use of standard time series econometric procedures that begins with unit root test as follows.

Unit root test: Unit root test is a pre-requisite of testing long run relationship between two or more time series data. Although Dickey-Fuller (DF) and Phillips-Perron (PP) tests are widely used in empirical research, they are known to have low power against the alternative hypothesis that the series is stationary or trend stationary [DeJong, *et al,* 1992]. Elliot, Rothenberg and Stock (ERS) [1996] develop a feasible point optimal test that relies on local GLS de-trending to improve the power of unit root tests, hereafter $\mathrm{ERS\,DF}^{\mathrm{GLS}}$. Another problem with ADF and PP tests is that when the series has a large negative moving average (MA) root they suffer from severe size distortion toward over-rejecting the null [Schwert, 1989]. Perron and Ng [1996] and Ng and Perron [2001]

suggest modification of PP test to correct this problem (hereafter Ng-Perron test). They extend the work of Elliot, Rothenberg and Stock [1996] and develop modified versions of PP test that have much better size properties and also retain the power of $\mathrm{ERS\,DF}^{\mathrm{GLS}}$ test. These unit root tests are based on local GLS de-trending method and use an autoregressive spectral density estimator of the long run variance [Kellard and Wohar, 2003]. Although it is claimed that these tests are improvements over the ADF and PP tests, there is no comprehensive comparative research on these tests [Maddala and Kim,1998]. So, this paper still relies on ADF and PP tests, however, it also uses $\mathrm{ERS\,DF}^{\mathrm{GLS}}$ to confirm the results obtained from ADF and PP tests.

Cointegration test: Cointegration test is applied to examine if there is long run equilibrium relationship among the underlying variables. When two variables, say x_t and y_t, are individually I(1), but their first difference is I(0), then it is possible that some linear combination of these variables, say $z_t = x_t - \beta y_t$, is I(0) and in that case these variables are said to be cointegrated. This paper employs cointegration test procedure developed by Johansen (1991, 1995). To make inference regarding the cointegrating relationship, the trace and maximum eigen-value are compared with the tabulated in Osterwald-Lenum [1992].

Causality test: While cointegration is concerned with long-run equilibrium, Granger causality is concerned with short run predictability. If two variables x_t and y_t are cointegrated and each variable is individually $I(1)$, then either x_t must Granger-cause y_t, or y_t must Granger-cause x_t [Gujarati, 2004]. After examining stationarity and cointegration, the paper will examine if macroeconomic variables are caused by commodity prices.

Sources of data: Monthly data spanning from July, 1982 to December, 2007 are used. Commodity price index data are obtained from **Reserve Bank of**

Australia (RBA) web site. Four different commodity price index data are used: (i) the overall index of commodity price [COM] (ii) commodity price index for rural commodities [COMRL], (iii) commodity price index of non-rural commodities [COMNRL], and (iv) commodity price index for base metal commodities [COMBSMTL]. Inflation [INFL], unemployment [UNEMPLMNT] and short term interest rate [STINT] data are obtained from **Datastream Advance, version 4.00**

Empirical Analyses And Findings

Stationarity of data is examined first. ADF, PP and $\mathrm{ERS\,DF}^{\mathrm{GLS}}$ tests are employed and the results are reported in Table1. ADF and PP test results show that all variables are non-stationary at level and stationary at their first differences, that is, they are I(1). Only INF is stationary at 5% significance level when the regression does not include a trend, but non-stationary at 1% significance level. $\mathrm{ERS\,DF}^{\mathrm{GLS}}$ test results also give the same conclusion as those of ADF and PP tests, that is, the variables are I(1). Only UNEMPLMNT is stationary at 5% level when the regression does not contain trend, but non-stationary at 1% significance level.

Table-1: ADF, PP, DF-GLS unit root tests

Variables	Augmented Dickey-Fuller (ADF) unit root test			
	Level		First difference	
	Constant	Constant & trend	Constant	Constant & trend
COM	-0.018[1]	-1.243[1]	-13.228[0]*	-13.261[0]*

COMRL	-1.773[1]	-2.842[1]	-13.945[0]*	-13.925[0]*
COMNRL	-0.026[1]	-1.194[1]	-12.888[0]*	-12.940[0]*
COMBSMTL	-2.164[5]	-2.999[5]	-5.034[4]*	-4.983[4]*
INFL	-3.049[2]**	-3.035[2]	-6.873[1]*	-6.900[1]*
STINT	-2.145[1]	-2.378[1]	-12.891[0]*	-12.914[0]*
UNEMPLMNT	-2.192[6]	-2.523[6]	-5.170[5]*	-5.037[5]*
Phillips-Perron (PP) unit root test				
COM	0.062[5]	-1.139[5]	-13.264[1]*	-13.194[2]
COMRL	-1.599[4]	-2.578[2]	-13.732[9]*	-13.712[9]*
COMNRL	-0.110[7]	-1.235[7]	-12.917[4]*	-12.943[3]
COMBSMTL	-1.234[10]	-2.140[10]	-15.402[10]*	-15.370[10]*
INFL	-2.717[11]	-2.652[10]	-9.782[7]*	-9.856[7]*
STINT	-1.943[0]	-1.938[1]	-12.555[7]*	-12.576[7]*
UNEMPLMNT	-1.046[12]	-2.424[13]	-20.255[12]*	-20.360[12]*
DF-GDL unit root test				
COM	1.297[1]	-1.470[1]	-13.016[0]*	-12.920[0]*
COMRL	0.130[1]	-2.559[1]	-13.696[0]*	-12.683[0]*
COMNRL	0.968[1]	-1.308[1]	-11.204[0]*	-12.171[0]*
COMBSMTL	-0.965[5]	-2.946[5]	-5.052[4]*	-4.616[4]*
INFL	-1.670[2]	-2.240[2]	-6.603[1]*	-6.900[1]*
STINT	-0.518[1]	-2.112[1]	-12.770[0]*	-12.952[0]*
UNEMPLMNT	-2.480[6]**	-2.635[6]	-5.103[5]*	-4.971[5]*

(i) * and ** indicate significant at 1% and 5% levels respectively.
(ii) Figures in the parentheses in ADF test indicate optimum lag length determined by SIC
(iii) Figures in the parentheses in PP test indicate Newey-West bandwidth.

Given the first difference stationarity of the variables, the next issue of interest is to examine if there is any long run equilibrium relationship among the variables. Johansen cointegration test shows that there is one cointegrating relationship among the variables (result not reported). It indicates that all variables are not cointegrated. To identify the cointegrated variables pair wise cointegration test is performed and the results are reported in Table-2. The results show that only inflation has a cointegrating relationship with all four indices of commodity price.

Table-2: Johansen cointegration test

Variables	Null Hypothesis	Trace statistic	Max-Eigen Statistic
COM, INFL	$r = 0$	14.176**	12.168**
	$r \leq 0$	2.007	2.007

COMRL, INFL	$r = 0$	12.320***	10.295***
	$r \leq 0$	0.822	0.822
COMNRL, INFL	$r = 0$	12.919**	11.563**
	$r \leq 0$	1.355	1.355
COMBSMTL, INFL	$r = 0$	11.090***	10.884***
	$r \leq 0$	0.205	0.205
COM, STINT	$r = 0$	6.062	3.286
	$r \leq 0$	2.775	2.775
COMRL, STINT	$r = 0$	4.716	3.878
	$r \leq 0$	0.838	0.838
COMNRL, STINT	$r = 0$	4.806	3.217
	$r \leq 0$	1.589	1.589
COMBSMTL, STINT	$r = 0$	4.028	3.875
	$r \leq 0$	0.152	0.152
COM, UNEMPLMNT	$r = 0$	4.876	3.822
	$r \leq 0$	1.054	1.054
COMRL, UNEMPLMNT	$r = 0$	3.073	2.992
	$r \leq 0$	0.080	0.080
COMNRL, UNEMPLMNT	$r = 0$	3.740	2.911
	$r \leq 0$	0.828	0.828
COMBSMTL, UNEMPLMNT	$r = 0$	7.421	6.282
	$r \leq 0$	1.139	1.139

Note: ** and *** indicate significant at 5% and 10% levels respectively.

Usual extension of cointegration analysis is to examine the speed of adjustment of disequilibrium between the cointegrated variables in the short run through error-correction model (ECM). Given the cointegrating relationship between inflation and three indices of commodity price, short run adjustments of these long run relationships are examined. The ECM results are reported in Tbale-3.

Table-3: Error Correction estimation result

Pairs of variables	ECM estimation output
COMR vs INFL	$\Delta INFL = -0.0057 + 0.0089\Delta COMR - 0.018\hat{\mu}_{t-1}$ $(-0.26) \quad (1.17) \quad (-2.04)^{**}$
COMNR vs INFL	$\Delta INFL = -0.013 + 0.036\Delta COMR - 0.020\hat{\mu}_{t-1}$ $(-0.65) \quad (3.97)^{*} \quad (-2.25)^{**}$
COMBSMTL vs INFL	$\Delta INFL = -0.008 + 0.011\Delta COMR - 0.022\hat{\mu}_{t-1}$ $(-0.42) \quad (2.95)^{*} \quad (-2.33)^{**}$

Note: * and ** indicate significant at 1% and 5% significance levels.

ECM results show that the magnitudes of speed of adjustments are not substantial; however, all three equilibrating errors are statistically significant. Given these long run and short run associations between the variables, the paper next follows the route of Granger causality test to see if commodity price can effectively be used as predictor of inflation. Cointegrating relationship between inflation and commodity price indices implies that there must be some causal link between them. Granger causality result reported in Table-4 shows that there is unidirectional causal effect running from three commodity price indices (COMRL, COMNRL and COMBSMTL) to inflation. It implies that any change in these commodity prices are subsequently followed by movements in inflation rate.

Table-4: Granger causality test

Null hypothesis	Lags	F-Statistic	Probability
INF does not Granger cause COM	4	1.22	0.30
INF does not Granger cause COMRL	4	1.88	0.11
INF does not Granger cause COMNRL	4	1.54	0.18
INF does not Granger cause COMBSMTL	2	0.39	0.67
COM does not Granger cause INFL	4	0.75	0.55
COMRL does not Granger cause INFL	4	2.74	0.02**
COMNRL does not Granger cause INFL	4	3.38	0.01*
COMBSMTL does not Granger cause INFL	2	3.24	0.04**

Note: * and ** indicate significant at 1% and 5% levels respectively.

Conclusion

This paper examines the role of commodity price indices in predicting inflation, unemployment, and short term interest rate in Australia. Four types of commodity price indices are used to see if any specific index is useful in predicting the variables under consideration. Econometric analyses indicate that three commodity price indices (COMRL, COMNRL and COMBSMTL) precede inflation. However, evidence of reverse causation is not found. This finding has important implication for monetary authority. Inflation targeting experience has so far been hit by positive supply shocks. In case of negative supply shock, commodity price may be useful in singling out the likely direction of inflation.

References

1. Awokuse, Titus O. and Jian Yang [2003], "The informational role of commodity prices in formulating monetary policy: A reexamination", ***Economics Letters,*** 79:219-224.

2. Bloch, Harry, A. Michael Dockery, C. Wyn Morgan and David Sapsford [2007], "Growth, commodity prices, inflation and the distribution of income", ***Metroeconomica***, 58(1):03-44.

3. Bloch, Harry, A. Michael Dockery, and David Sapsford [2006], "Commodity prices and the dynamics of inflation in commodity-exporting nations: Evidence from Australia and Canada", ***Economic Record***, 82:97-109.

4. Blomberg, S. Brock and Ethan S. Harris [1995], "The commodity-consumer price connection: Fact or Fable?", ***Economic Policy Review***, October, Federal reserve Bank of New York (FRBNY), pp.21-38.

5. Boughton, James M. and William H. Branson [1988], "Commodity prices as a leading indicator of inflation", ***NBER Working Paper No. 2750.***

6. Brown, Frank and David Cronin [2007], "Commodity prices, money and inflation", ***Working Paper No.738/March***, European Central Bank.

7. Cody, Brian J. and Leonard O. Mills [1991], "The role of commodity prices in formulating monetary policy", ***The Review of Economics and Statistics***, 73:358-365.

8. Cook, Steven [2004], "Finite-sample properties of the GLS-based Dickey-Fuller test in the presence of breaks in innovations variance", ***Australian Journal of Statistics***, 33(3):305-314.

9. Dejong, David N., John C. Nankervis, N.E. Savin, and Charls H. Whiteman [1992], "The power problem of unit root tests in time series with autoregressive errors", ***Journal of Econometrics***, 53(1-3):323-343.

10. Elliott, G., T. Rothenberg, and J. Stock [1996], "Efficient tests for an autoregressive unit root", ***Econometrica***, 64:813-836.

11. Fisher, Lance A. [1996], "Sources of exchange rate and price level fluctuations in two commodity exporting countries: Australia and New Zealand", ***Economic Record***, 72(219):345-358.

12. Furlong, Frederick T. [1989], "Commodity prices as a guide for monetary policy", ***Economic Review***, Winter (1): 21-38, Federal Reserve Bank of San Francisco.

13. Furlong, Fred and Robert Ingenito [1996], "Commodity prices and inflation", ***Economic Review***, 1:27-47, Federal Reserve Bank of San Francisco.

14. Garner, C. Alan [1989], “Commodity prices: Policy target or information variable?”, ***Journal of Money, Credit and Banking***, 21(4):508-514.

15. Garner, C. Alan [1985], “Commodity prices and monetary Policy”, ***Economic Review***, Federal Reserve Bank of Kansas City, February, pp. 7-21.

16. Gillitzer, Christian and Jonathan Kearns [2005], “Long term patterns in Australia’s terms of trade”, ***Research Discussion Paper: 2005-01,*** Reserve Bank of Australia.

17. Gujarati, Damodar N. [2004], ***Basic Econometrics***, Tata McGraw-Hill, New Delhi.

18. Johansen, S. (1991), “Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models”, ***Econometrica*****,** 59:1551–1580.

19. Johansen, S. (1995), ***Likelihood-based Inference in Cointegrated Vector Autoregressive Models*****,** Oxford: Oxford University Press.

20. Kellard, Neil and Mark Wohar [2003], “Trends and persistence in primary commodity prices”, ***Royal Economic Society Annual Conference 2003,*** paper no. 118.

21. Kugler, peter [1991], “Common trends, commodity prices and consumer prices”, ***Economics Letters***, 37:345-349.

22. Maddala, G.S., and In-Moo Kim [1998], ***Unit roots, cointegration, and structural change***, Cambridge University Press.

23. Ng, Serena, and Pierre Perron (2001). “Lag Length Selection and the Construction of Unit Root Tests with Good Size and Power”, ***Econometrica*** 69, 1519-1554.

24. Osterwald-Lenum, M. (1992), “A Note With Quantiles of the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistics”, ***Oxford Bulletin of Economics and Statistics***, 54: 461-472.

25. Perron, Pierre and Serena Ng [1996], “Useful modifications to some unit root tests with dependent errors and their local asymptotic properties”, ***Review of Economic Studies***, 63(216):435-465.

26. Polley, Susanne M. and Raymond E. lombra [1999], “Commodity prices, interest rate spread and exchange rate: Useful monetary policy indicators or redundant information?”, ***Eastern Economic Journal***, 25(2):129-140.

27. Reserve Bank of Australia [2005], “Commodity prices and the terms of trade”, ***Bulletin,*** April.

28. Sapsford, David [1990], “Primary commodity prices and the terms of trade”, ***The Economic Record****,* December, 342-356.

29. Schwert, G. William [1989], “tests for unit roots: A Monte Carlo investigation”, ***Journal of Business and Economic Statistics***, 7(2):147-159.

30. Stevens, GR [2003], “Inflation targeting: A decade of Australian experience”, ***Reserve Bank of Australia Bulletin***, April.