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The impact of financial deepening on income inequality: Empirical evidence from Australia

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The impact of financial deepening on income inequality: Empirical evidence from Australia

Abstract

The present research paper is designed to explore the role of financial development indicators on income inequality in Australia using yearly data from 1980 to 2014. Our study also accounts for other potential determinants of income inequality such as inflation, per capita income and trade openness. Our results from Bayer and Hanck (2013) cointegration test confirm the long-run equilibrium relationship across the models. Similarly, the long-run estimates from the quantile regression models and non-parametric approach indicate that the financial development indicators, FDI inflows, inflation, and trade openness have significant positive impact on income inequality in Australia. However, the growth in per capita income plays the opposite role. Given these findings, our study offers numerous policy and practical implications and adds an important value to the empirical literature on the nexus between financial development and income inequality.

JEL Classification: D31; E22; E24; O16; O47

Keywords: Financial development; FDI inflows; per capita income; trade openness; income inequalities; Australia

1. Introduction

Income inequality, an important socio-economic indicator, is a concern for both the advanced and emerging countries. Income inequality not only measures how income is distributed or concentrated across the population but also indicates how the society is benefited from income or wealth distribution patterns (Fleming & Measham, 2015). In past years, income inequality has started increasing for many of the Organisation for Economic Co-operation and Development (OECD) countries; whereas Australia has started to experience the rise of income inequality since the mid-1990s (Fletcher & Guttmann, 2013).

A number of previous studies (Dabla-Norris, Kochhar, Suphaphiphat, Ricka, & Tsounta, 2015; Seven & Coskun, 2016; Stiglitz, 1993) argued that the financial system plays a complex and significant role in determining income inequality or income distribution and poverty. Given the significant role that the financial system plays on income distribution; several scholars have attempted to examine the linkage between financial development and income inequality either for individual or for multiple countries. The empirical evidence on the impact of financial development on income inequality is mixed. More specifically, the financial deepening provides a greater access to financial resources towards confronting shocks and lowers the income inequality (e.g. Dabla-Norris et al., 2015), whereas other studies (e.g. Te Velde, 2003) indicated that financial globalisation increases income inequality due to an imperfect competition between the workers within the economy.

Further, a number of researchers proposed different hypothesis such as Kuznets inverted U-shaped hypothesis (Kuznets, 1955), linear hypothesis (Banerjee & Newman, 1993; Galor & Zeira, 1993), and augmented Kuznets hypothesis. The empirical results, based on these approaches, showed the mixed evidence on the nexus between financial development and income inequality. For instance, Liang (2006) confirmed a negative and linear relationship between financial development and inequality, whereas Kim and Lin (2011) proved nonlinear

relationship between these variables. The nonlinear relationship indicates that unless a country reached to a minimum threshold level of a financial development, any financial development of both banks and stock markets can increase income inequality or create uneven income distribution in the country.

There have been some attempts made to measure income inequality in Australia. For instance, Kennedy et al. (2017) have measured income inequality for Australia and its states and territories using taxation statistics for the period of 1942 to 2013. Their analysis revealed that the income inequality has been rising across Australia for the last few decades and has an adverse effect, with time lag, on the economic growth. Another study by Wilkins (2015) also estimated income inequality using various available data sources and showed that the income inequality is negatively associated with increasing employment opportunities in the country. However, there is no systematic empirical study that has undertaken to investigate the impact of financial development on income inequality in Australia.

Given this backdrop, this study particularly focuses on Australian context. There are number of factors that motivated us to examine the impact of financial deepening on income inequality in Australia. More specifically, Australia is a small country, by population, but one of the highly developed nations in the world. The Australian case is special, in the sense that, it is a small nation but plays an important role in the global economy in terms of economic and financial aspects. For instance, Australia has maintained its position as the world's 13th largest economy, with an estimated nominal gross domestic product (GDP) of US$1.3 trillion (ATIC, 2017). The country has also shown considerable growth in its financial deepening in the last few decades. For example, the growth rates of bank deposits to GDP, domestic credit to the private sector by the banks to GDP, and stock market capitalization to GDP are 173.35%, 367.10% and 163.78%, respectively during 1980-2014. Further, both the foreign direct investment, net inflows to GDP and real per capita income are also shown significant growth

rates i.e., 152.00% and 82.56%, respectively.[1] These growth rates indicate that the Australian financial market and economy as a whole witnessed considerable growth during the last few decades.[2]

However, the growth of economy and financial sector development didn't help to improve the income distribution in Australia.[3] This argument is supported by a recent report (ACOSS, 2018), which suggested that the Australia's level of income inequality is more unequal as compared to average income inequality among other OECD countries. Our estimates also show that the income inequality in Australia is increased by 16% during 1980-2014. The rate of growth in income has also increased unevenly from the "top end/s" to the ''bottom end'' of the distribution (ACOSS, 2018; Kennedy, Smyth, Valadkhani, & Chen, 2017). It further implies that a person in the highest 20% income group lives with five times higher disposable income as compared with someone in the lowest 20% ($3978 per week compared to $735 per week).

Given this background, the present study is designed to empirically examine the impact of financial development on income inequality in Australia. More specifically, our study considers comprehensive list of financial indicators, including banking sector development, in the form of savings and credit, and financial market scale and depth. The study also accounts for other possible determinants of income inequality such as inflation, per capita income and trade openness. To achieve the study objectives, we employ a number of recently developed time series econometric techniques and yearly data from 1980 to 2014. Precisely, the long-run equilibrium relationship is explored using a cointegration technique, while long-run parameters are estimated by making use of quantile regression and fully modified ordinary least squares

[1] This data is sourced from the World Bank and calculated by the authors for the period of 1980-2014.

[2] Overall, the banking sector of the country has also displayed an increasing trend, indicates the growth in bank assets surpasses the growth in nominal GDP (Thangavelu, Beng Jiunn, & James, 2004).

[3] Greenville (2013) argues that between the years 1988–89 and 2009–2010, the income of individuals and households in Australia rose substantially in real terms compared to other OECD countries.

(FMOLS) methods, finally the causal relationship among the variables is examined using Granger non-causality test.

The present study makes a number of contributions to the body of knowledge and policy. More specifically, this is the first study that examines the impact of comprehensive financial indicators on income inequality in Australia by accounting other conventional determinants in the models. This is also the first study, to the best of authors' knowledge, to make use of Bayer and Hanck (2013) cointegration test, quantile regression and non-parametric techniques for the empirical investigation. This study adds further value to the literature by making use of longest available time series data in the analysis, 1980-2014. Our results established that the growths of financial indicators, across banking and stock markets, have positive and statistically significant impact on income inequality. Given these findings, we suggest that the policymakers need to work on framing suitable policies to make use of financial sector development to improve income distribution among the individuals. Specifically, the policies need to be redesigned for access to the capital from the financial institutions, so that all sections of the society can borrow funds much more easily and can establish small-scale firms which may provide additional employment opportunities for the unskilled and unemployed individuals, which eventually improves income distribution in the country. Further, the expansion of financial sector to the rural areas can also play an important role in reducing inequalities. Given all of that, our study makes a significant contribution to the empirical literature on the nexus between financial deepening and income inequality.

The rest of the paper is organized as follows: Section 2 provides a detailed discussion on the relevant empirical literature. Section 3 presents data measurement, empirical models and econometric techniques. Section 4 reports empirical findings and detailed policy implications. Finally, Section 5 discusses the conclusion of the paper.

2. Literature Review

Over the last five decades, two phenomenon: increasing financial development and income inequality – have been observed around the world (Jauch & Watzka, 2016). There has been long-standing theoretical and empirical interest among economists and practitioners in examining the determinants of income inequality and its relationship with other development indicators. A number of studies across different countries have also examined how financial development, financial market reforms, and financial liberalisation, along with other determinants, affect income distribution. Given that this study will focus particularly on the role of financial deepening on income inequality in the context of Australia.

The issue of income inequality is a significant concern in Australia for the last few decades but there is no clear empirical consensus on the factors that contribute for unequal income distribution in the country. A very few attempts have been made to examine the determinants of income inequality and its impact on economic growth in Australia. More specifically, Kennedy et al. (2017) have made considerable efforts to measure the Gini coefficient, using taxation statistics, for the period of 1942 to 2013 for Australia as well as its eight states and territories. Authors suggested that the income inequality has significantly risen not only at the country level but also across its states and territories since early 1980s. Further, authors have examined the role of income inequality on economic growth, by accounting other potential determinants in the model, using data from 1986 to 2013 on its states and territories. Their results indicated that the income inequality, with a time lag, has an adverse effect on economic growth in the country. Given this finding, authors suggested that the policy makers should make efforts to improve human capital development in the country, which will not only assist to reduce income inequality but also helps to improve its long-run economic growth and social benefits. Another important study in the case of Australia is Wilkins (2015), who has made considerable attempts to measure income inequality using a number of data sources. Specifically, author looked at the impact of income taxes, government benefits and

employment growth on income inequality trends for Australia over the decades. The evidence suggested that the growth of employment is negatively associated, whereas income taxes and changes to government benefits are positively related with the income inequality in Australia.

It implies from the literature that there is no systematic empirical study that has examined the nexus between financial development and income inequality in Australia. However, there is an ample of empirical literature on this issue at the cross-country level. For instance, by making use of comprehensive sample countries (126) and data set (1963-2002), Hamori and Hashiguchi (2012) empirically examined the impact of financial development (measured by banking credit and money supply) on income inequality (household data). Authors confirmed that the financial development, both measurements, played an important role in raising income levels of poor much more than that of rich; hence it reduced inequality. Similarly, Beck et al. (2007) have measured financial development through banking credit and have collected yearly data from 1960 to 2005 on 72 developed and developing economies around the world. Their results indicated that the financial development helped to reduce income inequality by improving income distribution to the poorest.

A number of other research studies have also looked at the impact of financial reforms, banking and capital markets, on income distribution. Precisely, Agnello et al. (2012) have investigated the effect of financial reforms on income inequality in a sample of 62 countries using data from 1973 to 2005. The financial reforms are measured through the aggregate index of financial reform which takes into account of removal of government control and direction of the financial sector, and also considered other nine dimensions of financial reforms. Their overall results implied that the financial reforms have a significant role in reducing income inequality in the selected countries. Likewise, Li and Yu (2014) examined the effect of financial reforms on income inequality in a sample of 18 Asian economies. By making use of yearly data, 1996-2005, and panel econometric techniques, authors showed that the better

banking supervision, lift of credit control and security market development are significantly associated with the reduction of inequality in the selected Asian countries.

In contradiction to the above evidence, several other scholars (Claessens & Perotti, 2007; Seven & Coskun, 2016; Sharma and Paramati, 2018) argued that the unequal opportunities can enhance the countries' income inequality even a greater extent if that country already has experienced a high level of inequality historically. For example, Jauch and Watzka (2016) used private credit (% of GDP) as a proxy for financial development, and GINI coefficient as a proxy for income inequality. By making necessary adjustments to the empirical modelling such as controlling for country fixed effects, endogeneity problems, and control variables, authors showed that financial development increases income inequality in a sample of 138 countries. Hence, an improved financial system, such as banking and stock market development, will not always benefit poor people. However, a recent study by Paramati and Nguyen (2018) documented that the growth in banking credit helps to minimize the income inequality across the panels of developed and emerging economies. Nonetheless, authors suggested that the growth in stock market indicators have positive and negative effects on income inequality for developed and emerging economies, respectively. Other empirical studies that have examined the relationship between financial development and income inequality have shown both positive and negative relationship (See Table 1). While, other authors (Christopoulos and McAdam, 2017; Lo Prete, 2013; Seven and Coskun, 2016) confirmed that there is no significant relationship between financial development and income inequality.

[Insert Table 1 Here]

The above literature review indicated that the financial development is mostly measured using banking credit, money supply and stock market capitalization. The impact of these financial indicators on income inequality is not uniform across the studies (i.e. positive,

negative and no relationship). This might be due to the selection of the sample period, countries and econometric methods. Further, none of the previous studies examined the detailed impacts of financial development indicators, which cover from banks' savings and credit, and capital market scale, efficiency and depth, on income inequality in Australia. Furthermore, none of the previous studies, to the best of authors' knowledge, employed Bayer and Hanck (2013) cointegration test, quantile regression and non-parametric techniques for the empirical investigation. In addition to that, our study focuses on Australia due to its significant development in the financial sector, increasing economic prosperity, and raising income inequalities over the last few decades. This is an important economic issue and needs a thorough investigation to identify the determinants of income inequality. Hence, these factors motivated us to empirically investigate the impact of financial development on income inequality in Australia by using annual data from 1980 to 2014 and employing several robust time series econometric techniques. Hence, the findings derived from these analyses will be crucial for the policy, practice and to the body of knowledge.

2.1 Theoretical linkage between financial development and income inequality

Theoretically, there are two arguments exist in relation to the nexus between financial development and income inequality. The first strand of arguments suggests that the financial development widens income inequality (non-linear relationship). This is because in the early stages of financial development, it benefits the rich due to their credit-worthiness, while the poor individuals, who are economically, politically and socially backward, lack in collateral and credit-worthiness. Given that the rich individuals have more access to the financial services than that of poor individuals. Due to this fact, the poor individuals will not be able benefit from the financial system and hence will engage in unskilled job market and earn lower wages (Clarke et. al., 2006). The second aspect of arguments suggests that the financial development reduces income inequality (linear relationship). The scholars (e.g. Galor and Zeira, 1993;

Banerjee and Newman, 1993) argued that the borrowing costs are higher in an underdeveloped financial market; hence it will not benefit the poor individuals at this stage. However, as economy grows, the financial system deepens in such a way to support this expanding economy with a broader financial products and services. This is when the borrowing costs are significantly reduced and the financial services are more accessible to all sections of the society, which eventually helps poor individuals to improve their earning opportunities by investing in physical and human capital.

Similarly, other scholars (Beck et al., 2007; Hamori and Hashiguchi, 2012) argued that the impact of banking system on income inequality is determined by the fact that whether the rich or the poor who benefits the most from banking credit allocation. Likewise, Wies and Moorman (2015) reported that the companies that go public allow access to more capital and hence it stimulates investment and innovations. Likewise, some other researchers (Singh, 2008; Choong et al., 2010) documented that the stock markets in developed economies are large, liquid and stable over the years. Further, these authors suggested that the developed stock markets are mostly concentrated with highly industrialized and service oriented companies, which tend to produce technology intensive products and services; hence these companies mostly rely on skilled labour. Given that fact, the financial development in developed economies may increase income disparity among the individuals. These empirical evidences are contradicting with the theoretical expectation on the relationship between financial development and income inequality. Hence, given the nature of financial development in Australia, we expect that the all of the financial deepening indicators may have a positive impact on income inequality.

3. Data and methodology

3.1 Data measurement

This paper makes use of annual data from 1980 to 2014 on the selected variables. The measurement of the variables is as follows: we measure the income inequality through the Gini index (IIE). We consider a number of indicators as a proxy for financial development (FD) in Australia such as bank deposits to GDP (BD); central bank assets to GDP (CBA); credit to government and state-owned enterprises to GDP (CGSE); domestic credit to the private sector by the banks to GDP (DCPS); deposit money banks' assets to GDP (DMBA); financial system deposits to GDP (FSD); liquid liabilities to GDP (LL); private credit by deposit money banks to GDP (PC); stock market capitalization to GDP (SMC); stock market turnover ratio (SMTOR); and stock market total value traded to GDP (SMTVT). We also consider foreign direct investment, net inflows to GDP (FDI) and three control factors such as consumer price index (2010 = 100) is a proxy for inflation (CPI); GDP per capita in constant Australian dollars (AUD) (PI) and finally, trade openness is the total exports and imports to GDP (TO). The required data on IIE is sourced from the Standardized World Income Inequality Database (SWIID) of Solt (2019), while data on BD, CBA, CGSE, DMBA, FSD, LL, PC, SMC, SMTOR and SMTVT are obtained from the Global Financial Development (GFD, 2017) and finally data on DCPS, FDI, CPI, PI and TO is collected from the World Development Indicators (WDI, 2017). Before the analysis, we convert all of our variables into natural logarithms to avoid the issues that are related to data measurement.

3.2 Empirical setting

This paper is designed to investigate the role of financial development indicators and FDI inflows on income inequality in Australia. The study also considers other major drivers of income inequality in the models such as inflation, per capita income and trade openness. To achieve our study objectives, we develop the following empirical models using both theoretical and empirical literature:

$$IIE_t = f\,(CPI_t, PI_t, TO_t, FD_t, \varepsilon_t) \quad (1)$$

$$IIE_t = f\,(CPI_t, PI_t, TO_t, FDI_t, \varepsilon_t) \quad (2)$$

where, IIE, CPI, PI, TO, FD and FDI indicate GINI index of income inequality, inflation, per capita income, trade openness, financial development indicators (such as BD, CBA, CGSE, DCPS, DMBA, FSD, LL, PC, SMC, SMTOR and SMTVT) and FDI net inflows, respectively. Finally, ε and t represent for error term and time period, respectively.

To begin our empirical analysis, we first employ a time series unit root test to investigate the order of integration of our considered variables in the study. For this reason, we apply Augmented Dickey-Fuller (Dickey and Fuller, 1979) unit root test. Further, to account for a structural break in the data series while testing a unit root, we employ Perron's (1989) approach. More specifically, we identify the structural break in a given data series using minimum Dickey-Fuller t-statistic under the *Innovational Outlier* approach. The required lag length was selected using Schwarz criterion. We test the null hypothesis of a unit root as against the alternative hypothesis of no unit root. The results obtained from this unit root test will help us to choose appropriate econometric techniques to achieve the study objectives.

First, we aim to examine the long-run cointegration relationship among the variables of equation (1) and (2). For this purpose, we make use of a recently developed time series cointegration technique of Bayer and Hanck (2013). In applied economics, cointegration testing is a standard tool for analysing whether two or more time series variables are cointegrated together in the long-run. To date, a number of techniques have been developed in the literature, and all of these tests reached with different conclusions. Therefore, to overcome these deficiencies, Bayer and Hanck (2013), proposed a new cointegration test that combines various cointegration tests and provides reliable empirical findings on the long-run equilibrium relationship. The authors have developed this time series cointegration test by making use of four individual cointegration tests such as Engle and Granger (1987), Johansen (1991), Boswijk (1994) and Banerjee, Dolado, and Mestre (1998).

In the next step, we employ quantile regression models to explore the long-run impacts of financial development indicators, FDI net inflows, inflation, per capita income and trade openness on income inequality in Australia. The quantile regression method provides many advantages over the conventional regression techniques while estimating the coefficients for the entire distribution. Quantile regression techniques were first introduced by Koenker and Bassett Jr (1978), and have been utilized in the literature for many years. One of the key advantages that quantile regression can provide is its ability not only to describe the mean of the distribution like the other conventional regression techniques do but also to describe the entire conditional distribution of the dependent variable (Coad & Rao, 2008). Therefore, it would be worthwhile to investigate the long-run impact of financial development indicators and FDI inflows on income inequality by estimating the slope parameters for various quartiles of the conditional distribution. More specifically, in this study, we estimate the models by using four different quantiles such as tau 0.2, 0.4, 0.6 and 0.8. This technique was run across 12 models, of which 11 models represent financial development indicators, while another one represents FDI inflows.

Finally, the study aims to examine the causal relationship between the variables of equation (1) and (2). To do this, we employ the approach suggested by Toda and Yamamoto (1995). The advantage of using Granger no-causality methodology developed by Toda and Yamamoto (1995) lies in its simplicity and also the ability to overcome many shortcomings of other econometrics techniques while testing the causal relationship between variables (Altinay & Karagol, 2005; Shan & Sun, 1998). The key ideas behind the Toda-Yamamoto test are to artificially augment the true lag length (say, p) of the VAR model up to the maximal order of integration (d_{max}) that might occur in the process. Then the VAR model will be estimated by using the $(p + d_{max})$ order and test the linear or non-linear restrictions on the first k coefficient matrices by the standard Wald Test. The Wald statistic which is used in this setting converges

in distribution to a random χ^2 variable, no matter if the process is stationary or nonstationary. This test functions under the null hypothesis of no causality against the alternative hypothesis of causality.

3.3 Preliminary analysis

We present the summary statistics on the selected variables using data from 1980 to 2014. Table 2 reports summary statistics on different time periods. It indicates that the income inequality is increasing over time in Australia. Further, the summary statistics suggest that most of the financial development indicators are also increasing over time. However, some of the financial indicators such as CBA, CGSE, SMC, SMTOR and SMTVT have slightly declined in the recent time. It is interesting to find out that Australia is able to attract higher and higher FDI inflows over the years. The FDI inflows have reached to a record high of 3.63 percent of Australian GDP during 2010-2014. Likewise, the per capita GDP has also significantly increased from 39416 AUD (1980-89) to 65765 AUD (2010-14). Finally, the trade openness of Australia is also in raise over the last three decades. Overall, our summary statistics indicate that the income inequality, along with financial development, FDI inflows, per capita income and trade openness, is significantly rising over the years. Given that, it is important to identify the factors that are contributing to higher income inequalities in Australia.

[Insert Table 2 Here]

Table 3 presents average annual growth rates using data from 1980-2014. The table shows that the income inequality has higher growth rates during 1980-89 and 2000-09, however, it has negative growth rates in the recent period, 2010-14. On average, all of the financial development indicators also have positive growth rates during the sample period with the exception of CBA. The FDI inflows had negative growth rates only during 1990-99; though, overall it has more than 20 per cent growth in the sample period. The per capita income has

highest growth rates during 1990-99, while lowest was in the 2010-14 period. Finally, the trade openness also showed considerable positive growth rates; but, it showed negative growth in the recent period. Our growth rates suggest that all of the considered variables, with the exception of CBA, have significant positive growth rates during the entire sample period.

[Insert Table 3 Here]

4. Empirical analysis and discussion

We begin our empirical investigation by analysing the order of integration and structural breakpoints for each of the series under consideration. The time series unit root test results are presented in Table 4. The findings on level data show that none of the considered variables rejects the null hypothesis of a unit root at the 5% significance levels. Further, we notice that the considered variables have varying breakpoints during the sample period. Given that, we again apply the unit root test on the first difference data series to see whether the null hypothesis of a unit root can be rejected. The findings suggest that all of the considered variables strongly reject the null hypothesis. It implies that the considered variables have the same order of integration that is I (1). It is argued in the literature that if all of the selected variables in any given model are integrated of the same order then these variables may be cointegrated, as a group, in the long-run. Hence, we explore the long-run association among these variables in the following.

[Insert Table 4 Here]

4.1 Long-run estimates of income inequality

To examine the long-run association among the variables of income inequality, inflation, per capita income, trade openness, financial development indicators, and FDI, we employ Bayer and Hanck (2013) cointegration technique. The results of this test are displayed in Table 5. The cointegration test results across the 12 models imply that the null hypothesis of a no

cointegration is strongly rejected for all of the individuals as well as combined tests. These findings, therefore, suggest that there is a strong evidence of long-run association among the variables of our study. The cointegration test results indicate that these variables, as a group, reach an equilibrium point sometime in the long-run.

[Insert Table 5 Here]

The above cointegration test findings only indicate whether the considered variables have a long-run relationship or not, but do not imply the nature of the impact of inflation, per capita income, trade openness, financial development indicators and FDI inflows on income inequality in the long-run. Therefore, to investigate the long-run impact of financial development indicators and FDI inflows on income inequality, we employ quantile regression models. The results of these models are reported in Table 6.

We estimate quantile regression models using four different quantiles such as tau 0.2, 0.4, 0.6, and 0.8. The results show that the financial development indicators have a significant positive impact on income inequalities in Australia. Our results also indicate that these financial indicators are statistically significant only in the case of upper quantiles. More specifically, a 1% growth in bank deposits (BD), central bank assets (CBA), credit to government and state-owned enterprises (CGSE) and financial system deposits (FSD) raise income inequalities by 0.108%, 0.025%, 0.012% and 0.108%, respectively. Similarly, other financial development indicators, in most cases, and FDI inflows also have a positive impact on income inequalities but statistically insignificant. Further, we find that the inflation (CPI) growth seems to be positively associated with income inequality, while growth in per capita income has a negative impact.

[Insert Table 6 Here]

For the purpose of robustness check, we further apply fully modified ordinary least squares (FMOLS) method. This is a robust technique to investigate the long-run estimates among the variables as it uses a non-parametric approach to handle the issues of endogeneity and serial correlation. Therefore, the results obtained from the FMOLS are more reliable than that of standard ordinary least squares (OLS) method. The results of FMOLS models are presented in Table 7. The results suggest that the growth in financial development indicators, FDI inflows, inflation and trade openness make a significant positive contribution to the income inequality in Australia, while the growth in per capita income reduces inequality. These findings are consistent across the models.

More specifically, a 1% raise in bank deposits (BD), central bank assets (CBA), credit to government and state-owned enterprises (CGSE), domestic credit to the private sector (DCPS), deposit money banks' assets (DMBA), financial system deposits (FSD), liquid liabilities (LL), private credit by deposit money banks (PC), stock market capitalization (SMC), stock market turnover ratio (SMTOR), and stock market total value traded (SMTVT) increases income inequalities by 0.056%, 0.015%, 0.003%, 0.051%, 0.060%, 0.056%, 0.033%, 0.043%, 0.005%, 0.017%, and 0.011%, respectively. Similarly, a 1% increase in FDI inflows also raises income inequality by 0.009%. We also find a similar impact from inflation and trade openness on income inequality. However, the growth in per capita income has a substantial negative effect on the income inequalities in Australia.[4] Overall, these long-run estimates from quantile regression and FMOLS models indicate that the financial development indicators, FDI inflows, inflation and trade openness deteriorate income distribution in Australia, which eventually endorsing income inequality. These empirical evidences are consistent with our earlier expectations in regards to the relationship between financial development and income

[4] Similar results are found in a cross-country study. More specifically, Alam and Paramati (2016) documented that the growth in FDI inflows and trade openness increases income inequality, while economic growth has an opposite effect in developing economies.

inequality. However, the growth in per capita income is playing a considerable role in fighting the rise of income inequality.

[Insert Table 7 Here]

4.2 Direction of causalities

Finally, we explore the direction of causality between income inequality, financial development indicators, FDI inflows, per capita income, inflation, and trade openness using Toda-Yamamoto (1995) Granger non-causality test. The findings of this test are displayed in Table 8. The results show the evidence of feedback association between bank deposits –income inequality, financial system deposits – income inequality and liquid liabilities – income inequality. Further, we also find unidirectional causality that runs from deposit money banks' assets, private credit by deposit money banks, stock market turnover ratio and inflation to income inequalities. These results suggest that some of the financial indicators (BD, FSD and LL) share significant bidirectional causality with income inequality, while other financial indicators (DMBA, PC and SMTOR) drive income inequality but no evidence of reverse causality.

[Insert Table 8 Here]

5. Conclusion

There has been an increasing concern among the individuals, government officials, and policymakers in relation to the economic disparity in the Australian society for the last three decades. During this time, the country also witnessed tremendous growth in financial sector development. However, there is no empirical evidence that supports the argument of financial development increased income inequality in Australia. Therefore, to understand the factors that are contributing to higher income inequalities, we aimed to investigate the effect of financial

deepening on income inequality in Australia. Our study also accounted for other potential determinants in the models such as inflation, per capita income and trade openness. For this purpose, our study has utilized the longest available annual data set, 1980-2014, and utilized a battery of recently developed time series econometric techniques for the empirical investigation.

Our empirical findings from the Bayer and Hanck (2013) cointegration test suggested that there is a significant long-run equilibrium association among the variables of financial development indicators, FDI inflows, inflation, per capita income, trade openness and income inequality across the models. Our long-run estimates from the quantile regression and non-parametric models indicated that the growth in financial development indicators has a substantial positive impact on income inequalities. Further, results showed that the growth in FDI inflows, inflation and trade openness also have a positive effect on income inequalities. In contrary, the growth in per capita income has played a considerable negative role on income inequality. Finally, our results in the direction of causality suggested the evidence of bidirectional causality between bank deposits – income inequality, financial system deposits – income inequality and liquid liabilities – income inequality. We also found unidirectional causality that runs from deposit money banks' assets, private credit by deposit money banks and stock market turnover ratio to income inequalities.

Given these findings, we argue that the growth in financial development indicators and FDI inflows have caused for higher income inequalities in Australia. Therefore, the policymakers need to work on framing suitable policies to make use of both financial development and FDI inflows for improving income distribution among the individuals. More specifically, to the access of capital from the financial institutions need to be relaxed so that all sections of the society can borrow funds much more easily and can establish small-scale firms which may provide additional employment opportunities for the unskilled and unemployed individuals. The policymakers should also develop policies to provide required training

facilities for the unskilled and unemployed labour so that they can improve their employment and earning opportunities. Finally, the FDI inflows also need to be diverted to rural and underdeveloped areas so that the people those who live in that areas can have better-earning possibilities. If these policies are implemented effectively then the growth in financial sector development and FDI inflows can significantly improve income distribution and thus reduces inequalities.

Our study also makes an important contribution to the empirical literature and to the body of knowledge. For instance, this is the first study to consider longest annual data set, 1980-2014, and several financial development indicators. In this context, our study is the first one to employ Bayer and Hanck (2013) cointegration test for exploring the long-run equilibrium relationship among the variables, and also first study to use quantile regression models for exploring the long-run elasticities of income inequalities. Therefore, the findings derived from these analyses are reliable and robust. Overall, our study has offered a number of policy and practical implications and also adds significant value to the empirical literature on the nexus between financial indicators and income inequality in Australia.

Statement of availability of data: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Table 1: A summary of literature review

Authors	Sample countries	Econometric methods	Sample period	Major findings
Abosedra et al. (2016)	Egypt	Auto Regressive Distributed Lag (ARDL) method	1975-2011	The income inequality is reduced through two-ways. More specifically, the direct channels of reducing income inequality are through increasing access to financial services such as credit and insurance risk services by poor people in Egypt. The indirect channel is through the positive impacts on economic growth due to financial sector development, which eventually reduced unemployment and income inequality in Egypt
Jauch & Watzka (2016)	138 countries	Pooled Regression, Benchmarks model: fixed effects estimation and dynamic panel model	1960-2008	A positive and significant relationship has been found where an increase in the provision of credit by 10% leads to an average increase in the Gini coefficient by 0.22
Jaumotte et al. (2013)	51 countries	Panel data regression models	1981-2003	Trade and export growth are reducing income inequality, while financial globalisation is increasing.
Law & Tan (2009)	Malaysia	Augmented Dickey Fuller test, ARDL bounds test	1980-2000	Financial market development is very week and statistically insignificant in reducing income inequality in Malaysia.
Liang (2006)	China	Generalized Method of Moments (GMM)	1986–2000	Financial development has a significant negative impact on income inequality for post-reform urban China.
Reuveny & Li (2003)	69 countries	Pooled time series, cross-sectional research design	1960-1996	A negative relationship is found between trade openness and income inequality, whereas a positive relationship between FDI and income inequality
Sehrawat & Giri (2015)	India	ARDL method	1982-2012	Financial development, economic growth and inflation widened the income inequality in case of both long run and short run. However, trade openness reduced the income inequality by providing higher job opportunity in the economy.
Seven & Coskun (2016)	45 emerging countries	Dynamic panel GMM techniques	1987-2011	An improved financial system, measured by bank and stock market development, do not always benefit poor people, particularly from emerging economies.
Shahbaz and Islam (2011)	Pakistan	ARDL and error correction models	1971–2005	Though financial development reduced income inequality. However, economic growth and trade openness worsened the income distribution in Pakistan
Uddin et al. (2014)	Bangladesh	ARDL with structural breaks	1975-2011	The results showed a negative non-linear relationship between financial development and income inequality, which implies that financial development helped to reduce income inequality in Bangladesh.

Notes: Most of the previous studies measured the financial development through the 'domestic credit to the private sector by the banks as a percentage of GDP. However, some studies also used various indicators of banking development, including bank deposits, banking credit, liquid liabilities, etc., and stock market development, which is measured through market capitalization, trade volume and turnover ratio, which broadly represent the financial sector development in any given country. Given that our study measures various indicators of banking and stock market to represent the comprehensive financial sector development in Australia.

Table 2: Summary statistics on the selected variables, 1980-2014

Variable	1980-89	1990-1999	2000-2009	2010-2015	1980-2014
IIE	28.91	30.65	31.86	31.96	30.69
BD	34.31	52.94	73.16	94.17	59.29
CBA	2.90	2.89	3.32	2.48	2.96
CGSE	9.30	6.20	1.68	3.46	5.40
DCPS	36.72	69.20	105.75	125.07	78.34
DMBA	40.86	71.08	99.97	124.59	78.34
FSD	34.31	52.94	73.16	94.17	59.29
LL	37.64	56.58	76.81	101.02	63.30
PC	31.85	64.86	98.42	121.75	73.15
SMC	40.45	61.28	110.65	98.75	74.79
SMTOR	22.91	43.55	80.18	67.31	51.51
SMTVT	9.28	25.52	85.65	70.35	44.47
FDI	1.81	1.75	3.21	3.63	2.45
CPI	40.71	65.99	85.84	105.30	70.05
PI	39416.22	47143.56	59520.69	65764.64	51132.23
TO	31.51	36.21	41.10	41.25	36.98

Note: Summary statistics were calculated using before log conversion data.

Table 3: Average annual growth rates, 1980-2014

Variable	1980-1989	1990-1999	2000-2009	2010-2014	1980-2014
IIE	1.11	0.31	0.65	-0.87	0.45
BD	2.62	3.98	4.79	-1.21	3.09
CBA	-10.50	13.23	9.78	-31.32	-0.62
CGSE	-2.61	-3.32	51.91	6.15	14.50
DCPS	9.19	3.59	3.87	1.06	4.78
DMBA	5.38	4.03	4.31	0.41	3.94
FSD	2.62	3.98	4.79	-1.21	3.09
LL	2.39	3.80	4.54	1.08	3.24
PC	7.68	5.04	4.76	0.10	4.93
SMC	8.38	7.54	1.21	-0.77	4.68
SMTOR	19.98	7.50	7.19	-9.23	8.25
SMTVT	29.19	12.49	8.03	-9.23	12.41
FDI	64.37	-0.43	16.40	3.10	22.19
CPI	8.22	2.50	3.17	2.57	4.22
PI	1.87	2.08	1.83	1.04	1.80
TO	0.04	1.99	1.58	-1.20	0.88

Note: The average annual growth rates were calculated using before log conversion data.

Table 4: Augmented Dickey-Fuller test results with breakpoints

	Level			First difference		
Variable	t-Statistic	Prob.	Break date	t-Statistic	Prob.	Break date
IIE	-2.870	0.753	1997	-6.000***	0.000	1992
BD	-2.283	0.950	2006	-4.689**	0.025	2012
CBA	-3.936	0.179	2013	-5.051***	0.000	2013
CGSE	-2.256	0.954	1999	-9.479***	0.000	2005
DCPS	-2.120	0.972	1986	-4.655**	0.028	1992
DMBA	-2.111	0.973	1986	-4.899**	0.013	1993
FSD	-2.283	0.950	2006	-4.689**	0.025	2012
LL	-2.484	0.907	2006	-4.794**	0.018	2007
PC	-3.902	0.193	2002	-4.860**	0.015	1992
SMC	-3.529	0.371	1994	-6.513***	0.000	2007
SMTOR	-3.151	0.597	1992	-11.230***	0.000	2008
SMTVT	-3.330	0.486	1998	-4.577**	0.035	2011
FDI	-4.165	0.107	2010	-13.655***	0.000	2007
CPI	-3.653	0.306	1999	-6.850***	0.000	1990
PI	-2.516	0.899	1993	-5.005***	0.000	1992
TO	-3.542	0.364	1992	-6.474***	0.000	2001

Notes: The unit root test was estimated using a constant variable in the model; ** and *** imply the rejection of the null hypothesis of a unit root at the 5% and 1% significance levels, respectively.

Table 5: Bayer-Hanck (2013) cointegration test results

Models	Engle-Granger	Johansen	Banerjee	Boswijk	EG-JOH	EG-JOH-BAN-BOS
IIE = f (CPI, PI, TO, BD)	-4.258*	61.506***	-5.752***	103.283***	60.592**	132.888**
IIE = f (CPI, PI, TO, CBA)	-4.392**	72.173***	-10.644***	146.311***	61.278**	171.802**
IIE = f (CPI, PI, TO, CGSE)	-4.146*	119.406***	-16.987***	359.084***	60.065**	170.589**
IIE = f (CPI, PI, TO, DCPS)	-4.481**	89.372***	-10.288***	358.686***	61.771**	172.295**
IIE = f (CPI, PI, TO, DMBA)	-4.394**	94.292***	-13.622***	313.134***	61.286**	171.810**
IIE = f (CPI, PI, TO, FSD)	-4.258*	61.506***	-5.752***	103.283***	60.592**	132.888**
IIE = f (CPI, PI, TO, LL)	-4.279*	69.543***	-5.058***	97.060***	60.701**	128.295**
IIE = f (CPI, PI, TO, PC)	-4.376*	84.123***	-9.312***	247.302***	61.194**	171.719**
IIE = f (CPI, PI, TO, SMC)	-4.386**	94.925***	-11.285***	256.381***	61.246**	171.770**
IIE = f (CPI, PI, TO, SMTOR)	-4.553**	71.791***	-11.150***	171.100***	62.184**	172.708**
IIE = f (CPI, PI, TO, SMTVT)	-4.341*	95.251***	-16.533***	351.322***	61.016**	171.540**
IIE = f (CPI, PI, TO, FDI)	-4.581**	82.167***	-8.627***	151.158***	62.350**	172.874**

Notes: The models were estimated using unrestricted constant; *, ** and *** imply the rejection of the null hypothesis of a no cointegration at the 10%, 5% and 1% significance levels, respectively.

Table 6: The long-run estimates using Quantile Regression models

	tau = 0.2		tau = 0.4		tau = 0.6		tau = 0.8	
Variable	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
IIE = f (CPI, PI, TO, BD)								
Constant	3.122***	0.002	3.575***	0.000	4.060***	0.000	4.058***	0.000
CPI	0.137***	0.000	0.115**	0.022	0.094	0.137	0.089*	0.078
PI	-0.026	0.816	-0.093	0.317	-0.158*	0.091	-0.143	0.259
TO	0.040	0.643	0.088	0.195	0.120	0.113	0.033	0.719
BD	-0.038	0.514	0.014	0.842	0.061	0.448	0.108*	0.094
IIE = f (CPI, PI, TO, CBA)								
Constant	3.802***	0.000	3.515***	0.000	3.286***	0.000	3.208***	0.000
CPI	0.138***	0.000	0.132***	0.001	0.146***	0.000	0.150***	0.000
PI	-0.097	0.292	-0.073	0.368	-0.040	0.630	-0.038	0.627
TO	0.024	0.868	0.038	0.715	-0.016	0.859	-0.003	0.969
CBA	-0.004	0.786	0.007	0.605	0.019*	0.069	0.025***	0.002
IIE = f (CPI, PI, TO, CGSE)								
Constant	4.124***	0.000	2.969**	0.043	3.139**	0.037	2.078***	0.007
CPI	0.154***	0.000	0.108**	0.015	0.126***	0.003	0.106***	0.001
PI	-0.160*	0.052	-0.029	0.863	-0.050	0.771	0.068	0.456
TO	0.105	0.170	0.086	0.357	0.082	0.411	0.045	0.562
CGSE	-0.001	0.757	0.003	0.684	0.006	0.499	0.012***	0.010
IIE = f (CPI, PI, TO, DCPS)								
Constant	4.421***	0.000	4.227***	0.000	3.625***	0.000	2.700**	0.016
CPI	0.132**	0.024	0.062	0.514	0.087	0.460	0.144*	0.096
PI	-0.188**	0.031	-0.147*	0.064	-0.096	0.307	0.002	0.985
TO	0.093	0.216	0.059	0.456	0.091	0.261	0.057	0.560
DCPS	0.033	0.595	0.073	0.313	0.034	0.718	-0.022	0.787
IIE = f (CPI, PI, TO, DMBA)								
Constant	3.118***	0.001	3.593***	0.000	3.798***	0.000	3.122***	0.006
CPI	0.152***	0.006	0.107	0.261	0.055	0.701	0.004	0.976
PI	-0.023	0.818	-0.095	0.233	-0.120	0.170	-0.019	0.882
TO	0.025	0.794	0.093	0.170	0.106	0.166	-0.002	0.981
DMBA	-0.045	0.525	0.018	0.850	0.073	0.584	0.120	0.338
IIE = f (CPI, PI, TO, FSD)								
Constant	3.122***	0.002	3.575***	0.000	4.060***	0.000	4.058***	0.000
CPI	0.137***	0.000	0.115**	0.022	0.094	0.137	0.089*	0.078
PI	-0.026	0.816	-0.093	0.317	-0.158*	0.091	-0.143	0.259
TO	0.040	0.643	0.088	0.195	0.120	0.113	0.033	0.719
FSD	-0.038	0.514	0.014	0.842	0.061	0.448	0.108*	0.094

Note: ***, ** & * indicate the significance levels at the 1%, 5% and 10%, respectively.

Table 6: Cont'd

	tau = 0.2		tau = 0.4		tau = 0.6		tau = 0.8	
Variable	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
IIE = f (CPI, PI, TO, LL)								
Constant	2.958***	0.003	3.570***	0.000	3.839***	0.000	4.030***	0.000
CPI	0.133***	0.000	0.115**	0.015	0.092	0.169	0.090*	0.086
PI	-0.006	0.958	-0.093	0.313	-0.135	0.144	-0.143	0.238
TO	0.038	0.647	0.088	0.199	0.122	0.110	0.033	0.720
LL	-0.045	0.372	0.015	0.819	0.054	0.573	0.114	0.106
IIE = f (CPI, PI, TO, PC)								
Constant	3.185***	0.000	3.609***	0.000	3.699***	0.000	2.876***	0.007
CPI	0.162**	0.012	0.104	0.273	0.076	0.583	0.073	0.538
PI	-0.036	0.681	-0.095	0.207	-0.101	0.252	0.006	0.958
TO	0.028	0.787	0.093	0.176	0.092	0.269	0.014	0.880
PC	-0.038	0.489	0.016	0.817	0.041	0.674	0.033	0.728
IIE = f (CPI, PI, TO, SMC)								
Constant	3.667***	0.000	3.340***	0.000	3.216***	0.002	2.201**	0.018
CPI	0.131***	0.000	0.119***	0.001	0.125***	0.001	0.117***	0.001
PI	-0.082	0.321	-0.070	0.392	-0.064	0.549	0.053	0.636
TO	0.013	0.895	0.100	0.185	0.120	0.120	0.070	0.473
SMC	0.008	0.572	-0.006	0.736	-0.012	0.601	-0.020	0.395
IIE = f (CPI, PI, TO, SMTOR)								
Constant	3.384***	0.000	3.795***	0.000	3.567***	0.000	2.631***	0.003
CPI	0.090**	0.043	0.112***	0.007	0.121***	0.004	0.124***	0.007
PI	-0.053	0.509	-0.115	0.133	-0.093	0.255	0.019	0.859
TO	0.037	0.596	0.094	0.184	0.092	0.215	0.029	0.753
SMTOR	0.023	0.157	0.018	0.296	0.007	0.721	-0.006	0.819
IIE = f (CPI, PI, TO, SMTVT)								
Constant	3.531***	0.000	3.776***	0.000	3.542***	0.005	2.080*	0.090
CPI	0.104***	0.008	0.110***	0.006	0.147***	0.003	0.140**	0.011
PI	-0.055	0.477	-0.103	0.164	-0.105	0.376	0.060	0.643
TO	0.001	0.994	0.077	0.291	0.118	0.113	0.049	0.608
SMTVT	0.010	0.183	0.008	0.453	-0.006	0.788	-0.016	0.509
IIE = f (CPI, PI, TO, FDI)								
Constant	3.567***	0.000	3.483***	0.000	3.733***	0.000	2.947***	0.001
CPI	0.137***	0.000	0.119***	0.001	0.136***	0.000	0.119***	0.000
PI	-0.060	0.457	-0.082	0.286	-0.118	0.161	-0.014	0.893
TO	-0.024	0.803	0.087	0.199	0.108	0.158	0.028	0.764
FDI	0.001	0.912	0.005	0.557	0.009	0.379	0.017	0.153

Note: ***, ** & * indicate the significance levels at the 1%, 5% and 10%, respectively.

Table 7: The long-run estimates using non-parametric approach

Variable	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Constant	3.824***	3.342***	2.990***	3.552***	3.609***	3.824***	3.570***	3.509***	3.273***	3.201***	3.442***	3.186***
CPI	0.101***	0.139***	0.112***	0.068***	0.074***	0.101***	0.108***	0.073***	0.115***	0.092***	0.095***	0.115***
PI	-0.126***	-0.054***	-0.032***	-0.082***	-0.095***	-0.126***	-0.099***	-0.077***	-0.061***	-0.044***	-0.066***	-0.054***
TO	0.088***	0.018***	0.086***	0.072***	0.077***	0.088***	0.093***	0.072***	0.086***	0.069***	0.072***	0.090***
BD	0.056***											
CBA		0.015***										
CGSE			0.003***									
DCPS				0.051***								
DMBA					0.060***							
FSD						0.056***						
LL							0.033***					
PC								0.043***				
SMC									0.005***			
SMTOR										0.017***		
SMTVT											0.011***	
FDI												0.009***
R^2	0.873	0.879	0.864	0.868	0.871	0.873	0.865	0.868	0.861	0.866	0.867	0.865
Adjusted R^2	0.855	0.862	0.845	0.850	0.853	0.855	0.847	0.850	0.842	0.848	0.848	0.846

Note: *** implies the significance level at the 1%.

Table 8: Toda-Yamamoto Granger causality test results

Null hypothesis	Chi-sq	Probability
BD doesn't Granger cause IIE	10.790***	0.005
IIE doesn't Granger cause BD	7.837**	0.020
CBA doesn't Granger cause IIE	0.512	0.774
IIE doesn't Granger cause CBA	1.381	0.501
CGSE doesn't Granger cause IIE	0.895	0.639
IIE doesn't Granger cause CGSE	2.359	0.308
DCPS doesn't Granger cause IIE	2.852	0.240
IIE doesn't Granger cause DCPS	0.869	0.647
DMBA doesn't Granger cause IIE	19.091***	0.000
IIE doesn't Granger cause DMBA	3.056	0.217
FSD doesn't Granger cause IIE	10.790***	0.005
IIE doesn't Granger cause FSD	7.837**	0.020
LL doesn't Granger cause IIE	9.837***	0.007
IIE doesn't Granger cause LL	6.573**	0.037
PC doesn't Granger cause IIE	14.279***	0.001
IIE doesn't Granger cause PC	2.504	0.286
SMC doesn't Granger cause IIE	3.871	0.144
IIE doesn't Granger cause SMC	0.212	0.900
SMTOR doesn't Granger cause IIE	10.507***	0.005
IIE doesn't Granger cause SMTOR	1.356	0.508
SMTVT doesn't Granger cause IIE	3.126	0.210
IIE doesn't Granger cause SMTVT	0.533	0.766
FDI doesn't Granger cause IIE	4.036	0.133
IIE doesn't Granger cause FDI	1.179	0.555
CPI doesn't Granger cause IIE	9.942***	0.007
IIE doesn't Granger cause CPI	0.217	0.897
PI doesn't Granger cause IIE	0.766	0.682
IIE doesn't Granger cause PI	3.605	0.165
TO doesn't Granger cause IIE	2.574	0.276
IIE doesn't Granger cause TO	4.196	0.123

Note: ** and *** imply the rejection of the null hypothesis of no causality at the 5% and 1% significance levels, respectively; the suitable lags were selected based on AIC approach.