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LONG- AND SHORT-RUN EFFECTS OF INCOME INEQUALITY ON THE PER CAPITA OUTPUT OF AUSTRALIAN STATES

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Abstract:
This paper makes two contributions. Firstly, using taxation statistics we compile consistently defined Gini coefficients for the period 1942–2013 for all Australian states and territories. The computed Gini coefficients are comparable with available series reported by the Australian Bureau of Statistics. While income inequality exhibited a downward trend until 1979, it has since been on the rise not only over time, but also across states and territories. Secondly, we examine long- and short-run effects of income inequality by state on per capita output using all available panel data (1986–2013). We find that income inequality adversely affects per capita output in the long-run in the larger states (New South Wales, Queensland, South Australia and Victoria) with the opposite occurring in the ACT. Our findings are consistent with median voter theory when mean income exceeds the median income, incentivising individuals to vote for redistributive taxes and transfers.

Keywords: Gini coefficient, Taxation, Income Distribution, States and territories, Australia.

JEL Classification Numbers: D31, E25, H24, O15

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1. INTRODUCTION

The relationship between income inequality and economic growth has been much studied. This is not surprising because this relationship has important policy implications. If income inequality enhances (hinders) economic growth this would provide a strong argument against (in favour of) redistributive policies. The effect of income inequality on economic growth, however, remains open to debate. One reason for this is that most studies that have examined this relationship have done so using cross-country data for large numbers of countries. There are myriad problems with cross-country aggregate data, including cross-country heterogeneity of data and measurement standards, aggregation problems, measurement error in key variables, difficulties associated with comparing estimates of income inequality and cultural and institutional differences across countries.

For these reasons, there have been increasing calls to focus on examining the relationship between income inequality and growth within countries using sub-national data. For example, following an extensive review of the literature, De Dominicis *et al.* (2008, p. 678) suggest that "it is particularly promising if attention would shift toward samples of regions within one country". In practice, a limiting factor in this endeavour has been the lack of longitudinal data on income inequality at the sub-national level. As Naguib (2015, p.36) puts it "…it would … be preferable to use separate data concerning each year in each country. This theoretical exigency is however often in contrast with the practical problem given the absence of annual recording of data about the Gini coefficient".

In response to calls for more studies of the inequality-growth nexus at the sub-national level, a relatively small branch of the inequality-growth literature has emerged over the last fifteen years or so that uses sub-national state or regional data. Most of these studies have used panel data for US counties or states (Fallah and Partridge, 2007; Frank, 2009; Partridge, 1997, 2005; Panizza, 2002; Roth, 2010) or regions in Europe (Perugini and Martino, 2008; Rodriguez-Pose and Tselios, 2008; Rooth and Stenberg, 2012). Reflecting Naguib's (2015) point above, most of the US studies lack annual data on income inequality. Hence, in most studies income inequality measures have been typically spaced at 10-year intervals, creating panels with large-*N* and small-*T* (see e.g. Panizza, 2002; Partridge, 1997, 2005). Frank (2009) is one of the few studies to use a panel with annual data on economic growth and income inequality, with annual observations for 48 US states over the period 1945 to 2004.

Compared with cross-country aggregate data, the use of state- or regional-level data to investigate the relationship between inequality and growth has several advantages. First, the data are compiled using the same collection standards and methodologies, facilitating state-to-state comparisons. Second, each of the states within a country has the same political institutions, eliminating much of the institutional and cultural differences inherent in cross-country studies. Cross-country studies largely fail to capture structural differences across countries, including corruption levels, labour market flexibility and tax regimes (Barro, 2000). These sorts of factors are much less likely to contribute to omitted variables bias across states than across countries (Frank, 2009). Third, large factor flows between states should magnify how relatively small disparities in initial conditions influence economic growth (Partridge, 2005). In addition, if the panel has annual inequality measures for each state or region, the inequality-growth relationship can be more reliably tracked over time compared with using data at periodic intervals that produce more of a snapshot.

In the Australian context, concerns over data quality and the lack of long-term official inequality statistics have prevented a robust study of the growth–inequality nexus (Leigh, 2004; Saunders, 2004). The present study contributes to the existing literature on inequality and its relationship with growth in three distinct ways. First, we construct a national income inequality series for Australia by calculating Gini coefficients based on individual tax payers. To do so, we use taxation statistics released by the Australian Taxation Office (ATO) for the period 1942 to 2013. This series is considerably longer than the biennial inequality statistics released by the ABS since 1995 (ABS, 2015, Cat. 6523). Leigh (2004) also calculates Gini coefficients for Australia as a whole over a long period. We differ from Leigh (2004) in that his study is based on male tax payers only, while we use data on all tax payers.

Second, the ATO publishes detailed information on the distribution of income by state and territory.[1] Using these tables, we calculate Gini coefficients for all states and territories (Victoria, New South Wales, ACT, Queensland, Northern Territory, Western Australia, South Australia and Tasmania) in Australia from 1942 to 2013. This is the first attempt to provide disaggregated, long-run inequality estimates for all eight states and territories in Australia.

Third, using state- and territory-level Gini coefficients, we undertake a state-based single-country panel study of the inequality–growth nexus. While we compile Gini coefficients for the period 1942 to 2013, data on real output, human capital (proxied by the total number of

[1] Taxation statistics are published annually in the Report of the Commissioner of Taxation from 1942 – 1999. From 2000 – 2013, the ATO has published taxation statistics on their website.

university course completions) and fixed capital formation by states and territories are only available from 1986. Hence, our panel data estimates are for the shorter period 1986 to 2013. Our panel data estimates contribute to the relatively small number of such studies that exists using state- or regional-level data for Europe and the US.

Our approach in using taxation statistics to construct a measure of income inequality for the states to then use in a state-based inequality–growth regression follows the approach used by Frank (2009) for the US. Income inequality may have different long-run and short-run effects on economic growth (Forbes, 2000; Partridge, 2005). For example, redistributive policies might impede short-run growth through higher taxes, but enhance growth in the long run as the workforce becomes more productive. Alternatively, because higher inequality is associated with credit constraints, it may produce cyclical volatility that hinders growth in the short run (Partridge, 2005). Hence, in compiling our panel data estimates, we distinguish between the long- and short-run effects of inequality on per capita output growth.

Australia makes an interesting country to study the income inequality–growth nexus. Despite being a country that prides itself on egalitarianism, it has become increasingly unequal in terms of both income and wealth distribution (see Greenville *et al.*, 2013; Leigh, 2004; Wilkins, 2014, 2015). In this sense, rising income inequality in Australia is representative of trends in Europe and the US (Piketty, 2014) and across the OECD more generally (see e.g. OECD, 2014). But Australia is also interesting because it has been a primary beneficiary of the resources boom. As a consequence, there have been growing disparities in income distribution across regions, reflecting some regions benefitting more than others from the resource boom since the late 1990s (Fleming and Measham, 2015). This makes a state-based study of inequality and growth for Australia particularly worthwhile.

We find that income inequality has increased in all Australian states and territories since the late-1970s. We find that since the mid-1980s, in the long run income inequality has negatively impacted per capita output in the larger states (New South Wales, Queensland, South Australia and Victoria), but enhanced per capita output in the ACT. Furthermore, in the short run, rising inequality only has a transitory positive effect on output growth in Victoria and Western Australia. These results suggest that political economy mechanisms are influential in linking inequality and growth in the Australian context. Our findings are consistent with the median voter theory, which arises when mean income in a exceeds the median income, incentivising individuals to vote for redistributive taxes and transfers. These policies are hypothesised to involve a loss of efficiency, misallocation of resources and dis-incentivise worker effort, in turn lowering economic growth (Alesina and Rodrik, 1994).

2. MEASURES OF INCOME INEQUALITY IN AUSTRALIA

There are five key official data sources for the study of income inequality in Australia: the Household Income Surveys (HIS), the Household Expenditure Surveys (HES), the Household, Income and Labour Dynamics in Australia (HILDA) Survey, the Census and taxation statistics.[2] The inaugural Australian Bureau of Statistics (ABS) household income distribution survey was conducted in 1969, with five similar studies undertaken from 1974 to 1990, at intervals ranging from three to five years. Since 1995, household income has been surveyed on a biennial basis, in what is now called the Survey of Income and Housing (SIH). The SIH is used as source data for a variety of ABS publications and provides estimates of the 90/10 percentile ratio and Gini coefficients for equivalised disposable household income.

While the SIH provides useful information on Gini coefficients in Australia, it suffers from three major shortcomings. Firstly, Wilkins (2015) notes that the preferred income measure of the ABS is household weekly income, which may underrepresent income from other sources such as capital gains, which is typically not accounted for in households average weekly pay. Secondly, considerable changes to its survey methodology were made in recent decades, making comparison of inequality over the 1969–2012 period impossible (Wilkins, 2014). Finally, there are large gaps between surveys prior to 1995, leaving inequality between survey years undocumented. Piketty and Saez (2003) argue that in the US such gaps are problematic when assessing the evolution of income inequality.

The HES was administered eight times over the period 1975–2010 and is currently administered once every six years. Its main inequality indicator is the share of gross income from all income sources accruing to different income groups. The two most recent surveys were combined with the SIH. The main criticisms of the HES are that the survey methodology has been significantly altered since inception and the long time period between surveys means that there are only very infrequent updates on household income distribution.

The HILDA survey was first administered in 2001 and collects data on total household disposable income for the previous financial year. It provides estimates of inequality in terms of percentile ratios (90/10, 50/10) and Gini coefficients. The high frequency of this

[2] Taxation statistics are collected by the ATO, the HILDA survey is commissioned by the Department of Social Services, while the remaining sources are surveyed by the ABS.

publication remains its main advantage vis-à-vis ABS survey data on income distribution. While this dataset provides comprehensive coverage on household income, its limited time span has prevented the use of conventional time series analyses on the data.

Although the Census data dates back to the early twentieth century, income data was not collected on a regular basis until 1976. The main inequality measure in the Census is the 90/10 percentile ratio. Income data is collected in broad categories, making the calculation of inequality indices, such as the Gini coefficient, impossible. The main criticism of the Census data is that "income categories change from one census to the next, making it difficult to ascertain the extent to which apparent distributional change simply derives from changes in the categories" (Wilkins, 2015, p. 97). Furthermore, the five-year survey interval suggests that Census data may overlook important information on inequality between survey years.

Despite the differences in methodology, each of these data sources indicates that income inequality in Australia has widened in recent decades. The HIS suggests that income has become increasingly concentrated since the early-1980s. Similarly, the HILDA survey notes widening inequality since the survey was first conducted in 2001. Both the HIS and HILDA surveys display a temporary decline in inequality from 2008, which potentially reflects falling capital income in the aftermath of the global financial crisis (GFC) (for recent studies documenting increasing income inequality in Australia using these datasets see Fleming and Measham, 2015; Greenville *et al.,* 2013; Herault and Azpitarte, 2015; Wilkins, 2014, 2015).

Compared with data from the Census, HES, HILDA and SIH, taxation statistics have some important advantages. The major advantage is that they allow one to investigate income inequality in Australia using annual data over a much longer period than other sources. There is no other source that allows one to examine long-run trends in income inequality in Australia, certainly at the state-and-territory level. Another advantage is that they provide a more accurate indicator of top incomes compared with surveys that tend to under-sample high earners (Leigh, 2004). But, taxation statistics also have limitations in terms of estimating income inequality. First, income-distribution surveys allow greater freedom of responses and are better able to distinguish between sources of income growth (i.e. labour/capital split) than taxation statistics. Second, in countries, such as Australia, in which the tax unit is the individual, taxation statistics may not fully capture inequalities across households. Third, not everyone files a tax return, meaning taxation statistics potentially do not provide a complete picture of income distribution across the population (Leigh, 2004). Using estimates of the size of the labour force published by the ABS from 1978 to 2013 and ATO taxation statistics over the same period, we find that taxation statistics, on average, capture 87.7% of the total labour force. We address other limitations below.

Leigh (2004) uses taxation statistics to estimate income inequality for Australian adult males only. Atkinson and Leigh (2007) and Burkhauser *et al.* (2015) have used taxation statistics to estimate income inequality for the top-10% of the income distribution. Leigh (2004) calculates Gini coefficients for Australian male taxpayers, which, after adjustments, are used as a proxy for household inequality in Australia over the period 1942–2002. We differ from Leigh (2004) in that we calculate Gini coefficients for all taxpayers for Australia as a whole as well as for each of the states and territories separately.

3. THE GROWTH-INEQUALITY NEXUS

3.1. Alternative Hypotheses Concerning the Growth–Inequality Nexus

There are alternative hypotheses concerning the relationship between income inequality and growth. There are two channels through which a positive growth-inequality relationship is thought to evolve. The first is based on Kaldor (1957), who hypotheses that since high-income individuals have a higher propensity to save, and given saving equals investment, more unequal societies should experience a higher growth rate. Bourguignon (1981) formalises this concept by showing that when savings is a convex function of income, output is shown to be larger in societies in which income is more unevenly distributed.

The second channel stems from Mirrlees (1971), who suggests that higher inequality may lead to favourable behavioural responses, incentivising individuals to work harder and invest in order to achieve greater utility. This incentive-based approach is related to the efficiency-wage hypothesis, where effort is positively correlated to an individual's real wage. This theory can be used to explain income disparities in the labour market since different firms or industries are likely to have different linkages between effort and the wage rate (Katz, 1986). As such, workers in industries in which the wage–productivity relationship is prominent may earn more than those in industries in which such a relationship is less important. These income disparities encourage workers to move to more productive firms or industries, thereby, lifting real GDP growth (Galor and Tsiddon, 1997).

There are three channels through which a negative growth-inequality relationship is thought to exist. First, Hibbs (1973) argues that a high concentration of economic resources can create incentives for rent-seeking behaviour and lead to the exploitation of political power. This fosters a general lack of trust in government, creating civil unrest and disincentives to invest. The second is based on the role of imperfect credit markets in shaping the growth–inequality relationship. For example, Banerjee and Newman (1991) and Galor and Zeira (1993) show that when income distribution is highly concentrated, many individuals do not possess the collateral needed to borrow freely against future income in credit markets. This creates a binding constraint on the household sector, limiting the ability for poorer individuals to invest in either physical or human capital. This driver is often associated with theories built on human-capital accumulation, in which failure to invest in education limits an individual's long-term income prospects and hampers social mobility.

Finally, Perotti (1993, 1996), Alesina and Rodrik (1994) and Persson and Tabellini (1994) suggest political economy channels, through which voters may regard inequality beyond a critical threshold unacceptable, forcing governments to implement redistributive policies. Political economy theory is closely related to the behaviour of the median voter. If the median voter feels that their income is below the economy-wide average, they will vote in favour of policies that redistribute income and wealth from high- to low-income individuals. Such redistributive policies often lead to a misallocation of resources and a loss of economic efficiency as a result of the costs inherent in taxing and transferring income, as well as the disincentive effects on the labour-supply decision of high-income individuals.

3.2. Empirical Evidence Concerning the Growth–Inequality Nexus

Alesina and Rodrik (1994) find a negative relationship between growth and inequality using cross-country data from 1960 to 1985. Subsequent studies by Persson and Tabellini (1994), Perotti (1996) and Deininger and Squire (1996) over the same time period support these findings. We note two drawbacks of these early studies. First, cross-country regressions are likely to only capture an average relationship that suffers from aggregation bias, which is amplified when the sample consists of developed and developing countries. This point is highlighted by Barro (2000), who finds that the nature of the inequality–growth nexus differs distinctively between developed and developing economies. Second, cross-country regressions only estimate the inequality–growth nexus at a point in time, providing no indication of its stability over time. This is important given the evidence that the relationship between growth and inequality may change as an economy matures (Kuznets 1955).

In order to improve on the early cross-country findings, more recent studies have employed panel data (see eg. Barro, 2000; Cingano, 2014; Forbes, 2000; Naguib, 2015). The findings from the panel studies have been mixed. For instance, Cingano (2014) finds a negative relationship between income inequality and growth, while Naguib (2015) finds that growth and inequality are positively related. These mixed results suggest that sample selection is critical when uncovering the inequality–growth nexus in cross-country studies. Barro (2000) separates a sample of 100 countries over the period 1960 to 2000 into rich and poor categories. He finds that income inequality is detrimental to growth in poorer countries, while some degree of inequality proves to be beneficial for wealthier nations. As Naguib (2015, p.34) puts the emerging consensus, the relationship between income inequality and economic growth "operates in different ways in developed and developing economies".

A small number of studies examine the inequality–growth nexus using panel data for US counties or states (Fallah and Partridge, 2007; Frank, 2009; Partridge, 1997, 2005; Panizza, 2002; Roth, 2010) or regions in Europe (Perugini and Martino, 2008; Rodriguez-Pose and Tselios, 2008; Rooth and Stenberg, 2012). Findings for the US have been mixed. Some studies have found a positive association (Partridge, 1997, 2005; Frank, 2009). Panizza (2002) found a negative association. Using US county data, Roth (2010) found a negative relationship, while Fallah and Partridge (2007) found a positive relationship in urban counties, but a negative relationship in rural counties. Among the studies for European regions, Perugini and Martino (2008) and Rodriguez-Pose and Tselios (2008) found a positive relationship between income inequality and growth, but Rooth and Stenberg (2012) found mixed results depending on how inequality was measured. Overall, the mixed results for Europe and the US with sub-national data reflect the use of different estimation methods, different measures of income inequality and different time periods.

4. EMPIRICAL METHODOLOGY

Our calculations are based on the annual taxation statistics included in the Report of the Commissioner of Taxation for the period 1942–1999 and the ATO website for the remaining years (2000 – 2013). Taxation statistics provide detailed information on taxable income, net tax, gender, location and income source among others. Individuals are categorised into different taxable-income bands. Following, the approach in Leigh (2004), we use equation (1) to estimate the Gini coefficient (G_i^A) for Australia and for each of its states and territories over the period 1942-2013.

$$G_i^A = \frac{N}{N-1}\left[1 - \sum_{i=1}^{N} P_i (S_i + S_{i-1})\right] \tag{1}$$

where N is the number of income groups, P_i is the fraction of the population in group i and S_i is the share of total income in group i and all groups below, with $S_0 = 0$. Leigh (2004) notes that the grouping of income data into a relatively small number of bands may impose a non-negligible bias on the Gini coefficient estimates. To correct for this bias, Leigh (2004) adopts a correction, proposed by Deltas (2003), through which the Gini estimate is scaled by *(N/N-1)* in equation (1). This adjustment technique has been found to reduce any bias owing to data grouping.

The ATO includes non-taxpayers, or those who pay net tax of zero, in all state- and territory-level data only for the decade from 2000 to 2010. This creates a sharp temporary level shift in income inequality during this period. We remove this definitional bias by adjusting the resulting taxation-based Gini coefficients in each state and territory, and for each year, by using the ABS Gini measures (by states) in the year 2010 as follows:

$$\bar{\lambda}_i = \left(\frac{G^{A}_{1995i}}{G^{ABS}_{1995i}} + \frac{G^{A}_{1996i}}{G^{ABS}_{1996i}} + \frac{G^{A}_{1997i}}{G^{ABS}_{1997i}} + \frac{G^{A}_{1998i}}{G^{ABS}_{1998i}} \right) . \frac{1}{4} \tag{2}$$

$$G_{ti} = \frac{G^{A}_{ti}}{G^{A}_{t-1i}} G_{ti-1}, \text{ where t=2001,2002,...,2010.} \tag{3}$$

$$G_{2002i} = \bar{\lambda}_i \; .G^{ABS}_{2002i} \tag{4}$$

where G_{ti} denotes the bias-corrected Gini coefficient in state or territory *i*, and G^{ABS}_{2002i} is the ABS measure of the Gini in 2010 in state or territory *i*. In making this correction we assume that the average percentage of zero income tax-return lodgers remains the same. We specify the following per capita Cobb-Douglas production function for the period 1986-2013:

$$Ln(Y_{it} / L_{it}) = \alpha + \beta_1 Ln(K_{it} / L_{it}) + \beta_2 Ln(H_{it} / L_{it}) + \beta_3 Ln(R_{it} / L_{it}) + \gamma Ln(G_{it}) + \varepsilon_{it} \tag{5}$$

Or:

$$y_{it} = \alpha + \beta_1 k_{it} + \beta_2 h_{it} + \beta_3 r_{it} + \gamma g_{it} + \varepsilon_{it} \tag{6}$$

where

Y_{it} = Real output in state or territory *i* and time *t*,

K_{it} = Real fixed capital formation,

L_{it} = Labour force,

H_{it} = Human capital (proxied by the total number of university course completions),

R_t = Real national expenditure on research and development (R&D),

$y_{it} = Ln(Y_{it} / L_{it})$,

$k_{it} = Ln(K_{it} / L_{it})$,

$h_{it} = Ln(H_{it} / L_{it})$,

$r_{it} = Ln(R_{it} / L_{it})$,

$g_{it} = Ln(G_{it}) \oplus$

The estimated coefficients β_1, β_2 and β_3 are expected to be positive, suggesting that a per capita rise in physical capital, human capital and R&D will increase per capita real output. However, the sign on γ is ex ante uncertain. In order to capture heterogeneities among the eight state and territories in Australia we test the relevance of a fixed-effects model by allowing the intercept coefficient to be state-specific.

Differences in resource endowments between states and territories have meant that states and territories have often experienced very different growth rates. The most recent example of this divergence was during the decade of the 2000s, in which state final demand in Western Australia considerably outpaced the east-coast states due to unprecedented investment in the resources sector. We use fixed-effects models to account for differences due to such growth episodes, i.e. we use α_i rather than α. The same rationale is adopted to estimate the state-specific coefficient for the Gini coefficient, i.e. γ_i in lieu of γ.

$$y_{it} = \alpha_u + \beta_1 k_{it} + \beta_2 h_{it} + \beta_3 r_{it} + \gamma_i g_{it} + \varepsilon_{it} \qquad (7)$$

We examine time series properties of individual variables by using the Im, Pesaran and Shin (2003) panel unit root test. We then conduct the cointegration test on equation (7) by utilising tests proposed by Maddala and Wu (1999) and Kao (1999). Once we have established that the variables in equation (7) are cointegrated, we proceed to estimate the following equation to determine the short-run determinants of per capita output growth:

$$\Delta y_{it} = \phi_i + \sum_{j=0}^{k} \theta_j \Delta k_{it-j} + \sum_{j=0}^{k} \eta_j \Delta h_{it-j} + \sum_{j=0}^{k} \delta_j \Delta r_{it-j} + \sum_{j=0}^{k} \pi_j \Delta g_{it-j} + \omega \varepsilon_{it-1} + \sum_{j=1}^{k} \varsigma_j \Delta y_{it-j} + e_{it} \qquad (8)$$

Where ε_{it-1}, the residuals obtained from equation (7), serves as an error correction mechanism with an expected negative sign for ω. We expect that the short-run effects of changes in capital (θ_j), human capital (η_j) and R&D expenditure (δ_j) to be positive. Similar to the long-run effect of the Gini coefficient, the short-run dynamic effect of changes in the Gini coefficient (π_j) on per capita growth in real output is *ex ante* uncertain. We use the Schwarz information criterion to determine the lag structures and the general-to-specific modelling strategy to estimate a parsimonious version of equation (8). We do not assume π_j to be fixed. Instead, we estimate equation (8) by allowing π_j to be state-specific, i.e. π_{ij} .

5. GINI COEFFICIENTS FOR AUSTRALIAN STATES AND TERRITORIES

To estimate Gini coefficients for Australia as a whole, and for the Australian states and territories separately, for both males and females we use taxation statistics published annually by the ATO. These statistics include the number of individual tax payers, taxable income, gender, location and net tax, among others.

5.1. Impact of Non-Lodgers on Gini Coefficient Estimates

While taxation statistics cover the vast majority of Australia's labour force, the exclusion of non-lodgers may potentially lead to biased results.[3] To determine the effect of non -lodgers on national level Gini coefficients, we separately compute an alternate inequality series where non-lodgers are assimilated into the existing income distribution based on assumptions regarding their taxable income.[4] Taxable income assumptions are derived from the ATO's Review into the Non-Lodgement of Individual Income Tax Returns (Inspector General of Taxation, 2009), where non-lodgers were asked to provide reasons for failing to lodge a tax return in a given year. Based on these responses we separate non-lodgers into two sub-groups (a) low-income earners whose income lies below the taxable threshold and (b) late submitters/tax avoiders. Sub-group (a) account for 80% of non-lodgers, while the remaining 20% is comprised of individuals from sub-group (b). The income distribution of sub-group (b) is thought to be similar to that of tax-return lodgers, and can therefore be assimilated into taxation statistics based on the income distribution of tax return lodgers.

Low-income earners are less visible, with possible annual income for an individual in sub-group (a) ranging between $0 and the tax-free threshold. Thus, we estimate two separate Gini coefficients based on the minimum and maximum parameters of this range. Specifically,

[3] Non-lodgers are those individuals with net tax payable greater than $0, who failed to lodge a tax return.

[4] Calculated as the size of the labour force less the number of tax returns submitted in a given year.

the first Gini coefficient assumes that all individuals in this sub-group earn zero income, and the second assumes that all individuals in this sub-group have an income equal to the tax-free threshold. We find that the inclusion of non-lodgers into national Gini coefficient estimates do not have a material impact on the evolution of income inequality in Australia; a conclusion which likely extends to the states and territories considered separately.

5.2 Income Assistance and Taxation Statistics

Our estimate of the number of non-lodgers may be distorted by individuals on government income assistance who are not actively seeking employment, but still submit a tax return in a given year. If this were the case, the number of tax returns relative to the labour force is likely to be inflated, causing an underestimation of the number of non-lodgers in a given year.

While potentially problematic we do not expect individuals on income assistance to have a material influence on inequality estimates. Indeed, the overwhelming majority of such individuals are required to actively seek employment in order to be eligible for income assistance. Notwithstanding exemptions to this requirement, the Labour Market and Related Payment (LMRP) monthly profile released by the Department of Social Services (DSS) indicates that individuals who qualify for such exemptions remain a very small minority. Indeed, based on the LMRP September 2015 report, less than 2% of the working-age population received income assistance without the accompanying requirement to actively seek employment.

5.3. Australian and State and Territory Gini Coefficients

Figure 1 shows the computed state and territory Gini coefficients as well as the Gini coefficients for Australia as a whole during the period 1942-2013 as far back as the taxation statistics are available. We report all these Gini coefficients in the appendix table. While we do not use the Gini coefficients for Australia as a whole in modelling the growth-inequality relationship below, they serve as an interesting point of comparison with those for the states and territories. The inequality trends for Australia as a whole in Figure 1, not surprisingly, are very similar to the trends reported in Leigh (2004), based on taxation statistics for adult males only. There is a brief spike in inequality in the early 1950s, associated with the 1950-1951 wool boom. Apart from this, income inequality fell in the 1950s, was fairly stable in the 1960s, fell again in the early 1970s and then increased again from the late 1970s. This trend is also consistent with the finding in Atkinson and Leigh (2007) that during the 1980s and

1990s top income shares increased dramatically. Possible reasons for the growth in income inequality, and rise in the share of top incomes accruing to the rich, observed in Australia since the late 1970s is declining unionisation, a reduction in the top marginal tax rates and the internationalisation of the market for English speaking CEOs (Leigh, 2004).

[FIGURE 1 ABOUT HERE]

Each of the states and territories had similar starting points in terms of the value of the Gini coefficient in 1942, but have exhibited different patterns since World War II. With the exception of the Northern Territory, inequality in the states and territories spikes to varying degrees in the wool boom, then declines through the 1950s, is fairly stable through the 1960s and then declines again in the 1970s. Income inequality across the states and territories begins to increase in the late 1970s. These trends generally reflect the overall pattern for Australia as a whole. Northern Territory, Tasmania and, to a lesser extent, the ACT consistently reported the lowest Gini coefficient in Australia over time. Putting aside the level of income, this trend suggests that the extent of income inequality was relatively smaller in the smaller states and territories. In other words, the larger the pie, the more uneven the distribution. During the post-GFC period, the Gini coefficient was falling in New South Wales, Victoria and Queensland, but rising in Northern Territory and Western Australia. Finally, and in relation to the preceding point, both Northern Territory and Western Australia have registered the highest growth rate in the Gini coefficient since 2008; a sign of rapidly rising income inequality in both of these states/territories.

5.4. Compiled Gini Coefficients versus. the ABS Irregular Estimates

We next compare our estimates with the ABS estimates for those years for which the ABS produces Gini coefficients for the Australian states and territories. This serves as a robustness check on our figures. According to Figure 2 there is a strong relationship between the compiled state and territory Gini coefficients in this study and those of the ABS (2015, Cat. 6523.0 Household Income and Wealth, Australia, 2013–14) for the biennially available years in the post-1995 era, particularly for the largest four states (New South Wales, Victoria, Queensland and Western Australia). The insignificant positive correlation between the two series for the smaller states is not surprising due to the use of different survey methods, statistical coverage and definitional changes discussed in ABS (2015, Cat. 6523.0).

[FIGURE 2 ABOUT HERE]

6. INCOME INEQUALITY AND GROWTH IN AUSTRALIA

Table 1 provides the descriptive statistics, variable definitions, measurement scales and sources of data used in estimating the relationship between income inequality and economic growth. With the exception of labour force and R&D expenditure, the data on real output, human capital (proxied by the total number of university course completions) and fixed capital formation by states and territories are only available from 1986. Thus, while we have compiled Gini coefficients for the period 1942–2013, our panel estimates are confined to the period 1986–2013. On average, the Gini coefficient falls within the range 0.294 (Northern Territory) and 0.382 (New South Wales). While this is for a shorter period, it is consistent with the general trend identified in Figure 1, where Northern Territory and New South Wales reported a more equal and unequal income distribution, respectively.

[TABLES 1-3 ABOUT HERE]

According to the results of the Im, Pesaran and Shin (2003) panel unit root test, shown in Table 2, all the variables appearing in equation (6) are integrated of order one. In order to test the robustness of the panel cointegration results, we conduct both Johansen-Fisher (Maddala, and Wu, 1999) and Kao (1999) tests. The results in Table 3 clearly show that the null of no cointegration is rejected at the 1% level of significance.

In order to address the simultaneity problem, we also estimate equations (6) and (7) using ordinary least squares (OLS) and two-stage least squares (2SLS) and present the results in Table 4. Irrespective of which estimation method is considered, the coefficients on the level of state per capita human and physical capital as well as national expenditure on R&D remains positive and statistically significant at the 10% level or better. According to Model 1, the imposed common long-run effect of inequality on per capita output is negative and significant at the 10% level, but the use of 2SLS renders it insignificant. However, when the Gini coefficient is allowed to exert different effects across the eight states and territories, the results in Model 3 (OLS) and Model 4 (2SLS) in Table 4 suggest that falling inequality in the long run can boost per capita output in the larger states (New South Wales, Queensland, South Australia and Victoria). Such long-run effects are mainly insignificant in the smaller states and territories (Northern Territory, Tasmania and Western Australia) with the only exception being ACT where γ_1 is positive. Therefore, imposing the same coefficient could have masked substantial differences among all states and territories. The use of fixed-effects models are justified based on the Wald test reported at the bottom of Table 4. All four models perform well in terms of goodness-of-fit statistics with the minimum adjusted-R^2 being 0.966.

[TABLE 4 ABOUT HERE]

These results are consistent with the findings of Panizza (2002) and Roth (2010) in their respective studies focusing on inequality–growth in the US. Both of these studies explain their findings in terms of political economy theory in linking inequality and growth in the US. Our findings can similarly be explained in terms of political economy theory.

There are three reasons to assume political economy channels are influencing Australia's inequality–growth nexus. First, Australia has a highly redistributive tax system, with personal income tax (Joumard *et al.*, 2012) and transfers from high- to low-income earners (Whiteford, 2010), which is considerably more progressive than the OECD average. According to ACOSS (2015, p.25) "various income, asset and employment tests mean that as a proportion of overall transfer payments, Australia redistributes more income to the bottom 20 per cent than virtually any other OECD country". Median voter theory posits that voter pressure forces policy makers to retain redistributive income policies, which in the long run hinder economic growth. Although our results are not homogenous across regions, we find a significant negative inequality-growth nexus in New South Wales, Victoria, Queensland and South Australia, which are home to approximately 85% of the population.

Second, the differences in our findings between the large and small states/territories are likely owing to state-level political economy drivers, with each state/territory government elected separately. While personal income tax in Australia is legislated, and collected, at the national level, the state and territory governments are primarily responsible for investment and spending decisions influencing their jurisdiction. As such, voter pressure likely influences state and territory government's budget plans, potentially leading to a misallocation of resources in the larger states.

Third, based on the ABS's Household Income and Wealth and Household Income and Income Distribution publications (2001–2014, Cat. 6523.0), the ratio between mean and median income is consistently highest in Australia's more populous states, an outcome which "motivates more redistribution through the political process" (Barro, 2000, p. 6). In contrast, the ratio of mean to median income in the ACT, the only region with a significant positive long-run inequality–growth nexus, is consistently below the national average. That the gap between mean and median income in the larger populous states is the highest not only puts pressure on governments to implement redistributive policies, but suggests that the mean income in these states is being driven up because of a concentration of high income earners. ACOSS (2015) found that people living in Brisbane and Sydney and, to a lesser extent, Melbourne, are more likely to be in the top 20 per cent, and less likely to be in the bottom 20 per cent, of income earners, most likely reflecting better employment opportunities in these major cities. To the extent that redistributive income policies have disincentive effects on worker effort for high-income earners, with flow on effects to lower productivity and lower growth (Alesina and Rodrik, 1994), one would expect to see this in the larger states in which these major cities are located, which is consistent with our results.

In terms of the long-run contributions, Model 4 in Table 4 shows that physical capital, by far, has the largest impact on per capita real output. Specifically, a 1% increase in physical capital formation raises per capita real output by 0.49%, all things being equal. Meanwhile, a 1% increase in human capital and R&D expenditure raises per capita real output by 0.20% and 0.09%, respectively. These results are consistent with our a priori expectations.

The results of short-run dynamic panel regressions are shows in Models 5 and 6 in Table 5. Despite all variables being expressed in natural logarithm changes, both models perform very well in terms of goodness-of-fit statistics, i.e. the adjusted-R^2 is 0.83 in both models. Similar to the results in Table 4, in the short run, policies aimed at increasing physical and human capital as well as national R&D expenditure will boost per capita output growth. According to the results of Model 5 in Table 5, the estimated coefficient for π_0 is not statistically significant at any conventional level. Even when the Gini coefficient is allowed to exert different short-run effects across different states and territories, the Gini coefficient only becomes significant in Victoria and Western Australia. While inequality may have limited positive effects in these two states in the short run, persistent rising levels of inequality will have detrimental and widespread effects on long-run economic prosperity. Once again the Wald test at the bottom of Table 5 justifies the use of fixed-effects models.

[TABLE 5 ABOUT HERE]

According to Model 6 in Table 5, all the regressors are consistent with our expectations. After controlling for inter-state differences in income inequality, contemporaneous fixed capital formation, as in the case for the long run, remains the most important catalyst for per capita output growth in the short run. Specifically, a 1% increase in fixed capital formation raises per capita output growth by 0.31% in the short run, holding all else constant. However, the effect of physical capital formation seems to dissipate as the number of lags increases; for example, the coefficient on Δk_{it-2} is 0.03, down from 0.31 for Δk_{it}.

7. CONCLUSIONS

Using ATO taxation statistics for males and females we compute Gini coefficients for Australia as a whole and for the Australian states and territories during the period 1942 to 2013. While taxation statistics do not present a first best option for measuring income inequality (Leigh, 2004), they have the advantage that it is possible to get a long-run measure of income inequality at the sub-national level that is not possible with other sources (Frank, 2009; Leigh, 2004). We find that income inequality dipped in the early 1970s, but has widened in all states and territories since 1979. We then examine the long- and short-run effects of income inequality on per capita output across all Australian states and territories from 1986 to 2013. We find that inequality adversely affects per capita output in the long run in the larger states (New South Wales, Queensland, South Australia and Victoria) with the opposite occurring only for ACT. These findings are consistent with the predictions of political economy theory. We find that in the short run, rising inequality contributes to transitory output growth only in two states; namely, Victoria and Western Australia.

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TABLE 1
DESCRIPTIVE STATISTICS BY STATES (1986-2013)

Description	ACT	NSW	NT	QLD	SA	TAS	VIC	WA
Gini coefficient								
Mean	0.330	0.382	0.294	0.352	0.332	0.340	0.366	0.358
SD	0.008	0.027	0.015	0.019	0.010	0.017	0.027	0.021
Source: Authors' computations using tax return data								
Real output (A$ Millions, Chain volume measures)								
Mean	33635	319084	13997	183627	68540	20682	234419	111364
SD	13194	80988	6126	73502	17785	4857	71067	49119
Source: ABS (2015, *Cat.* 5206.0, Table 25)								
Labour force (thousands)								
Mean	177	3151	99	1799	746	226	2423	986
SD	25	355	17	383	60	16	305	190
Source: ABS (2015, *Cat.* 5202.0, Table 12)								
Fixed capital formation (A$ Millions, Chain volume measures)								
Mean	4445	66928	4304	50280	14326	4118	50852	38302
SD	2247	20517	2802	26264	5007	1261	21412	25063
Source: ABS (2015, *Cat.* 5206.0, Table 25)								
Human capital (the number of university course completions)								
Mean	5921	57223	906	30922	13513	3569	51093	18123
SD	2151	22796	247	13019	5197	991	20305	7625
Sources: http://docs.education.gov.au/node/34949 DETYA (2001), Department of Education, Training and Youth Affairs, Higher Education Students Time Series Tables, Canberra.								
R&D expenditures (Million US$ at 1977 prices)								
Mean	4539	4539	4539	12134	12134	4539	4539	4539
SD	1223	1223	1223	5614	5614	1223	1223	1223
Source: https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm								

TABLE 2
THE PANEL UNIT ROOT TEST (IM, PESARAN AND SHIN, 2003) RESULTS

Variable	*W*-stat	*p*-value
Per capita real output		
$y_{it} = Ln(Y_{it} / L_{it})$	-0.914	0.18
Δy_{it}	-6.370	0.00
Per capita fixed capita formation		
$k_{it} = Ln(K_{it} / L_{it})$	-1.173	0.12
Δk_{it}	-9.041	0.00
Per capita human capital		
$h_{it} = Ln(H_{it} / L_{it})$	0.930	0.82
Δh_{it}	-7.275	0.00
Per capital R&D		
$r_{it} = Ln(R_{it} / L_{it})$	-0.107	0.46
Δr_{it}	-2.979	0.00
Gini coefficient		
$g_{it} = Ln(G_{it})$	-0.968	0.17
Δg_{it}	-9.530	0.00

TABLE 3
PANEL COINTEGRATION TEST RESULTS

Johansen-Fisher test (trend assumption: linear deterministic trend)

Hypothesized no. of cointegrating vectors	Fisher Stat. (from trace test)	*p*-value	Fisher Stat. (from max-eigen test)	*p*-value
None	111.8	0.00	60.3	0.00
At most 1	64.13	0.00	37.1	0.00
At most 2	38.35	0.00	20.1	0.21
At most 3	29.93	0.02	23.7	0.10
At most 4	29.18	0.02	29.2	0.02

Kao residual cointegration test (trend assumption: no deterministic trend)

	ADF *t* stat.	*p*-value
Null hypothesis: no cointegration	-6.77	0.00

TABLE 4

LONG-RUN DETERMINANTS OF PER CAPITA REAL OUTPUT: $y_{it} = \alpha + \beta_1 k_{it} + \beta_2 h_{it} + \beta_3 r_{it} + \gamma g_{it} + \varepsilon_{it}$

Variable	Model 1 Estimation method: OLS			Model 2 Estimation method: 2SLS♣			Model 3 Estimation method: OLS			Model 4 Estimation method: 2SLS♣		
	Coeff.	*t* ratio	*p*-value	Coeff.	*t* ratio	*p*-value	Coeff.	*t* ratio	*p*-value	Coeff.	*t* ratio	*p*-value
k_{it}	0.518	28.09	0.00	0.494	17.64	0.00	0.516	25.62	0.00	0.492	15.89	0.00
h_{it}	0.139	4.94	0.00	0.188	4.13	0.00	0.129	4.23	0.00	0.196	3.89	0.00
r_{it}	0.072	2.77	0.00	0.073	1.77	0.08	0.096	2.76	0.01	0.094	1.81	0.07
g_{it} (common γ)	**-0.163**	**-1.63**	**0.10**	-0.260	-1.50	0.13						
g_{it} (state specific γ_i):												
ACT γ_1							1.493	3.19	0.00	1.164	1.97	0.05
NSW γ_2							-0.165	-1.72	0.09	-0.494	-2.68	0.01
NT γ_3							-0.175	0.69	0.49	0.047	0.09	0.93
QLD γ_4							-0.227	-1.88	0.06	-0.459	-1.96	0.05
SA γ_5							-1.093	-3.92	0.00	-1.680	-3.51	0.00
TAS γ_6							0.209	1.29	0.20	0.199	0.73	0.47
VIC γ_7							-0.312	-3.01	0.00	-0.523	-2.85	0.00
WA γ_8							-0.249	-1.49	0.14	-0.399	-1.30	0.20
Fixed effects												
α_1	2.679	16.26	0.00	2.477	8.83	0.00	4.479	8.42	0.00	3.956	5.78	0.00
α_2	2.455	14.34	0.00	2.286	7.83	0.00	2.480	13.82	0.00	2.037	6.38	0.00
α_3	2.229	13.66	0.00	2.105	7.60	0.00	2.154	6.83	0.00	2.386	3.76	0.00
α_4	2.212	13.78	0.00	2.052	7.48	0.00	2.137	13.01	0.00	1.790	5.79	0.00
α_5	2.223	14.25	0.00	2.041	7.64	0.00	1.171	3.53	0.00	0.408	0.72	0.47
α_6	2.244	14.92	0.00	2.073	8.05	0.00	2.608	1330	0.00	2.485	7.62	0.00
α_7	2.378	13.69	0.00	2.207	7.48	0.00	2.252	12.18	0.00	1.915	5.99	0.00
α_8	2.175	13.09	0.00	2.034	7.18	0.00	2.088	8.82	0.00	1.843	4.42	0.00
R^2	0.983			0.968			0.986			0.971		
Adjusted R^2	0.982			0.966			0.985			0.969		
F statistic	1083			516			780			341.2		0.00
Unit root test for the panel residuals: Im, Pesaran and Shin *w* stat.	-2.45		0.00	-6.57		0.00	-3.60		0.00	-7.72		0.00
Wald test: H_0: $\alpha_1=\alpha_2=\ldots=\alpha_8$	$F(7,204)=342.8$		0.00	$F(7,188)=142.9$		0.00	$F(7,197)=7.60$		0.00	$F(7,181)=3.98$		0.00

Note: ♣ The first and second lagged values of y_{it}, k_{it}, h_{it}, r_{it} and g_{it} are used as the pre-determined variables in the reduced form equations.

TABLE 5

SHORT-RUN DETERMINANTS OF PER CAPITA OUTPUT GROWTH

$$\Delta y_{it} = \phi_i + \sum_{j=0}^{k}\theta_j \Delta k_{it-j} + \sum_{j=0}^{k}\eta_j \Delta h_{it-j} + \sum_{j=0}^{k}\delta_j \Delta r_{it-j} + \omega\varepsilon_{it-1} + \sum_{j=1}^{k}\varsigma_j \Delta y_{it-j} + e_{it} + \begin{cases} \sum_{j=0}^{k}\pi_j \Delta g_{it-j} & \text{Model 5} \\ \sum_{j=0}^{k}\pi_{ij} \Delta g_{it-j} & \text{Model 6} \end{cases}$$

Variable	Model 5 ($\hat{\pi}_j$ is fixed)			Model 6 ($\hat{\pi}_{ij}$ is state specific)		
	Coeff.	*t* ratio	*p*-value	Coeff.	*t* ratio	*p*-value
Δk_{it}	0.316	23.80	0.00	0.307	22.71	0.00
Δk_{it-2}	0.035	2.70	0.01	0.031	2.41	0.02
Δh_{it}	0.039	1.86	0.06	0.051	2.37	0.02
Δr_{it}	0.116	3.50	0.00	0.104	3.15	0.00
$\hat{\varepsilon}_{it-1}$	-0.132	-0.132	0.00	-0.125	-2.96	0.00
Δg_{it} (common π_0)	0.038	0.78	0.43			
Δg_{it} (state specific π_{i0}) effects:						
ACT-π_{10}				0.064	0.32	0.75
NSW-π_{20}				0.099	1.39	0.17
NT-π_{30}				-0.146	-1.35	0.18
QLD-π_{40}				0.109	0.97	0.34
SA-π_{50}				-0.094	-0.67	0.51
TAS-π_{60}				0.138	1.33	0.19
VIC-π_{70}				0.166	1.77	0.08
WA-π_{80}				0.338	2.25	0.03
Fixed effects						
ACT-ϕ_1	0.016	3.88	0.00	0.016	3.98	0.00
NSW-ϕ_2	0.005	2.93	0.00	0.005	2.82	0.01
NT-ϕ_3	0.014	3.42	0.00	0.016	3.83	0.00
QLD-ϕ_4	0.005	2.08	0.04	0.005	2.16	0.03
SA-ϕ_5	0.004	1.28	0.20	0.005	1.51	0.13
TAS-ϕ_6	0.007	2.71	0.01	0.007	2.82	0.01
VIC-ϕ_7	0.005	2.16	0.03	0.004	1.95	0.05
WA-ϕ_8	0.008	2.53	0.01	0.007	2.18	0.03
R^2	0.838		0.02	0.848		0.02
Adjusted R^2	0.827		0.04	0.831		0.04
Overall *F* statistic	74.2		0.00	50.0		0.00
DW	1.95			1.97		
Wald test: H_0: $\phi_1=\phi_2=...=\phi_8$	*F*(7,186)=1.69		0.10	*F*(7,179)=1.97		0.06

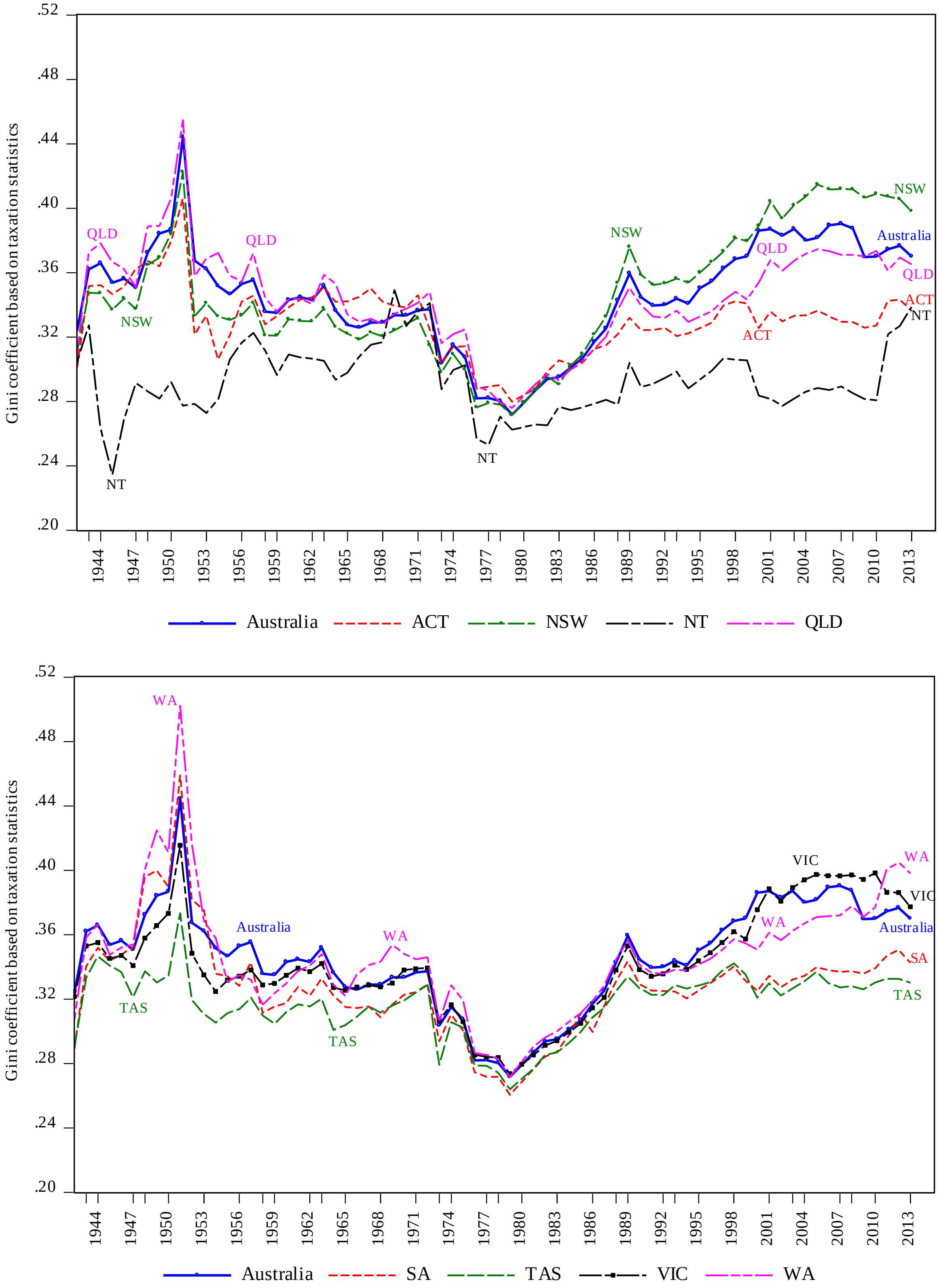

Figure 1. Computed national, state and territory (1960-2013) Gini coefficients based on taxation statistics (1942-2013)

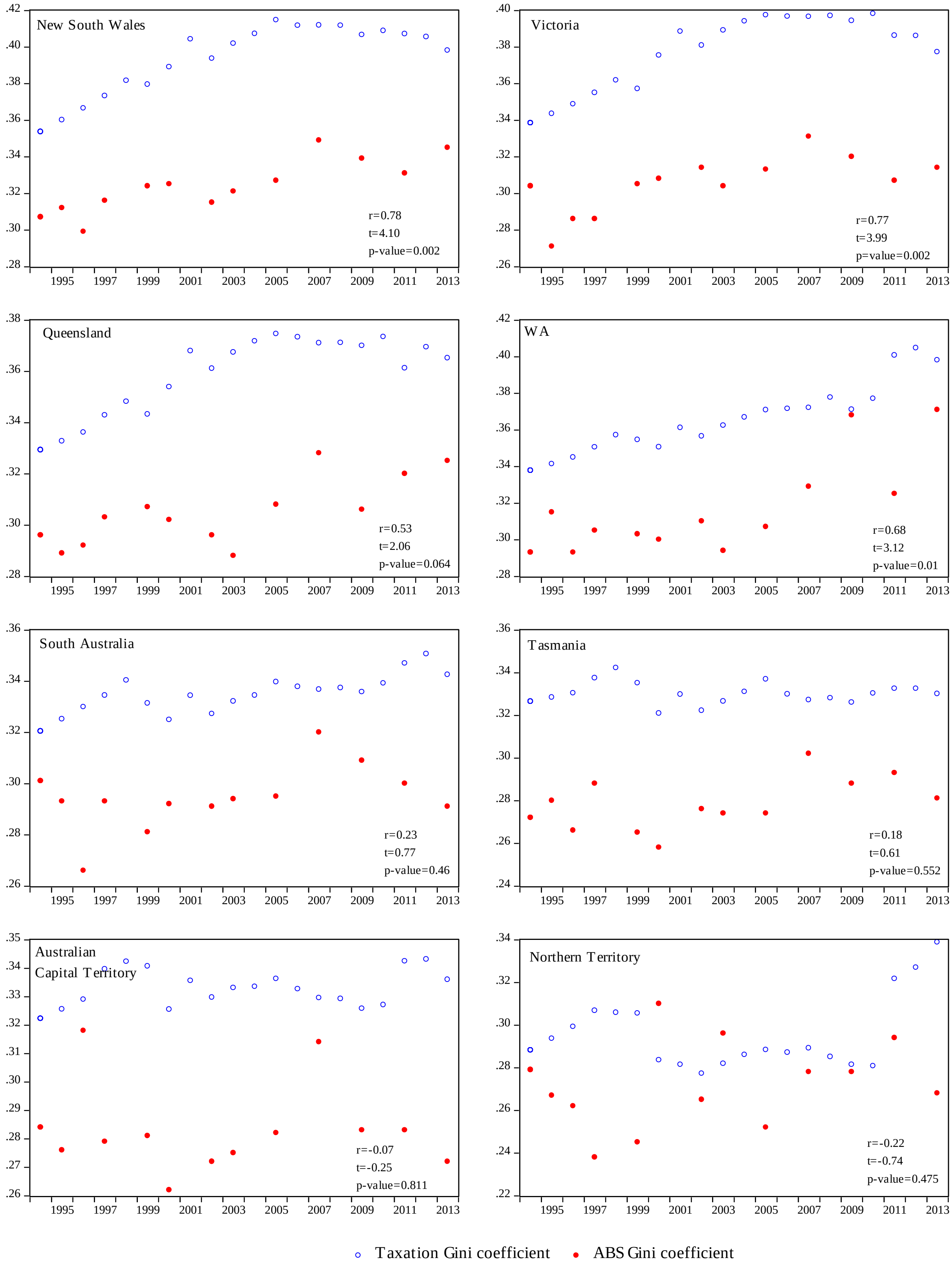

Figure 2. Taxation-based Gini coefficients vs. the ABS biennially available Gini coefficients

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LONG- AND SHORT-RUN EFFECTS OF INCOME INEQUALITY ON THE PER CAPITA OUTPUT OF AUSTRALIAN STATES

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Abstract:
This paper makes two contributions. Firstly, using taxation statistics we compile consistently defined Gini coefficients for the period 1942–2013 for all Australian states and territories. The computed Gini coefficients are comparable with available series reported by the Australian Bureau of Statistics. While income inequality exhibited a downward trend until 1979, it has since been on the rise not only over time, but also across states and territories. Secondly, we examine long- and short-run effects of income inequality by state on per capita output using all available panel data (1986–2013). We find that income inequality adversely affects per capita output in the long-run in the larger states (New South Wales, Queensland, South Australia and Victoria) with the opposite occurring in the ACT. Our findings are consistent with median voter theory when mean income exceeds the median income, incentivising individuals to vote for redistributive taxes and transfers.

Keywords: Gini coefficient, Taxation, Income Distribution, States and territories, Australia.

JEL Classification Numbers: D31, E25, H24, O15

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APPENDIX TABLE
COMPUTED GINI COEFFICIENTS USING TAXATION STATISTICS

Year	Australia	ACT	NSW	NT	QLD	SA	TAS	VIC	WA
1942	0.3243	0.3010	0.3109	0.3044	0.3088	0.2891	0.2903	0.3214	0.3072
1943	0.3621	0.3515	0.3474	0.3273	0.3725	0.3403	0.3333	0.3530	0.3582
1944	0.3659	0.3521	0.3472	0.2631	0.3781	0.3518	0.3464	0.3550	0.3663
1945	0.3537	0.3465	0.3370	0.2345	0.3664	0.3438	0.3408	0.3452	0.3474
1946	0.3563	0.3514	0.3440	0.2688	0.3620	0.3478	0.3366	0.3470	0.3520
1947	0.3505	0.3622	0.3373	0.2913	0.3510	0.3523	0.3212	0.3408	0.3539
1948	0.3724	0.3671	0.3646	0.2861	0.3886	0.3958	0.3373	0.3578	0.4004
1949	0.3843	0.3639	0.3693	0.2817	0.3890	0.4000	0.3303	0.3655	0.4248
1950	0.3867	0.3794	0.3842	0.2920	0.4057	0.3899	0.3347	0.3732	0.4112
1951	0.4443	0.4060	0.4225	0.2773	0.4547	0.4590	0.3733	0.4155	0.5022
1952	0.3674	0.3215	0.3328	0.2784	0.3578	0.3816	0.3195	0.3483	0.4166
1953	0.3622	0.3331	0.3409	0.2727	0.3686	0.3750	0.3106	0.3350	0.3686
1954	0.3516	0.3059	0.3327	0.2812	0.3723	0.3358	0.3053	0.3247	0.3580
1955	0.3465	0.3212	0.3305	0.3061	0.3581	0.3341	0.3113	0.3317	0.3309
1956	0.3530	0.3420	0.3334	0.3164	0.3543	0.3282	0.3137	0.3340	0.3349
1957	0.3554	0.3457	0.3411	0.3225	0.3719	0.3429	0.3208	0.3380	0.3319
1958	0.3358	0.3279	0.3210	0.3116	0.3444	0.3114	0.3097	0.3287	0.3166
1959	0.3350	0.3330	0.3208	0.2963	0.3359	0.3154	0.3045	0.3297	0.3235
1960	0.3431	0.3385	0.3311	0.3091	0.3435	0.3173	0.3119	0.3347	0.3296
1961	0.3447	0.3433	0.3300	0.3073	0.3436	0.3276	0.3167	0.3391	0.3374
1962	0.3431	0.3446	0.3296	0.3066	0.3404	0.3221	0.3154	0.3370	0.3407
1963	0.3518	0.3509	0.3377	0.3051	0.3585	0.3327	0.3203	0.3420	0.3479
1964	0.3363	0.3419	0.3262	0.2935	0.3528	0.3220	0.3008	0.3271	0.3288
1965	0.3276	0.3421	0.3220	0.2979	0.3339	0.3150	0.3038	0.3254	0.3219
1966	0.3259	0.3449	0.3184	0.3077	0.3294	0.3144	0.3092	0.3274	0.3353
1967	0.3289	0.3502	0.3227	0.3152	0.3313	0.3154	0.3154	0.3286	0.3410
1968	0.3290	0.3419	0.3204	0.3168	0.3277	0.3087	0.3115	0.3275	0.3432
1969	0.3334	0.3393	0.3242	0.3491	0.3344	0.3166	0.3160	0.3298	0.3536
1970	0.3335	0.3383	0.3282	0.3267	0.3375	0.3226	0.3191	0.3380	0.3480
1971	0.3365	0.3459	0.3318	0.3358	0.3412	0.3242	0.3240	0.3388	0.3447
1972	0.3372	0.3247	0.3149	0.3411	0.3481	0.3292	0.3287	0.3393	0.3460
1973	0.3037	0.3035	0.2980	0.2876	0.3161	0.2938	0.2792	0.3069	0.3057
1974	0.3150	0.3139	0.3093	0.2995	0.3218	0.3103	0.3056	0.3164	0.3286
1975	0.3074	0.3142	0.2997	0.3024	0.3246	0.3004	0.3022	0.3059	0.3193
1976	0.2819	0.2879	0.2762	0.2567	0.2893	0.2744	0.2787	0.2852	0.2865
1977	0.2820	0.2890	0.2790	0.2529	0.2865	0.2717	0.2786	0.2841	0.2853
1978	0.2803	0.2901	0.2779	0.2705	0.2791	0.2717	0.2741	0.2836	0.2826
1979	0.2717	0.2798	0.2716	0.2624	0.2759	0.2605	0.2640	0.2735	0.2716
1980	0.2792	0.2839	0.2791	0.2640	0.2833	0.2685	0.2705	0.2793	0.2810
1981	0.2869	0.2880	0.2867	0.2657	0.2907	0.2765	0.2769	0.2852	0.2904
1982	0.2938	0.2985	0.2954	0.2652	0.2970	0.2843	0.2852	0.2912	0.2962
1983	0.2952	0.3055	0.2904	0.2766	0.2928	0.2872	0.2869	0.2940	0.3000
1984	0.3010	0.3030	0.3020	0.2746	0.2998	0.2975	0.2928	0.2994	0.3059
1985	0.3069	0.3048	0.3094	0.2763	0.3040	0.3113	0.2997	0.3048	0.3113
1986	0.3170	0.3124	0.3215	0.2785	0.3125	0.2995	0.3087	0.3144	0.3189
1987	0.3253	0.3149	0.3325	0.2810	0.3203	0.3158	0.3146	0.3210	0.3282
1988	0.3428	0.3218	0.3534	0.2780	0.3367	0.3311	0.3249	0.3380	0.3445
1989	0.3594	0.3320	0.3759	0.3040	0.3506	0.3434	0.3338	0.3530	0.3562
1990	0.3446	0.3243	0.3586	0.2889	0.3395	0.3292	0.3266	0.3381	0.3412
1991	0.3396	0.3242	0.3523	0.2908	0.3327	0.3252	0.3227	0.3341	0.3363
1992	0.3400	0.3255	0.3532	0.2946	0.3320	0.3249	0.3223	0.3356	0.3357
1993	0.3438	0.3205	0.3562	0.2985	0.3363	0.3246	0.3286	0.3409	0.3382
1994	0.3407	0.3222	0.3537	0.2881	0.3293	0.3204	0.3265	0.3384	0.3377
1995	0.3503	0.3256	0.3601	0.2936	0.3327	0.3252	0.3284	0.3436	0.3414
1996	0.3546	0.3289	0.3665	0.2991	0.3361	0.3299	0.3304	0.3487	0.3450
1997	0.3626	0.3396	0.3732	0.3067	0.3428	0.3345	0.3375	0.3550	0.3505
1998	0.3684	0.3422	0.3815	0.3058	0.3481	0.3403	0.3422	0.3617	0.3572
1999	0.3701	0.3406	0.3795	0.3055	0.3432	0.3313	0.3351	0.3572	0.3546
2000	0.3861	0.3255	0.3890	0.2835	0.3538	0.3249	0.3209	0.3754	0.3505
2001	0.3870	0.3356	0.4042	0.2814	0.3679	0.3344	0.3298	0.3884	0.3611
2002	0.3830	0.3297	0.3936	0.2772	0.3611	0.3272	0.3222	0.3808	0.3566
2003	0.3871	0.3331	0.4018	0.2818	0.3674	0.3321	0.3266	0.3891	0.3624
2004	0.3800	0.3334	0.4072	0.2860	0.3717	0.3344	0.3310	0.3940	0.3669
2005	0.3816	0.3363	0.4147	0.2883	0.3746	0.3397	0.3370	0.3974	0.3708
2006	0.3894	0.3326	0.4117	0.2871	0.3733	0.3378	0.3299	0.3966	0.3715
2007	0.3904	0.3295	0.4119	0.2892	0.3710	0.3368	0.3272	0.3965	0.3720
2008	0.3875	0.3292	0.4116	0.2851	0.3711	0.3373	0.3280	0.3970	0.3777
2009	0.3696	0.3257	0.4065	0.2814	0.3699	0.3357	0.3260	0.3943	0.3710
2010	0.3699	0.3271	0.4089	0.2807	0.3735	0.3391	0.3303	0.3982	0.3770
2011	0.3746	0.3424	0.4072	0.3217	0.3613	0.3469	0.3325	0.3862	0.4007
2012	0.3767	0.3431	0.4055	0.3269	0.3694	0.3507	0.3325	0.3861	0.4048
2013	0.3699	0.3360	0.3981	0.3387	0.3651	0.3426	0.3301	0.3772	0.3980

Source: Authors' calculations.