THE UNIVERSITY OF WESTERN AUSTRALIA
Achieve International Excellence

ECONOMICS

AUSTRALIA AND THE GFC: SAVED BY ASTUTE FISCAL POLICY?

by

Nicolaas Groenewold

Business School
University of Western Australia

DISCUSSION PAPER 12.28

AUSTRALIA AND THE GFC: SAVED BY ASTUTE FISCAL POLICY?

Nicolaas Groenewold,*

Economics,

UWA Business School,

University of Western Australia,

Crawley, WA 6009

email: nic.groenewold@uwa.edu.au

DISCUSSION PAPER 12.28

ABSTRACT

Both before and after the federal election campaign in 2010, Australians were frequently told that they were spared the worst effects of the Global Financial Crisis because of the government's timely and decisive fiscal stimulus. However, there are at least two other possibilities: monetary policy and foreign demand. This paper assesses the relative importance of these possibilities in driving output in the past few years. It does this within the framework of a structural vector-autoregressive model based on recent literature measuring the effects of fiscal and/or monetary policy on output. The results suggest that the government's claims are considerably exaggerated.

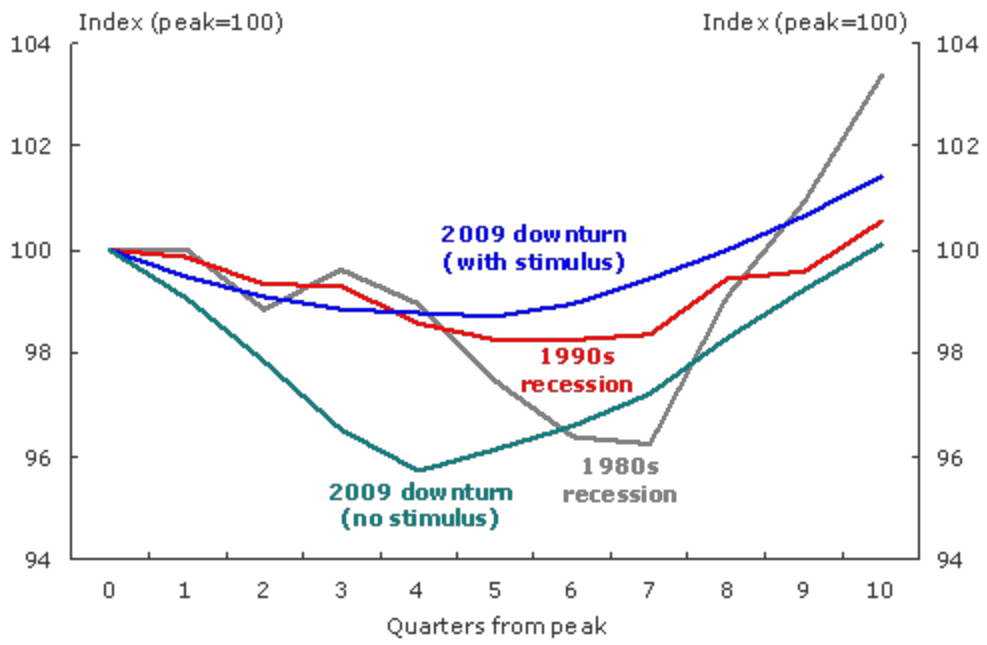
*I am grateful for comments on earlier drafts of this paper received at an Economics "Brown Bag" seminar at UWA, May 2011, at a seminar at Deakin University in July 2011 and at a Workshop on VAR modelling at the University of Tasmania in February 2012. Mardi Dungey and Graeme Wells have given me useful and encouraging advice at various stages of the research underlying the paper.

I Introduction

It has been a common claim in recent years that Australia was spared the worst effects of the Global Financial Crisis (GFC) by the Rudd/Gillard government's astute fiscal expansions in 2008 and 2009. Three items from the web-site of Australian Treasurer Wayne Swan in his "Treasurer's Economic Notes" series from the first half of 2009 give the flavour of such claims: [1]

- "The Government has taken decisive action to stimulate our economy and cushion Australians from the worst the world can throw at us – targeting first household incomes, then shovel-ready projects, and now larger-scale infrastructure in the Budget. The one thing we know for sure about our first quarter [2009] GDP outcome, is that without the Government's substantial economic stimulus, the result would be much worse." (31/5/2009)
- "The Government's cash stimulus payments to households are working to support jobs and growth in our economy. In fact, Treasury estimates that without these cash payments, the Australian economy would have contracted by around 0.2 per cent in the quarter [rather than growing by 0.6%]." (7/6/2009).
- The following graph of an index of the level of GDP and commentary:

[1] See http://www.treasurer.gov.au/listdocs.aspx?pageid=012&doctype=4&year=2009&min=wms



The implied message was clear: "This graph clearly shows that were it not for the Government's economic stimulus, the global recession would have pulled the Australian economy into a downturn more severe than the recessions of the 1980s and the 1990s. However, as a result of our stimulus measures, the downturn in Australia is expected to be milder than both of these past recessions."

It is possible and, indeed quite likely, that other influences on the Australian economy also contributed to Australia's performance excelling that of most other developed economies during this period. Indeed, it is by no means clear that fiscal policy was the major factor. Thus, for example, Andrew Priestley in a Parliamentary Briefing in 2009 was more circumspect: "Australia's strong economic performance during the GFC can be attributed to the Government's stimulus measures, a sound and

liquid banking system and not least China's robust demand for energy and minerals imported from Australia."[2]

It is the purpose of this paper to evaluate the relative importance of possible alternative factors which might account for Australia's above-average performance. I do this by estimating a minimal structural vector-autoregressive (SVAR) model and simulating it under the counterfactual assumptions reflecting no fiscal stimulus, a neutral monetary policy and no extraordinary assistance from overseas. The main finding is that the contributions of fiscal policy and foreign demand were, at best, modest; if anything, monetary policy is what saved us from the worst effects of the GFC. These findings are robust to a large variety of alternative modelling assumptions – variable definitions, lag structure, sample period, identification assumptions and additional variables.

The structure of the paper is as follows. In section II the literature is briefly reviewed. I set out the model, including the scheme used to identify policy shocks, in section III. In section IV the data are described and data transformations and the results of tests for stationarity are reported. The results for the base model are reported in section V and section VI is devoted to presenting the outcomes of a range of tests of the robustness of the results. Conclusions are drawn in the final section.

II Literature Review

There has been a considerable empirical literature on the effects of fiscal and monetary policy. A variety of models has been used for the analysis of these effects, ranging from single-equation models (e.g., Alesina and Ardagna, 2009, and Candelon, *et al.*, 2010) to structural models (such as Muscatelli *et al.*, 2004, Smets and Wouters,

[2] See http://www.aph.gov.au/library/pubs/BriefingBook43p/australia-china-gfc.htm

2007, Fragetta and Kirsanova, 2010, Freedman *et al*., 2010, Coenen *et al.*, 2012 and Kollmann *et al.*, 2012) and, most commonly, a variant of the vector-autoregressive (VAR) model. While some papers report analyses of both fiscal and monetary policy, most focus on one or the other and this division is followed in the review of the literature, beginning with fiscal policy. Papers which investigate policy specifically for the Australian economy are dealt with separately at the end of the section.

While in the standard Keynesian model of first-year economics courses in which prices are rigid and there are unemployed resources, it is straightforward to show that the fiscal policy multiplier is positive and generally greater than unity, the outcome of a fiscal expansion is considerably less certain when model assumptions are relaxed. Then private expenditure may be partially of wholly crowded out and, in the extreme, the multiplier may become negative if the fiscal expansion crowds out an equal amount of more productive private expenditure. It is not surprising, therefore, that the size of the fiscal policy multiplier has become the subject of considerable empirical research recently.

Relatively little of this work has been carried out within the context of an empirical macro model although some examples of this approach exist; Muscatelli *et al.* (2004) use a dynamic stochastic general equilibrium (DSGE) model to analyse both fiscal and monetary policy, as do Smets and Wouters (2007). Freedman *at al.* (2010), on the other hand, use a large numerical New-Keynesian model, the IMF Global Integrated Monetary and Fiscal Model, and focus on the analysis of various fiscal multipliers. All find government expenditure multipliers to be positive but varying in magnitude from considerably less than 1 to greater than 2.

Most of the empirical literature on fiscal policy uses a variant of the VAR model. An important part of this approach involves the identification of the fiscal

policy component of government expenditure and taxes since, with at least a part of both government expenditure and tax revenues being endogenous, simply shocking expenditure or tax receipts as a whole is generally inappropriate. Some papers, such as Muscatelli *et al.* (2002), Beetsma and Giuliodori (2010) and Monacelli *et al*. (2010) use the common identification based (partly, at least) on the Cholesky decomposition of the covariance matric of model residuals. Others use more sophisticated schemes. An early and seminal paper in this literature, Blanchard and Perotti (2002), use what they call a "mixed structural VAR/event study approach" which involves the use of outside information to identify the fiscal shocks combined with Bernanke-Sims style restrictions on the VAR model. This approach is applied to a number of countries in Perotti (2005). Favero and Giavazzi (2007) also apply the Blanchard-Perotti method but emphasise the importance of adding debt to the model as do Chung and Leeper (2007). Monacelli *et al.* (2010) combine the Blanchard-Perotti scheme with a Cholesky-based identification method in a VAR framework. Auerbach and Gorodnichenko (2012) extend the Blanchard and Perotti approach to incorporate regime-switching between recessions and expansions. Romer and Romer (2010) use a "narrative" approach to the identification of fiscal shocks – they use the record of policy decisions to identify policy changes based on policy-makers' own stated intentions. Ramey (2011) argues that with standard VAR shock-identification procedures, shocks are partly predictable and therefore cannot be considered to be unexpected shocks as generally assumed in the theoretical analysis. She shows that macroeconomic response to news is greater than to actual expenditure changes. Finally, a recent paper by Mountford and Uhlig (2009) uses sign restrictions on the model multipliers to identify policy shocks.[3] Thus, there has been a recent

[3] See Fry and Pagan (2011) for a recent survey and critiques of this approach to identification.

proliferation of methods of identification of policy shocks. Despite this, most papers report positive, often small, effects on output of fiscal expansions. Exceptions are the papers by Perotti (2005), Mountford and Uhlig (2009) and Auerbach and Gorodnichenko (2012) all of which report several negative multipliers.

The literature which deals with the effects of monetary policy has been more limited. In an early paper Cochrane (1998) emphasised the importance of the distinction between anticipated and unanticipated policy shocks and demonstrates the empirical significance of this distinction in a VAR framework but, unfortunately, does not suggest a method for making the distinction in practice. The paper by Bernanke and Mihov (1998) is also concerned with the identification of the monetary policy shock in a VAR model, using external information in the form of a model of the central bank's operating method to restrict the VAR model. They show that the procedure is also applicable to the case where there is more than one policy instrument in which case a policy index is derived from the data. The papers by Kasa and Popper (1997) and Nakashima (2006) both exploit the Bernanke and Mihov model to analyse the effects of monetary policy in Japan. Finally, an interesting paper by Olivei and Tenreyro (2007) argues that the effectiveness of monetary policy depends on the quarter of the year in which it is implemented. They show that this is important empirically as well as providing a theoretical rationalisation of the effect.

In addition to papers which consider either fiscal policy or monetary policy in isolation, there are various which analyse both, frequently focussing on the interaction between them. Thus, two papers by Muscatelli *et al.* (2002 and 2004) consider strategic interaction between fiscal and monetary policy, the first in a standard VAR model as well as in a Bayesian VAR model while the second uses a New Keynesian DSGE model.

Finally there is a limited literature on the effects of fiscal and/or monetary policy in Australia. Foremost amongst these is the work by Dungey and others which uses one variant or another of the VAR model – Dungey and Pagan (2000, 2009) and Dungey and Fry (2009, 2010). In addition, there has been some recent discussion of fiscal policy, some of it within the context of the GFC – the papers by Day (2011) and Makin (2010) are examples.

The pair of papers by Dungey and Pagan (2000 and 2009) are closely related, the second being an update and extension of the first. Both are VAR models of the Australian economy and neither is specifically designed for the analysis of policy. In fact, neither has an explicit fiscal policy variable although both analyse monetary policy using the cash rate as the instrument. Identification is achieved by short-run restrictions in the first paper while the second extends the model to include non-stationary variables and long-run restrictions. The paper by Dungey and Fry (2009) is also a VAR model and is specifically focussed on the identification of monetary and fiscal policy shocks. It uses a more complex set of identification restrictions including short-run, long-run and sign restrictions. The paper is not focussed on Australia's experience during the GFC; indeed, it uses data for New Zealand for the period 1983(2) to 2006(4) and thus finishes before the beginning of the GFC. Finally, the paper by Dungey and Fry (2010) is also specifically focussed on fiscal and monetary policy and uses Australian data; the sample period is not clearly stated but appears to be the same as that for Dungey and Pagan (2009) and so ends before the GFC. In all papers the policy shocks are shown to have their expected effects. A rise in short-term interest rates has a negative effect on GDP in all models although the magnitude varies. In Dungey and Pagan (2000) monetary policy was shown to have contributed considerable counter-cyclical effects to the evolution of GDP over time.

Monetary policy was not always so beneficial, however – in an early application of a VAR model to the analysis of monetary policy in Australia, Weber (1994) finds that the 1989 recession in Australia was significantly exacerbated by monetary policy. Moreover, the later (2009) Dungey and Pagan paper argued that the magnitude of the monetary-policy effect was overstated according to the more sophisticated model analysed there. In Dungey and Fry (2010) a government expenditure shock was shown to have a persistent and unambiguously positive effect on output while the effect on output of a rise in the short-term interest rate is initially positive (but small) and negative thereafter.

Finally, there has been a number of papers which have analysed the GFC in Australia in a less formal manner. Makin (2010) uses an historical decomposition of the changes in output over the period of the GFC to argue that "it was the behaviour of exports and imports, and not increased fiscal activity, that was primarily responsible for offsetting the fall in private investment due to the Global Financial Crisis" (p.5). Similarly, Day (2011), using similar methods to those of Makin, attributes much of the above-average performance of the Australian economy during the GFC to the resilience of Chinese imports from Australia driven by the Chinese fiscal stimulus.

To sum up, while there has been extensive analysis of policy effects on output, particularly fiscal policy, relatively little has been carried out for the Australian economy and none of the existing formal analysis is focussed on the contributions of policy to saving Australia from the adverse effects of the GFC. This paper sets out to begin to fill this gap within the framework of a small VAR model of the Australian economy which is used to decompose the historical evolution of GDP according to contributions from fiscal and monetary policy and foreign factors.

III The Model

Given that this is a first attempt at analysing this question for Australia, the simplest model possible is used. In the first place, like Blanchard and Perotti (2002) who use only three variables (output, a fiscal policy variable and a monetary policy variable), I begin with a model with the minimal number of variables. In particular, I specify a model with just the four variables of interest: real output, a fiscal policy variable, a monetary policy variable and a foreign demand variable. Secondly, the model structure is that of an SVAR identified using only short-run identification restrictions, rather than the more complicated methods used by Dungey *et al*. or extraneous information such as used in the approach pioneered by Blanchard and Perotti (2002).

In the base model real output is measured using real GDP (Y), the fiscal policy variable is measured by real government expenditure plus transfers (G), the cash rate (R) is used as the monetary-policy variable and real exports of goods and services (X) are used to capture foreign demand. The structural model from which the VAR model is derived may be written as:

$$\boldsymbol{A}\boldsymbol{Z}_t = \boldsymbol{B}(L)\boldsymbol{Z}_{t-1} + \boldsymbol{\varepsilon}_t \qquad (1)$$

where $\boldsymbol{Z}$ is a vector $(X,G,R,Y)'$, $\boldsymbol{A}$ is a matrix of coefficients, $\boldsymbol{B}(L)$ is a matrix polynomial in the lag operator, L, and $\boldsymbol{\varepsilon}$ is a vector of independent error terms which include the policy shocks. To enable the (structural) errors in $\boldsymbol{\varepsilon}$ to be shocked, the model in (1) must be estimated in such a way as to enable the retrieval of estimates of the elements of $\boldsymbol{\varepsilon}$. However, since all equations in (1) are identical, the structural shocks cannot be identified and the system must be restricted to achieve identification.

Another and useful way of viewing this is to re-write the model as a reduced form:

$$Z_t = A^{-1}B(L)Z_{t-1} + A^{-1}\varepsilon_t \equiv C(L)Z_{t-1} + u_t \qquad (2)$$

which can be estimated with OLS and estimates of the residuals retrieved. However, the reduced-form VAR errors, $\boldsymbol{u}$, are linear combinations of the structural shocks, $A^{-1}\varepsilon_t$, from which estimates of the structural shocks can be derived only with further restrictions.

A common way of identifying these errors is based on the Cholesky decomposition of the covariance matrix of the reduced-form errors, Σ,

$$\Sigma = PP' \qquad (3)$$

where $\boldsymbol{P}$ is a lower triangular (4×4) matrix. The structural errors can then be written in terms of the reduced-form errors as:

$$\varepsilon = P^{-1}u \qquad (4)$$

which are contemporaneously uncorrelated as required, given the properties of the $\boldsymbol{P}$ matrix. While this scheme achieves the aim of identifying the structural errors from the estimated system so that the model can be simulated under various alternative policy assumptions, the method has two disadvantages – the simulation results generally depend on the order of the variables in the system and, for any particular variable-ordering, the restrictions may not make much economic sense. Instead, I use a simple generalisation of the Cholesky approach which imposes restrictions directly on the structural model on the basis of economic priors. In particular, the following restrictions are applied:

(i) Exports are affected contemporaneously only by their own shock.

(ii) Government expenditure is affected contemporaneously by its own shock as well as by output. Thus there is no within-the-period feedback from the cash rate and exports but there may be an endogenous component of G which reacts to output.

(iii) The cash rate is affected contemporaneously by its own shock as well as by output. Thus monetary policy reacts within the period to output but not to exports or government expenditure.

(iv) Output is affected contemporaneously by all four shocks. This follows from the observation that both *X* and *G* are part of aggregate demand and that it is quite possible for the cash rate to affect output within the quarter, especially for cash rate changes in the first month of the quarter.

These assumptions allow the system of equations to be wrtitten as (assuming a single lag for ease of exposition):

$$\begin{aligned}
X_t &= \alpha_1^1 X_{t-1} + \beta_1^1 G_{t-1} + \gamma_1^1 R_{t-1} + \delta_1^1 Y_{t-1} + \lambda_1^1 \varepsilon_{1t} \\
G_t &= \alpha_1^2 X_{t-1} + \beta_1^2 G_{t-1} + \gamma_1^2 R_{t-1} + \delta_1^2 Y_{t-1} + \lambda_2^2 \varepsilon_{2t} + \lambda_4^4 \varepsilon_{4t} \\
R_t &= \alpha_1^3 X_{t-1} + \beta_1^3 G_{t-1} + \gamma_1^3 R_{t-1} + \delta_1^3 Y_{t-1} + \lambda_3^3 \varepsilon_{3t} + \lambda_4^4 \varepsilon_{4t} \\
Y_t &= \alpha_1^4 X_{t-1} + \beta_1^4 G_{t-1} + \gamma_1^4 R_{t-1} + \delta_1^4 Y_{t-1} + \lambda_1^4 \varepsilon_{1t} + \lambda_2^4 \varepsilon_{2t} + \lambda_3^4 \varepsilon_{3t} + \lambda_4^4 \varepsilon_{4t}
\end{aligned} \tag{5}$$

with the restrictions used to disentangle the relationship between the reduced-form errors, u_{it} and the structural errors, ε_{it}. The structural errors are interpreted as follows: ε_{1t} as the export (or foreign) shock, ε_{2t} as the fiscal-policy shock, ε_{3t} as the monetary-policy shock and ε_{4t} as the (other) output shock. Thus all contemporaneous and lagged responses of *G* to the other variables are excluded from the fiscal-policy shock and similarly for the monetary-policy shock.

IV The Data

The data used are quarterly and were collected for the period 1959(3) to 2011(4). The variables of the model were measured as follows:

Y: GDP, seasonally adjusted, real

G: central government, national, non-defence final consumption expenditure and

gross fixed capital formation (both seasonally adjusted and real) plus total personal benefit payments which are not seasonally adjusted or real. Benefit payments were deflated by the personal consumption deflator and tested for seasonal components but found to have none and so are not seasonally adjusted.

R: monthly cash rate for the period July 1998 to March 2011 and the 11 am call rate for the period March 1959 to June 1998. The monthly data were averaged to obtain quarterly data. They were found not to have any detectable seasonal components and are therefore not seasonally adjusted.

X: exports of goods and services, real, seasonally adjusted.

All data are in logs (*R* as the log(1+cash rate)) and had a trend removed using the Hodrick-Prescott (HP) filter using a standard value of 1,600 for the lambda parameter. The data were de-trended since the focus is on the short-term fluctuations of output about trend. De-trending is also likely to avoid the issue of non-stationarity and (possible) cointegration. The HP trend rather than, say, a linear trend was removed because of the obvious non-linearity of the trend component in (at least) exports and the cash rate. These properties of the data can be seen from the graphs of the data and HP trends which are reported in Appendix 1 which also contains details of the sources of the data. Alternatives to the HP method of de-trending are explored in section VI.

The de-trended data were tested for stationarity using the standard ADF test and the results are reported in Table 1 below. Clearly, all variables are stationary at the 1% level; this is independent of deterministic specification of the testing equation and is also independent of the number of lags. The variables were therefore modelled using a stationary SVAR.

Table 1: Augmented Dickey-Fuller Tests

	Deterministic Component	
Variable	Intercept	Intercept and trend
X	-6.9836**	-6.9647**
G	-4.9260**	-4.9037**
R	-8.8637**	-8.6110**
Y	-5.7859**	-5.7893**

Notes: ** indicates significance at 1%; critical values are -3.4638 and -4.0061 for intercept and intercept and trend respectively; all tests were run with 4 lags.

V Results: The Base Case

Data are available for all four variables in the model for the period from 1959(3) onwards. On the basis that more is better than less as far as data are concerned, estimates were originally based on the longest possible sample period: 1959(3) to 2011(4). However, there have been significant changes in the structure of the financial system in general from the beginning of the 1980s and in the operation of monetary policy in particular over this period which might result in instability in the model parameters. I therefore experimented with three different sample periods: the full sample from 1959(3) to 2011(4), a sample starting in 1980(1) to coincide with the beginning of financial deregulation in Australia and a sample starting in 1993(1) to coincide with the beginning of the current monetary policy regime which focusses on manipulating the cash rate with inflation the primary target. It turned out that the overall conclusions about the relative efficacy of fiscal policy and monetary policy were not sensitive to the choice of sample and the sample period 1980(1) to 2011(4) was chosen for the base case as a compromise between maximising the number of observations and restricting the period to one in which model instability is likely to be minimised.

Model estimates are reported in Appendix 2. Intercepts are omitted from all equations since they were not significant in any equation at any reasonable levels of

significance. Lag-choice criteria gave mixed results with the Akaike criterion suggesting five lags and the Schwarz and Hannan-Quinn criteria suggesting one. There was some evidence of autocorrelation in a model with one lag which was largely removed by moving to two lags. In view of this, the base case reported in this section is based on one lag; results for two lags are presented as part of the sensitivity analysis in the next section.

Impulse response functions for Y following shocks to each of the ε_is (i = 1,2,3) are shown in Figure 1. Shocks sizes were chosen as the maximum deviation of each variable from its trend following the GFC. The IRFs therefore give a rough measure of the relative contributions of each of exports, fiscal policy and monetary policy at their peak during the GFC.

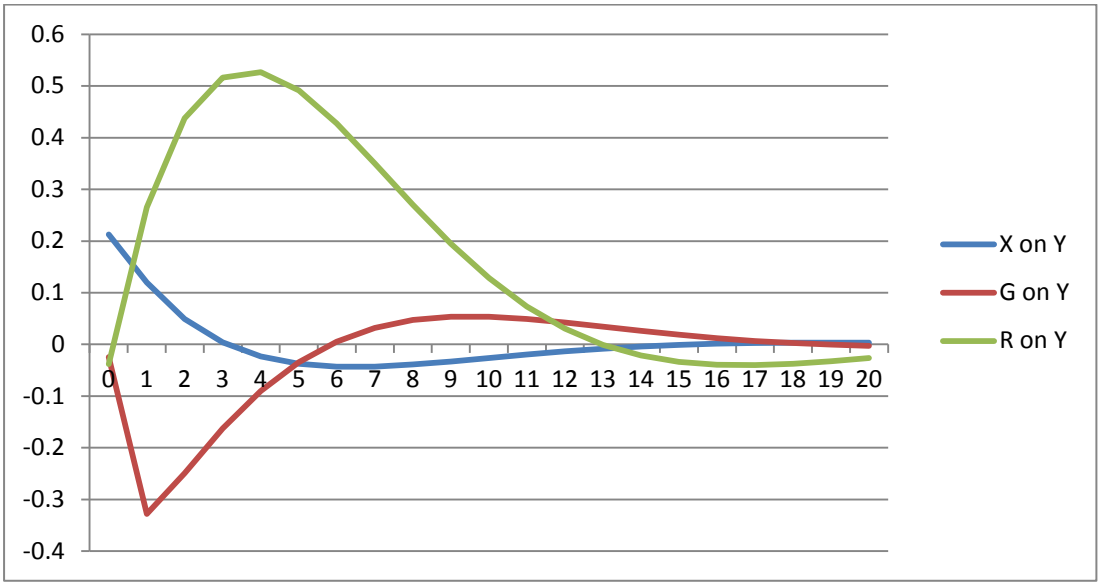


Figure 1: Impulse responses for Y to export, fiscal and monetary shocks.

Several features of the IRFs stand out. First, monetary policy dominates. Second, for the first year-and-a-half following the shock, fiscal policy has an effect with the "wrong" sign which is inconsistent with the sign reported in many of the

papers reviewed in Section 2 although some, such as Dungey and Fry (2009), Perotti (2005), Mountford and Uhlig (2009) and Auerbach and Gorodnichenko (2012) report some negative fiscal-policy multipliers. Third, the effect of the export shock is mostly positive but quite small compared to that of the monetary-policy shock; this contrasts with the widespread belief that the continued growth of exports to China during the GFC was a major influence in Australia's relatively good performance (see, e.g., Day, 2011).

But the results reported in Figure 1 are at best indicative measures of the response of the economy to anti-GFC policy reactions. An historical decomposition of the output variable over the GFC period will provide a more systematic account of the dynamic effects on output of each of the four shocks and this is reported in Table 2 for the period 2007(1) to 2011(4). The decomposition computes each period's *Y* as the accumulated effects of past and present shocks to exports, government expenditure, the cash rate and (other) output as indicated. Recall that output is in terms of deviations of the log from HP trend so units of measurement are proportional deviations from trend. They have all been multiplied by 100 to convert them to percentages.

Table 2: Contributions to output 2007(1) to 2011(4): Base Case

Quarter	Exports	Fiscal	Monetary	Other output
Mar 2007	0.04	0.19	-0.27	0.98
June 2007	0.03	0.16	-0.31	1.10
Sept 2007	0.05	0.06	-0.29	1.21
Dec 2007	-0.03	0.04	-0.25	1.17
Mar 2008	0.06	0.03	-0.21	1.59
June 2008	0.14	0.06	-0.20	0.97
Sept 2008	0.04	0.03	-0.21	1.03
Dec 2008	-0.07	0.01	-0.24	-0.09
Mar 2009	0.01	-0.30	-0.05	0.15
June 2009	-0.12	-0.26	0.25	-0.49
Sept 2009	-0.09	-0.48	0.54	-0.35
Dec 2009	0.00	-0.31	0.68	-0.50
Mar 2010	0.11	-0.14	0.70	-0.72
June 2010	0.20	0.00	0.65	-0.84
Sept 2010	0.03	0.09	0.53	-0.91
Dec 2010	0.11	0.17	0.39	-0.85
Mar 2011	-0.27	0.18	0.24	-1.22
June 2011	-0.17	0.19	0.05	-0.33
Sept 2011	-0.08	0.21	-0.14	-0.03
Dec 2011	0.02	0.11	-0.27	-0.02

Note: the base case is estimated over the period 1980(1) to 2011(4) and uses one lag in the underlying VAR.

To interpret the results in the context of the GFC, we need to establish some timing conventions for the crisis. The credit crunch was first apparent in the US in mid-2007 but it was not until the third quarter of the following year that there was a widespread downturn in world stock markets. The US government stimulus started in early 2009 and Lehman Bros failed in September 2009. In Australia, government stimulus began with an increase in first home-buyers grants in late 2008, the first of

the cash hand-outs in February, 2009 and the second in March and April of the same year. Thus we might reasonably count the GFC to have begun (for Australia, at least) at the earliest from the middle of 2008. Inspection of the data in Figure 2 in Appendix 1 indicates that Australian seasonally adjusted real GDP fell below its HP trend for the first time in the fourth quarter of 2008. Thus in our discussion the effectiveness of policy based on the model results, we will focus particularly on how the economy fared in 2009 and 2010.

Several features of the results in the table stand out. First, the other output shocks substantially drive output over the period. The correlation of this component with output over the 2007-2011 period was 87%. Other components could be considered counter-cyclical if they are negatively correlated with the other output component since they would then offset the effects on output of the other output shocks. By this measure, exports were weakly pro-cyclical with a correlation of 27% (-1% since 2009). Fiscal policy also showed pro-cyclical behaviour over the 2007-2011 period with a correlation of 19% (but -25% for the period 2009-2011) while monetary policy showed strong counter-cyclical behaviour with a correlation of -79% over 2007-2011 and -65% over 2009-2011. On the timing and magnitude of the policy effects, fiscal policy was actually counter-productive until the middle of 2010 by which time GDP had returned to trend while monetary policy made a positive contribution from the second quarter of 2009 just as the effect of the other output shock was about to turn negative. Thus, on the basis of these results we could conclude that the government's repeated claims that fiscal expansion saved Australia from the worst of the effects of the GFC are considerably exaggerated and that monetary policy made a larger, more timely and more consistent contribution; the effects of external shocks were mixed and weak.

VI Results: Sensitivity Analysis

It goes without saying that the conclusions above are dependent on the modelling assumptions made along the way, many of which might reasonably have been made differently. It is useful, therefore, to identify some of these assumptions and examine what would have happened had I made them otherwise. The alternatives are divided into three groups: (i) sample period, lags and variable definition; (ii) identification assumptions including the use of the HP de-trending procedure; and (iii) additional variables. In this section I report only the outcomes of the analysis – tables with decompositions for each case are reported in Appendix 3.

(i) Sample period, lags and variable definition

The sensitivity analysis begins with a point made earlier that the choice of sample period is not crucial to the thrust of the results. In particular, the decomposition was recomputed for two alternatives to the base case: 1959(3) to 2011(4) and 1993(1) to 2011(4). The results are in Tables 1 and 2 in Appendix 3. For all three sample periods the basic conclusion holds that fiscal policy made a positive contribution about a year later than monetary policy and the contribution was weaker. The conclusion drawn from the base case results in the previous section are therefore not dependent on the choice of sample period.

In the specification of the base case, there was some uncertainty as to the appropriate lag length for the VAR model. A lag of one was chosen but two lags might also have been imposed. In Table 3 in Appendix 3 the decomposition is reported for the model estimated over the 1980(1) to 2011(4) sample period but using two lags in the VAR model. The results for the two-lag case are more strongly

supportive of our base-case conclusion that fiscal policy was weak and late in offsetting the GFC compared to monetary policy.

I now turn to variable definition, beginning with the fiscal policy variable, *G*. In a recent paper, Aizenman and Pasricha (2011) show that, for the US, it was quite misleading to measure fiscal stimulus using only central government expenditure during the response to the GFC because expansions in central government expenditure were substantially offset by contractions in spending at the state and local levels. This may be an important issue for the measurement of fiscal policy in Australia since expenditure by state and local governments exceeds that of the central government although they have no direct responsibility for fiscal policy. It is straightforward to assess the effect of this on the output decomposition reported earlier for the base case by expanding the definition of government expenditure to include that by state and local governments. Data used for this conform to the definition of that used earlier for central government expenditure and are obtained from the same source. The resulting contributions for exports, fiscal policy and monetary policy are reported in Table 4 of Appendix 3 The results show a boost in the efficacy of monetary policy relative to fiscal policy, thus strengthening our base-case conclusions.

A different possible weakness of the use of *G* in the base model is that it ignores taxes; it is possible that some of fiscal policy is implemented via tax changes rather than expenditure shocks although popular discussion of fiscal policy during the GFC focussed very much on the expenditure side. This potential weakness was addressed by defining a “surplus” as the difference between taxes on production, imports and income and the government expenditure used in the base case. The data were taken from the National Accounts, as were the expenditure data used earlier.

Like the transfers included in the expenditure measure, tax data were not seasonally adjusted or deflated. A regression-based test for seasonality showed no significant seasonality in the data and they were therefore not seasonally adjusted. They were deflated by the consumption deflator following the procedure used for the transfer data included in *G*. The decomposition for the model using the surplus in the place of *G* is reported in Table 5 of Appendix 3. The results reported there do not require a change in conclusions drawn from the base-case simulations.

Another possible omission from the fiscal policy measure is the First Home Buyers grants which were a prominent early part of the government's strategy to combat the adverse effects of the GFC. A recent analysis of these grants is by Dungey *et al.* (2011) who provide extensive data on schemes operated by both the federal and state governments. Unfortunately, they provide no data on total expenditure on the scheme by the federal government which would be needed to supplement the *G* variable used in the base model. The ABS records the expenditure on this scheme in the item "capital transfer" in the "Government Finance Statistics" (Catalogue No. 5519.0.55.001) and data were taken from this source and added to *G* to test the sensitivity of the conclusions to the omission of this item. The data are not seasonally adjusted and not deflated. There was no significant seasonality so they were left unadjusted and they were deflated by the consumption deflator. Unfortunately the data are available only from 2002(3). To provide a sensible basis for comparison, the base model was first re-estimated over the period 2002(3) to 2011(4) after which the transfers were included in *G* to assess the difference they made to the outcome. The inclusion of the grants made almost no difference to the decomposition for the shorter sample period suggesting that the omission of these grants from the measure of *G* used in the base model is not important for the results.

Next I consider the measure of monetary policy used. Dungey and Pagan (2000) proposed a broader measure of monetary policy than just the innovation to the cash rate, namely one which adds to the effect already measured above (which they call the "direct effect") the response of the cash rate to lagged changes in variables other than the cash rate itself (the "indirect effects"), it being argued that these were properly part of the monetary-policy response to economic conditions. The results for the model with 1 lag are reported in Table 6 of Appendix 3 which is the base case with an "IMP" column added which contains the Dungey-Pagan Index of Monetary Policy (IMP). A comparison of the results in the two monetary policy columns shows little effect on the overall conclusions of this change in the measurement of monetary policy. Fiscal policy has a positive contribution starting only in the second half of 2010 whereas monetary policy starts having a positive impact a year earlier. The magnitudes for monetary policy are smaller when measured with IMP but still larger than those of fiscal policy. Thus it appears that the relatively strong contribution attributed to monetary policy in the base case are not sensitive to the way in which it is measured.

Finally consider a variation on the variable used to measure international shocks, exports in the base model. As an alternative I use the terms of trade, the data for which were obtained from the RBA's web-site. The results of this variation are in Table 7 of Appendix 3. From a comparison to the results for the base case in Table 2 above it is clear that little changes as a result of this alteration to the model specification; external influences still did little to help Australia through the GFC, the effects of fiscal policy become positive only late in 2010 and the effects of monetary policy are beneficial from early in 2009 and are sustained until early in 2011. Thus,

little changes when exports are replaced by the terms of trade as the variable capturing international effects.

In summary, none of the eight variations of the base model reported in this sub-section require any change to the overall conclusions drawn from the base-case decomposition; in fact, in many cases the earlier conclusions were strengthened.

(ii) Model identification and de-trending

Next I consider the sensitivity of the conclusions to the method of identifying the shocks and to the HP method used to de-trend the data.

In the base case the shocks were identified using short-run identifying restrictions of the Bernanke-Sims type as set out in equation (5). An alternative is to use the standard identification scheme based on the more common Cholesky decomposition of the covariance matrix of the VAR model residuals. Applying this method for an ordering of the variables X, G, R, and Y are reported in Table 8 in Appendix 3. In this case the beneficial effects of fiscal policy are felt earlier but not as early as those of monetary policy and in this sense the results are similar to those generated in the base case. However, there is a strong contrast between the magnitudes. If the Cholesky identification scheme is used, the relative magnitudes of the effects of fiscal policy and monetary policy are reversed with fiscal policy far more powerful than monetary policy. Since there are many differences between the Cholesky and the Bernake-Sims identification restrictions, it is worth exploring the source of the differences between the model predictions. Both sets of restrictions can be formulated in terms of zero restrictions on the matrix relating the structural and reduced-form errors, $\boldsymbol{A}$ in equations (1) and (2). Since G is in the second position, I focussed on the second row and column and a little experimentation with alternatives

shows that the greater magnitude of the fiscal policy effects depends crucially on the presence of a non-zero element in the third position of the second column. Economically, it is crucial that the fiscal-policy shock have a contemporaneous effect on the cash rate, something that seems to be difficult to rationalise *a priori*. All other variations of the restrictions experimented with predict the usual predominance of monetary policy over fiscal policy. I, therefore, do not consider the Cholesky-based results to significantly undermine the thrust of the results so far obtained.

A related issue is the de-trending of the data using the HP filter. Since the HP procedure uses both past and future observations to compute the trend, the de-trended series will be contaminated by future data which might compromise the identification of the policy shocks. I experiment with a number of alternatives. First the log of variables are tested for stationarity and, not surprisingly, they are all found to be I(1) but not cointegrated. Results are reported in Tables 9A, 9B and 9C of Appendix 3. Thus the use of a VECM to accommodate the stochastic trends is not appropriate. Increasingly in recent literature, modelling of apparently non-stationary variables has proceeded by largely ignoring non-stationarity; examples are Olivei and Tenreyo (2007), Mountford and Uhlig (2009), Romer and Romer (2010), Monacelli *et al*. (2010), Ramey (2011), Beetsma and Giuliodori (2011), Coibion (2012) and Auerbach and Gorodnichenko (2012).[4] Following this literature, I consider first estimating the VAR in log levels ignoring trends. The resulting decomposition is reported in Table 10 of Appendix 3. It shows that the overall thrust of the earlier conclusions stands up:

[4] See also the earlier paper by Toda and Yamamoto (1995) who show that a range of tests can be applied to VAR models estimated in levels even if some or all the variables in the model are non-stationary.

monetary policy starts having a positive offsetting effect earlier and, at least until the end of 2010, has a larger effect than fiscal policy.[5]

A further alternative to HP-de-trending, consistent with the literature cited above, is to include a linear trend in the model. The results for a decomposition based on such a model are reported in Table 11 of Appendix 3. Clearly the earlier conclusions regarding the relative efficacy of monetary and fiscal policy continue to hold.[6] A final alternative is linear de-trending of the data before estimating the model – a method used, *inter alia*, by Dungey and Fry (2009). The decomposition resulting from such a procedure are reported in Table 12 of Appendix 3. The conclusions that monetary policy dominates fiscal policy during the GFC continue to hold for this variation.

In conclusion, while there may be objections to the use of the HP filter to deal with the obvious trends in the data, alternatives explored here based on recent literature, show that the overall conclusions regarding the dominance of monetary policy in helping Australia through the GFC continue to hold.

(iii) Additional variables

I argued in section III that, given the paucity of analysis of policy effects during the GFC in Australia, it is sensible to start with the simplest possible model – in the present case one in the four variables of interest: output and variables representing fiscal policy, monetary policy and foreign demand. While there are eminent precedents for such a simple approach (see, e.g., Blanchard and Perotti, 2002, who have three variables), the final subsection on sensitivity analysis addresses a

[5] The results in Table 10 are based on a model with two lags; if one lag is used, there is extensive autocorrelation which is substantially removed with two lags. Results for a model with one lag show a reversal of the relative importance of fiscal and monetary policies.
[6] In this case, too, two lags were needed to remove (most) autocorrelation; but results are not sensitive to whether one or two lags are chosen.

common criticism of VAR models: missing variables. Most commentators will have one (or more) suggestions for additional variables and below I report on the effects of adding a number of popular variables to the base model, one-at-a-time. A brief survey of the literature cited in section II suggests the following candidates: prices (inflation), imports, the exchange rate, commodity prices, tax rates and government debt. Consider the effects of adding each one of these variables. In all variants of the model, only the four components computed previously will be reported since the question is whether the addition of a variable will affect earlier conclusions regarding the relative efficacy of fiscal and monetary policy. In each case identification assumptions need to be made for the expanded model and I start with the assumption that the additional variable affects only itself and is affected only by itself, contemporaneously. Alternative restrictions were experimented with in some cases and are reported as appropriate.

I begin with prices/inflation. Results for a model with the inflation rate calculated from the GDP deflator are reported in Table 13. They support the earlier conclusion that, compared to fiscal policy, monetary policy has a beneficial effect several quarters earlier and, at least when it counts, has a stronger effect on output. Nothing much changes when the CPI is used instead of the GDP deflator.

Next, an additional source of foreign influence was considered by adding real imports as a fifth variable to the base model. The results are in Table 14 in Appendix 3 and show that the conclusions are largely unaffected: fiscal policy is late and small while monetary policy is timely and generally has a stronger effect. This outcome is not changed when the identification assumption is expanded to allow for a contemporaneous effect of output on imports.

Another variable frequently included in models surveyed is a measure of the exchange rate. I experimented with three alternatives: the trade-weighted index (TWI) produced by the Reserve Bank, the US dollar exchange and a measure of the real exchange rate. The results are reported in Table 15 of Appendix 3 and show that the earlier conclusions continue to hold. This outcome is unaffected by assuming that the exchange rate has a contemporaneous effect on the cash rate and by using the US dollar exchange rate in the place of the TWI. The Reserve Bank also publishes a series on the real exchange rate and I also experimented with adding this to the base model. The resulting decomposition of output is shown in Table 16 and clearly support the earlier conclusions regarding the relative effectiveness of fiscal and monetary policy during the GFC.

A number of papers surveyed have included a measure of commodity prices as part of the model and it might be argued that this is especially important for a country like Australia which, it has been argued, was heavily dependent on commodity exports to see it through the GFC. A commodity price series is available from the RBA web-site although only for the period from 1982(3) so that for this experiment the sample period was truncated accordingly. The decomposition of output using the base model expanded to include commodity prices is reported in Table 17 of Appendix 3 and shows, as before, that the conclusions drawn earlier are not significantly affected – monetary policy continues to dominate fiscal policy during the GFC period.

In the previous sub-section I included tax revenue as part of the fiscal policy measure by replacing government expenditure with a government deficit variable. In several papers, tax rates have been considered as a variable additional to government expenditure and this is briefly considered here. Three alternative tax rates were

experimented with: two calculated as the ratio of income tax revenue received by the central government to household income and the other the labour-income tax rate from the Treasury's NIF model data base. All produced vary similar results (only those for the NIF-based tax rate are reported in Table 18 of Appendix 3) : monetary policy had a greater effect earlier and fiscal policy had a later effect than the base case. Thus, this experiment does nothing to change the broad conclusions reached on the relative efficacy of monetary and fiscal policy to offset effects of the GFC on GDP in Australia which were reached on the basis of the base case.

Finally I consider the inclusion of government debt in the model. Various papers have argued strongly for the importance of this variable in a model used to analyse the effects of fiscal policy; see, for example, Favero and Giavazzi (2007) and Chung and Leeper (2007). I experimented with both the level of debt and the debt/GDP ratio and with two alternative identification assumptions – the standard one and a variant in which fiscal policy is allowed to have a contemporaneous effect on debt. All produced similar results. The case using the debt/GDP ratio is reported in Table 19 of Appendix 3. The results show that while monetary policy is weaker in this case, it still has a greater and earlier effect than fiscal policy and in this sense the earlier conclusion continues to hold.

The purpose of analysis reported in this section was to assess the sensitivity of the results derived in the base case to a variety of assumptions. A large number of variants of the base model were reported and with only one exception showed the original results to be remarkably robust: the government's claim that fiscal policy was instrumental in helping Australia weather the GFC is unwarranted. Fiscal policy did little to offset the adverse effects of the GFC until quite late (usually the second half

of 2010) while monetary policy had a positive effect on output a year earlier and had a larger effect throughout the GFC period.

VI Conclusions

This paper has subjected the assertion that fiscal policy made a major contribution to saving the Australian economy from the worst effects of the GFC to systematic econometric evaluation within a simple four-variable VAR model. The evidence does not support the assertion. To the contrary, monetary policy has had the greatest effect. In addition the beneficial effects stemming from export growth were found to be modest. These conclusions are robust to a large range of variants of the base model: definitions of the monetary and fiscal policy and external shocks, identification assumptions, de-trending method and variable addition.

References

Alesina, A. and S. Ardagna (2009), "Large Changes in Fiscal Policy: Taxes versus Spending", NBER Working Paper No. 15438.

Aizenman, J. and G. K. Pasricha (2011), "The Net Fiscal Expenditure Stimulus in the US, 2008-9: Less than What You Might Think and Less than the Fiscal Stimulus of Most OECD Countries", *The Economist's Voice*, 8, 1-6.

Auerbach, A. J. and Y. Gorodnichenko (2012), "Measuring the Output Responses to Fiscal Policy", *American Economic Journal*: *Economic Policy*, 4, 1-27.

Beetsma, R. and M. Giuliodori (2010), "Discretionary Fiscal Policy: Review and Estimates for the EU", CESifo Working Paper No. 2948.

Bernanke, B. S. and I. Mihov (1998), "Measuring Monetary Policy", *Quarterly Journal of Economics*, 113, 869-902.

Blanchard, O. and R. Perotti (2002), "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output", *Quarterly Journal of Economics*, 116, 1329-1368.

Candelon, B., J. Muysken and R. Vermeulen (2010), "Fiscal Policy and Monetary Integration in Europe", *Oxford Economic Papers*, 62, 323-349.

Chung, H. and E. M. Leeper (2007), "What Has Financed Government Debt?" NBER Working Paper No. 13425.

Cochrane, J. H. (1998), "What Do the VARs Mean? Measuring the Output Effects of Monetary Policy", *Journal of Monetary Economics*, 41, 277-300.

Coenen, G., R. Straub and M. Traband (2012), "Fiscal Policy and the Great Recession in the Euro Area", *American Economic Review (Papers and Proceedings)*, 102, 71-76.

Coibion, O. (2012), "Are the Effects of Monetary Policy Shocks Big or Small?", *American Economic Journal*: *Macroeconomics*, 4, 1-32.

Day, C. (2011), "China's Fiscal Stimulus and the Recession Australia Never Had: Is a Growth Slowdown Now Inevitable?", *Agenda*, 18, 23-34.

Dungey, M. and R. Fry (2009), "The Identification of Fiscal and Monetary Policy in a Structural VAR", *Economic Modelling*, 26, 1147-1160.

Dungey, M. and R. Fry (2010), "Fiscal and Monetary Policy in Australia: An SVAR Model", working paper.

Dungey, M. and A. Pagan (2000), "A Structural VAR Model of the Australian Economy", *Economic Record*, 76, 321-342.

Dungey, M. and A. Pagan (2009), "Extending a SVAR Model of the Australian Economy", *Economic Record*, 85, 1-20.

Dungey, M., G. Wells and S. Thompson (2011), "First Home Buyers' Support Schemes in Australia", *Australian Economic Review*, 44, 468-479.

Favero, C. and F. Giavazzi (2007), "Debt and the Effects of Fiscal Policy", NBER Working Paper 12822.

Fragetta, M. and T. Kirsanova (2010), "Strategic Monetary and Fiscal Policy Interactions: An Empirical Investigation", *European Economic Review*, 54, 856-879.

Freedman, C., Kumhof, M., Laxton, D., Muir, D. and S. Mursula (2010), "Global Effects of Fiscal Stimulus During the Crisis", *Journal of Monetary Economics*, 57, 506-526.

Fry, R. and A. Pagan (2011), "Sign Restrictions in Structural Vector Autoregressions: A Critical Survey", *Journal of Economic Literature*, 49, 938-960.

Kasa, K. and H. Popper (1997), "Monetary Policy in Japan: A Structural VAR Analysis", *Journal of the Japanese and International Economies*, 11, 275-295.
Kollmann, R., W. Roeger and J. in 't Veld (2012), "Fiscal Policy in a Financial Crisis: Standard Policy versus Bank Rescue Measures", *American Economic Review (Papers and Proceedings)*, 102, 77-81.
Makin, A. J. (2010), "Did Australia's Fiscal Stimulus Counter Recession?: Evidence from the National Accounts", *Agenda*, 17, 5-16.
Monacelli, T., R. Perotti and A. Trigari (2010), "Unemployment Fiscal Multipliers", *Journal of Monetary Economics*, 57, 531-553.
Mountford, A. and H. Uhlig (2009), "What Are the Effects of Fiscal Policy?", *Journal of Applied Econometrics*, 24, 960-992.
Muscatelli, V. A., P. Tirelli and C. Trecroci (2002), "Monetary and Fiscal Policy over the Cycle: Some Empirical Evidence", CESifo Working Paper No. 817.
Muscatelli, V. A., P. Tirelli and C. Trecroci (2004), "Fiscal and Monetary Policy Interactions: Empirical Evidence and Optimal Policy using a Structural New-Keynesian Model", *Journal of Monetary Economics*, 26, 257-280.
Nakashima, K. (2006), "The Bank of Japan's Operating Procedures and the Identification of Monetary Policy Shocks: A Reexamination using the Bernanke-Mihov Approach", *The Japanese and International Economies*, 20, 406-433.
Olivei, G. and S. Tenreyro (2007), "The Timing of Monetary Policy Shocks", *American Economic Review*, 97, 636-663.
Perotti, R. (2005), "Estimating the Effects of Fiscal Policy in OECD Countries", CEPR Discussion Paper No. 4842.
Ramey, V. A. (2011), "Identifying Government Spending Shocks: It's All in the Timing", *Quarterly Journal of Economics*, 126, 11-50.
Romer, C. D. and D. H. Romer (2010), "The Macroeconomic Effects of Tax Changes: Empirical Estimates Based on a New Measure of Fiscal Shocks", *American Economic Review*, 100, 763-801.
Smets, F. and R. Wouters (2007), "Shocks and Frictions in US Business Cycles: A Bayesian DSGE Approach", *American Economic Review*, 97, 586-606.
Toda, H. Y. and T. Yamamoto (1995), "Statistical Inference in Vector Autoregressions with Possibly Integrated Processes", *Journal of Econometrics*, 66, 225-250.
Weber, E. J. (1994), "The Role of Money during the Recession in Australia in 1990-92", *Applied Financial Economics*, 4, 355-361.

Appendix 1: Data

The data used are quarterly and the sample period runs from 1959(3) to 2011(4). The definitions of the variables and sources of the data are:

Y: GDP, seasonally adjusted, real; source: Australian Bureau of Statistics web-site (www.abs.gov.au)

G: central government, national, non-defence final consumption expenditure and gross fixed capital formation (both seasonally adjusted and real) plus total personal benefit payments which are not seasonally adjusted or real. Benefit payments were deflated by the personal consumption deflator and tested for seasonal components but found to have none and so are not seasonally adjusted. Source: Australian Bureau of Statistics web-site (www.abs.gov.au)

R: monthly cash rate for the period July 1998 to December 2011 and the 11 am call rate for the period March 1959 to June 1998. The monthly data were averaged to obtain quarterly data. They were found not to have any detectable seasonal components and are therefore not seasonally adjusted.
Source: Reserve Bank of Australia web-site (www.rba.gov.au).

X: exports of goods and services, real, seasonally adjusted; source: Australian Bureau of Statistics web-site (www.abs.gov.au)

GDP Deflator: deflator for GDP, seasonally adjusted; source: Australian Bureau of Statistics web-site (www.abs.gov.au)

CPI: All groups, Australia; source: Australian Bureau of Statistics web-site (www.abs.gov.au)

Imports: chain volume measure, seasonally adjusted; source: Australian Bureau of Statistics web-site (www.abs.gov.au)

Government debt:" Total Commonwealth Government Securities on Issue" for 1974

from the RBA plus accumulation of "Net Saving", central government, nominal, not seasonally adjusted; source: Australian Bureau of Statistics web-site (www.abs.gov.au) and Reserve Bank of Australia web-site (www.rba.gov.au). Deflated using the GDP deflator.

Commodity prices: RBA Index of Commodity Prices, all items, A$; source: Reserve Bank of Australia web-site (www.rba.gov.au).

TWI: Monthly data converted to quarterly by averaging; not seasonally adjusted; source: Reserve Bank of Australia web-site (www.rba.gov.au).

USD exchange rate: Monthly data converted to quarterly by averaging; not seasonally adjusted; source: Reserve Bank of Australia web-site (www.rba.gov.au).

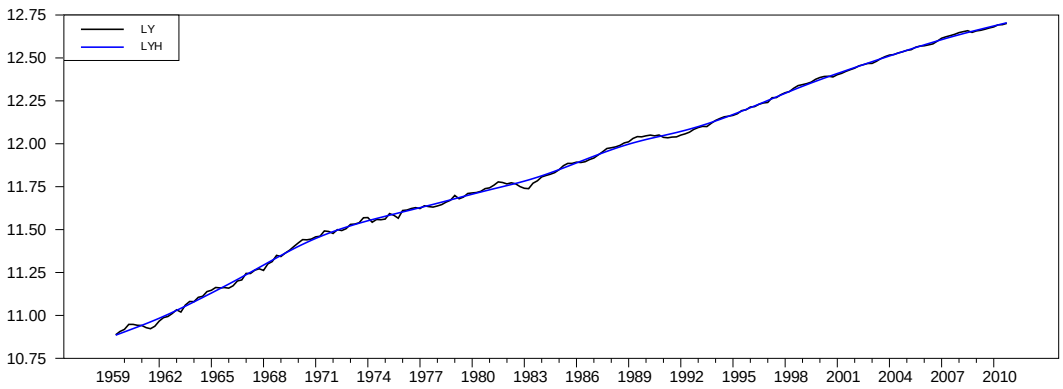
Real exchange rate: real trade-weighted; not seasonally adjusted; source: Reserve Bank of Australia web-site (www.rba.gov.au).

Income tax rates: Tax on income/income where tax on income is taken from Taxes on income – individuals: Central Government Income. Two definitions of income are used: Total primary income receivable and Total gross income receivable. All from the National Accounts

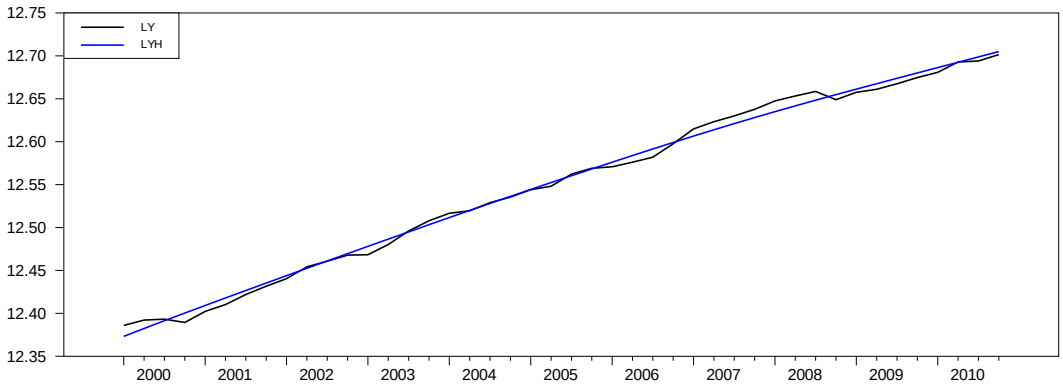
Labour-income tax rate: from the NIF data base accessed on dXtime

Graphs of original and de-trended data for the four core variables are reported below.

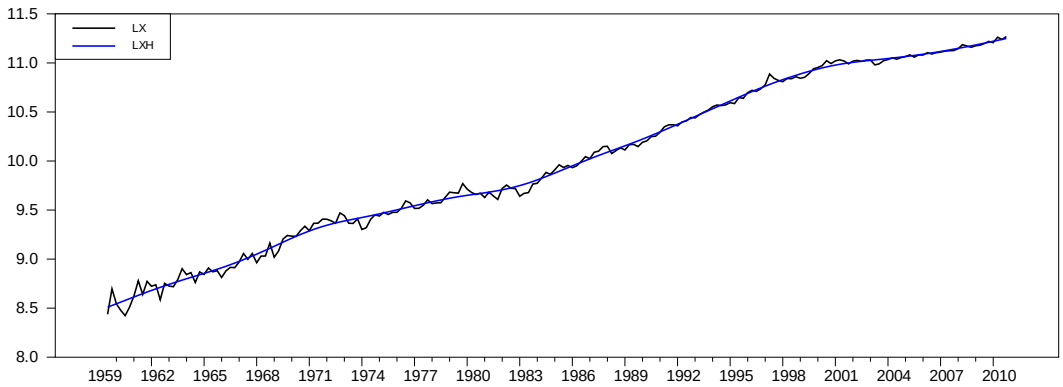
1. Output: (a) whole sample



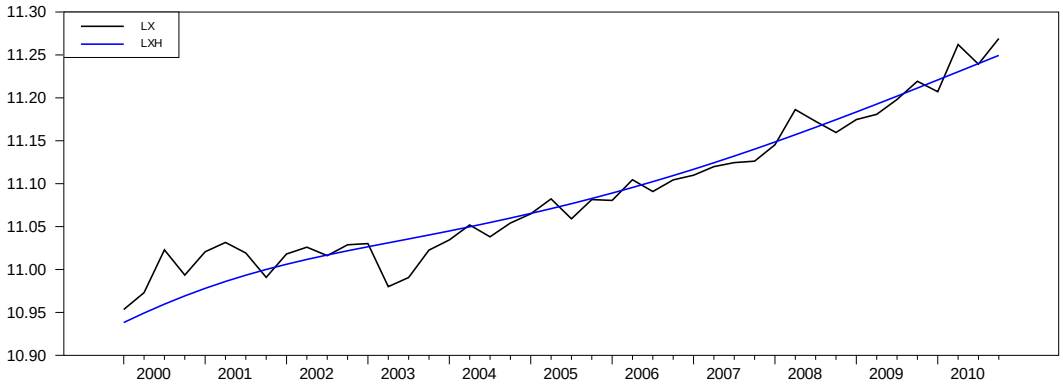
2. Output: (b) from 2000



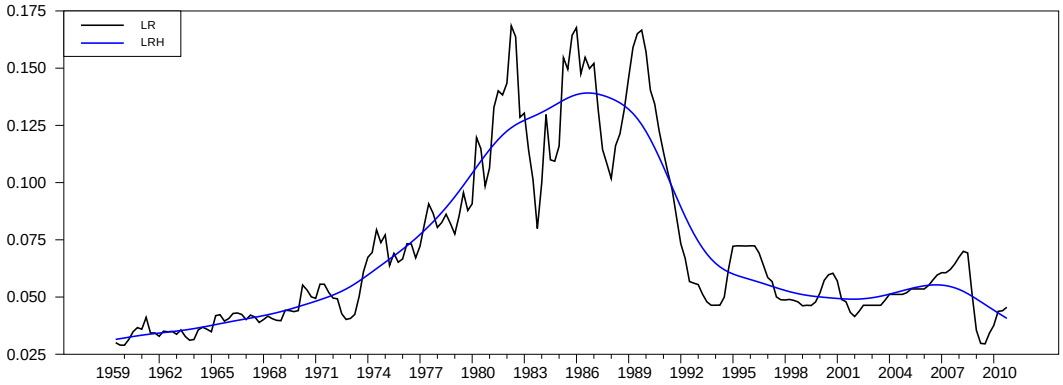
3. Exports: (a) whole sample



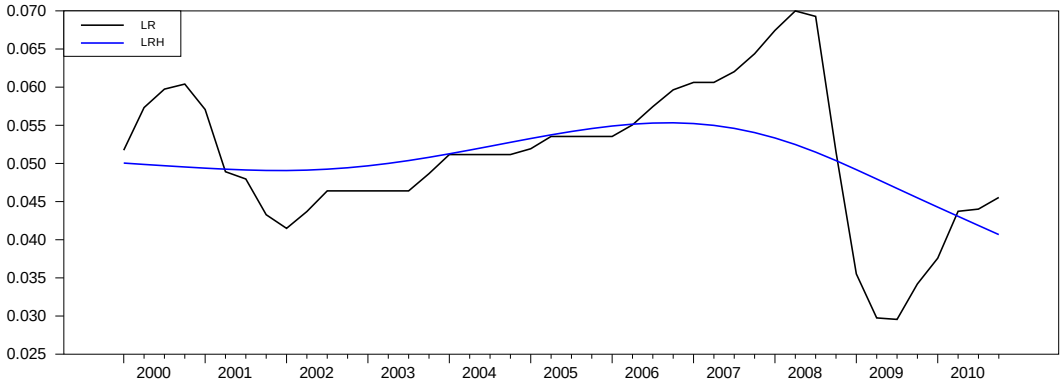
4. Exports: (b) from 2000



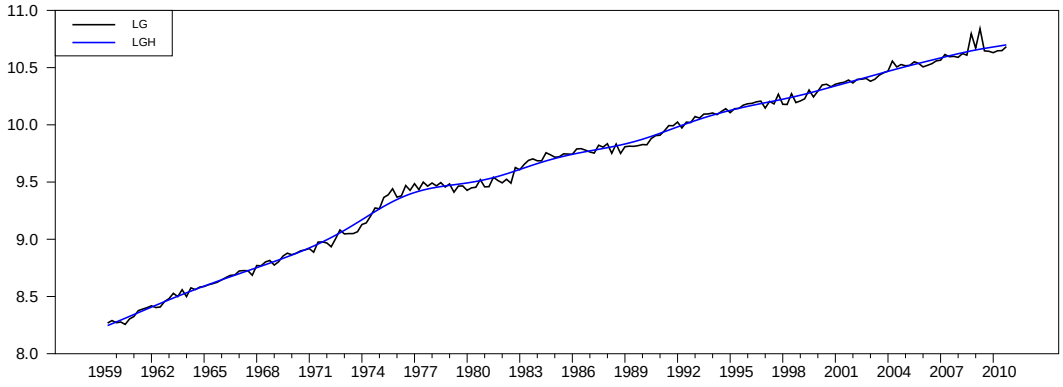
5. Cash rate: (a) whole sample



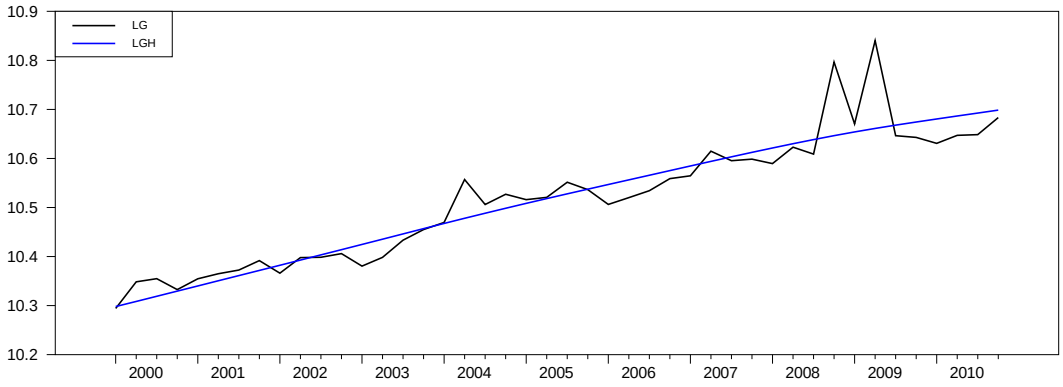
6. Cash rate: (b) from 2000



7. Government expenditure: (a) whole sample



8. Government expenditure: (b) from 2000



Appendix 2: Model estimates, one lag

Variable	Coefficient	Significance
X Equation		
X_{t-1}	0.5362	0.0000
G_{t-1}	-0.0002	0.9972
R_{t-1}	-0.1344	0.4373
Y_{y-1}	0.0175	0.9360
R^2	0.3153	
G Equation		
X_{t-1}	0.1219	0.2232
G_{t-1}	0.0797	0.3908
R_{t-1}	-0.0374	0.8719
Y_{y-1}	-0.9272	0.0019
R^2	0.1223	
R Equation		
X_{t-1}	0.0036	0.8755
G_{t-1}	-0.0242	0.2647
R_{t-1}	0.6781	0.0000
Y_{y-1}	0.3305	0.0000
R^2	0.7218	
Y Equation		
X_{t-1}	-0.0165	0.3767
G_{t-1}	-0.0171	0.3228
R_{t-1}	-0.1571	0.0004
Y_{y-1}	0.8986	0.0000
R^2	0.7158	

Appendix 2: Model estimates, two lags

Variable	Coefficient	Significance
X Equation		
X_{t-1}	0.5585	0.0000
X_{t-2}	-0.0549	0.5451
G_{t-1}	0.0103	0.8841
G_{y-2}	0.1291	0.0666
R_{t-1}	0.1390	0.6517
R_{t-2}	-0.2355	0.4073
Y_{t-1}	-0.1322	0.7247
Y_{y-2}	0.2158	0.5890
R^2	0.3306	
G Equation		
X_{t-1}	0.1039	0.3941
X_{t-2}	0.0183	0.8778
G_{t-1}	0.0465	0.6182
G_{y-2}	0.2773	0.0030
R_{t-1}	-0.1684	0.6772
R_{t-2}	0.4717	0.2072
Y_{t-1}	-0.4196	0.3955
Y_{y-2}	-0.4423	0.3997
R^2	0.1939	
R Equation		
X_{t-1}	0.0281	0.2991
X_{t-2}	-0.0691	0.0098
G_{t-1}	-0.0051	0.8033
G_{y-2}	0.0014	0.9465
R_{t-1}	0.8593	0.0000
R_{t-2}	-0.2513	0.0028
Y_{t-1}	0.0340	0.7553
Y_{y-2}	0.3473	0.0033
R^2	0.7699	
Y Equation		
X_{t-1}	-0.0039	0.8631
X_{t-2}	-0.0239	0.2824
G_{t-1}	-0.0084	0.6295
G_{y-2}	-0.0217	0.2050
R_{t-1}	-0.0105	0.8893
R_{t-2}	-0.1583	0.0242
Y_{t-1}	0.9382	0.0000
Y_{y-2}	-0.1030	0.2932
R^2	0.7393	

Appendix 3: Detailed results of sensitivity analysis

Table 1: Contributions to output 2007(1) to 2011(4): Sample 1959(3) to 2011(4)

Quarter	Exports	Fiscal	Monetary	Other output
Mar 2007	0.01	0.15	-0.02	0.79
June 2007	0.02	0.11	-0.10	0.93
Sept 2007	0.05	0.02	-0.10	1.05
Dec 2007	-0.01	0.02	-0.09	1.01
Mar 2008	0.09	0.03	-0.07	1.42
June 2008	0.17	0.05	-0.10	0.83
Sept 2008	0.09	0.04	-0.14	0.89
Dec 2008	0.00	-0.04	-0.42	0.04
Mar 2009	0.02	-0.29	-0.37	0.44
June 2009	-0.08	-0.27	-0.19	-0.09
Sept 2009	-0.11	-0.43	0.13	0.02
Dec 2009	-0.02	-0.23	0.29	-0.18
Mar 2010	0.10	-0.06	0.34	-0.42
June 2010	0.20	0.05	0.38	-0.60
Sept 2010	0.08	0.11	0.30	-0.74
Dec 2010	0.16	0.15	0.23	-0.72
Mar 2011	-0.18	0.14	0.16	-1.18
June 2011	-0.12	0.15	0.09	-0.36
Sept 2011	-0.06	0.16	-0.01	-0.11
Dec 2011	0.00	0.08	-0.08	-0.15

Note: derived from a model with one lag.

Table 2: Contributions to output 2007(1) to 2011(4): Sample period 1993(1) to 2011(4)

Quarter	Exports	Fiscal	Monetary	Other output
Mar 2007	-0.01	0.06	-0.10	0.96
June 2007	0.02	0.06	-0.12	0.99
Sept 2007	0.05	-0.02	-0.11	1.10
Dec 2007	-0.08	-0.03	-0.11	1.13
Mar 2008	0.09	-0.04	-0.12	1.51
June 2008	0.14	-0.02	-0.13	0.96
Sept 2008	-0.12	-0.02	-0.16	1.17
Dec 2008	-0.23	0.13	-0.22	-0.08
Mar 2009	-0.05	-0.14	-0.09	0.09
June 2009	-0.16	0.04	0.11	-0.61
Sept 2009	-0.04	-0.22	0.31	-0.42
Dec 2009	0.15	-0.14	0.38	-0.52
Mar 2010	0.24	-0.05	0.37	-0.60
June 2010	0.22	0.03	0.33	-0.56
Sept 2010	-0.16	0.05	0.23	-0.39
Dec 2010	-0.01	0.11	0.14	-0.43
Mar 2011	-0.56	0.09	0.06	-0.66
June 2011	-0.15	0.08	-0.03	-0.16
Sept 2011	0.08	0.13	-0.10	-0.13
Dec 2011	0.18	0.03	-0.13	-0.22

Table 3: Contributions to output 2007(1) to 2011(4): Model with two lags

Quarter	Exports	Fiscal	Monetary	Other output
Mar 2007	0.07	0.44	-0.08	0.52
June 2007	0.02	0.52	-0.26	0.67
Sept 2007	0.01	0.56	-0.42	0.90
Dec 2007	-0.11	0.48	-0.52	1.10
Mar 2008	-0.04	0.43	-0.52	1.65
June 2008	0.09	0.35	-0.47	0.99
Sept 2008	0.04	0.30	-0.41	0.95
Dec 2008	-0.11	0.09	-0.36	-0.05
Mar 2009	-0.05	-0.11	-0.28	0.22
June 2009	-0.21	-0.60	0.00	0.17
Sept 2009	-0.20	-0.74	0.45	0.10
Dec 2009	-0.13	-1.05	0.85	0.17
Mar 2010	0.11	-0.94	1.10	-0.33
June 2010	0.34	-0.74	1.15	-0.73
Sept 2010	0.23	-0.49	1.05	-1.08
Dec 2010	0.20	-0.20	0.82	-1.01
Mar 2011	-0.21	0.10	0.52	-1.47
June 2011	-0.26	0.34	0.17	-0.47
Sept 2011	-0.10	0.49	-0.18	-0.20
Dec 2011	0.11	0.58	-0.49	-0.35

Note: model estimated over a sample of 1980(1) to 2011(4).

Table 4: Contributions to output 2007(1) to 2011(4): Government expenditure includes state and local government expenditure

Quarter	Exports	Fiscal	Monetary	Other output
Mar 2007	0.04	0.10	-0.24	1.02
June 2007	0.03	0.10	-0.30	1.14
Sept 2007	0.05	0.03	-0.28	1.23
Dec 2007	-0.03	0.03	-0.24	1.17
Mar 2008	0.07	0.02	-0.20	1.58
June 2008	0.14	0.03	-0.19	0.98
Sept 2008	0.04	0.00	-0.19	1.04
Dec 2008	-0.07	-0.02	-0.25	-0.06
Mar 2009	0.01	-0.17	-0.08	0.06
June 2009	-0.12	-0.12	0.20	-0.57
Sept 2009	-0.10	-0.22	0.50	-0.56
Dec 2009	0.00	-0.14	0.67	-0.65
Mar 2010	0.11	-0.07	0.71	-0.79
June 2010	0.20	-0.03	0.68	-0.83
Sept 2010	0.04	0.01	0.54	-0.85
Dec 2010	0.11	0.05	0.39	-0.74
Mar 2011	-0.27	0.06	0.23	-1.10
June 2011	-0.17	0.08	0.05	-0.22
Sept 2011	-0.07	0.10	-0.15	0.09
Dec 2011	0.03	0.09	-0.30	0.03

Note: model estimated over a sample of 1980(1) to 2011(4) with one lag.

Table 5: Contributions to output 2007(1) to 2011(4): Fiscal policy measured as a surplus

Quarter	Exports	Fiscal	Monetary	Other output
Mar 2007	-0.01	0.54	-0.37	0.81
June 2007	-0.02	0.66	-0.57	0.91
Sept 2007	-0.01	0.69	-0.68	1.06
Dec 2007	-0.09	0.64	-0.73	1.15
Mar 2008	-0.02	0.51	-0.67	1.74
June 2008	0.07	0.50	-0.61	1.03
Sept 2008	-0.02	0.45	-0.47	0.95
Dec 2008	-0.17	0.31	-0.31	-0.27
Mar 2009	-0.12	-0.02	-0.05	-0.03
June 2009	-0.14	-0.29	0.26	-0.48
Sept 2009	-0.12	-0.57	0.74	-0.45
Dec 2009	-0.01	-0.91	1.14	-0.38
Mar 2010	0.15	-1.15	1.40	-0.46
June 2010	0.25	-1.08	1.41	-0.58
Sept 2010	0.07	-0.95	1.30	-0.73
Dec 2010	0.03	-0.73	0.99	-0.52
Mar 2011	-0.30	-0.51	0.60	-0.90
June 2011	-0.28	-0.15	0.16	0.04
Sept 2011	-0.04	0.14	-0.28	0.19
Dec 2011	0.17	0.34	-0.62	-0.03

Note: model estimated over a sample of 1980(1) to 2011(4) with one lag.

Table 6: Contributions to output 2007(1) to 2011(4): Using IMP for Monetary Policy

Quarter	Exports	Fiscal	Monetary	IMP	Other output
Mar 2007	0.04	0.19	-0.27	0.04	0.98
June 2007	0.03	0.16	-0.31	0.05	1.10
Sept 2007	0.05	0.06	-0.29	-0.05	1.21
Dec 2007	-0.03	0.04	-0.25	-0.12	1.17
Mar 2008	0.06	0.03	-0.21	-0.34	1.59
June 2008	0.14	0.06	-0.20	-0.37	0.97
Sept 2008	0.04	0.03	-0.21	-0.51	1.03
Dec 2008	-0.07	0.01	-0.24	-0.63	-0.09
Mar 2009	0.01	-0.30	-0.05	-0.58	0.15
June 2009	-0.12	-0.26	0.25	-0.32	-0.49
Sept 2009	-0.09	-0.48	0.54	0.03	-0.35
Dec 2009	0.00	-0.31	0.68	0.28	-0.50
Mar 2010	0.11	-0.14	0.70	0.38	-0.72
June 2010	0.20	0.00	0.65	0.36	-0.84
Sept 2010	0.03	0.09	0.53	0.37	-0.91
Dec 2010	0.11	0.17	0.39	0.23	-0.85
Mar 2011	-0.27	0.18	0.24	0.03	-1.22
June 2011	-0.17	0.19	0.05	-0.26	-0.33
Sept 2011	-0.08	0.21	-0.14	-0.40	-0.03
Dec 2011	0.02	0.11	-0.27	-0.39	-0.02

Table 7: Contributions to output 2007(1) to 2011(4): International effects measured by terms of trade

Quarter	Terms of Trade	Fiscal	Monetary	Other output
Mar 2007	0.04	0.23	-0.21	0.90
June 2007	0.01	0.23	-0.24	1.00
Sept 2007	-0.03	0.14	-0.20	1.15
Dec 2007	-0.07	0.11	-0.15	1.08
Mar 2008	-0.10	0.09	-0.13	1.66
June 2008	-0.12	0.10	-0.14	1.14
Sept 2008	0.00	0.07	-0.17	1.02
Dec 2008	0.13	0.06	-0.18	-0.43
Mar 2009	0.15	-0.26	0.06	-0.15
June 2009	0.07	-0.26	0.41	-0.87
Sept 2009	-0.08	-0.53	0.70	-0.49
Dec 2009	-0.16	-0.45	0.81	-0.35
Mar 2010	-0.22	-0.31	0.76	-0.31
June 2010	-0.23	-0.17	0.63	-0.24
Sept 2010	-0.09	-0.06	0.42	-0.56
Dec 2010	-0.01	0.06	0.23	-0.49
Mar 2011	0.03	0.13	0.05	-1.31
June 2011	0.07	0.18	-0.15	-0.37
Sept 2011	0.13	0.26	-0.31	-0.10
Dec 2011	0.15	0.20	-0.40	-0.10

Note: model estimated over a sample of 1980(1) to 2011(4) with one lag.

Table 8: Contributions to output 2007(1) to 2011(4): Identification using Cholesky

Quarter	Exports	Fiscal	Monetary	Other output
Mar 2007	0.04	0.19	-0.06	0.77
June 2007	0.03	0.03	-0.07	0.97
Sept 2007	0.05	-0.08	-0.07	1.13
Dec 2007	-0.03	-0.11	-0.06	1.12
Mar 2008	0.07	-0.09	-0.04	1.52
June 2008	0.14	-0.10	-0.03	0.95
Sept 2008	0.04	-0.12	-0.05	1.01
Dec 2008	-0.07	-0.39	-0.10	0.15
Mar 2009	0.02	-0.47	-0.20	0.46
June 2009	-0.12	-0.50	0.04	-0.05
Sept 2009	-0.09	-0.38	0.08	-0.01
Dec 2009	0.00	0.01	0.10	-0.24
Mar 2010	0.11	0.29	0.10	-0.53
June 2010	0.19	0.43	0.16	-0.76
Sept 2010	0.03	0.49	0.13	-0.90
Dec 2010	0.11	0.46	0.16	-0.91
Mar 2011	-0.27	0.37	0.17	-1.34
June 2011	-0.17	0.32	0.15	-0.55
Sept 2011	-0.07	0.17	0.12	-0.25
Dec 2011	0.03	0.03	0.00	-0.21

Note: model estimated over a sample of 1980(1) to 2011(4) with one lag.

Table 9A: Augmented Dickey-Fuller tests for log of variables, not de-trended

	Deterministic Component	
Variable	Intercept	Intercept and trend
X	0.4596	0.5301
G	0.2356	0.5322
R	0.1139	0.3458
Y	0.4378	0.5861

Notes: figures in the table are marginal significance levels; all tests were run with 4 lags; sample 1959:3 to 2011:4

Table 9B: Augmented Dickey-Fuller tests for first-differences of log of variables, not de-trended

	Deterministic Component	
Variable	None	Intercept
X	0.0000	0.0000
G	0.0000	0.0000
R	0.0000	0.0000
Y	0.0034	0.0000

Notes: figures in the table are marginal significance levels; all tests were run with 4 lags; sample 1959:3 to 2011:4

Table 9C: Johansen cointegration tests for log of variables, not de-trended

	Deterministic Component	
Test	No trends	Trend in CV
Trace	0.0831	0.4362
Eigenvalue	0.5068	0.7817

Notes: figures in the table are marginal significance levels; all tests were run with 4 lags; sample 1959:3 to 2011:4

Table 10: Contributions to output 2007(1) to 2011(4): Model in log levels, no trend

Quarter	Exports	Fiscal	Monetary	Other output
Mar 2007	-0.75	-0.07	-0.08	2.33
June 2007	-0.81	0.06	-0.09	2.30
Sept 2007	-0.64	0.02	-0.02	2.50
Dec 2007	-0.83	0.16	-0.01	2.51
Mar 2008	-0.72	0.64	0.02	3.26
June 2008	0.30	0.95	-0.05	2.40
Sept 2008	0.29	0.56	-0.10	2.27
Dec 2008	-0.36	0.21	-0.19	1.02
Mar 2009	-0.44	0.30	-0.23	1.10
June 2009	-0.83	-0.81	-0.17	0.67
Sept 2009	-0.61	-0.49	0.03	0.49
Dec 2009	-0.55	-0.03	0.26	0.35
Mar 2010	-0.48	0.20	0.42	0.06
June 2010	-0.39	0.38	0.55	-0.16
Sept 2010	-0.19	0.19	0.57	-0.71
Dec 2010	-0.29	0.29	0.64	-0.63
Mar 2011	-0.49	0.93	0.65	-1.05
June 2011	-0.75	1.23	0.68	-0.07
Sept 2011	-0.75	1.22	0.65	-0.07
Dec 2011	-0.64	1.03	0.61	-0.73

Note: model estimated over a sample of 1980(1) to 2011(4) with two lags.

Table 11: Contributions to output 2007(1) to 2011(4): Model in log levels with trend

Quarter	Exports	Fiscal	Monetary	Other output
Mar 2007	-0.26	-0.18	0.68	1.91
June 2007	-0.28	-0.18	0.61	2.07
Sept 2007	-0.19	-0.14	0.53	2.04
Dec 2007	-0.30	-0.09	0.45	1.99
Mar 2008	-0.21	-0.02	0.37	2.29
June 2008	0.22	0.03	0.29	1.71
Sept 2008	0.18	0.04	0.22	1.68
Dec 2008	-0.16	-0.01	0.16	0.57
Mar 2009	-0.14	0.08	0.13	0.48
June 2009	-0.41	0.04	0.19	-0.04
Sept 2009	-0.36	0.14	0.38	-0.24
Dec 2009	-0.37	0.15	0.61	-0.44
Mar 2010	-0.27	0.10	0.83	-0.85
June 2010	-0.16	-0.03	0.97	-1.20
Sept 2010	-0.18	-0.15	1.05	-1.43
Dec 2010	-0.23	-0.24	1.02	-1.48
Mar 2011	-0.56	-0.25	0.90	-2.10
June 2011	-0.69	-0.23	0.70	-1.30
Sept 2011	-0.61	-0.21	0.44	-1.13
Dec 2011	-0.45	-0.16	0.14	-1.29

Note: model estimated over a sample of 1980(1) to 2011(4) with two lags.

Table 12: Contributions to output 2007(1) to 2011(4): Model using linearly-de-trended data

Quarter	Exports	Fiscal	Monetary	Other output
Mar 2007	-0.67	0.06	0.36	1.64
June 2007	-0.68	0.01	0.31	1.79
Sept 2007	-0.59	0.04	0.28	1.76
Dec 2007	-0.72	0.04	0.25	1.69
Mar 2008	-0.58	0.07	0.21	1.98
June 2008	-0.18	0.04	0.16	1.41
Sept 2008	-0.32	0.05	0.08	1.43
Dec 2008	-0.60	-0.12	-0.01	0.40
Mar 2009	-0.56	0.05	0.04	0.19
June 2009	-0.79	-0.11	0.18	-0.28
Sept 2009	-0.68	0.09	0.35	-0.56
Dec 2009	-0.69	0.11	0.48	-0.74
Mar 2010	-0.67	0.12	0.56	-1.01
June 2010	-0.69	0.11	0.58	-1.22
Sept 2010	-0.81	0.12	0.53	-1.38
Dec 2010	-0.83	0.09	0.43	-1.46
Mar 2011	-1.24	0.09	0.31	-2.02
June 2011	-1.26	0.12	0.15	-1.39
Sept 2011	-1.25	0.05	-0.01	-1.17
Dec 2011	-1.24	0.07	-0.17	-1.30

Note: model estimated over a sample of 1980(1) to 2011(4) with two lags.

Table 13: Contributions to output 2007(1) to 2011(4): Base model with inflation

Quarter	Exports	Fiscal	Monetary	Other output
Mar 2007	0.04	0.21	-0.20	0.94
June 2007	0.03	0.20	-0.25	1.07
Sept 2007	0.04	0.09	-0.24	1.20
Dec 2007	-0.04	0.06	-0.21	1.18
Mar 2008	0.07	0.04	-0.20	1.59
June 2008	0.14	0.06	-0.19	0.99
Sept 2008	0.06	0.03	-0.22	1.04
Dec 2008	-0.04	0.02	-0.25	-0.13
Mar 2009	0.02	-0.34	-0.02	0.16
June 2009	-0.15	-0.29	0.32	-0.44
Sept 2009	-0.15	-0.52	0.60	-0.23
Dec 2009	-0.04	-0.35	0.69	-0.38
Mar 2010	0.10	-0.17	0.66	-0.63
June 2010	0.20	-0.02	0.60	-0.79
Sept 2010	0.07	0.08	0.46	-0.92
Dec 2010	0.14	0.16	0.37	-0.88
Mar 2011	-0.25	0.19	0.25	-1.25
June 2011	-0.16	0.22	0.08	-0.37
Sept 2011	-0.06	0.26	-0.10	-0.09
Dec 2011	0.03	0.15	-0.23	-0.06

Table 14: Contributions to output 2007(1) to 2011(4): Base model with imports

Quarter	Exports	Fiscal	Monetary	Other output
Mar 2007	-0.03	0.24	-0.08	0.88
June 2007	-0.03	0.22	-0.19	0.97
Sept 2007	-0.01	0.11	-0.21	1.12
Dec 2007	-0.08	0.06	-0.20	1.12
Mar 2008	0.04	0.02	-0.19	1.56
June 2008	0.13	0.03	-0.18	0.92
Sept 2008	0.04	0.00	-0.17	0.94
Dec 2008	-0.07	0.02	-0.16	-0.25
Mar 2009	-0.01	-0.31	0.16	0.12
June 2009	-0.14	-0.27	0.54	-0.43
Sept 2009	-0.13	-0.54	0.82	-0.12
Dec 2009	-0.01	-0.41	0.84	-0.21
Mar 2010	0.13	-0.23	0.68	-0.45
June 2010	0.23	-0.05	0.50	-0.60
Sept 2010	0.06	0.08	0.26	-0.72
Dec 2010	0.12	0.20	0.06	-0.69
Mar 2011	-0.27	0.25	-0.13	-1.10
June 2011	-0.16	0.27	-0.32	-0.27
Sept 2011	-0.04	0.30	-0.47	-0.06
Dec 2011	0.07	0.20	-0.56	-0.13

Table 15: Contributions to output 2007(1) to 2011(4): Base model with TWI

Quarter	Exports	Fiscal	Monetary	Other output
Mar 2007	0.00	0.25	-0.15	0.91
June 2007	-0.01	0.23	-0.24	1.03
Sept 2007	0.01	0.12	-0.26	1.19
Dec 2007	-0.07	0.09	-0.23	1.18
Mar 2008	0.04	0.07	-0.19	1.62
June 2008	0.12	0.08	-0.16	1.02
Sept 2008	0.03	0.04	-0.14	1.12
Dec 2008	-0.09	0.02	-0.15	0.01
Mar 2009	-0.02	-0.35	0.08	0.25
June 2009	-0.14	-0.30	0.33	-0.47
Sept 2009	-0.12	-0.56	0.50	-0.30
Dec 2009	0.00	-0.41	0.56	-0.47
Mar 2010	0.13	-0.23	0.51	-0.70
June 2010	0.21	-0.07	0.44	-0.84
Sept 2010	0.05	0.04	0.31	-0.93
Dec 2010	0.12	0.16	0.19	-0.89
Mar 2011	-0.27	0.20	0.05	-1.26
June 2011	-0.16	0.23	-0.09	-0.38
Sept 2011	-0.05	0.27	-0.23	-0.08
Dec 2011	0.05	0.16	-0.31	-0.05

Table 16: Contributions to output 2007(1) to 2011(4): Base model with real exchange rate

Quarter	Exports	Fiscal	Monetary	Other output
Mar 2007	0.00	0.26	-0.14	0.91
June 2007	-0.01	0.24	-0.24	1.02
Sept 2007	0.01	0.13	-0.25	1.18
Dec 2007	-0.07	0.09	-0.23	1.17
Mar 2008	0.04	0.07	-0.20	1.62
June 2008	0.12	0.08	-0.17	1.03
Sept 2008	0.02	0.04	-0.16	1.14
Dec 2008	-0.09	0.01	-0.19	0.04
Mar 2009	-0.01	-0.37	0.04	0.24
June 2009	-0.13	-0.32	0.29	-0.52
Sept 2009	-0.11	-0.59	0.49	-0.36
Dec 2009	0.01	-0.42	0.56	-0.54
Mar 2010	0.13	-0.22	0.53	-0.75
June 2010	0.21	-0.06	0.47	-0.87
Sept 2010	0.04	0.06	0.35	-0.94
Dec 2010	0.12	0.18	0.24	-0.90
Mar 2011	-0.27	0.22	0.11	-1.25
June 2011	-0.15	0.24	-0.04	-0.37
Sept 2011	-0.05	0.29	-0.19	-0.06
Dec 2011	0.05	0.17	-0.28	-0.03

Table 17: Contributions to output 2007(1) to 2011(4): Base model with commodity prices

Quarter	Exports	Fiscal	Monetary	Other output
Mar 2007	0.05	0.37	-0.20	0.40
June 2007	0.02	0.33	-0.37	0.66
Sept 2007	0.02	0.30	-0.42	0.84
Dec 2007	-0.12	0.28	-0.41	0.95
Mar 2008	0.04	0.29	-0.37	1.36
June 2008	0.16	0.27	-0.33	0.83
Sept 2008	0.07	0.26	-0.30	0.86
Dec 2008	0.00	-0.10	-0.39	0.05
Mar 2009	0.17	-0.20	-0.27	-0.06
June 2009	0.01	-0.56	-0.01	-0.40
Sept 2009	-0.10	-0.64	0.24	-0.27
Dec 2009	-0.02	-0.58	0.47	-0.32
Mar 2010	0.09	-0.47	0.59	-0.43
June 2010	0.20	-0.36	0.67	-0.51
Sept 2010	0.01	-0.20	0.63	-0.62
Dec 2010	0.19	-0.06	0.55	-0.71
Mar 2011	-0.37	0.05	0.41	-0.96
June 2011	-0.17	0.20	0.23	-0.31
Sept 2011	-0.02	0.21	0.02	-0.07
Dec 2011	0.10	0.23	-0.17	-0.19

Note: model estimated over the period 1982(3) to 2011(4).

Table 18: Contributions to output 2007(1) to 2011(4): Base model with labour-income tax rate

Quarter	Exports	Fiscal	Monetary	Other output	Tax Rate
Mar 2007	0.13	0.38	-0.05	0.37	0.11
June 2007	0.05	0.54	-0.25	0.44	0.21
Sept 2007	0.02	0.63	-0.45	0.61	0.25
Dec 2007	-0.14	0.60	-0.57	0.84	0.21
Mar 2008	-0.07	0.61	-0.58	1.42	0.13
June 2008	0.08	0.55	-0.53	0.80	0.05
Sept 2008	0.04	0.49	-0.46	0.83	-0.01
Dec 2008	-0.11	0.24	-0.42	-0.09	-0.05
Mar 2009	-0.04	-0.06	-0.33	0.26	-0.03
June 2009	-0.22	-0.65	-0.06	0.25	0.02
Sept 2009	-0.25	-0.86	0.40	0.24	0.07
Dec 2009	-0.19	-1.23	0.82	0.37	0.07
Mar 2010	0.07	-1.10	1.10	-0.21	0.08
June 2010	0.34	-0.90	1.20	-0.71	0.08
Sept 2010	0.26	-0.61	1.14	-1.18	0.11
Dec 2010	0.23	-0.24	0.91	-1.22	0.14
Mar 2011	-0.21	0.15	0.61	-1.67	0.06
June 2011	-0.27	0.44	0.25	-0.58	-0.06
Sept 2011	-0.08	0.63	-0.10	-0.30	-0.14
Dec 2011	0.12	0.72	-0.42	-0.39	-0.18

Table 19: Contributions to output 2007(1) to 2011(4): Base model with real government debt/real GDP

Quarter	Exports	Fiscal	Monetary	Other output
Mar 2007	0.05	0.15	-0.01	0.84
June 2007	0.04	0.13	-0.09	1.00
Sept 2007	0.06	0.03	-0.09	1.19
Dec 2007	-0.02	0.03	-0.10	1.21
Mar 2008	0.08	0.05	-0.12	1.69
June 2008	0.16	0.10	-0.18	1.14
Sept 2008	0.07	0.12	-0.27	1.33
Dec 2008	-0.03	0.18	-0.48	0.30
Mar 2009	0.02	-0.09	-0.47	0.61
June 2009	-0.11	-0.04	-0.34	-0.06
Sept 2009	-0.12	-0.30	-0.12	0.02
Dec 2009	-0.02	-0.19	0.01	-0.24
Mar 2010	0.09	-0.08	0.09	-0.56
June 2010	0.18	0.01	0.16	-0.80
Sept 2010	0.02	0.05	0.16	-0.96
Dec 2010	0.10	0.10	0.15	-0.97
Mar 2011	-0.27	0.08	0.13	-1.38
June 2011	-0.17	0.08	0.08	-0.53
Sept 2011	-0.08	0.10	-0.01	-0.24
Dec 2011	0.02	0.01	-0.07	-0.22

Editor, UWA Economics Discussion Papers:
Ernst Juerg Weber
Business School – Economics
University of Western Australia
35 Sterling Hwy
Crawley WA 6009
Australia

Email: ecoadmin@biz.uwa.edu.au

The Economics Discussion Papers are available at:
1980 – 2002: http://ecompapers.biz.uwa.edu.au/paper/PDF%20of%20Discussion%20Papers/
Since 2001: http://ideas.repec.org/s/uwa/wpaper1.html
Since 2004: http://www.business.uwa.edu.au/school/disciplines/economics

ECONOMICS DISCUSSION PAPERS
2011

DP NUMBER	AUTHORS	TITLE
11.01	Robertson, P.E.	DEEP IMPACT: CHINA AND THE WORLD ECONOMY
11.02	Kang, C. and Lee, S.H.	BEING KNOWLEDGEABLE OR SOCIABLE? DIFFERENCES IN RELATIVE IMPORTANCE OF COGNITIVE AND NON-COGNITIVE SKILLS
11.03	Turkington, D.	DIFFERENT CONCEPTS OF MATRIX CALCULUS
11.04	Golley, J. and Tyers, R.	CONTRASTING GIANTS: DEMOGRAPHIC CHANGE AND ECONOMIC PERFORMANCE IN CHINA AND INDIA
11.05	Collins, J., Baer, B. and Weber, E.J.	ECONOMIC GROWTH AND EVOLUTION: PARENTAL PREFERENCE FOR QUALITY AND QUANTITY OF OFFSPRING
11.06	Turkington, D.	ON THE DIFFERENTIATION OF THE LOG LIKELIHOOD FUNCTION USING MATRIX CALCULUS
11.07	Groenewold, N. and Paterson, J.E.H.	STOCK PRICES AND EXCHANGE RATES IN AUSTRALIA: ARE COMMODITY PRICES THE MISSING LINK?
11.08	Chen, A. and Groenewold, N.	REDUCING REGIONAL DISPARITIES IN CHINA: IS INVESTMENT ALLOCATION POLICY EFFECTIVE?
11.09	Williams, A., Birch, E. and Hancock, P.	THE IMPACT OF ON-LINE LECTURE RECORDINGS ON STUDENT PERFORMANCE
11.10	Pawley, J. and Weber, E.J.	INVESTMENT AND TECHNICAL PROGRESS IN THE G7 COUNTRIES AND AUSTRALIA
11.11	Tyers, R.	AN ELEMENTAL MACROECONOMIC MODEL FOR APPLIED ANALYSIS AT UNDERGRADUATE LEVEL
11.12	Clements, K.W. and Gao, G.	QUALITY, QUANTITY, SPENDING AND PRICES

11.13	Tyers, R. and Zhang, Y.	JAPAN'S ECONOMIC RECOVERY: INSIGHTS FROM MULTI-REGION DYNAMICS
11.14	McLure, M.	A. C. PIGOU'S REJECTION OF PARETO'S LAW
11.15	Kristoffersen, I.	THE SUBJECTIVE WELLBEING SCALE: HOW REASONABLE IS THE CARDINALITY ASSUMPTION?
11.16	Clements, K.W., Izan, H.Y. and Lan, Y.	VOLATILITY AND STOCK PRICE INDEXES
11.17	Parkinson, M.	SHANN MEMORIAL LECTURE 2011: SUSTAINABLE WELLBEING – AN ECONOMIC FUTURE FOR AUSTRALIA
11.18	Chen, A. and Groenewold, N.	THE NATIONAL AND REGIONAL EFFECTS OF FISCAL DECENTRALISATION IN CHINA
11.19	Tyers, R. and Corbett, J.	JAPAN'S ECONOMIC SLOWDOWN AND ITS GLOBAL IMPLICATIONS: A REVIEW OF THE ECONOMIC MODELLING
11.20	Wu, Y.	GAS MARKET INTEGRATION: GLOBAL TRENDS AND IMPLICATIONS FOR THE EAS REGION
11.21	Fu, D., Wu, Y. and Tang, Y.	DOES INNOVATION MATTER FOR CHINESE HIGH-TECH EXPORTS? A FIRM-LEVEL ANALYSIS
11.22	Fu, D. and Wu, Y.	EXPORT WAGE PREMIUM IN CHINA'S MANUFACTURING SECTOR: A FIRM LEVEL ANALYSIS
11.23	Li, B. and Zhang, J.	SUBSIDIES IN AN ECONOMY WITH ENDOGENOUS CYCLES OVER NEOCLASSICAL INVESTMENT AND NEO-SCHUMPETERIAN INNOVATION REGIMES
11.24	Krey, B., Widmer, P.K. and Zweifel, P.	EFFICIENT PROVISION OF ELECTRICITY FOR THE UNITED STATES AND SWITZERLAND
11.25	Wu, Y.	ENERGY INTENSITY AND ITS DETERMINANTS IN CHINA'S REGIONAL ECONOMIES

ECONOMICS DISCUSSION PAPERS 2012		
DP NUMBER	**AUTHORS**	**TITLE**
12.01	Clements, K.W., Gao, G., and Simpson, T.	DISPARITIES IN INCOMES AND PRICES INTERNATIONALLY
12.02	Tyers, R.	THE RISE AND ROBUSTNESS OF ECONOMIC FREEDOM IN CHINA
12.03	Golley, J. and Tyers, R.	DEMOGRAPHIC DIVIDENDS, DEPENDENCIES AND ECONOMIC GROWTH IN CHINA AND INDIA
12.04	Tyers, R.	LOOKING INWARD FOR GROWTH
12.05	Knight, K. and McLure, M.	THE ELUSIVE ARTHUR PIGOU
12.06	McLure, M.	ONE HUNDRED YEARS FROM TODAY: A. C. PIGOU'S WEALTH AND WELFARE
12.07	Khuu, A. and Weber, E.J.	HOW AUSTRALIAN FARMERS DEAL WITH RISK
12.08	Chen, M. and Clements, K.W.	PATTERNS IN WORLD METALS PRICES
12.09	Clements, K.W.	UWA ECONOMICS HONOURS
12.10	Golley, J. and Tyers, R.	CHINA'S GENDER IMBALANCE AND ITS ECONOMIC PERFORMANCE
12.11	Weber, E.J.	AUSTRALIAN FISCAL POLICY IN THE AFTERMATH OF THE GLOBAL FINANCIAL CRISIS
12.12	Hartley, P.R. and Medlock III, K.B.	CHANGES IN THE OPERATIONAL EFFICIENCY OF NATIONAL OIL COMPANIES
12.13	Li, L.	HOW MUCH ARE RESOURCE PROJECTS WORTH? A CAPITAL MARKET PERSPECTIVE
12.14	Chen, A. and Groenewold, N.	THE REGIONAL ECONOMIC EFFECTS OF A REDUCTION IN CARBON EMISSIONS AND AN EVALUATION OF OFFSETTING POLICIES IN CHINA
12.15	Collins, J., Baer, B. and Weber, E.J.	SEXUAL SELECTION, CONSPICUOUS CONSUMPTION AND ECONOMIC GROWTH
12.16	Wu, Y.	TRENDS AND PROSPECTS IN CHINA'S R&D SECTOR
12.17	Cheong, T.S. and Wu, Y.	INTRA-PROVINCIAL INEQUALITY IN CHINA: AN ANALYSIS OF COUNTY-LEVEL DATA
12.18	Cheong, T.S.	THE PATTERNS OF REGIONAL INEQUALITY IN CHINA
12.19	Wu, Y.	ELECTRICITY MARKET INTEGRATION: GLOBAL TRENDS AND IMPLICATIONS FOR THE EAS REGION
12.20	Knight, K.	EXEGESIS OF DIGITAL TEXT FROM THE HISTORY OF ECONOMIC THOUGHT: A COMPARATIVE EXPLORATORY TEST
12.21	Chatterjee, I.	COSTLY REPORTING, EX-POST MONITORING, AND COMMERCIAL PIRACY: A GAME THEORETIC ANALYSIS
12.22	Pen, S.E.	QUALITY-CONSTANT ILLICIT DRUG PRICES
12.23	Cheong, T.S. and Wu, Y.	REGIONAL DISPARITY, TRANSITIONAL DYNAMICS AND CONVERGENCE IN CHINA

12.24	Ezzati, P.	FINANCIAL MARKETS INTEGRATION OF IRAN WITHIN THE MIDDLE EAST AND WITH THE REST OF THE WORLD
12.25	Kwan, F., Wu, Y. and Zhuo, S.	RE-EXAMINATION OF THE SURPLUS AGRICULTURAL LABOUR IN CHINA
12.26	Wu. Y.	R&D BEHAVIOUR IN CHINESE FIRMS
12.27	Tang, S.H.K. and Yung, L.C.W.	MAIDS OR MENTORS? THE EFFECTS OF LIVE-IN FOREIGN DOMESTIC WORKERS ON SCHOOL CHILDREN'S EDUCATIONAL ACHIEVEMENT IN HONG KONG
12.28	Groenewold, N.	AUSTRALIA AND THE GFC: SAVED BY ASTUTE FISCAL POLICY?

ECONOMICS DISCUSSION PAPERS 2013		
DP NUMBER	**AUTHORS**	**TITLE**
13.01	Chen, M., Clements, K.W. and Gao, G.	THREE FACTS ABOUT WORLD METAL PRICES
13.02	Collins, J. and Richards, O.	EVOLUTION, FERTILITY AND THE AGEING POPULATION