

## FINANCE-INEQUALITY NEXUS: THE LONG AND THE SHORT OF IT

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*Financial development affects income inequality differently in the short and in the long term. Investigating OECD countries from 1870–2011, we find in the short run, an improvement in financial development tends to reduce inequality, while in the long run, more finance contributes to more inequality. The short-run effect concurs with theories advocating financial development increases the availability of financial services, primarily for the poor. However, this effect becomes nil within a few years. Results thus imply that policies aimed at reducing inequality through improving access of the poor to finance need to be carefully designed to ensure longevity of impact. (JEL O15, O16, D31, G20, E44)*

### I. INTRODUCTION

The finance-inequality nexus has been the subject of extensive discussions for a long time (e.g., Beck, Demirgüç-Kunt, and Levine 2007; de Haan and Sturm 2017; Fischer, Huerta, and Valenzuela 2019; Greenwood and Jovanovic 1990; Kuznets 1955). Moreover, the apparent upward movement in income inequality over the last few decades, especially in developed countries, has increased academic interest in inequality and its potential determinants (Farias, Scavia, and Fuentes 2019; Piketty 2005, 2014; Roser and Cuaresma 2016; Tridico 2017; Xie and Zhou 2014). A possible factor is financial development; however, both theoretical and empirical studies in the extant literature offer mixed views with regard to its impact on inequality. Theoretically, improved access to finance should reduce inequality, while improved quality of financial services to existing customers may contribute to more inequality. Empirical studies offer evidence

of both positive and negative impacts. In this paper we offer a new perspective by focusing on the time it takes to reap any gains from changes in the financial opportunities brought by financial development. The speed of response to these opportunities may depend on the individual's income level and associated access to financial services, for which reason the finance-inequality relation may vary between the short and the long run. This is exactly what we examine in this paper.

Theoretical arguments underpinning a relationship between financial development and income distribution refer to the ability of the financial system to cover a larger number of people (the so-called extensive margin) and/or to its ability to absorb a larger amount of funds

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### ABBREVIATIONS

ARDL: Autoregressive Distributed Lag  
 DFE: Dynamic Fixed Effects  
 GDP: Gross Domestic Product  
 GMM: Generalised Method of Moments  
 MG: Mean Group  
 OECD: Organisation for Economic Co-operation and Development  
 OLS: Ordinary Least Squares  
 PMG: Pooled Mean Group  
 SBC: Schwarz Bayesian Criterion  
 SWIID: Standardized World Income Inequality Database  
 VIF: Variance Inflation Factor

from each individual (the intensive margin).<sup>1</sup> Underdeveloped credit markets limit access to financial services for the most risky segment of households and firms (Banerjee and Newman 1993), hence, on the extensive margin, financial development alleviates entry barriers and expands the economic opportunities of poorer individuals, thus reducing income inequality (Becker and Tomes 1979, 1986; Galor and Moav 2004; Paulson and Townsend 2004).<sup>2</sup> On the intensive margin, financial development improves the quality of financial services for those who already have access to them, most likely relatively high-income individuals and well-established firms (Antzoulatos et al. 2016; Greenwood and Jovanovic 1990),<sup>3</sup> thus contributing to more income inequality.<sup>4</sup> The overall impact of financial development is then the superposition of the two margins: some studies find a positive nexus (e.g., de Haan and Sturm 2017; Denk and Cournède 2015; Gimet and Lagoarde-Segot 2011; Jauch and Watzka 2016; Jaumotte, Lall, and Papageorgiou 2013) while others show that financial development has a negative impact on inequality (e.g., Beck, Demirgüç-Kunt, and Levine 2007; Hamori and Hashiguchi 2012; Kappel 2010; Naceur and Zhang 2016).

1. The terms “intensive and extensive margins” with regard to the financial industry have been in use since at least as early as Gurley and Shaw (1967), who, in particular, write: “Whatever the first choice may be, it is tilted intensively until there is obvious advantage in trying the extensive margin . . .” (p. 268). Below, we use the same argument to advocate that because intensive development may be too costly for banks in the short-run, they opt for the extensive strategy, until, in the longer-run, they return to the intensive path.

2. For example, Paulson and Townsend (2004) note that wealthier people may start and expand businesses without the need for external finance, whilst the poor are financially constrained and, moreover, for them external finance may be unavailable. This is evidence in favor of a typical argument of why financial development works against inequality: it helps the poor to start businesses. In this case, wealth inequality (rich vs. poor) defines the opportunity set and, in particular, the decision to engage in (extra) entrepreneurship, as in Braggion, Dwarkasing, and Ongena (2018); however, financial development, through the extensive margin, may cover more poor people and thus improve their income opportunities. The latter will have an effect on income inequality but hardly any immediate effect on wealth inequality. We discuss the distinction between income and wealth inequality, also in the context of our research objectives, later in the introduction.

3. Antzoulatos et al. (2016) suggest that as “financial development gathers pace,” larger and more profitable firms with greater access to capital markets, tend to increase leverage more.

4. See Demirgüç-Kunt and Levine (2009) and Beck (2012), for more details about these theoretical predictions.

We differ from the above literature in that we stress the relative effects of the extensive and the intensive margin depend on the length of the time period considered. Extending financial services to those who had no access to them earlier, might require less time than, for example, accumulating more resources from those already involved in the financial system, through offering new and/or better-quality services. This asymmetry in the realization of the extensive and the intensive margins of financial development implies asynchronous implications for the income opportunity sets of those affected: while the extensive margin may first lead to an improvement of the income stream of the poor, the intensive margin later would improve the income opportunities of the rich. While wealth inequality plays a role in this argument, our focus is on income inequality, as it is the income opportunity set that is theoretically affected by the financial system. Braggion, Dwarkasing, and Ongena (2018) offer a useful distinction between the two concepts: while wealth captures accumulated fortunes, power, and opportunities of people, income describes current earnings and determines extra savings in each period; through opportunity sets, wealth affects income, yet through savings decisions, income determines a *change* in wealth. Alvaredo et al. (2018) emphasize the link from income inequality to wealth inequality: they stress it is the difference in incomes from labor and capital that reinforces wealth inequality. One would thus expect income and income distribution to change faster than wealth and wealth distribution, which is important for our analysis of short- and long-run effects of financial development. Conveniently, as we discuss below, income inequality data have recently become available for a longer time period, as is necessary for our research; such a long time series for wealth inequality indices is currently out of reach.

After developing testable hypotheses in the subsequent section of the paper, to investigate our theoretical conjecture we require (a) data over a sufficiently long period of time and (b) a suitable econometric approach. For the former, recent research by Madsen, Islam, and Doucouliagos (2018) constructed annual data on income inequality for 21 OECD countries, over the period of 1870–2011,<sup>5</sup> and shows that economic

5. Our focus on OECD countries is also interesting as the current literature suggests that most developed countries experienced a sharp increase in inequality over the last few decades.

growth is constrained by inequality at lower levels of financial development. Taking advantage of this, we newly position these inequality series as the dependent variable. As to the latter requirement, most of the empirical studies cited above are based on panel data and use static models such as ordinary least squares (OLS) and fixed and random effects models, or dynamic panel models, particularly employing the GMM estimator.<sup>6</sup> Unlike these approaches, we apply an autoregressive distributed lag (ARDL) model, which allows one to distinguish between the short- and long-run effects of financial development on inequality. We use two popular proxies for inequality—the Gini index<sup>7</sup> and the 10% income share. While the former captures the overall distribution of income in the population, the latter isolates the wealthy cohort, helping us to judge whether, indeed, the short-term effect of financial development occurs primarily via the poor. A number of controls are employed including education, GDP per capita, financial volatility, and inflation while robustness tests are carried out to assess whether results are affected by time-variation, different levels of financial development, endogeneity, and observation period length.

Madsen, Islam, and Doucouliagos (2018) provide the post-tax, post-transfer Gini coefficient; in other words, the net Gini index, which we therefore employ in our main analysis. It is important to note that while other studies, such as Agnello, Mallick, and Sousa (2012) and Denk and Cournède (2015), also use the post-tax Gini index, Delis, Hasan, and Kazakis (2014) and de Haan and Sturm (2017), among others, use gross Gini index, and yet others use both gross and net Gini indices (e.g., Christopoulos and McAdam 2017). The two measures give different perspectives on inequality: the former represents inequality before income redistribution, while the latter does so after redistribution takes place, and hence also reflects governments' responses to inequality (e.g., van Velthoven, de Haan, and Sturm 2019).<sup>8</sup> Moreover, financial development

may affect the two measures differently: for example, Jauch and Watzka (2016) note that, theoretically, by supporting risk taking, financial development can lead to an increase in gross Gini; while sharing risks, again due to financial development, enables households and countries to potentially decrease their net Gini. Therefore, although we primarily employ the net Gini given its long time series availability, as an alternative approach, we latterly turn to the standardized world income inequality database (SWIID) which provides data from 1960 including the gross Gini index.

Over the 142-year sample period, our empirical findings show that a rise in financial development reduces the Gini index in the short run, while increasing it over the longer term. These results suggest that financial development may operate chiefly on the extensive margin in the short run by relaxing credit constraints and thus widening the availability of financial services for the poor, lessening inequality. In the long run however, we observe the opposite effect. Strikingly, the results for the top 10% income share indicate that growth in financial development does not significantly affect the rich in the short run, only over the long run. This provides further evidence that the observed short-run effect in the Gini data comes through the extensive margin and its effect on the relatively poor. In any case, in the long run either the redistribution channel transfers financial gains to the rich, or the intensive margin takes over and reverses the impact of financial development on income distribution. This may explain the mixed findings of earlier studies as the employed empirical models conflate the short- and long-term effects. Notably the only control variable to reduce inequality over the short and long run is education, which may in part be proxying for financial literacy (see Gill and Prowse 2015; Kadoya and Khan 2017; Lusardi and Mitchell 2014).

The organization of the paper is as follows: Section II presents the literature and theoretical underpinnings while Section III outlines the data used. Section IV describes the empirical

6. Some studies use other methods such as panel Bayesian SVAR (Gimet and Lagoarde-Segot 2011) or IV regression (Naceur and Zhang 2016).

7. Although the Gini coefficient is the most popular measure of inequality, it does present some drawbacks. For example, Galbraith (2012) in his discussion of new inequality measures cites Pyatt (1976) in noting that whilst the coefficient can be compared between distributions, it cannot be disaggregated into subpopulations without difficulty.

8. Interestingly, Ostry et al. (2014) and van Velthoven, de Haan, and Sturm (2019) examine income redistribution

employing a dependent variable which is the difference between market (gross) and net Gini measures. To examine "finance-related" income inequality on redistribution, van Velthoven, de Haan, and Sturm (2019) regress income redistribution on the portion of the market Gini coefficient explained by financial development, financial liberalization and banking crises. This work suggests that policymakers engage in some redistribution in response to increases in "finance-related" income inequality.

estimation methodology. Section V presents the findings and several robustness tests. Finally, Section VI concludes.

## II. LITERATURE AND THEORETICAL UNDERPINNINGS

Our central premise is that financial development will likely have differing intertemporal effects. For the banking sector, Burgess and Pande (2005) stress that banks themselves prefer expanding in rich areas, and the relationship banking literature emphasizes that banks favor existing customers (Petersen and Rajan 1994; Berger and Udell 1995; Boot 2000; Agarwal et al. 2018, to mention a few). From this supply-side perspective, a credit expansion along the financial development path should benefit the richer part of the population. However, in the short run, financial institutions may be unable to follow their preferred strategy and may expand where the demand is more flexible, which is likely to be the poorer section of potential customers. For example, Burgess and Pande (2005) find, *inter alia*, that a state-led expansion of the banking sector into rural areas reduces poverty via accumulation of deposits and disbursement of credit among the poor; this change in wealth is likely to occur due to, and be associated with, a change in the income opportunities of the poor cohort. Therefore along with poverty reduction (less wealth inequality), we ought to witness a reduction in income inequality.<sup>9</sup> Along the same lines, in Ergungor (2010), opening new branches improves the ability of the poorer segment of the population to borrow, while branch presence is not correlated with mortgage availability in high income neighborhoods, in particular because the latter are more likely to qualify for credit scored mortgages.

Arguably, offering existing [simple] financial instruments to customers who had no or limited access to them, is a quicker solution than developing new financial instruments to meet the more sophisticated demand of existing customers. Similarly, the “keeping up with the Joneses” effect (e.g., Bazillier and Hericourt 2017; Christen and Morgan 2005; Coibion et al. 2014) assumes high demand of poorer households for credit, to help them “keep up” in consumption

9. The increase in income also follows from the increase in savings, despite an increase in expenditures due to repayments on credits (assuming nondecreasing consumption expenditures).

with richer households. It is this high demand that makes it easier for banks to extend credit to poorer households in the short run.<sup>10</sup> While the above literature focuses on consumption, one should extend the argument to the income opportunity set as well (after all, borrowing to boost consumption should be accompanied by adjusting income to be able to repay the loan in the future), which would imply a reduction of income inequality.

In a recent paper, Farias, Scavia, and Fuentes (2019) theoretically<sup>11</sup> investigate the relationship between credit availability, adoption of new technologies and inequality. In particular, in a full liquidity (no credit constraints) state, investment can lead to faster adoption of technology and, if the technology is “skill-neutral,” a reduction in income inequality. However, if the technology is “skill-biased,” in the sense that it requires skilled workers, and those workers are relatively few, inequality can actually increase. Such an effect is exacerbated when financial markets are liquidity constrained. This mechanism can, of course, be placed in intertemporal context. For example, assuming firms are credit constrained in the short run, the Farias, Scavia, and Fuentes (2019) result would support the view that credit expansion benefits the poor (as long as technology is skill-neutral) and reduces income inequality. In the long run, with technology likely to be more skill-biased, credit expansion may raise the income gap between skilled and unskilled workers.

Parallels may be drawn between the inequality impact of financial development and that of monetary policy shocks that drive shorter-term credit expansions and contractions. The distributional effect of monetary policy is a fast-growing

10. As Coibion et al. (2014) note, the above “keeping up” effect only describes the demand side, yet the overall relationship between inequality and credit depends on the supply side as well, which we account for by allowing the expansion strategy of banks to vary over the short- and long-run. In this discussion, we have focused on the banking sector because financial development is usually measured as the amount of credit issued by domestic financial intermediaries. Whilst the role of stock and bond markets is outside of this scope, evidence on their effect on inequality is rather mixed: for example, developed financial markets may contribute to a reduction in inequality in Kappel (2010), yet financial development measured by stock market capitalization increases inequality in de Haan and Sturm (2017).

11. Note that their theoretical derivation takes place in a small country setting. Here technological improvement is adopted from abroad and involves skill-bias. Additionally, note that by their Proposition 1, full liquidity corresponds to the case of complete markets, and insufficient liquidity, to the case of incomplete markets.

field of research. Doepke and Schneider (2006) argue that expansionary monetary policies favor low income households, while at the same time low interest rates potentially work against higher income savers and investors (i.e., those with higher accumulated wealth). Note that, in line with our short- and long-term view, wealthier households would need to readjust their portfolios to respond to low interest rates, which takes time, while availability of credit that favors lower income customers, benefits them immediately. Focusing on the contractionary monetary policy in the United Kingdom. Mumtaz and Theophilopoulou (2017) provide evidence that it harms low income households more than high-earners, who remain by a large extent unaffected; their suggested explanation is via the higher reliance of the latter category on financial markets relative to financial intermediaries. The same directional effect is reported in Furceri, Loungani, and Zdzienicka (2018), who, on top of contractions, consider monetary easing, and show the latter reduces income inequality; effects of contractions and easing on inequality are stronger where the share of labour income is higher. Coibion et al. (2017) also stress the different income sources of the wealthy, who receive a disproportionate fraction of financial income, and of the poor, who obtain a large share of their income from transfers. In the U.S. data of Coibion et al. (2017), contractionary policy appears to favor the rich as financial income sharply rises after a monetary policy shock and harms the poor as real wages rise faster than transfers. Effects of monetary policy shocks, however, seem to be different in the short and the long run, in a similar manner to the intertemporal effects we advocate for financial development. In El Heradi and Leroy (2019), unlike the above studies, monetary expansion benefits the rich disproportionately more than the poor; the effect is visible in the medium run and works through the asset price channel. Colciago, Samarina, and de Haan (2019) survey the literature on the distributional effects of central bank policies; they highlight the mixed evidence from various studies and explain this, at least in part, by the multiplicity of channels through which monetary policy may affect income (and wealth) inequality. While we do not study monetary policy effects, we add the time dimension to this debate.

From the discussion above, the superposition of the extensive and intensive margins should generate different effects on incomes, and thus on the income distribution, in the short and the

long run. Importantly, the extensive margin works primarily through the poorest cohort of population, those previously excluded from finance. The intensive margin, to a larger extent, operates within the richer part of the population. Under this paradigm, understanding how financial development affects each of the cohorts in the short and the long run will be crucial for policy design and leads us to two new hypotheses:

H1. *Over the short run, the extensive margin is likely to dominate the intensive margin and increases in financial development will lead to decreases in inequality.*

H2. *Over the long run, the intensive margin will dominate, and therefore increases in financial development will lead to increases in inequality.*

To examine the above hypotheses, we will employ a measure of income inequality, such as the commonly used Gini coefficient, which covers the whole income distribution. However, other measures of inequality exist that focus on the richest cohort, including the top 10% income share, which might not be so sensitive to the short-run effects of financial development given we theorize these affect mainly the relatively poor. Therefore, our final hypothesis follows:

H3. *Over the short run, changes in financial development will not affect inequality measures that focus on the relatively wealthy.*

### III. DATA

This study employs annual data for 21 OECD countries over the lengthy period of 1870–2011. Specifically, Table 1 presents the countries<sup>12</sup> included in our sample.

The dependent variable is income inequality, proxied by the post-tax, post-transfer Gini coefficient, that is, the net Gini coefficient. A high value of this index indicates more unequal distribution of income. We use the Gini coefficient because it is the most widely used measure of inequality in the empirical literature (e.g., Beck, Demirgüç-Kunt, and Levine 2007; Braun, Parro, and Valenzuela 2019; Delis, Hasan, and Kazakis 2014; Denk and Cournède 2015; Jaumotte, Lall, and Papageorgiou 2013). The main advantage of Gini index is that it covers the entire spectrum of the income distribution (Madsen, Islam,

12. The source of much of the data is the excellent work of Madsen and Ang (2016) and Madsen, Islam, and Doucouliagos (2018).

**TABLE 1**  
Sample of Countries

Australia	Japan
Austria	Netherlands
Belgium	New Zealand
Canada	Norway
Denmark	Portugal
Finland	Spain
France	Sweden
Germany	Switzerland
Greece	United Kingdom
Ireland	United States
Italy	

and Doucouliagos 2018). This is an important feature as it allows us to investigate the impact of financial development on income disparity across different cohorts.<sup>13</sup>

Next, we follow the literature by using private credit to GDP as a proxy of financial development (see for instance, Beck, Demirgüç-Kunt, and Levine 2007; Jaumotte, Lall, and Papageorgiou 2013; Madsen and Ang 2016; Braun, Parro, and Valenzuela 2019), allowing the comparison of our findings with other studies. Furthermore, this index has an advantage over alternative measures of financial development, such as M2 over GDP, as it captures the main function of financial intermediaries, that is, the channeling of the savings of society to private sector (Beck, Demirgüç-Kunt, and Levine 2007). However, to check the robustness of our results, we additionally follow work such as Ang and McKibbin (2007), Gries, Kraft, and Meierrieks (2009) and Samargandi, Fidrmuc, and Ghosh (2015) by using the first principal component of several financial development indicators (i.e., the ratios of credit to GDP, bank assets to GDP, and monetary stock to GDP<sup>14</sup>) as a proxy of the aggregate financial development level.

Several control variables are also employed: GDP per capita, population, education level, inflation, financial stability, and the age dependency ratio. These variables are commonly used in the inequality literature (see, e.g., Beck, Demirgüç-Kunt, and Levine 2007; Jeanneney and Kpodar 2011, Delis, Hasan, and Kazakis 2014; Baiardi and Morana 2018).<sup>15</sup> Moreover, we check the robustness of our

13. We use also the top 10 % income share to test the impact of financial development on the wealthy.

14. The source of the latter two variables is Madsen and Ang (2016).

15. Some studies control for trade openness and government expenditure, however these data are not available for

results to several other control variables such as technology (Galor and Moav 2000; Jaumotte, Lall, and Papageorgiou 2013), stock market capitalization (Aggarwal and Goodell 2009; Denk and Cournède 2015; Gimet and Lagoarde-Segot 2011), globalization (Gimet and Lagoarde-Segot 2011), and trade unions (Cecchi and Garcia-Peflalosa 2010; Machin 1997). The annual data for GDP per capita and population are obtained from the Maddison Project Database, version 2018 (Bolt et al. 2018). The primary source of inflation series is Jordà, Schularick, and Taylor (2017), which offers data for 17 OECD countries since 1870, so we obtain inflation data for remaining countries from the Varieties of Democracy Institute at the University of Gothenburg (Coppedge et al. 2018). The source of the globalization index, exports plus imports to GDP, is Jordà, Schularick, and Taylor (2017).<sup>16</sup> The source of all remaining variables is Madsen and Ang (2016) and Madsen, Islam, and Doucouliagos (2018). The appendix provides a brief definition of all variables, as well as summary statistics.

Finally, note that we employ annual data given we wish to analyze both the short- and long-term effects of finance on inequality. However, more generally in an inequality context, some studies (e.g., Delis, Hasan, and Kazakis 2014) prefer not to use this frequency given (a) annual data may be noisy, (b) annual inequality data are occasionally imputed, and (c) to circumvent any business cycle effects (e.g., van Velthoven, de Haan, and Sturm 2019). As an alternative approach therefore, later in the empirical results section we also employ our data at 5 and 3-year intervals.

#### IV. METHODOLOGY

Several empirical studies use static panel models, such as pooled OLS, or fixed and random effects models, to examine the financial development and income inequality nexus (see e.g., de Haan and Sturm 2017; Denk and Cournède 2015; Jaumotte, Lall, and Papageorgiou 2013; Kappel 2010; Naceur and Zhang 2016) while others employ dynamic GMM-type procedures (Beck, Demirgüç-Kunt, and Levine 2007; Hamori and Hashiguchi 2012; Jeanneney and Kpodar 2011).

our long sample period. In addition, the impact of these variables on income inequality is inconclusive (Delis, Hasan, and Kazakis 2014).

16. This index is available only for 17 countries.

Although we estimate static models for our preliminary analysis, and as a comparison with prior literature, they do not differentiate between short- and long-run effects (inter alios, see Loayza and Ranciere 2006) and are therefore unsuitable to address our particular research question.<sup>17</sup> Dynamic GMM-type approaches only model the short run, again rendering them unsuitable for our purposes, and can generate spurious results (see Roodman 2006) when, for example, the number of countries  $N$  in the panel is relatively small compared with the number of years  $T$ .

In this study, we primarily employ a panel ARDL model<sup>18</sup> given this allows us to distinguish between short- and long-run effects and use three estimators typically employed in the literature (e.g., see Pesaran, Shin, and Smith 1999; Samargandi, Fidrmuc, and Ghosh 2015); the mean group (MG), dynamic fixed effects (DFE), and pooled mean group (PMG). By employing an ARDL ( $p, q$ ) approach, Pesaran and Smith (1995), Pesaran (1997), and Pesaran, Shin, and Smith (1999) introduce dynamic heterogeneous panel regressions in an error-correction form, where  $p$  and  $q$  are the lags of the dependent variable and the independent variables respectively. In our case, this can be written as follows:

$$(1) \quad \Delta Gini_{i,t} = \lambda_i [Gini_{i,t-1} - \{\beta_{i,0} + \beta_{i,1} X_{i,t-1}\}] \\ + \sum_{j=1}^{p-1} \theta_{i,j} \Delta Gini_{i,t-j} + \sum_{j=0}^{q-1} \eta_{i,j} \Delta X_{i,t-j} + \epsilon_{i,t},$$

where  $Gini$  is the Gini index (in logs) for country  $i$  at year  $t$  and  $X$  is a group of potential income inequality determinants (in logs<sup>19</sup>) including financial development and other control variables.  $\theta$  and  $\eta$  refer to the short-run coefficients of the lagged dependent variable and other regressors respectively, while  $\beta$  represents the long-run coefficients.  $\lambda$  is the coefficient

of speed of adjustment to the long-run equilibrium and the first term on the right-hand side of Equation (1) will capture any long-run relationship between financial development and inequality. As the system is expected to return to the long-run equilibrium, we expect  $\lambda < 0$ . Based on the theoretical discussion in the introduction, we also expect a negative short-run relationship between financial development and inequality, as given by the coefficient  $\eta_j^{FD} < 0$  ("FD" for financial development). The same theoretical discussion implies the opposite long-term relationship, which is given by the coefficient  $\beta_1^{FD} > 0$ . By replacing  $Gini_{i,t}$  with a measure for top 10% share, we obtain an alternative model, where we expect  $\eta_j^{FD} = 0$ , as financial development is hypothesized to only affect the relatively poor in the short run.

In terms of estimating (1), the MG approach of Pesaran and Smith (1995) allows all coefficients to be heterogeneous, initially estimating individual regressions for each country and subsequently, group coefficients are calculated by averaging country coefficients. Moreover, Pesaran and Smith (1995) show that this approach produces consistent estimates of the averages as long as  $N$  and  $T$  are reasonably large. Along such lines, Favara (2003) offer some words of caution, noting the MG estimator can suffer from sensitivity to both outliers and small model permutations. For example, in small country samples, this estimator is probably inefficient (Martínez-Zarzoso and Bengochea-Morancho 2004), given the relatively large number of parameters that require estimation. To reduce the number of parameters to be estimated, a very different approach is taken by a second estimator (i.e., the DFE estimator), whereas aside from intercepts, other coefficients and error variances are homogenous across countries, which might be seen as a rather unrealistic assumption. Finally, the PMG estimator of Pesaran, Shin, and Smith (1999) assumes the long-run coefficients are homogenous across countries but allows for heterogeneity in the short-run coefficients, the intercepts, the speed of adjustment coefficients, and error variances. Such an approach makes sense if we have grounds to believe the long run association between financial development and inequality is the same across our OECD countries—which ex ante appears plausible, particularly if we allow the short run paths to differ. Given this long run homogeneity assumption holds, which can be tested by a Hausman test (Li, Wang, and Zhao 2016; Ojede

17. See Samargandi, Fidrmuc, and Ghosh (2015) for a useful summary of the shortcomings of static models (i.e., pooled OLS, fixed, and random effects) and GMM estimators, whilst covering the advantages of panel ARDL models. In particular, they note that ARDL models, such as those that use PMG estimation (see also Pesaran, Shin, and Smith 1999), mitigate endogeneity issues given the allowance for potential lags in the dependent and regressor variables.

18. Samargandi, Fidrmuc, and Ghosh (2015) used an analogous panel ARDL model to assess the relationship between financial development and economic growth over the period 1980–2008.

19. With the exception of financial volatility which is standard deviation of the log of monthly stock prices within the year, and inflation.

and Yamarik 2012), the PMG estimator will be more efficient than the MG estimator, reducing the magnitude of the long-run coefficient standard errors. Note that Pesaran, Shin, and Smith (1999) show the consistency and asymptotic distributions for the PMG estimators, under certain regularity conditions, in cases where the regressors are either  $I(0)$  or  $I(1)$ .<sup>20</sup> Overall, the PMG estimator can be viewed as an intermediate approach between the two extremes of MG and DFE, and is consequently less likely to be sensitive to small model issues relative to the MG approach.

Analogously to the literature, we focus on PMG and MG estimators<sup>21</sup> and use the Hausman test to choose the most appropriate estimator. The null hypothesis of the Hausman test is that the difference between these estimators is not significant and we employ a 5% level of significance. Finally, we impose a ARDL lag structure in (1) as follows;  $p = 1$  and  $q = 1$  (for all regressors) based on the Schwartz Bayesian criterion. In fact, this specification,  $p = q = 1$ , is not surprising as it has been widely used in previous studies that employ ARDL models to test a variety of economic issues (see e.g., Li, Wang, and Zhao 2016; Ojede and Yamarik 2012; Samargandi, Fidrmuc, and Ghosh 2015).<sup>22</sup>

## V. EMPIRICAL RESULTS AND DISCUSSION

### A. *The Impact of Financial Development on Inequality*

As a prelude to estimating the panel ARDL model, we employ three static estimators; the OLS, fixed effects and random effects models with cluster-robust standard errors at the country level to control for any potential autocorrelation and/or heteroskedasticity. Table 2 presents the results of these traditional estimators.

The three estimators indicate that financial development has a positive and statistically significant impact on inequality. These preliminary results support the findings of other studies such as Gimet and Lagoarde-Segot (2011), Jau-motte, Lall, and Papageorgiou (2013), Denk and Courmède (2015), and de Haan and Sturm (2017) that higher financial development leads to higher

20. Samargandi, Fidrmuc, and Ghosh (2015) suggest this obviates the requirement to pretest variables for a unit root.

21. For comparison purposes, we show also results from the DFE estimator.

22. The results are robust for other lag structures ( $p = 2$  and  $q = 1$  and  $p = 2$  and  $q = 2$ ), see Table 8.

**TABLE 2**  
Financial Development and Income Inequality  
(Static Models)

	[1] OLS	[2] FE	[3] RE
Financial development	0.083** (2.51)	0.092*** (2.98)	0.088*** (2.94)
Education	-0.122 (-1.27)	-0.058 (-0.56)	-0.061 (-0.59)
GDP per capita	0.010 (0.16)	-0.072 (-0.94)	-0.072 (-0.96)
Inflation	0.000 (1.01)	-0.000 (-0.48)	-0.000 (-0.43)
Population	-0.009 (-0.56)	0.129 (1.60)	0.086 (1.45)
Age dependency ratio	0.190 (1.20)	0.137 (1.27)	0.125 (1.19)
Financial volatility	-0.009** (-2.12)	-0.007*** (-3.25)	-0.007*** (-3.26)
Constant	3.215*** (3.43)	2.675* (1.99)	3.107*** (2.69)
Observations	2,865	2,865	2,865

Notes: *t* statistics in parentheses.

\* $p < .10$ ; \*\* $p < .05$ ; \*\*\* $p < .01$ .

inequality. All these studies use static models, except Gimet and Lagoarde-Segot (2011) who employ a structural vector autoregressive model.

This result implies that the intensive margin dominates the extensive margin. Notably, the impact of the included control variables appears limited. Although several coefficients present signs as expected (e.g., education reduces inequality while a rise in age dependence ratio increases the inequality) these are not statistically significant. The exception is financial volatility which has a negative impact on inequality, contradicting the findings of Gimet and Lagoarde-Segot (2011). However, as we mentioned in the previous section, these estimators have some potential shortcomings. In particular, they may generate misleading results by not distinguishing between potential short- and long-run relationships or accounting for other potential econometric issues. To address these, we next estimate panel ARDL models.

Table 3 shows the results of the PMG, MG and DFE estimators in columns 1, 2, and 3, respectively. The top part of the table displays the long-run coefficients while the bottom part presents the coefficients of the short run. The Hausman test assesses whether the PMG estimator is significantly different from the MG. Given the null is rejected at 5% level, we might prefer the PMG given it is efficient. In any case, for all regressions the estimated error-correction coefficients,



**TABLE 3**  
Financial Development and Income Inequality  
(ARDL Models)

	[1] PMG	[2] MG	[3] DFE
<i>Long-run coefficients</i>			
Financial development	0.128*** (7.22)	0.057* (1.80)	0.145*** (2.62)
Education	-0.136*** (-2.64)	-0.489** (-2.28)	-0.201** (-2.11)
GDP per capita	-0.069* (-1.84)	0.032 (0.45)	-0.155*** (-3.06)
Inflation	0.001 (1.32)	-0.380*** (-4.04)	0.000 (0.58)
Population	-0.017 (-0.40)	-0.279* (-1.85)	0.149 (1.23)
Age dependency ratio	0.007 (0.09)	0.110 (0.66)	0.326 (1.21)
Financial volatility	0.010** (2.28)	0.009** (2.22)	0.023*** (2.64)
<i>Short-run coefficients</i>			
Error-correction coefficient	-0.054*** (-5.25)	-0.164*** (-10.81)	-0.028*** (-4.90)
ΔFinancial development	-0.013* (-1.72)	-0.029*** (-2.96)	-0.013** (-2.08)
ΔEducation	-0.167** (-2.31)	-0.117 (-1.62)	-0.059 (-1.28)
ΔGDP per capita	0.037* (1.72)	0.024 (1.02)	0.044** (2.30)
ΔInflation	0.022 (1.63)	0.045*** (3.31)	-0.000 (-1.30)
ΔPopulation	0.152 (0.75)	-0.260 (-0.80)	0.253 (1.52)
ΔAge dependency ratio	-0.043 (-0.42)	0.008 (0.06)	-0.014 (-0.21)
ΔFinancial volatility	-0.000 (-0.47)	-0.000* (-1.88)	-0.000 (-1.57)
Constant	0.231*** (5.18)	1.108*** (5.59)	0.064 (1.36)
Observations	2,843	2,843	2,843
Hausman test	1.40		
<i>p</i> value	.99		

Notes: *t* statistics in parentheses. The lag structure is  $p = 1$  and  $q = 1$  based on SBC. *p* value represents the *p* value of the Hausman test for poolability. PMG is more efficient estimation than MG under the null hypothesis.

\* $p < .10$ ; \*\* $p < .05$ ; \*\*\* $p < .01$ .

$\lambda$ , are negative and highly significant in all regressions, thus the null hypothesis of no long run relation is rejected. All estimators generate analogous results regarding the effect of financial development on inequality in both the short and long run, and below we focus on the findings of PMG estimator.

From Table 3, in the short run, it would appear that increases in financial development decrease income inequality, providing evidence for H1. This supports the extensive margin view that higher financial development tends to broaden the access to financial services, particularly for low-income individuals who had previously not been using such services. The long-run coefficients tell a different story; that financial development has positive and statistically significant effect in all regressions. This implies that higher

financial development leads to higher inequality, supporting both the initial findings of the static models and H2.

As discussed earlier, a possible explanation of these opposing effects in the short and long run is that extensive financial development (improving access to finance of the poorest segment) that dominates in the short run, is later dominated by the exploitation of the intensive margin (serving existing relationship customers) in the long run. We further investigate this mechanism later on by testing the impact of financial development on the top 10% income share, thus explicitly focusing on the richer cohort alone. In any case, the differential impact in the short and long run may explain the mixed evidence provided by previous studies, highlighting the importance of distinguishing between the intertemporal effects of financial development on inequality.

Turning to the control variables education is, as expected, negatively related to inequality in both short and long run. However, unlike the prior static regressions, education is now typically statistically significant, underlining the usefulness of using an ARDL-type model. Additionally, as noted in the introduction, education is positively associated with financial literacy (see Gill and Prowse 2015; Kadoya and Khan 2017; Lusardi and Mitchell 2014), and it seems reasonable to suggest that part of education's reducing effect on income inequality relates to the increased ability to make competent financial decisions.

The results show also that GDP growth has a positive impact in the short run and a negative impact in the long run. This implies that the wealthy mainly benefit from economic growth in short run, while the distribution of this gain widens over the long run, reducing inequality. This finding is consistent with early work such as Kuznets (1955) who posits that by shifting labor from sectors with low productivity to sectors with high productivity, economic growth first leads to an increase in income inequality before it can decrease later on (more recent studies of the relationship include, inter alia, Adams Jr 2004; Dollar, Kleineberg, and Kraay 2016). Furthermore, financial volatility shows the expected positive impact, particularly in the long run, which is now in line with Gimet and Lagoarde-Segot (2011). The impacts of the remaining control variables are statistically insignificant.

As a next step, we check the robustness of our previous PMG results by re-estimating Equation (1) with several other factors that may affect inequality.

In the first column of Table 4, we control for the impact of technology on inequality. Technology can increase inequality by raising the skill premium, which widens the wage gap between skilled and unskilled workers (Jaumotte, Lall, and Papageorgiou 2013). Furthermore, it may also lead to higher unemployment via enhancing the use of labor-saving capital. In the second column, we use trade unions to capture the impact of labour market institutions that can influence wage inequality and thereby income inequality (see Checchi and Garcia-Peflalosa 2010; Machin 1997). In the third column of Table 4, we consider the impact of globalization, proxied by trade openness. The results, particularly in the long run, support literature that suggests a positive impact of globalization on inequality. In the fourth column, we control for the effect of the relative magnitude of financial markets. Similarly to private credit share, financial markets are also measure of financial development and its impact on income distribution is ambiguous. On the one hand, the development of the equity market can increase investment levels by providing additional financing sources to the real economy, which could reduce income inequality via transferring wealth from creditors to debtors (Aghion and Bolton 1997). On the other hand, financial markets can also lead to higher inequality as large firms disproportionately benefit from stock market development (Aggarwal and Goodell 2009). In the fifth column, we test the robustness of our findings by using an alternative measure of financial development. Specifically, we follow other studies such as Ang and McKibbin (2007) and Gries, Kraft, and Meierrieks (2009) by using the first principal component of the ratios of credit to GDP, bank assets to GDP, and monetary stock to GDP as an aggregate proxy of financial development.

A multicollinearity concern may arise due to a possible relationship between our financial stability measure and financial development. For example, de Haan and Sturm (2017) suggest that financial development leads to banking crises, which, in turn, are associated with lower financial stability. To address this issue, we measure the variance inflation factor (VIF) of FD and financial instability. The VIF of both variables is relatively small at 2.08 for financial development and 3.10 for financial stability. Additionally, in Table 4 (column 6), we test the robustness of our results by estimating the model with no control for financial volatility—results stay qualitatively unchanged.

Overall, our financial development results seem robust to controlling for these additional factors with negatively signed and significant financial development coefficients in the short run and positively signed and significant long-run coefficients for all regressions in Table 4, therefore providing further evidence for H1 and H2. Moreover, the results for education shown in Table 3 are predominantly carried over to Table 4. Turning to the newly added controls themselves, none show a significant impact on the short run, except trade openness which has significantly negative impact, while in the long run, all the relevant coefficients are significant and in line with the theory suggested above. For instance, technology and globalization have a positive and significant impact on inequality in the long run. The impact of financial markets is also positive, which supports our previous finding about the long-run effect of financial development. Notably, our only additional control to reduce inequality significantly is trade unions. Finally, our results are also robust to the employment of the alternative measure of financial development.

The Gini index is the main measure of inequality used by previous studies as it covers the entire spectrum of the income distribution; however, it is important to examine the impact of the financial development index on other measures. Therefore, we next estimate the impact of financial development on the top 10% income share, allowing us to capture the impact of financial development on the wealthy.

Table 5 shows the results of these estimations. The negative and significant error correction coefficient across all estimators suggests that the null hypothesis of no long run relation is rejected. The Hausman test statistic is not available,<sup>23</sup> however all estimators show the analogous impact of financial development on top 10% income share for both short and long run. In particular, the results show that financial development does not affect the top 10% income share in the short run yet leads to higher top income share and thus higher inequality, in the long run. These results provide further color to our previous findings presented in Tables 3 and 4. The increasing availability of financial services for the relatively poor reduces inequality in general (as measured by Gini index) but this does not imply any effect on the rich in the short run (as measured by top

23. As the model fails to meet the asymptotic assumptions of the Hausman test.

**TABLE 4**  
Financial Development and Income Inequality (PMG Sensitivity Analysis)

	[1]	[2]	[3]	[4]	[5]	[6]
	Technology	Trade Union	Globalization	Stock Market Capitalization to GDP	Aggregate Financial Development <sup>a</sup>	Without Financial Volatility
<i>Long-run coefficients</i>						
Financial development	0.142*** (7.10)	0.074*** (4.02)	0.088*** (4.69)	0.079*** (4.59)	0.084*** <sup>a</sup> (6.75)	0.135*** (8.02)
Education	-0.196*** (-3.58)	-0.077 (-1.57)	-0.209*** (-3.94)	-0.137*** (-2.96)	-0.093*** (-2.76)	-0.143*** (-2.72)
GDP per capita	-0.059 (-1.52)	-0.003 (-0.10)	0.068* (1.76)	0.004 (0.12)	-0.116*** (-3.83)	-0.02 (-0.85)
Inflation	0.001 (1.28)	-0.004 (-1.28)	-0.887*** (-4.99)	-0.008** (-1.96)	-0.001*** (-2.77)	-0.006 (-1.64)
Population	-0.098** (-2.23)	0.203*** (3.22)	-0.088** (-2.01)	-0.095** (-2.49)	0.020 (0.58)	-0.027 (-0.66)
Age dependency ratio	0.008 (0.11)	-0.212*** (-2.77)	-0.142* (-1.75)	-0.028 (-0.40)	0.075 (1.18)	0.019 (0.26)
Financial volatility	0.011** (2.57)	0.006** (2.35)	0.003 (0.67)	0.007* (1.93)	0.004 (1.03)	
R&D intensity	0.053*** (3.11)					
Union membership		-1.256*** (-14.96)				
Stock market capitalization to GDP				0.063*** (4.19)		
Trade openness			0.120*** (5.06)			
<i>Short-run coefficients</i>						
Error-correction coefficient	-0.054*** (-5.11)	-0.064*** (-4.22)	-0.055*** (-4.13)	-0.056*** (-4.42)	-0.061*** (-5.13)	-0.0514*** (-4.81)
ΔFinancial development	-0.014* (-1.73)	-0.019*** (-2.69)	-0.021** (-2.01)	-0.013* (-1.75)	-0.012* <sup>a</sup> (-1.87)	-0.015** (-1.99)
ΔEducation	-0.170** (-2.07)	-0.154* (-1.89)	-0.105** (-2.27)	-0.171** (-2.24)	-0.158** (-2.09)	-0.168** (-2.27)
ΔGDP per capita	0.041** (2.01)	0.045** (2.05)	0.070*** (2.60)	0.037* (1.77)	0.041* (1.95)	0.035 (1.64)
ΔInflation	0.013 (0.87)	0.027* (1.90)	0.060*** (2.63)	0.022 (1.59)	0.023 (1.59)	0.022 (1.64)
ΔPopulation	0.111 (0.52)	0.062 (0.32)	0.090 (0.44)	0.154 (0.84)	0.159 (0.86)	0.136 (0.72)
ΔAge dependency ratio	-0.030 (-0.30)	-0.048 (-0.46)	-0.023 (-0.19)	-0.034 (-0.33)	-0.116 (-1.16)	-0.037 (-0.36)
ΔFinancial volatility	-0.000 (-0.22)	-0.000 (-1.06)	0.000 (0.97)	-0.000 (-0.78)	0.000 (0.52)	
ΔR&D intensity	-0.015 (-1.36)					
ΔUnion membership		-0.128 (-1.41)				
ΔStock market capitalization to GDP				0.001 (0.20)		
ΔTrade openness			-0.022** (-2.01)			
Constant	0.279*** (5.04)	0.173*** (4.05)	0.265*** (4.06)	0.246*** (4.41)	0.266*** (5.06)	0.204*** (4.74)
Observations	2,843	2,843	2278 <sup>b</sup>	2,843	2,843	2,881

Notes: *t* statistics in parentheses. The lag structure is  $p = 1$  and  $q = 1$  based on SBC. <sup>a</sup>The aggregate measure of financial development is the first principal component of the following financial indicators: the ratios of credit to GDP, bank assets to GDP, and monetary stock to GDP<sup>b</sup>. Trade openness is available only for 17 countries.

\* $p < .10$ ; \*\* $p < .05$ ; \*\*\* $p < .01$ .

**Table 5**  
Financial Development and Top 10% Income Share (ARDL Models)

	[1] PMG	[2] MG	[3] DFE
<i>Long-run coefficients</i>			
Financial development	0.115*** (5.86)	0.074* (1.92)	0.132*** (4.21)
Education	-0.042 (-0.63)	-0.384 (-1.28)	-0.286*** (-3.58)
GDP per capita	-0.081** (-2.22)	0.119 (0.73)	-0.109** (-2.32)
Inflation	0.000 (1.15)	-0.809* (-1.86)	0.000 (0.87)
Population	-0.094** (-2.37)	-0.399* (-1.69)	0.093 (0.96)
Age dependency ratio	-0.000 (-0.00)	0.175 (0.61)	0.025 (0.17)
Financial volatility	0.012*** (3.01)	-0.002 (-0.29)	0.014** (2.03)
<i>Short-run coefficients</i>			
Error-correction coefficient	-0.057*** (-6.51)	-0.161*** (-8.62)	-0.035*** (-6.21)
ΔFinancial development	0.008 (0.96)	-0.007 (-0.71)	0.001 (0.26)
ΔEducation	-0.024 (-0.60)	-0.010 (-0.24)	-0.012 (-0.30)
ΔGDP per capita	-0.003 (-0.14)	-0.019 (-0.66)	0.014 (0.84)
ΔInflation	0.024 (1.34)	0.051*** (3.40)	-0.000** (-2.12)
ΔPopulation	0.068 (0.31)	0.127 (0.52)	0.224* (1.81)
ΔAge dependency ratio	0.011 (0.12)	0.056 (0.62)	0.058 (0.98)
ΔFinancial volatility	-0.000 (-0.94)	0.000 (0.15)	0.000 (0.17)
Constant	0.277*** (6.30)	1.055*** (4.24)	0.143*** (2.90)
Observations	2,843	2,843	2,843
Hausman test	n/a		

Notes: *t* statistics in parentheses. The lag structure is  $p = 1$  and  $q = 1$  based on SBC. *p* value represents the *p* value of the Hausman test for poolability. PMG is more efficient estimation than MG under the null hypothesis.

\* $p < .10$ ; \*\* $p < .05$ ; \*\*\* $p < .01$ .

10% income share) and supporting H3. However, the relaxation of credit constraints disproportionately benefits the wealthy in the long run using both measures of inequality.

In Section II we reviewed the growing field of research on the distributional effects of monetary policy, which offers a mixed view: some find monetary expansions reduce inequality (Doepke and Schneider 2006; Mumtaz and Theophilopoulou 2017); Furceri, Loungani, and Zdzienicka 2018), while others find expansions favor the rich, at least in the medium and long run (El Herradi and Leroy 2019). In our data, we cannot easily distinguish between monetary policy effects (whereby monetary expansion may boost credit, and thus affect our measure of financial development) and other factors (such as

technological) of financial development. Therefore, the measure of financial development we use, being credit-based, should be qualified. If it is the improved availability of credit to the poor that drives the income-inequality reducing effect of monetary policy, as in Doepke and Schneider (2006), then our findings emphasize the short-lived nature of this effect, with a reversal within a few years (below we demonstrate the effect disappears once one moves to 5-year averages). Regarding the longer-term “inequality-increasing” effect through asset price dynamics, as in El Herradi and Leroy (2019), our findings support such directionality in the long run, yet suggest it may be not only the increased income from asset holding but also a more general improvement in the income opportunity set of the rich that drives the effect.

### B. Further Empirical Results and Robustness

Although using 14 decades of annual data importantly provides far more degrees of freedom than much of the extant literature, it is also useful to explore whether the finance-inequality nexus may present some time-variation. To do so, we divide the full sample into two subsamples (early and late).<sup>24</sup> Table 6 below shows the PMG model in Table 3, re-estimated employing the new subsamples.<sup>25</sup>

We focus on the PMG estimator given it is efficient according to the Hausman test at the 5% level. Importantly, the results in Table 6 again show the positive relation between financial development and income inequality in the long run and the negative relation in the short run, occurs in both subsamples. The only exception is that any short-run effect of financial development appears statistically insignificant before 1950. The significance of the short-run effect post-1950 is perhaps indicative of banks being more conscious of expanding their customer base.

Next, we compare the distributional impact of FD across different financial systems. To do so, we classify the systems into three levels (developed, intermediate, and underdeveloped) using the quartiles of their financial development in each observation-year: specifically, the top and the bottom quartiles are classified as developed and underdeveloped respectively, while the

24. We follow Madsen, Islam, and Doucouliagos (2018) by estimating our model before and after 1950.

25. From now on, for brevity, we only report the estimates for our key variables of interest; controls are the same as before.

TABLE 6

Financial Development and Income Inequality (PMG Estimator) of Early and Late Subsamples

	Early [1]	Late [2]
<i>Long-run coefficients</i>		
Financial development	0.045*** (3.19)	0.135*** (3.59)
Controls	Yes	Yes
<i>Short-run coefficients</i>		
Error-correction coefficient	-0.113*** (-3.99)	-0.074*** (-2.92)
$\Delta$ Financial development	-0.014 (-0.98)	-0.045** (-2.51)
$\Delta$ Controls	Yes	Yes
Constant	Yes	Yes
Observations	1,504	1,260

Notes:  $t$  statistics in parentheses. The lag structure is  $p = 1$  and  $q = 1$ . The  $p$  value of the Hausman test of early and late subsamples is 0.43 and 0.06, respectively. The early subsample is from 1870 to 1949 while the late subsample uses data from 1950 to 2011. The early subsample includes only 20 countries due to the availability of financial volatility data for Greece. Controls are those employed in Table 5 but are omitted to save space.

\* $p < .10$ ; \*\* $p < .05$ ; \*\*\* $p < .01$ .

intermediate category includes observations in the second and third quartiles. We thus effectively examine a type of nonlinearity in the relationship between financial development and inequality and Table 7 presents the results.

The findings show that the short-run coefficients are analogous across the three systems, indicating that an innovation in financial development reduces income inequality regardless of the level of financial system. On the other hand, a positive and significant long-run coefficient is associated only with intermediate and higher levels of development, being statistically nil for low levels. This supports our conjecture that the reduction in inequality is due to the extensive margin, which only requires there are people lacking access to standard financial products and services. For the intensive margin to work, there needs to be a large group of sophisticated users of complex financial services and products, which is more likely to hold for higher levels of financial development. This is exactly where we observe the significant long-run effect that counteracts the short-run reduction in inequality.

Moving on, we check the robustness of our main findings using different lag structures in the panel ARDL model. More specifically, we re-estimate our results presented in Table 3 using  $p = 2$  and  $q = 1$ , as well as  $p = 2$  and  $q = 2$ . Note

TABLE 7

Financial Development and Income Inequality (PMG Estimator)

	Different Systems
<i>Long-run coefficients</i>	
FD (underdeveloped system)	0.028 (1.33)
FD (intermediate system)	0.036** (2.14)
FD (developed system)	0.072*** (4.69)
Controls	Yes
<i>Short-run coefficients</i>	
Error-correction coefficient	-0.063*** (-5.11)
$\Delta$ FD (underdeveloped system)	-0.018** (-2.21)
$\Delta$ FD (intermediate system)	-0.018** (-2.16)
$\Delta$ FD (developed system)	-0.018** (-2.22)
$\Delta$ Controls	Yes
Constant	Yes
Observations	2,843

Notes:  $t$  statistics in parentheses. Underdeveloped FD are systems in 25th percentile of FD, developed FD are systems in 75th percentile of FD, and intermediate FD are systems between these two extreme categories.

\* $p < .10$ ; \*\* $p < .05$ ; \*\*\* $p < .01$ .

that although the lag structure,  $p = 1$  and  $q = 1$ , is selected based on SBC and used in Table 3, using an additional lag of the dependent variable is a useful practice to investigate the robustness of our results to potential types of endogeneity. For example, Fischer, Huerta, and Valenzuela (2019) find that inequality also affects access to credit in a reverse-causality effect. Pesaran, Shin, and Smith (1999) demonstrate that an ARDL model provides consistent coefficients despite the possible presence of endogeneity given appropriate lags of dependent and independent variables. The new results confirm our main findings, see Table 8.

While we use annual data in our previous analysis, primarily dictated by our wish to focus on short-term as well as long-term effects, we now employ 5-year intervals to assess the financial development-inequality nexus. Although lowering the degrees of freedom, this allows us to abstract somewhat from business cycle fluctuations (i.e., to focus on the medium- and long-run effect of financial development on inequality). Importantly, however, this means that the short-run impact may become insignificant.

Table 9 presents the results of employing 5-year observations. The results of the PMG

**TABLE 8**  
Financial Development and Income Inequality (ARDL Models Using Different Lag Structures)

	$p = 2, q = 1$			$p = 2, q = 2$		
	[1] PMG	[2] MG	[3] DFE	[4] PMG	[5] MG	[6] DFE
<i>Long-run coefficients</i>						
Financial development	0.122*** (7.10)	0.046* (1.79)	0.138*** (2.72)	0.126*** (5.69)	0.041* (1.66)	0.146*** (2.84)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
<i>Short-run coefficients</i>						
Error-correction coefficient	-0.058*** (-5.06)	-0.177*** (-11.46)	-0.030*** (-4.85)	-0.042*** (-4.09)	-0.190*** (-10.82)	-0.032*** (-5.10)
$\Delta$ Gini index (-1)	0.079** (2.40)	0.096*** (3.32)	0.063 (1.62)	0.061 (1.62)	0.085*** (2.61)	0.061 (1.54)
$\Delta$ Financial development	-0.016** (-2.17)	-0.029*** (-2.95)	-0.013** (-2.13)	-0.019** (-2.12)	-0.029*** (-2.63)	-0.014** (-2.02)
$\Delta$ Financial development (-1)				-0.002 (-0.22)	-0.014** (-1.98)	-0.001 (-0.10)
$\Delta$ Controls	Yes	Yes	Yes	Yes	Yes	Yes
$\Delta$ Controls (-1)				Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,840	2,840	2,840	2,821	2,821	2,821
Hausman test	1.96			n/a		
$p$ value	.96					

Notes:  $t$  statistics in parentheses.  $p$  value represents the  $p$  value of the Hausman test for poolability. PMG is more efficient estimation than MG under the null hypothesis. This estimation takes place over the whole sample period.

\* $p < .10$ ; \*\* $p < .05$ ; \*\*\* $p < .01$ .

estimator, the efficient estimator as suggested by the Hausman test, confirm our previous results, particularly the positive impact of financial development on income inequality in the long run. As expected, the short-run coefficients are statistically insignificant, as collapsing the data does not allow us to capture the short run effect. As a corollary, these results suggest also that the positive effect of an innovation in financial development on income distribution lasts less than 5 years. This is consistent with the length of the period estimated by El Herradi and Leroy (2019) for the peak positive effect of a monetary expansion on the share of national income held by the wealthy.

Finally, our estimates above are based on net Gini indices from Madsen, Islam, and Doucouliagos (2018). To robustify our conclusions, we turn to the SWIID as an alternative source of inequality data (see Solt 2019, for methodological issues). SWIID is available from 1960 and provides the gross Gini index, along with the net index. As noted in the introduction, the two measures provide before and after redistribution assessments of inequality respectively. This point potentially strengthens the implications of

**TABLE 9**  
Financial Development and Income Inequality  
(ARDL Models 5-Year Intervals)

	[1] PMG	[2] MG	[3] DFE
<i>Long-run coefficients</i>			
Financial development	0.112*** (8.51)	0.068 (1.47)	0.200*** (2.84)
Controls	Yes	Yes	Yes
<i>Short-run coefficients</i>			
Error-correction coefficient	-0.363*** (-6.05)	-0.747*** (-8.70)	-0.117*** (-4.56)
$\Delta$ Financial development	0.004 (0.28)	-0.032 (-1.30)	-0.001 (-0.08)
$\Delta$ Controls	Yes	Yes	Yes
Constant	Yes	Yes	Yes
Observations	555	555	555
Hausman test	7.30		
$p$ value	.40		

Notes:  $t$ -statistics in parentheses. The lag structure is  $p = 1$  and  $q = 1$ .  $p$  value represents the  $p$  value of the Hausman test for poolability. PMG is more efficient estimation than MG under the null hypothesis.

\* $p < .10$ ; \*\* $p < .05$ ; \*\*\* $p < .01$ .

our *prior* findings, as the inequality-increasing impact of FD, where inequality is measured *after* possible redistributive interventions of

**TABLE 10**  
Financial Development and Income Inequality, Gross and Net Gini (3-Year Intervals)

	Gross Gini SWIID			Net Gini SWIID		
	[1] PMG	[2] MG	[3] DFE	[4] PMG	[5] MG	[6] DFE
<i>Long-run coefficients</i>						
Financial development	0.098*** (5.73)	0.933 (1.15)	0.132*** (4.05)	0.174*** (10.45)	-0.418 (-0.74)	0.072 (0.97)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
<i>Short-run coefficients</i>						
Error-correction coefficient	-0.452*** (-4.17)	9.695 (0.96)	-0.246*** (-6.09)	-0.371*** (-3.36)	-5.124 (-0.50)	-0.222*** (-10.16)
$\Delta$ Financial development	-0.044 (-1.52)	0.568 (0.38)	-0.017 (-0.73)	-0.039 (-1.08)	-8.360 (-0.90)	0.013 (0.61)
$\Delta$ Controls	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Observations	336	336	336	336	336	336
Hausman test	0.00			0.00		
<i>p</i> value	1.00			1.00		

Notes: *t* statistics in parentheses. The source of SWIID Gross and net Gini indices is Solt (2019) and these data are available from 1960.

\* $p < .10$ ; \*\* $p < .05$ ; \*\*\* $p < .01$ .

governments, is alarming. As in the previous exercise, to abstract from business cycle fluctuations and other concerns about annual data, we construct time intervals, yet the rather short (compared to our main sample) availability of data dictates we should not employ 5-year periods and opt to use 3-year periods instead (e.g., an approach adopted by Delis, Hasan, and Kazakis 2014). Table 10 presents the results of this estimation and note here that PMG is again the efficient estimator. Although the series is shorter, the result for both gross and net Gini is analogous to Table 9 when we collapse the data: the finding of the inequality-increasing effect of financial development in the long run.

## VI. CONCLUSION

This paper examines the impact of financial development on income inequality and in particular, develops new hypotheses which suggest a difference in the short- and long-run impacts. Using suitably lengthy data, specifically a sample of OECD countries over the period 1870–2011, our main finding is that financial development has a negative impact on income inequality in the short run but a positive impact over the long

run. The results suggest that, in the short run, financial development operates primarily on the extensive margin by relaxing credit constraints and increasing the availability of financial services for the poor. As a result, an improvement in financial development leads to a reduction in income inequality in the short run. In the long run, however, the effect is the opposite—the wealthy appear to benefit more.

Our results emphasize the importance of considering the intertemporal relationship between finance and the income distribution. This provides a message for policy-makers: short-term inequality benefits from policies aimed at credit expansion may vanish or even become harmful in the long run. To avoid this, complementary policies may be needed in the aftermath of credit expansion, such as, for example, fiscal redistribution through progressive income tax and regulation and/or financial education aimed at helping households not to take on excessive amounts of credit. Finally, as more data becomes available, more research needs to examine the long- versus short-run nexus advocated in this paper, in contexts such as developing countries, where the extensive margin can potentially take longer to work than the intensive margin.

## APPENDIX

**TABLE A1**  
Variable Definition

Variable	Definition
Gini coefficient	The post-tax, post-transfer Gini coefficient
Top 10% income share	Income share held by highest 10%
Financial development	bank credit to the non-bank private sector divided by nominal GDP
Education	The fraction of the school age population that is enrolled in primary, secondary and tertiary schooling
GDP per capita	Real GDP per capita
Inflation	The change in consumer price index
Population	Population in thousands
Age dependency ratio	Age dependency ratio computed as the fraction of the population outside working age (15–64)
R&D intensity	The ratio of R&D to nominal GDP
Trade union	The ratio of union membership to economy-wide employment
Financial volatility	The standard deviation of the log of monthly stock prices within the year
Stock market capitalization to GDP	The ratio of Market capitalization of listed domestic companies to GDP
Bank assets to GDP	Claims on domestic real nonfinancial sector by deposit money banks as a share of GDP
Monetary stock to GDP	Broad money is the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveler's checks; and other securities such as certificates of deposit and commercial paper
Trade openness to GDP	The sum of imports and exports to GDP ratio

**TABLE A2**  
Summary Statistics

	Obs.	Mean	SD
Gini index	2,982	3.492	0.233
Top 10% income share	2,982	3.538	0.230
Financial development	2,982	3.537	1.034
Monetary stock to GDP	2,940	0.744	0.593
Bank assets to GDP	2,940	0.863	0.859
Education	2,982	3.918	0.449
GDP per capita	2,933	9.196	0.905
Inflation	2,903	2.605	50.101
Population	2,982	9.352	1.274
Age dependency ratio	2,982	4.051	0.144
R&D intensity	2,982	-0.541	1.361
Union membership	2,940	0.188	0.164
Financial volatility	2,940	1.299	3.137
Stock market capitalization to GDP	2,940	3.065	1.080
Trade openness to GDP	2,351	-1.073	0.654

Notes: All variables in logarithms except inflation and financial volatility.

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