INFLATION TARGETING MACROECONOMIC DISTORTIONS AND THE POLICY REACTION FUNCTION*

ABSTRACT

The paper examines the evolution of monetary policy design in Australia over the past quarter of a century culminating recently in the adoption of an inflation targeting approach through the institutional mechanism of CBI (Central Bank Independence). Cross-country empirics have repeatedly confirmed the stylized fact that high CBI delivers low inflation. This study covers new ground by using time-series techniques to test the nexus between CBI and inflation using Australian quarterly time-series data for the sample period 1973Q3-1998Q4. The theoretical analysis based on a quadratic social loss function subject to a Lucas supply curve demonstrates that the exclusive focus on the institutional mechanism of CBI to reduce inflation bias may be flawed because it ignores the spillover effects of macroeconomic distortions on inflation. Time-series composite indices were constructed to proxy CBI and macroeconomic distortions in the labour market, the tax system and in the arena of international competition. The general-to-specific methodology was applied to sequentially derive a parsimonious VECM (Vector Error Correction Model) linking CBI and macroeconomic distortions to inflation during the study period. Granger causality tests indicated that both CBI and macroeconomic distortions Granger caused inflation. The VECM empirics revealed that CBI and neocorporatism contributed in a significant manner to reduction of inflation during the study period. The fact that neocorporatism curbed inflation during the study period raises the issue that the industrial relations reforms agenda aimed at eroding neocorporatism are politically motivated and lack an economic rationale. However, when the link between inflation and neocorporatism was reanalyzed taking feedback effects into account using the VAR methodology a different picture emerged. The impulse response functions revealed that an increase in neocorporatism exacerbated inflation in the short run. Thus the VAR empirics therefore provided a rationale for the labour market reforms aimed at rectifying labour market distortion attributed to neocorporatism. Both the VECM and VAR empirics make a strong case for tax reform in order to reduce welfare payments without compromising on safety net and equity issues. It also makes a case for reducing the volatility or the real exchange rate to sharpen Australia's competitive edge. The significance of macroeconomic distortions in causing output to deviate from potential underscore that the policy reaction function is influenced by distortions. Non-nested tests revealed that the Taylor rule taking account of deviations of output from potential due to macro distortions was superior to an inflation rate only rule. Therefore the study results recommend that policymaker (Reserve Bank of Australia) should pursue a Taylor rule rather than inflation rate only rule in smoothing the overnight cash rate to achieve the pre-announced inflation target.

1. INTRODUCTION

The adoption of inflation targeting as the primary goal of monetary policy has been rationalized by game-theoretic and principal-agent approaches designed to enhance policy credibility and thereby reduce inflation bias (Muscatelli, 1998; Pearson and Tabellini, 1993; Walsh, 1995). The inflation targeting approach to monetary policy has evolved over the past

* I am thankful to Assoc. Professor Bob Jackson and Dr. Bruce Littleboy of the Department of Economics, The University of Queensland for their valuable comments on the draft of this paper.

century with its intellectual pedigree traced to the writings of Marshall (1887), Wicksell (1898), Fisher (1911) and Keynes (1923). Moreover the analytical difference between inflation targeting and its forebears such as exchange rate and monetary targeting is regarded as a matter of semantics rather than economics (Haldane, 1998:3). Therefore, this study analyses the evolution of monetary policy design over the quarter of a century using quarterly time-series data (1973Q3-1999Q3). Numerous cross-country studies have repeatedly confirmed that the institutional innovation CBI (Central Bank Independence), a the pivotal mechanism for inflation targeting, has delivered the stylised fact of low inflation with the "free lunch" of an improved macroeconomic performance (Alsenia, 1988; Cukeriman, 1992). In this study we attempt to cover new ground by examining whether CBI over time has delivered low inflation. For this purpose a time-series composite index of CBI was constructed using the same ingredients used in the cross-country studies. Furthermore, based on theoretical insights, we contend that the exclusive focus on CBI in contemporary monetary policy design may be misplaced. This is because this institutional approach virtually neglects important macroeconomic distortions that may destabilize output and exacerbate inflation bias. In this study an attempt has been made to identify and construct proxy time-series indices for the various macroeconomic distortions in the labour market, the tax system and in the arena of international competition that could have spillover effects on inflation bias. Several dynamic econometric modeling techniques have been used to analyze the nexus between inflation and CBI after controlling for the macroeconomic distortions.

Inflation targeting or the achievement of a pre-announced numerical inflation target over the business cycle is currently the primary goal of monetary policy in Australia. However, the evolution of monetary policy design in Australia and in other advanced economies reveals that monetary authorities have used different targets (exchange rate anchors, monetary and interest rate targets) to combat the bugbear of inflation. The theoretical debate on monetary policy in the shape of rules versus discretion has emphasized that rules or targeting deliver optimal inflation outcomes by anchoring inflationary expectations compared to the sub-optimal outcomes that result from policy discretion. Policy discretion allows scope for time-inconsistent behavior as policymakers could renege on their policy commitments for short-run gains (Kydland and Prescott, 1977; Barro and Gordon, 1988; Calvo, 1978). These short-run gains result in the long-run social deadweight loss of policy credibility resulting in the exacerbation of inflation bias.

The paper is organized as follows. Section 2 reviews the obsession of monetary policy with the inflation bugbear. The evolution of monetary policy design to tackle inflation in Australia over the past quarter of a century is analyzed in terms of episodes or sub-periods highlighting the influence of macroeconomic paradigms on policy formulation. Section 3 models the conventional wisdom on inflation targeting based on minimizing a quadratic social loss function subject to a Lucas supply curve. The theoretical analysis demonstrates that the exclusive focus on CBI to increase inflation aversion and reduce inflation bias may gloss over important feedback effects of macroeconomic distortions on inflation bias. Section 4 enumerates the alternative institutional mechanisms that could deliver low inflation in the same way as CBI. The self-contradictory nature of the principal-agent approach to inflation curbing is noted, although the glossing over of the feedback effects of macroeconomic distortion inflation bias is regarded as more serious. Section 5 explains the construction of composite indices to proxy CBI and the macroeconomic distortions in the labour market, the tax system and in the arena of international competition that impinge on inflation bias. Section 6 presents the unit root and cointegration tests that preceded the derivation of a parsimonious Vector Error Correction Model (VECM) using the general to specific methodology. The Granger causality tests based on the VECM model reveal that both CBI and the distortion variables Granger caused inflation. The augmented VECM also provides an

estimate of the historical sacrifice ratio of 1.8%. The VECM empirics reveal that neocorporatism curbed inflation during the study period, thereby raising questions about the current labour market reforms aimed at diluting neocorporatism. Section 7 presents results of the application of the VAR methodology whereby the feedback effects of the monetary system variable on inflation are analyzed in terms of impulse response functions and forecast error variance decompositions. The empirical results reveal that increase in neocorporatism can exacerbate inflation in the short run. Thus, the VAR empirics provide a rationale for the current agenda for labour market reforms aimed at eroding the labour market distortion as embodied in neocorporatism. Furthermore, the empirics reveal that one standard deviation positive innovation to CBI permanently reduces inflation by about 5% over the long-run forecast horizon. Section 8 concludes the paper by recommending that policymakers' reaction function for setting the short-term interest rate should be a Taylor rule rather than an inflation only rule in view of the significance of macroeconomic distortions in the Australian monetary policy design aimed at targeting inflation.

2. THE INFLATION BUGBEAR AND THE EVOLUTION OF MONETARY POLICY DESIGN

Inflation arises either because too much money chases too few goods or because the increase in money wages outstrips labour productivity. Inflation could be caused by either demand-pull or supply-side cost-push factors. In the policy literature no other variable has been more demonized than inflation. It has been tagged the public enemy number one, a thief, a scourge and the debaucher of the capitalist economy (attributed to Lenin). Macroeconomic theory explains that inflation causes high transactions or 'shoe-leather' costs because it reduces real balances by raising interest rates. It entails 'menu costs' or price changes resulting in 'noise' that distorts the price signal leading to coordination failures and the misallocation of resources. It has been chastised for 'bracket creep' that erodes the earnings of fixed income earners and pensioners. Unanticipated inflation favors creditors against debtors resulting in risk adverse behavior and the postponement of trade and investment decision. It generates a bias against real capital gains and in favor of nominal gains and thus contributes to tax distortions and investment misallocation. Moreover in an open economy if the exchange rate is pegged the real exchange rate does not adjust to reflect true competitiveness. If the exchange rate were floating inflation could generate excessive volatility and thus undermine confidence in trade and investment with detrimental effects on long-term growth. Despite the widespread concerns about the baneful effects of inflation the static welfare gains, as a ratio of GDP due to a 1-% disinflation appears to be a minuscule 0.0005% when measured using Harberger triangles. However, the dynamic permanent welfare gain due to a disinflation of 1% is estimated to deliver a massive steady state welfare gain 18% as a ratio of GDP, for a sacrifice ratio of 1.8% when discounted using a social discount rate r=5% and a growth rate=2%. This result is based on the NPV formula B/(r-g)=0.18/(0.05-0.04=18% suggested by (Haldane, 1997).

The evolution of monetary policy design in Australia as in most other countries demonstrates the over riding concern of the policymakers to achieve the target of low inflation through the deployment of various policy Instruments. The Charter of the Reserve Bank of Australia (*RBA Act*, 1959) specified that it should achieve the three goals of full employment, growth or national prosperity and low inflation or price stability. The evolution of monetary policy during the study period clearly demonstrates how the choice of policy instruments and intermediate targets for curbing inflation bias was influenced by the dominant macroeconomic paradigm of the day.

The evolution of monetary policy design in Australia during the study period (1973Q3 – 1998Q3) has been categorized into various sub-periods or episodes. In Episode 1 (1973Q4-1976Q1) the pegged exchange rate provided the nominal anchor to impose price discipline and weigh down inflationary expectations. During Episode 1 under the influence of the dominant Keynesian paradigm policymakers used the levers of monetary and fiscal policy to fine-tune demand and stabilize the business cycle. During Episode 2 (1976Q2-1985Q1) under the influence of monetarism a constant money growth rate rule or monetary targeting based on the monetary aggregate (M3) was practiced with the aim of countering the destabilizing effects of long and variable policy lags. However, financial innovations and disintermediation unleashed by the forces of financial deregulation undermined the stable transmission mechanism that underpinned the money demand and velocity functions. This led to the abandonment of monetary targeting in early 1985. In Episode 3 (1985Q2-89Q4) the checklist approach or an array of macroeconomic indicators was used to guide monetary policy. However, the checklist of policy indicators virtually opened the door to the practice of unbridled discretionary policy severely undermining policy accountability and credibility. The misery index skyrocketed and a severe recession occurred during this episode. During Episode 4 (1990Q1-1992Q4) there was a quiet policy reversal from the multiple goal checklist approach to a single instrument geared to curb inflation. The RBA (Reserve Bank of Australia) had adopted the nominal short-term interest rate (the overnight cash rate) as its policy instrument for implementing monetary policy and controlling the inflation bugbear. The superiority of interest rate targeting vis-à-vis monetary targeting for delivering output stabilisation during this episode when the economy was exposed more to monetary rather than real shocks received theoretical support (Poole, 1970). In Episode 5 (1993Q1-1996Q2) the RBA engaged in a covert shift to the dual targeting of both inflation and output. However, because of a simmering political feud between the incumbent Treasurer and the Leader of the Opposition regarding the merits of inflation targeting the RBA kept under wraps its operation of the dual inflation output targeting policy framework. During Episode 6 (1996Q3-1998Q3) the Treasurer of the newly elected Coalition government announced that the RBA would be granted CBI so that it could achieve the sole aim of monetary policy: the attainment of a pre-announced 'thick point' inflation target of 2-3% over the business cycle. The granting of CBI to achieve the numerical inflation target was a key institutional innovation of the new monetary policy design introduced during this episode. Table 1 below recaps the salient episodes in the evolution of monetary policy design in Australia during the study period.

***Table* 1 The evolution of monetary policy design in Australia (1973- 98)**

Episode	Monetary policy design	Paradigm
I. (73Q4-76Q1)	Exchange rate anchor	Keynesian fine-tuning
II.(76Q2-85Q1)	Monetary (M3) targeting	Friedmanite rules
III.(85Q2-89Q4)	Check-list approach	Unbridled discretion
IV.(90Q1-92Q4	Interest rate targeting	Poole analytics
V. (93Q1-96Q2)	Inflation & output targeting	Dual targeting
VI.(96Q3-98Q3)	Inflation targeting & CBI	Time-inconsistency problem

Sources: Macfarlane (1998); Grenville (1997)

Australia's adoption of the inflation-targeting framework to conduct monetary policy in 1993 announced a thick-point to be achieved over the business cycle. The thick point or the

numerical range of 2-3% for the inflation target was specified in terms of changes in the consumer price index (CPI). It aimed to capture the Hicksian notion of a cost of living index. But it suffered from a serious mismeasurement of at least 1% due to the failure to account for the changes in quality and the introduction of new goods into the consumption basket or the weight diagram in the Lasperyres' CPI index (Boskin, 1996). Besides the measurement bias, the need to provide a lubrication through real wage and real interest adjustments provides further explanations as to why inflation targets have been fixed as a positive number (see Table 2) rather than at the theoretical optimum of zero (Akerlof et al., 1996).

***Table* 2 The Inflation Targeting (IT) League**

Country	Year/Qtr	Target %	Measure
1.N Zealand	1990Q1	0-3	CPI
2. Canada	1991Q1	1-2	CPI
3. UK	1992Q3	1-2.5	RPI
4.Sweden	1993Q1	1-2	CPI
5. Finland	1993Q1	2	CPI
6. Australia	1993Q1	2-3	CPI
7. Spain	1994Q2	3.5- 4	CPI

Source: Bank for International Settlement, Annual Report 1996.
Notes: Measures: CPI: Consumer Price Index. RPI: Retail Price Index

3. THE CONCEPTUAL FRAMEWORK UNDERPINNING MONETARY POLICY DESIGN

The conventional wisdom on monetary policy design incorporating the time-inconsistency problem has been reformulated in a game theoretic framework (Backus and Driffil, 1985) and explained heuristically in the context of reneging on wage agreements (Goodhart, 1994). The institutional mechanism of CBI has been shown to be the circuit breaker that removes the principal (the government) from making the agent (the central bank) from abandoning policy commitments to achieve short run gains motivated by the political business cycle. In the process monetary policy credibility and reputation of the central bank is irrevocably damaged. Cross-section empirical studies have shown that granting of CBI or similar alternative mechanisms reduce inflation bias by increasing inflation aversion. The algebraic exposition of this received theory whilst confirming that the reinforcing of the institutional mechanisms such as CBI can reduce inflationary bias ignores the fact that macroeconomic distortions too can contribute to inflation bias through increase in output variability. Therefore monetary policy design with an exclusive focus on the institutional remedy of CBI to achieve inflation targets may be flawed.

The algebraic structure of the basic model or the conventional wisdom related to modern monetary policy design can be represented in terms of a quadratic loss function (L) comprising the quadratic loss arguments of the inflation rate (π_t) deviating from its social optimum ($\pi_t^* = 0$) and the GDP or output (y_t) deviating from its natural rate (y_t^*) as defined by the function (1).

$$L = \gamma(\pi_t - \pi_t^*)^2 + (y_t - \delta y_t^*)^2 \quad (1)$$

The policymakers' pre-commitment to fight inflation or inflation aversion is quantified by the weight accorded to the parameter (γ). The deviation of output from the natural rate is captured by the distortion parameter $0<\delta < 1$ (Blanchard and Fischer, 1989:56).

The Lucas supply curve captures the policymakers' scope for bringing output above the natural rate (y^*) which is the optimal output in the absence of policy surprises. Thus, the Lucas supply or equivalently a short-run Phillips curve given by equation (2) reveals that policy surprises could ratchet output above the natural rate of output, thereby generating a positive inflation bias or the actual inflation rate to exceed the socially optimal expected inflation rate.

$$y_t = y_t^* + (\pi_t - \pi_t^e) \; .. \quad (2)$$

The quadratic loss function (1) subject to the Lucas curve constraint (2) yields the following quadratic function:

$$L = \gamma\pi_t^2 + [(1-\delta)y_t^* + (\pi_t - \pi_t^e)]^2 \quad (3)$$

The first order condition for the minimization of the above quadratic function with respect to inflation yields the following policy reaction function:

$$(dL/d\pi_t) = 2\gamma\pi_t + 2[(1-\delta)y_t^* + (\pi_t - \pi_t^e)] = 0 \quad (4)$$

After rearranging we obtain the policy reaction function below:

$$\pi_T = [(\delta-1)y_t^* + \pi_t^e]/(1+\gamma) \quad (5)$$

Under rational expectations, where $\pi_t^e = \pi_t$ the optimal solution to the policy reaction function (5) is given by:

$$\pi_t = [(\delta-1)y_t^*]/\gamma \quad (6)$$

In the above solution the parameter γ defines the weight attached to the policymakers' inflation aversion parameter. Contemporary monetary policy design emphasizes the role of institutional mechanisms that would enhance the inflation aversion parameter (γ) thereby causing a reduction of inflationary bias. However, equation (6) demonstrates that the inflation bias could also be reduced by reducing the degree of macroeconomic distortions measured by $(1-\delta)$. Therefore, although $\pi_t \to 0$, if $\gamma \to \infty$ or $(1-\delta) \to 0$; the latter has been glossed over in contemporary monetary policy design.

The institutional innovation of CBI that constitutes the nub of contemporary monetary policy design is linked to the raising of the aversion parameter (γ) in order to reduce inflation bias. In the process contemporary monetary policy design has glossed over the importance of the spillover effects of macroeconomic distortions $(1-\delta)$ in nurturing inflation bias. One of the primary aims of this study is to empirically analyze the contributions of these macroeconomic distortions to inflation bias after controlling for the effects of CBI.

4. INSTITUTIONAL MECHANISMS FOR ENHANCING INFLATION AVERSION

Contemporary monetary policy design has assigned the institutional innovation of CBI (Central Bank Independence), whereby the principal (government) delegates to the agent (the central bank) independence in setting the policy instrument to achieve a pre-committed inflation target. Thus the principal circumscribes the scope for discretionary policy action and thereby increases policy credibility, which reduces inflationary bias. The granting of CBI has been either in the form of policy statement or through a legal enactment and emphasizes that the central bank has autonomy in setting the policy instruments to achieve a pre-committed inflation target. The contemporary literature on monetary policy design reveals that the reduction of inflation bias by eliminating the scope for time-inconsistent policy behavior can be achieved in several alternative ways. First, by the appointment of a conservative central banker who is committed to the reduction of inflation rather than output stabilisation (Rogoff, 1985). Second, by implementing an incentive contract whereby the incumbent governor could be penalized if he fails to achieve the pre-announced inflation target (Walsh, 1995). Third, by specifying the numerical magnitude of the inflation target that has to be achieved (Svensson, 1995; 1997). Fourth, by stipulating that the fixed rule of an inflation target should be achieved whilst making provision for an escape clause to cope with unforeseen contingencies that could emerge due to supply shocks (Lohmann, 1992). Fifth, by the implementation of ironclad or legally mandated inflation targets (Green, 1996, Stemp, 1997). Sixth, by the central bank building a reputation or a good track record as inflation fighter thereby enhancing policy credibility – a proposition that has been illustrated using multi-period modeling of policy credibility (Barro and Gordon, 1983). It has been argued that that in the face of the central bank's preference uncertainty the discretionary approach would be superior to the delegation of CBI by contracts and target prescriptions. Furthermore, if the central bank has private information about supply shocks the granting of goal independence in addition to instrument independence would be preferable, provided accountability of the central bank is ensured by imposing penalties in the event of failing to meet the pre-announced inflation targets (Muscatelli, 1998). However, others contend that the optimal combination of an incentive contract with inflation targets would be superior as it would eliminate inflation bias and output variability that is not generated by supply shocks (Beetsma and Jensen, 1998). Some analysts doubt whether the agent, the central bank, may have preferences that are independent from those of the government (McCallum, 1995) and others express reservations about the effectiveness of imposition of penalties on governors who fail to achieve inflation targets (Blinder, 1995). Table 3 summarizes the various institutional

***Table* 3 Institutional mechanisms for reinforcing inflation aversion (γ)**

Institutional Mechanism	**Proponents**
0. CBI (Legal & instrument independence)	Alseina (1988), Cukierman (1992)
1. Appointment of a conservative central banker	Rogoff (1985)
2. Optimal incentive contract with penalties	Walsh (1995)
3. Numerical Inflation targets based on forecasts	Svensson (1997)
4. Inflation target or rule with an escape clause	Lohmann (1992)
5. Ironclad or legally mandated inflation targets	Green(1996), Stemp (1997)
6. Reputation and policy credibility	Barro and Gordon, (1983); Chang (1998)

mechanisms that vie with CBI to deliver on inflation targets policy design. Nonetheless, these institutional mechanisms fail to tackle head on the spillover effects of macroeconomic distortions on inflation bias operating either via output variability or through other transmission channels.

The elimination of macroeconomic distortions has long occupied a top billing on the agenda of economic policy reform. In the Australian context the debate on policy reforms has increasingly focused on the need to eliminate distortions in the labour market, the tax system and in the sphere of international competition in order to galvanise the Australian economy. In this study we contend that the contemporary monetary policy designs that focus exclusively on inflation targeting to the virtual exclusion of the need to tackle macroeconomic distortions needs to be reviewed. Besides, the macroeconomic distortions include: first, the case for revamping the industrial relations system in order to infuse labour market flexibility. Second, distortions underline the case for overhauling the tax system by reconfiguring welfare expenditure out of tax revenue in such a manner that efficiency would be delivered without compromising equity. Third, the case for sharpening the edge of international competitiveness by reducing volatility and uncertainty that causes the postponement of investment and trade decision is highlighted. In the next section we discuss how empirical analysis can shed light on the links between the macroeconomic distortions and inflation bias after controlling for the institutional mechanism of CBI.

5. MACROECONOMIC DISTORTIONS AND INFLATIONARY BIAS

In this section we explain the various factors that were taken into account in the construction of composite time-series indicators to measure (CBI_t). Also the other macroeconomic distortions relating to the labour market have been captured by the index of neocorporatism (NCI_t) showing the efficacy of centralized wage fixing principles; the welfare benefits to tax revenue ratio proxying the efficacy of the tax system (BTX_t) and the index of international competitiveness has been proxied by an index of volatility (VOL_t) reflecting distortions impinging on international trade and investment.

CBI_t (Central Bank Independence) Index

The time-series proxy for CBI_t index for Australia was compiled by assigning scores to ten sub-indices to take account of legal, policy instrument, operational and goal independence, factors such as transparency and accountability (see Table 4 and Appendix Table 3a). The sub-indices used for measuring CBI indices were analogous to those used in the cross-country studies (Cukierman, 1992; Cukierman, Webb and Neyapati, 1992). Since most of the sub-indices were highly correlated a composite index based on the average of the sub-indices was used as the measure of CBI for this study. The composite CBI_t index reveals that the degree of CBI increased three-fold during the study period and hovered around 6 during the penultimate stage of the study period, thus falling short of the maximum attainable score of 10. The quarterly time-series CBI index compiled in this study is based on a reckoning of more dimensions of CBI and covers an extended time-span than only other time-series CBI compiled for Australia based on annual data (Stemp, 1997).

NCI_t (Neocorporatist Index)

In this study the labour market distortions were proxied by computing a neocorporatist index to capture the degree of centralised wage fixing in a manner analogous to the cross-section

***Table* 4 Constituents of the Composite Central Bank Independence Index**

Central Bank Independence	Indicator	Further description
1. Legal independence	Tenure	Turnover
2. Conflict resolution	Based on RBA Act , 1959	Dominance of Treasury
3. Instrument independence	Deficit finance (tap/tender)	Money/ interest rate targets
4. Goal independence	NFL/interest/money targets	Set by RBA /Government
5. Final targets.	Numerical inflation target	Set by RBA/Government
6. Transparency	Disclosure of information	Publication of reports
7. Accountability	Responsibility for targets	RBA/Government

neocorporatist index (Tarantelli, 1986). There are two conflicting macroeconomic paradigms proclaiming Pareto optimal wage outcomes that deliver the public good of low inflation. One is based on the Neo-Keynesian corporatist ethos, which favors centralized wage bargaining for low inflation wage outcomes. The other is based on the neoclassical frictionless labour market paradigm. During the 1970s centralised wage bargaining and rent-seeking by insiders led to a real wage outbreak and the incumbent Coalition government was on the verge of abolishing the centralised wage bargaining system when it was voted out of office. In 1983 the Labor government introduced the Prices and Incomes Accord or the corporatist ethos. The early Accords delivered wage restraint and boosted job creation (Chapman and Gruen, 1990). However, starting with Accord Mk 3 there was a move towards enterprise bargaining and the erosion of neocorporatism. In the mid-1980s wage bargaining in Australia combined the centralist elements of an industry based award system with the elements of an occupation based trade union structure (Wooden and Sloan 1998). The resulting wage rigidity and inefficiency placed the Australian labor market outcomes in the middle of the Calmfors-Driffill hump, which exhibited the worst of both worlds of the Neo-Keynesian and neo-classical labour market paradigms (Calmfors and Driffill, 1988).

The evolution of the various Accords reveals the erosion of the corporatist ethos and the process is briefly sketched next. Accord Mk 1 & 2 (1983) relied on full wage indexation while Accord Mk 2 (1985) shifted to partial indexation; Accord Mk 3 (1987) adopted the restructuring and efficiency principles; Accord Mk 4 & 5 (1988, 1989) embraced the structural efficiency principle; Accord Mk 6 (1991) ushered in enterprise bargaining. Accord Mk 7 (1993) introduced the enterprise award principle with safety net adjustments. The election of the Coalition government occurred during the implementation of Accord Mk 8 (1995). The new government announced its strategy for the deregulation of the labour market in line with the tenets of the neoclassical paradigm in the Workplace Reform Act (1996). This Act ushered in the first wave of industrial relations reforms pushing wage negotiations more in the direction of the market based neoclassical paradigm.

The neocorporatist index (NCI_t) aims to capture the effects of the conflicting paradigmatic forces that operated in the labour market during the study period through three important sub-indices. These sub-indices refer to the trade union density (UNI_t), the number of industrial disputes (DIS_t), and real earning (REA_t) overhang. The latter measures the extent to which award wages exceed productivity. Finally, the effect of the Accord process on collective wage bargaining (CWB_t) was estimated in a sub-index using a scoring system. The sum of these highly correlated sub-indices provides a measure of the degree of neocorporatism or

centralisation of wage fixing in the Australian labour market during the study period. Over the entire study period the composite NCI_t index has decreased by about 30% indicating the gradual switch from the centralised or corporatist wage-fixing principles to the market based principles that are favoured by the incumbent conservative government. Table 5 below summarises the various constituents of the time-series NCI_t composite index.

***Table* 5 The Neocorporatist Index (NCI_t)**

Index	Description	Computation
UNI_t	Trade union density	100(Union members/Workforce)
DIS_t	Industrial disputes	100(No. disputes/300)
REA_t	Real Earnings	100(Real Earnings/104.2)
CWB_t	Collective Bargaining + Accord Effects	Scores for centralised wage bargaining & Accord effects
NCI_t	Neocorporatist Index	$NCI_t=(UNI_t+DIS_t+REA_t+CWB_t)/4$

BTX_t (Benefits to Tax Revenue) Index

A high ratio of welfare benefits funded by tax revenue or high benefits to tax revenue (BTX_t) could be regarded as a proxy measure of tax distortion. There are numerous other equally controversial measures that could be proposed to proxy tax distortions, but for the purpose of this study the ratio of transfer payments and in particular the unemployment benefits are regarded as an important macroeconomic distortion that needs to be addressed by tax reform. Tax reform in Australia has highlighted the need to replace the Wholesale Sales Tax (WST) system introduced in the 1930s by a more modern Goods and Services Tax (GST). This would broaden the tax base and reduce the inefficiencies arising from multiple tax rates, numerous exceptions and other loopholes that provide opportunities for rent seeking by tax avoidance. In the current tax system the high transfer payments from tax revenue to fund welfare expenditure as captured in the BTX_t ratio can be regarded as distortionary. High unemployment benefits as captured in a high BTX_t ratio could increase the reservation wage in excess of labour productivity and thus shift the wage setting curve upwards. Furthermore, financing the unemployment benefits would require the imposition of higher taxes on the employed raising the tax wedge and generating disincentive effects causing a downward shift in the wage demand curve (Katz, 1998). Unemployment benefits, which are a critical component of the BTXt, have been more generous in countries such as Australia and some other European countries than in the USA. Empirical evidence shows that the high BTX_t ratio generated by the high unemployment benefits gained by the rent seeking activities of insiders resulted in longer duration of spells of unemployment in countries like Australia than in the USA (Layard et al., 1991). Furthermore if the high unemployment rate leads to high ratios of long-term unemployed it could lead to skill atrophy and erosion of human capital causing an increase in the ratio of the long-term unemployed and triggering unemployment hysteresis. The removal of the tax distortion by honing down unemployment benefits could exacerbate income inequity and poverty and undermine the social cohesion the safety net welfare payments deliver. Therefore, radical solutions involving negative income taxes and tax credits have been mooted to overcome the adverse inegalitarian spillover effects that tax reform aimed at reducing unemployment benefits entails. In rectifying the distortionary effects of high welfare payments out of tax revenue the tax reformer faces a formidable

challenge in the balancing of the equity and efficiency goals. Although the welfare payments out of tax revenue may exacerbate inflation and unemployment and contribute to a distortionary tax system, it needs to be borne in mind that the equity and social cohesion that high welfare expenditure has delivered in some European countries has enabled the assignment of monetary policy to deliver the public good of low inflation and price stability (Prast, 1998).

VOL_t (Volatility) measure or a proxy for distortion of competitiveness

The increase of international competitiveness in an open economy is vital for ensuring price stability and low inflation (Alesina and Wacziarg, 1992). However, the volatility of the index of international competitiveness or the real exchange rate can be regarded as a proxy measure of distortion. Such volatility undermines a country's trade and investment prospects (Krugman, 1986; Dixit, 1989). For the purposes of this study the measure of international competitiveness based on trade-weighted bilateral exchange rates adjusted by trade-weighted world price indexes compiled for the TRYM model, was accepted as a good proxy for a real exchange rate and a measure of competitiveness. The log index of international competitiveness exhibited stochastic trends and had to be appropriately differenced to obtain the stationary series $\{y_t\}$. Several different ARMA(p, q) models were fitted to the above series and the best fit model was selected using the maximum SBC (Schwarz Bayesian Criterion) as suggested by Pesaran and Pesaran (1997). The SBC results for the various ARMA models are reported below in Table 6 and the maximum value of the SBC suggests that ARMA (1,1) or AR (1) model best fits the series $\{y_t\}$.

***Table* 6 SBC for the choice of the best-fit ARMA (p, q) model**

p/q	0	1	3	4
0	168.86	169.98	166.69	167.09
1	171.25	172.91*	168.95	169.20
2	166.85	168.13	164.62	169.93
3	163.07	168.13	163.85	161.69

The conditional variance or standard error of the best fit model, or AR (1) model could follow an autoregressive conditional heteroscedastic (ARCH) process and its conditional standard error could be used to proxy volatility (Engle, 1982). The generalised ARCH or GARCH (1,1) process has been demonstrated to be a parsimonious fit to a higher order ARCH process (Bollerslev, 1986). Therefore in this study a GARCH (1,1) model was fitted to the errors of the AR (1) model and its conditional standard error was taken to proxy volatility (VOL_t), the measure of international distortion used for empirical analysis. This measure of volatility, which doubles up as the proxy for distortions of international competitiveness, is reported as VOL_t.

6. A VECTOR ERROR CORRECTION MODEL (VECM)

Here we report the specification of a VECM (Vector Error Correction Model) to provide insights into the short-run and long-run dynamics linking inflation, CBI and the

macroeconomic distortion variables identified earlier. The variables in the VECM are in logs and $LINF_t$ has been linked to $LCBI_t$ and distortion variables $LNCI_t$, $LBTX_t$ and $LVOL_t$, first in levels as a general or Autoregressive Distributed Lag or ADL (k) model for the sample period 1973Q3-1998Q4 or as Model 1. The definition of variables, transformations and the data sources are reported in the Appendix.

Model 1

$$LINF_t=\beta_0+\Sigma_{i=1}^{k}\beta_{1i}LINF_{it}+\Sigma_{i=0}^{k}\beta_{2i}LCBI_{it}+\Sigma_{i=0}^{k}\beta_{3i}LNCI_{it}+\Sigma_{i=0}^{k}\beta_{4i}LBTX_{it}+\ +\Sigma_{i=1}^{k}\beta_{5i}LVOL_{it}+\varepsilon_t \quad \ldots\ldots\ldots\ldots(1)$$

An ADL (3) model passed a battery of diagnostic tests at 5% level of significance. The lagged residual of Model 1 provided the error correction mechanism (ECM_{t-1}) or the proxy for the short-run adjustment process.

Diagnostics for Model 1

1974(2) –1998(3)	
AR 1-5F(5,69)	= 1.61
ARCH 4F(4,66)	= 1.49
Normality$\chi^2(2)$	= 8.68
HETxi^2 F (36,37)	= 0.44
RESET F (1,73)	= 0.15
Forecast $\chi^2(4)$	= 2.07
Chow F (4,74)	= 0.48

The model variables were tested for nonstationarity or unit roots using the Augmented Dickey Fuller (ADF) test (Dickey and Fuller, 1981). The ADF unit root test results are reported in Table 7 below and they indicate that most of the variables had to be first differenced to make them stationary or I (0).

***Table* 7 ADF Unit Root Tests (with drift and trend) 1975Q2-1998Q3, n=94**

Variable (y_t)	SBC	K	t-adf	I(d)	Variable (Δy_t)	SBC	K	t-adf	I(d)
$LINF_t$	85.09	1	-2.64	I(1)	$\Delta LINF_t$	84.4	0	-6.12	I(0)
$LCBI_t$	947.0	4	-.005	I(1)	$\Delta LCBI_t$	1681.	3	-32.5	I(0)
$LNCI_t$	64.42	0	-2.71	I(1)	$\Delta LNCI_t$	158.9	0	-10.3	I(0)
$LBTX_t$	95.87	4	-2.80	I(1)	$\Delta LBTX_t$	92.6	4	-3.4	~I(0)
CV α=.05	-3.46				CV α=.05	-3.46			

Notes: ADF (Augmented Dickey Fuller) test for the null hypothesis Ho that y_t has a unit root has been based on the equation with drift and trend: $\Delta y_t=\gamma_0+\gamma_1 y_{t-1}+\Sigma_{i=1}^{k}\beta_i\Delta y_{t-i}+\varepsilon_t$. The optimal lag length k to make the residuals white noise has been selected on the basis of the maximum SBC (Schwarz Bayesian Criterion) since it is asymptotically consistent and is not biased in favour of overparametrisation like the AIC (Akaike Information Criterion). In application across models the model selected is the one with the highest value of $SBC_I=ln\ (\theta)-plog(n)/2$ (Pesaran and Pesaran, 1997: 354) . The unit root null for y_{t-1} was not rejected when |t-calc| < |t-adf |, where t-adf denotes the critical value (CV) for ADF test based on the relevant nonstandard underlying distribution. An ADF $y_t(6)$ was used in the above calculations using MFIT. The order of integration is shown by I (d).

Furthermore, the likelihood-ratio (LR) tests (Johansen, 1988; Johansen and Juselius, 1991) based on the maximum eigen value or λ-max and λ–trace of the stochastic matrix indicated

that there were at least four cointegrating vectors spanning the five variables defining the monetary system and the test results are reported in Table 8.

***Table* 8 Johansen Cointegration LR- tests on the cointegrating vector**
$x_t = [LINF_t, LCBI_t, LNCI_t, LBTX_t, LVOL_t]$ (unrestricted intercepts & trends) Var=2

Null Ho:	**λ-max**	**95% CV**	**λ–trace**	**95% CV**
R = 0	318.80*	37.07	485.79*	82.23
R = 1	82.88*	31.00	166.99*	58.93
R = 2	59.53*	24.35	84.11*	39.33
R = 3	20.02	18.33	24.58*	23.83
R = 4	4.56	11.54	4.56	11.54

* 95% level of significance

Thus the Vector Error Correction Model or Model 2 was specified in terms of stationary or differenced variables or (Δ) with an ECM_{t-1} thus obviating the dangers of spurious regression inferences (Granger and Newbold, 1974). Moreover the VECM model captured the short-run dynamics via the ECM_{t-1} as the Johansen tests confirmed that the variables were cointegrated and it follows from the Engle-Granger Representation theorem that there must by an ECM_{t-1} linking the cointegrating variables (Engle and Granger, 1987). The VECM model was sequentially reduced using the general-to-specific or DHSY methodology (Davidson *et al*., 1978) to arrive at a conformable parsimonious specification. For the purpose of this study variables with |t-statistic| < 1 were eliminated and the resultant parsimonious VECM Model 2 has been reported below (see Table 9):

Model 2

$$\Delta LINF_t=\beta_0+\Sigma_{i=1}^{k}\beta_{1i}\Delta LINF_{it}+\Sigma_{i=0}^{k}\beta_{1i}\Delta LCBI_{it}+\Sigma_{i=0}^{k}\beta_{2i}\Delta LNCI_{it}+\Sigma_{i=0}^{k}\beta_{3i}\Delta LBTX_{it}+\Sigma_{i=0}^{k}\beta_{4i}\Delta LVOL_{it}+ECM_{t-1}+\varepsilon_t \ldots(2)$$

***Table* 9 Model 2 ECM inflation dynamics model 19974(3) –1998(3) less 4 forecasts**
Dependent variable $\Delta LINF_t$

Variable	**Coefficients**	**|t-value|**
$\Delta LINF_{t-1}$	0.3715	3.79**
$\Delta LINF_{t-2}$	0.2193	2.08**
$\Delta LINF_{t-3}$	0.0327	0.31
$\Delta LCBI_{t-1}$	-6.7899	3.01**
$\Delta LNCI_{t-1}$	-0.4623	1.97**
$\Delta LBTX_{t-1}$	0.0694	1.75*
$\Delta LVOL_{t-1}$	0.0346	0.96
ECM_{t-1}	-0.07193	2.75**
Statistics	R^2=0.38	DW=2.08

Notes: * Significant at 5% level. ** Significant at 1% level.

Diagnostics for Model 2

AR 1-5F(5,80)	= 1.13
ARCH 4F(4,77)	= 0.53
Normalityχ^2(2)	= 5.36
HETxi^2 F (16,68)	= 0.67
RESET F (1,84)	= 0.52
Forecast χ^2(4)	= 2.35
Chow F (4,85)	= 0.55

Model 2 provided the framework for the Granger causality tests incorporating the ECM_{t-1} thereby avoiding any mis-specification bias (Granger, 1988). The Granger causality tests reported in Table 10 indicate that both the institutional variable of CBI and macroeconomic distortion variables all Granger cause inflation.

***Table* 10 Granger causality tests incorporating the ECM_{t-1}**

Linear restrictions on subset	**Walled F- statistic**
$\Delta LINF_{t-1}$, $\Delta LINF_{t-2}$, $\Delta LINF_{t-3,}$ ECM_{t-1}	$F(4,85)^{**}$
$\Delta LCBI_{t-1}$, , ECM_{t-1}	$F(2,85)=5.65^{**}$
$\Delta LNCI_{t-1}$, ECM_{t-1}	$F(2,85)=5.07^{**}$
$\Delta LBTX_{t-1}$, ECM_{t-1}	$F(2,85)=3.86^{*}$
$\Delta LVOL_{t-1}$, ECM_{t-1}	$F(2,81)=4.64^{*}$

Notes: ** Significant at 1 % level; * Significant at 1 % level

Thus, the Granger causality tests lend empirical support to the proposition that the institutional innovation of CBI and the focus of the policy reform debate to tackle the distortions that were proxied in the empirical analysis had firm macroeconomic foundations. It is noteworthy that the CBI institutional variable appears to exert a dominant influence on the reduction of inflation when compared to the other distortion variables.

The VECM model was further augmented by the variables $YGAP_t$ and $YGAP_t^2$ so that the coefficients could provide insights in to the historical sacrifice ratio (SR) and hysteresis respectively. $YGAP_t$ was the deviation of log GDP_t from potential GDP_t, where potential GDP_t was calculated using the HP (Hordrick and Prescott, 1980) filter. The augmented VECM is reported as Model 3 in Table 11 and its long-run static equilibrium solution is also reported below it.

The long-run model empirics reveal that the institutional innovation of Central Bank Independence ($LCBI_t$) and the labour market distortion proxied by the neocorporatist index ($LNCI_t$) both make significant contributions to the reduction of inflation. While the transfer payments to finance welfare benefits out of tax revenue ($LBTX_t$) and distortions to international competition as proxied by the volatility measure ($LVOL_t$) exacerbate inflation during the study period. Moreover, the error correction mechanism (ECM_{t-1}) appears to be correctly signed indicating a move towards long-term equilibrium albeit at a slow speed.

***Table* 11 Model 3 ECM Model of Inflation Dynamics**
Dependent variable $\Delta LINF_t$

Variable	Coeff	|t-value|
$\Delta LINF_{t-1}$	0.3586	3.66
$\Delta LINF_{t-2}$	0.2175	2.04
$\Delta LINF_{t-3}$	0.0264	0.25
$\Delta LCBI_{t-1}$	- 6.8131	2.75
$\Delta LNCI_{t-1}$	-0.4883	2.04
$\Delta LBTX_{t-1}$	0.0997	1.32
$\Delta LVOL_{t-1}$	-0.0379	1.06
ECM_{t-1}	-0.0780	2.61
$YGAP_t$	0.2227	1.00
$YGAP_t^2$	-6.9948	1.60
Statistics	R^2=0.40	DW=2.11

Diagnostics for Model 3

AR1-5F (5,78) =1.08
ARCH 4F(4,75) =0.43
Normalityχ^2(2) = 6.85
HETxi^2 F (19,63) =0.80
RESET F (1,82) =0.32
Forecast χ^2(4) =2.69
Chow F (4,83) =0.63

Solved Static Long Run Equation for Model 3

$\Delta LINF_t$ = -17.13$\Delta LCBI_t$ – .23 $\Delta LNCI_t$ + 0.25$\Delta LBTX_t$ +. 09$\Delta LVOL_t$ -. 20$ECMt_{-1}$
(SE) (9.6) (0.72) (0.21) (0.09) (0.11)

- 0.56$YGAP_t$ + 17.59$YGAP_t^2$
(SE) (0.69) (12.81)

According to Model 3 a 1% increase in central bank independence ($LBCI_t$) contributed to a reduction of inflation by 6.8% during the study period, while a 1% increase in neocorporatism contributed to a 0.49% reduction in inflation (see Table 11). The long-run static solution indicates that a 1% increase in $LCBI_t$ and neocorporatism contribute inflation reduction by a massive 17% and 0.23% respectively. However, a 1-% increase in welfare payments out of tax revenue ($LBTX_t$) and an increase in volatility ($LVOL_t$), both contributed to an increase in inflation. Based on the long-run static solution the implicit historical Sacrifice Ratio (SR), given by the reciprocal of the coefficient of ($YGAP_t$), was estimated at1.8 or nearly 2 and the figure corresponds a similar estimate for an earlier period (Stevens,

1992). However, the SR is bound to vary considerably if it was calculated using the events methodology (Ball, 1994). The coefficient of ($YGAP^2_t$) also appears to be significant indicating the prevalence of hysteresis or persistence of the adverse effects of adverse shocks during the study period.

Hysteresis or monetary non-neutrality postulates that high costs of disinflation could permanently lower the equilibrium level of GDP resulting in high loss of potential output (Akerlof et al., 1996). Besides, low inflation could blunt the effectiveness of monetary policy for output stabilisation by imposing a non-negativity constraint on real interest rate (Summers, 1989). Also, the costs of disinflation would be higher in terms of loss in potential output at low levels of inflation if the Phillips curve is non-convex (Laxton *et al*., 1995). Thus, hysteresis, the real interest constraint and non-convexity of the Phillips curve can arguably result in higher costs of disinflation than measured by the historical SR (Haldane, 1997). However, it needs to be noted that these static and transitory costs measured by the historical SR appear to pale into insignificance compared to the permanent dynamic gains that can be generated by moving to a low steady state inflation environment through the implementation of disinflationary policies. According to the net present value of the benefits of disinflation as ratio of GDP could exceed 18% as shown earlier in Section 2.

The VECM empirics confirm that the increase in CBI with the evolution of monetary policy in Australia has contributed more than any other variable in the monetary system to inflation reduction. However, the finding that the increase in neocorporatism reduces inflation challenges the need for labour market reforms aimed at a weakening of the neocorporatist ethos. Therefore, based on the VECM results one could infer that the agenda for labour market reforms could be based on ideological or partisan considerations and lack an economic rationale. However, since VECM empirics ignore the feedback effects to resolve the issue it is necessary to analyze the interactions between inflation and the variables in a system context taking feedback effects into account. The VAR methodology provides a vehicle for performing such an investigation.

7. VECTOR AUTOREGRESSION (VAR) ANALYSIS OF THE MONETARY SYSTEM INTERACTIONS

In order to examine the feedback effects of CBI and macroeconomic distortions particularly in the labour market we have used the VAR methodology. An unrestricted five dimensional vector in levels, where $x_t = (LINF_t, LCBI_t, LNCI_t, LBTX_t, LVOL_t)$ was specified to represent the monetary system. The use of levels rather than difference of variables has been recommended in order to avoid discarding information on co-movements among the variables (Sims, 1980; Doan, 1992).

$$\underset{5x5}{B}\ \underset{5x1}{x_t} = \underset{5x1}{\Gamma_0} + \underset{5x5}{\Gamma_1}\ \underset{5x1}{x_{t-1}} + \underset{5x1}{\varepsilon_t} \qquad \text{Primitive Form}$$

$$\underset{5x5}{A}\ \underset{5x1}{x_t} = \underset{5x1}{A_0} + \underset{5x5}{A_1}\underset{5x1}{x_{t-1}} + \underset{5x1}{e_t} \qquad \text{Standard Form}$$

The identification of the primitive model required the imposition of restrictions on the error covariance matrix Σ or its orthogonalization using the Choleski decomposition. A sensitivity analysis revealed that the results of innovation accounting were quite robust and were unaffected by the ordering of the variables. Based on the Vector Moving Average

Representation (VMA) as given below, innovation accounting comprising of Impulse Response Functions (IRFs) and Forecast Error Variance Decompositions (FEVDs) should be implemented.

$$x_t = \mu + \Sigma^{\infty}_{i=0} \phi_i \varepsilon_i$$

The coefficients of the matrix ϕ_i give the impulse response functions or the time profile of variables when subject to a one standard deviation shock (Enders, 1995: 306). Figure 1 reports the IRFs resulting from a one-standard deviation shock to an innovation or disturbance term in the monetary system. The confidence bands generated by 100 Monte-Carlo simulations are also shown. The effects of the unit shocks are listed in the columns of the panels and the forecast horizons are shown on the rows of the panels in Figure 1. A positive unit innovation to the central bank independence ($LCBI_t$) results in a permanent reduction in inflation of about 5% over the long run or forecast horizon beyond 4 quarters (Column 2, Panel 1, and Figure. 1). The unit innovation to $LCBI_t$ also weakens the neocorporatist index ($LNCI_t$) in the short run without any discernible long-run effects either on neocorporatism or on the tax or international distortion indices (Column 2, Figure 1).

A unit innovation in the neocorporatist index increases inflation in the short-run, reduces central bank independence in the long run, and increases neocorporatism in the short-run with the LNCI index reverting to its original level in the long run. The shock has no effects on the tax or international competitiveness indices in the long-run (Column3, Figure 1). The VAR impulse response empirics taking feedback effects into account indicate that the positive unit shock or the strengthening of neocorporatism manifests itself in the form of high inflation in the short run, although not in the long run. Therefore the VAR impulse response empirics provide evidence to support the case for labour market reforms aimed at weakening elements of neocorporatism that have adverse feedback on inflation (Column 3, Figure 1).

Forecast Error Variance Decomposition (FEVD) Analysis

The Forecast Error Variance Decomposition (FEVD) analysis quantifies how much of the variation of a shock can be attributed to the variable itself and how much can be apportioned to other variables in the system. The relative importance of the five shocks over various forecasting horizons can be examined further using FEVDs. The variation in the system variables caused by 100% inflation ($LINF_t$) is mostly accounted for by itself over the short run of the first 4 quarters. After 8 quarters the labour market distortion proxied by ($LNCI_t$) accounts for about 23% of the variation caused by the shock and it nearly doubles to 41% in the long run after 24 quarters. These findings indicate that the inflation shocks while having impacts on itself in the short-run in the long-run through the rise in inflationary expectations affects labour market distortions. This could result in pressures wage renegotiations and are captured by the neocorporatist index ($LNCI_t$). The variation caused by the inflation shock on the tax and central bank independence indicators or ($LTBX_t$) and ($LCBI_t$) are small accounting for 4% and 2% of the FEVD respectively of a 100% inflation shock ($LINF_t$) after 24 quarters. The variation of the inflation shock impacts mostly on itself in the short run and affects the labour market distortion variable considerably in the long run while registering only negligible effects on the welfare benefits form tax revenue or the exchange rate volatility indicators (See Panel 1, Table 12).

In the case of a 100% shock to central bank independence ($LCBI_t$) more than 90% of the FEVD of the shock is accounted for by itself in the short run or the first 4 quarters with no effects on other variables in the system. However, after 12 quarters the FEVD of the central

bank independence shock on the labour market ($LNCI_t$) increases to nearly 55% of the FEVD whilst the ($LCBI_t$) index itself accounts only for only 37% of the FEVD. Thus, any innovation on $LCBI_t$ has greater implications for the labour market distortions than for any other variable in the system. (See Panel 2, Table 11). A 100% shock to the labour market distortion ($LNCI_t$) is accounted for mostly by itself in the short run, but after about 12 quarters nearly 5% each of the FEVD due to the shock is accounted for by inflation ($LINF_t$) and welfare benefits ($LBTX_t$) indicators whilst nearly 87% of the shock is still accounted for by ($LNCI_t$) itself, suggesting that it is an endogenous variable. (See Panel 3, Table 12).

***Table* 12 Forecast Error Variance Decompositions (FEVDs)**

Horizon		**$LINF_t$**	**$LCBI_t$**	**$LNCI_t$**	**$LBTX_t$**	**$LVOL_t$**
$LINF_t$	1	100.0	0.0	0.0	0.0	0.00
	4	96.78	0.05	1.36	1.74	0.06
	12	61.78	1.49	32.16	4.24	0.32
	24	51.65	2.13	41.24	4.52	0.47
$LCBI_t$	1	4.43	95.57	0.00	0.00	0.00
	4	7.86	90.86	1.17	0.05	0.06
	12	5.73	36.95	54.85	2.55	0.07
	24	4.32	22.94	68.97	3.49	0.27
$LNCI_t$	1	0.46	4.21	95.32	0.00	0.00
	4	0.21	5.06	89.30	4.40	1.03
	12	1.26	5.54	87.41	4.74	1.04
	24	1.80	5.76	86.58	4.84	1.02
$LBTX_t$	1	1.62	0.80	0.09	97.49	0.00
	4	5.81	1.07	5.88	86.77	0.46
	12	7.08	1.09	8.54	82.73	0.54
	24	7.05	1.89	11.01	80.20	0.55
$LVOL_t$	1	2.86	2.10	0.26	2.38	92.40
	4	5.34	2.04	1.44	2.55	86.62
	12	5.39	2.07	3.87	3.00	85.67
	24	5.39	2.09	4.53	3.03	84.96

8. CONCLUDING OBSERVATIONS AND POLICY IMPLICATIONS

The evolution of monetary policy design in Australia over the past quarter of a century has revealed that although the RBA changed the policy instruments and targets periodically, the ultimate goal of monetary policy remained steadfastly committed to the attainment of low inflation and price stability. Based on the theoretical framework of constrained minimization of a quadratic loss function subject to a Lucas supply constraint, it was demonstrated that

exclusive focus on the institutional mechanisms of CBI to deliver low inflation might be flawed. Such an institutional approach to curbing inflation ignores the important adverse spillover effects macroeconomic distortions may have on inflation by causing output to deviate from potential output. Tuning into the ongoing debate on policy reforms identified several macroeconomic distortions. Composite time-series indices were constructed for both CBI and the macroeconomic distortions. Thereafter a parsimonious Vector Error Correction Model (VECM) was specified to investigate the empirical nexus between macroeconomic distortions and the inflation rate after controlling for CBI.

The VECM empirics clearly demonstrated that gradual evolution and strengthening of CBI made a dominant contribution to inflation reduction in Australia during the study period. Furthermore, macroeconomic distortions also had significant causal effects in either ameliorating or exacerbating inflation. In particular, the labour market distortion proxied by the neocorporatist index ($LNCI_t$) appeared to have curbed inflation during the study period. This finding questions whether the contemporary agenda of industrial relation reforms aimed at weakening the neocorporatist ethos was motivated by partisan ideology rather than by an economic rationale. The VECM empirics clearly revealed that the welfare expenditure from tax revenue ($LBTX_t$) and the volatility ($LVOL_t$) distorting international competition contributed to the exacerbation of inflation. Therefore, the empirics provide support for pursuing policy measures to remove these macroeconomic distortions.

On review of the perverse result of neocorporatism and inflation based on the VECM empirics it was noted that the VECM approach failed to take account of the feedback effects of the macroeconomic distortion variables on inflation. This was remedied by re-analyzing the inflation and distortion dynamics using the VAR methodology. The impulse response functions from the VAR analytics revealed that the increase in neocorporatism in the short-run exacerbated inflation due to adverse feedback effects. Thus, the VAR empirics provide the missing economic rationale for the current agenda of labour market reforms aimed at whittling down neocorporatism.

The empirical results from both VECM and VAR modeling clearly demonstrate that besides the institutional mechanism of CBI, the macroeconomic distortions have significant spillover effects on inflation. This has significant implications for the for the monetary policy reaction function. The manipulation of the short-term interest rate (the cash rate) to achieve the inflation target should therefore not only take into consideration the deviation of inflation from the target ($\pi_t - \pi^*$) but also real GDP from potential GDP ($y_t - y^*$). A policy reaction function that follows such an approach would be consistent with the Taylor rule. The Taylor rule posits that that the short term interest rate (the overnight cash rate) should be adjusted on the basis of both deviation of inflation from the target (the inflation gap or $igap_t$) and output from potential (output gap or $ygap_t$) (Taylor, 1993; Bryant et al., 1993). In this study the policy reaction parameters of the Taylor policy reaction function were estimated econometrically using quarterly time-series data for the study period 1973Q3-1998Q3. The Taylor equation was also augmented by an error correction mechanism (ecm_{t-1}) to take account of the practice of interest rate smoothing or small step adjustments of the cash rate on in accordance with the suggestions of Judd and Rudebusch (1998). Furthermore open economy effects were incorporated in the Taylor policy reaction function by adding a proxy for the real exchange rate gap (the deviation of real exchange rate as measured by the real trade weighted index from its equilibrium value or reg_t) as suggested by Ball (1997). Applying the Hodrick-Prescott filter derived all the equilibrium values for the inflation rate, the real exchange rate and the GDP giving potential GDP. The estimation was done using log transforms of the variables. The econometric estimate of the Taylor policy reaction function

linking the change in the short-term interest rate ($\Delta lsti_t$) to the inflation gap and output gap and the real exchange gap with an error correction mechanism is reported below:

$(\Delta lsti_t)$= 0.00001 + 0.0003ligap$_t$ +0.01644lygap$_t$ -0.0717lreg $_t$-0.0854ecm$_{t-1}$
|t-stat| (0.94) (0.96) (2.26) (1.37) (2.64)

The augmented Taylor rule indicates that the change in the overnight cash rate ($(\Delta lsti_t)$) has reacted more to the deviation of output from potential rather than to deviation of inflation from the target level during the study period. Moreover, the appreciation of the real exchange rate may appear to have contributed to deflation and induced a downward adjustment of the short-term rate. Also the significance of the error correction mechanism (ECM_{t-1}) indicates that policy makers have engaged in interest rate smoothing rather than sharp adjustment of the short-term interest rate to achieve the inflation target during the study period.
The non-nested test results indicated that Model 1 or the Taylor rule dominated Model 2 or the inflation rate only rule as an efficient mechanism for the setting the overnight cash rate to achieve the inflation target. The non-nested small sample W and NT tests based on the modification of the Cox test qualify on the basis of power and size as good tests when compared to the asymptotic J-test due to Davidson and MacKinnon (1981) according to (Pesaran, 1982). The W and NT tests clearly favor the Taylor rule over the inflation rate only rule for inflation targeting in Australia. Besides, these small sample test results are supported by the model choice criteria: the AIC (Akaike Information Criterion) and the SBC (Schwarz Bayesian Criterion). Both criteria favor the Taylor rule (Model 1) over Inflation Rate only Model 2 (see Table 13).

***Table* 13 Non-nested tests of Taylor rule vs. inflation only rule**

Test statistic	M1 vs M2	M2 vs M1
NT-test	-1.42 (0.16)	-2.08 (.04)
W-test	-1.41 (0.16)	-2.04 (.04)
J-test	2.40 (0.02)	2.46 (.01)
Encompassing (F1,94)	5.34 (0.02)	5.47 (.01)
AIC M1 vs M2	1.54	Favors M1
SBC M1 vs M2	0.24	Favors M1

Notes: The NT and W- tests are regarded as robust small sample tests as they qualify on the criteria of power and size (Pesaran, 1982). The J-test (Davidson an MacKinnon, 1981) is an asymptotic test. The model selection criteria refer to the Akaike Unformation (AIC) and the Schwarz Bayesian Criterion (SBC). The tests and criteria are discussed in detail in Pesaran and Pesaran (1997): 355-356.

The empirical results based on VECM and VAR methodologies both underscore the important contribution that reinforcing of the institutional mechanism of CBI has played in curbing inflation bias in Australia during the study period. Nonetheless, the empirical findings caution against the cavalier treatment of the macroeconomic distortions that have adverse feedback effects on inflation. The econometric results from the augmented Taylor policy reaction function provide clear guidelines to policymakers for the efficient targeting of inflation when macroeconomic distortions matter. Macroeconomic policy distortions cause deviation of output from potential and no doubt contribute to preference uncertainty of

agents. These distortions have to be considered in the formulation of efficient policy reaction functions for the efficient implementation of inflation targeting policy. This suggests that in smoothing the overnight cash rate to achieve the pre-announced inflation target in an efficient manner the Reserve Bank of Australia should pursue the Taylor 's rule rather than an Inflation Rate only policy reaction function.

Variable Transformations and Data Sources

INF_t : Underlying Inflation Rate=$100[p_t - p_{t-1}]/ p_{t-1}$; where $p_t = \log(P_t)$. P_t: Underlying CPI (Consumer Price Index) is computed by subtracting from the headline CPI volatile price items such as fresh fruit and vegetables, mortgage interest rate charges, consumer credit charges, auto fuel and health services. These adjustments have also through splicing eliminated series in the headline CPI series. (Sources: ABS Catalogue 6410.0. & Treasury).

CBI_t: The central bank independence composite index was a simple average of the sum of ten sub-indices of various aspects of legal and policy independence as detailed in Table 3A, Appendix. The quarterly values of the composite $LCBI_t$ index was generated by fitting a trend to the annual observations of the composite $LCBI_t$ index.

Source: Table 2A (Appendix)

BTX_t :Social Benefit Expenditure to Tax Revenue Ratio
Source: Cat. 5206.0 ABS

NCI_t : Neocorporatist Index a composite of UNI (Trade Union Density)+ DIS (Number of Industrial Disputes) + REA (Real Earnings) + CWB (Degree of Centralized Wage Bargaining and Accord Effects). Sources: ABS Labour forces statistics

VOL_t : The best fit ARMA(p,q) model for the index of international competitiveness (IOC_t) . was an AR(1) model. The conditional variance of the AR(1) model revealed the existence of a higher order ARCH process. It was captured parsimoniously by a GARCH (1,1) model and its conditional standard deviation has been used to measure volatility (VOL_t) which acts as the proxy to measure the distortions in international competitiveness.

Sources. RBA and the DX-database.

$YGAP_t$: Is the deviation of log GDP=y_t from it s potential proxied by the Hordrick-Prescott (HP) filter using as smoothing parameter λ=1600, for quarterly data (Hordrick and Prescott, 1980) giving the smoothed value yt.

The smoothed value yt comprises of a sum of the a degree of fit and a degree of smoothness term, where y_t^f :is the fitted value and therefore

$$yt = \min \Sigma_{t=1}^{T}(y_t - y_t^f)^2 + \lambda [\Sigma_{t=2}^{T-1}(y_{t+1}^f - y_t^f)^2 - (y_t^f - y_{t-1}^f)]^2$$

Source: GDP=y_t, National Accounts. Cat. 5206.0 ABS.

REFERENCES

Akerlof, G.A., Dickens, W.T. and Perry, G.I. (1996) "The Macroeconomics of Low Inflation", *Brookings Papers on Economic Activity* 1 :1-76.

Alesina, A (1988) "Macroeconomics and politics**".** In Stanley Fischer (ed.) *NBER Macroeconomic Annual*. Cambridge. MIT Press.

Alesina, A. Summers, L.H. (1993) "Central Bank Independence and Macroeconomic Performance: Some Comparative Evidence" Journal *of Money Credit and Banking.* 25(2): 151-162.

Alesina, A. and Gatti, R. (1995) American *Economic Review*, 86: 196-200. *American Economic Review,* 85(May): 207-11.

Backus, D. and Driffill, J. (1985) "Inflation and reputation." *American Economic Review*. 75: 530-538.

Ball, L. (1994) "What Determines the Sacrifice Ratio", in N.G. Mankiw (ed.) *Monetary Policy,* University of Chicago press: 155-152

Ball, L. (1997) "Efficient Rules for Monetary Policy", *NBER* Working Paper. No. 5952

Barro, R.J. and Gordon, D.B. (1983) "Rules, Discretion and Reputation in A Model of Monetary Policy", *Journal of Monetary Economics* 12(1) July:

Beetsma, R.M.W.J and Jensen, H. (1998) "Inflation Targets and Contracts with Uncertain Central Bank Preferences." *Journal of Money Credit and Banking* 30(3): 384-403.

Blanchard, O. and Fischer, S. (1989) *Lectures in Macroeconomics.* MIT Press. Cambridge/London.

Blinder, A.S. (1995) "Central Banking in Theory and Practice – Lecture II: Credibility, Discretion and Independence," Marshall Lecture presented at the University of Cambridge.

Bollerslev, T. (1986) " Generalized Autoregressive Conditional Heteroscedasticity." *Journal of Econometrics,* 31:307-327.

Boskin Commission (1996) "Towards a More Accurate Measure of the Cost of Living" *Final Report in the Senate Finance Committee*. Washington. D.C.

Bryant, R.C., Hooper, P. and Mann, C.L. (1993) 'Design Implementation of the Empirical Simulations' in R.C. Bryant, P. Hooper and C.L. Mann (eds.), *Evaluating Policy Regimes.* Brookings Institution, Washington, D.C.: 219-260.

Calmfors, L. and Driffill, J. (1988) "Bargaining Structure, Corporatism and Macroeconomic Performance", *Economic Policy* 6: 14-61.

Calvo, G. A. (1978) "On Time Consistency of Optimal Policy in a Monetary Economy." *Econometrica* 46 (November): 1411-28.

Chang, R. (1998) "Policy Credibility and the Design of Central Banks" *Economic Review* Federal Reserve Bank of Atlanta. Fourth Quarter: 4-15.

Chapman, B. and Gruen, F. (1990) "An Analysis of the Australian Consensual Incomes Policy: The Prices and Incomes Accord", in C. de Neubourg (ed.) *The Art of Full Employment.* Elsevier/North Holland. Amsterdam: 475-504.

Cukierman, A. (1992) *Central Bank Strategy, Credibility, and Independence: Theory and Fallacy*. MIT Press. Cambridge. MA.

Davidson, J.H., Hendry, D.F., F. Srba and Yeo, S. (1978) "Econometric modelling of the aggregate time-series relationship between consumers' expenditure and income in the United Kingdom", *Economic Journal,* 88:661-692.

Dickey, D. A. and Fuller, W.A. (1981) "Likelihood ratio statistics for autoregressive time series with a unit root", *Econometrica 49:* 1057-1072.

Dixit, A. (1989) "Entry and Exit Decisions Under Uncertainty", *Journal of Political Economy* 97: 620-38.

Doan, T. (1992) *RATS* 4 User's Manual. Evanston. Ill. Estima.

Enders, W. (1995) Applied *Economic Time Series*. John Wiley and Sons. New York.

Engle, R. F. and Granger, C.W. J. (1987) "Co-integration and error correction representation, estimation and testing", *Econometrica* , 55: 251-276

Engle, R.F. (1982) "Autoregressive Conditional Heteroscedasticity, with Estimates of Variance of United Kingdom Inflation", *Econometrica* , 50: 987-1000.

EViews (1997) *User's Guide. Quantitative Micro Software*. Irvine. CA. USA.

Fischer , S. and Summers, I. (1989) "Should governments learn to live with inflation?" *American Economic Review* 79: 383-387.

Goodhart, C.A.E. (1994) "Game theory for central bankers: a report to the Governor of the Bank of England". *Journal of Economic Literature*, XXII:101-104.

Granger, C.W.J. (1989) "Some recent developments in a concept of causality*", Journal of Econometrics 39*: 199-211.

Granger, C.W.J. and Newbold (1974) "Spurious regressions in econometrics", *Journal of Econometrics* 35: 143-159.

Grenville, S. (1997) "The Evolution of Monetary Policy: From Money Targets to Inflation Targets". *Monetary Policy and Inflation Targeting*: Proceedings of a Conference. Phillip Lowe (ed.) Reserve Bank of Australia. Sydney. :125-158.

Grilli, V., Masciandaro, D. and Tabellini, G. (1991) "Political and monetary institutions and public financial policies in industrial countries"**.** *Economic Policy* 13; 341-392.

Haldane, A.G. (1997) "Designing Inflation Targets". *In Monetary Policy and Inflation Targeting.* Proceedings of a Conference. P. Lowe (ed.). Reserve Bank of Australia. Sydney: 74-112.

Haldane, A.G. (1998) "On Inflation Targeting in the United Kingdom." *Scottish Journal of Political Economy.* 45(1): 1-32.

Hendry, D.F. and Doornail, JA (1996) *Empirical Econometric Modelling Using PcGive 9.0 for Windows.* International Thompson Business Press. London.

Hordrick, R. J. and Prescott, E.C. (1980) "Postwar US Business Cycles: an Empirical Investigation", *Discussion Paper* No. 451 Carnegie Mellon University.

Johansen, S. (1988) "Statistical Analysis of Cointegration Vectors", *Journal of Economic Dynamics and Control,* 12: 231-254.

Johansen, S. and Juseilius, K. (1990) "Maximum Likelihood Estimation and Inference on Cointegration – With Application for Demand for Money", *Oxford Bulletin of Economics and Statistics,* 52: 169-210.

Judd, J. P and Rudebusch, G.D. (1998) "Taylor's Rule and the Fed: 1970-1997) *Federal Reserve Bank of San Francisco No*. 3: 3-16.

Katz, L.F. (1998) "Reflections on US Labor Market Performance" in G. Debelle and J. Borland (Eds.) *Unemployment and the Australian Labour Market*. Proceedings of a Conference. Reserve Bank of Australia, Sydney and Centre for Economic Policy Research, Australian National University Canberra.

Krugman, P. (1989) "The Case of Stabilizing Exchange Rates", *Oxford Review of Economic Policy.* 5: 61-72.

Kydland, F.E. and Prescott, E.C. (1977) "Rules Rather than Discretion: The Inconsistency of Optimal Plans", *Journal of Political Economy*, 85(3): 473-492.

Laxton. D., Meredith, G. and Rose, D. (1995) "Asymmetric Effects of Economic Activity on Inflation", *IMF Staff Papers* 42(2): 34-374.

Layard, R, Nickell, S. and Jackman, R. (1991) *Unemployment: Macroeconomic Performance and the Labour Market.* Oxford University Press, Oxford.

Lindbeck, A. and Snower, D. (1988*) The Insider-Outsider Theory of Employment and Unemployment.* MIT Press. Cambridge, Mass.

Lohamann, S. (1992) "Optimal Commitment in Monetary Policy: Credibility versus Flexibility". *American Economic Review*, 82(1): 273-288.

Macfarlane, I.J. (1998) "Australian Monetary Policy in the last quarter of a twentieth century". *Reserve Bank of Australia Bulletin***.** October 6-17.

Masciandaro, D. and Tabellini, G. (1988) "Monetary regimes and fiscal deficits: A comparative analysis". *Monetary Policy in Pacific basin countries***.** H.S. Cheng (ed.) Kluwer Academic Publishers. Norwell. M.A.

McCallum, B.T. (1995) “Two Fallacies Concerning Central Bank Independence.” *American Economic Review* 85: 207-11

Muscatelli, A. (1998) “Optimal Contracts and Inflation Targets with Uncertain Central Bank Preferences: Accountability through Independence?” *The Economic Journal,* 108: 529-542.

Pearson, T. and Tabellini, G. (1993) “Designing Institutions for Monetary Stability.” *Conference Series on Public Policy,* 90: 58-84.

Pesaran, M. H. (1982) "On the Comprehensive Method of Testing Non-nested Regression Models." *Journal of Econometrics.* 18: 263-74.

Pesaran, .M. H. and Pesaran, B. (1997) Microfit 4.0 Oxford University Press. Oxford.

Poole, W. (1970) “Optimal Choice of Monetary Policy Instruments in a Simple Stochastic Macro Model,” *Quarterly Journal of Economics* (May).

Prast, H.M. (1998) “Inflation, Distortionary Taxation and the Design of Monetary Policy: the Role of Social Cohesion”, *BNL Quarterly Review,* 204: 37-53.

Rogoff, K. (1985) “The Optimal Degree of Commitment to an Intermediate Target: Inflation Gains Versus Stabilization Costs,” Quarterly *Journal of Economics* 100 (4) (November): 1169-89.

Sargent, T.J. (1982) “The Ends of Four Big Inflations”, in R.E. Hall (ed.) *Inflation Causes and Effects.* University of Chicago Press. Chicago.

Sims, C. (1980) “Macroeconomics and Reality”, *Econometrica* 48(1980): 1-49.

Stemp, P.J. (1997) “The Australian Government’s Current Approach to Monetary Policy: An Evaluation” in P. Lowe (ed.) *Monetary Policy and Inflation Targeting*. Proceedings of a Conference Reserve Bank of Australia. Sydney. : 188-202.

Stevens, G. (1992) “Inflation and Disinflation in Australia: 1950-91,” in A. Blundell-Wignall (ed.) *Inflation, Disinflation and Monetary Policy.* Proceedings of a Conference. Reserve Bank of Australia: 182-244.

Summers, L. (1991) “How should long-term monetary policy be determined.” *Journal of Money Credit, and Banking*, 23(3) part 2: 625-31.

Svensson, L.E.O. (1997) “Optimal Inflation Targets, ‘Conservative Central Banks and Linear Inflation Targets.” *American Economic Review 87* (March): 98-114.

Svensson, L.E.O. (1997) “Inflation forecast targeting: Implementing and monitoring inflation targets.” *European Economic Review* 41: 1111-1146.

Tabellini, G. (1988) “Centralized wage setting and monetary policy in a reputational equilibrium.” *Journal of Money Credit and Banking* 20: 102-118.

Tarantelli, E (1986) “The regulation of inflation and employment.” *Industrial Relations* 25(1): 1-15.

Taylor, J.B. (1993) "Discretion Versus Policy Rules in Practice." *Carnegie-Rochester Conference Series on Public Policy*. 39:195-214.

Walsh, C.E. (1995) "Optimal Contracts for Central Bankers." *American Economic Review*, 85(1): 150-167.

Wooden, M. and Sloan, J. (1998) "Industrial Relations Reform and Labour Market Outcomes: A Comparison of Australia, New Zealand and the United Kingdom", in G. Debelle and J. Borland (Eds.) *Unemployment and the Australian Labour Market*. Proceedings of a Conference. Reserve Bank of Australia, Sydney: 169-203.