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The impact of finance on income inequality: a threshold analysis

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Abstract
We identify the optimal level of financial development for income inequality in a panel of countries employing a non-linear panel Generalized Method of Moments (GMM) approach. The impact of financial development is statistically significant above and below the optimal level, but its impact on income inequality is not asymmetric, with the costs of financial 'under-development' being greater than those for 'over-development'.

Keywords: income inequality, financial development, threshold estimation
JEL Classification Codes: D31, D63, F02, 011, 015

1. Introduction

Income inequality has increased in many countries in recent years (Alvaredo et al. 2018) and the impact of financial development on income inequality has received a lot of attention. One set of theoretical models implies that financial development enhances economic growth and reduces income inequality by improving the efficiency of capital allocation, which accelerates economic growth, and by relaxing credit constraints on the poor, which reduces income inequality (e.g., Galor and Zeira, 1993; Galor and Moav, 2004), and by moving resources from highly endowed to poorly endowed individuals (Braun et al., 2019). Other models (e.g., Greenwood and Jovanovic 1990) predict an inverted u-shaped relationship between income inequality and financial development wherein at early stages of development, only the high-income individuals can afford to access and benefit from financial markets, but at higher levels of economic development, many more people access financial markets so that financial

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development directly helps a larger proportion of society, and the distribution of income stabilizes.

The empirical evidence on the relationship between finance and income inequality is ambiguous. For example, Li et al. (1998), Beck et al. (2007), Naceur and Zhang (2016), and Thornton and Di Tommaso (2020) report that countries with higher levels of financial development have less income inequality; Jaumotte et al. (2013), de Haan and Sturm (2017), and Dabla-Norris et al. (2015) report a positive relationship; and Kim and Lin (2011) and Altunbaş and Thornton (2019), find an inverted ‘‘U-shaped’’ curve relationship with greater financial development beneficial up to a certain threshold but having a negative impact beyond that. More recently, a meta-analysis of 116 published studies by Chlestos and Sintos (2023) suggests that the overall effect of financial development on income inequality is on average zero, with the sign and magnitude of the effect depending on study characteristics.

In this paper, we revisit the notion of a ‘‘U- shaped’’ curve relationship and identify the optimal level of financial development for income inequality by employing the non-linear panel GMM approach that allows for a threshold effect with endogenous regressors and threshold variables.[1] We measure financial development using an index of financial development developed by IMF staff, which is designed to capture the depth, access and efficiency dimensions of financial institutions and financial markets (see Svirydzenka, 2016). This contrasts with most other studies that have relied on the ratio to GDP of bank credit or broad money supply as a measure of financial development, both of which reflect narrow banking sector-oriented measures. In addition, we use a panel of countries at different levels of economic development, enabling us to examine the effects of finance both broadly and across countries’ income groups.

2. Methods and data

The threshold model takes the following form:

$$Gini_{i,t} = \alpha_i + \emptyset Gini_{i,t-1} + \beta_1 FD_{i,t} I(FD_{i,t} \leq \gamma) + \beta_2 FD_{i,t} I(FD_{i,t} > \gamma) + \delta X_{i,t} + \upsilon_t + \varepsilon_{i,t} \quad (1)$$

Our dependent variable, $Gini_{i,t}$ is the Gini coefficient based on households’ income before taxes to proxy for income inequality before redistribution via the tax system, and is from Solt’s (2009) Standardized World Income Inequality Database (SWIID).[2] α_i is the individual effect for each country which captures individual heterogeneity, υ_t is the common time effect, which

[1] Recent applications of these approach to applied economics questions include Asimakopoulos and Karavias (2016) and Kremer et al. (2013).

[2] The SWIID is widely used in empirical research because of its convenience and accessibility as a source of cross-national data with global coverage for a relatively long time periods. However, like other cross-country datasets there are issues with respect data quality and comparability and the imputation model used for missing observations (see e.g., Jenkins, 2015).

captures co-movement of the series due to external shocks, and $\varepsilon_{i,t}$ is the error term. FD_{it} is the level of financial development measured by the index of financial development developed by Svirydzenka (2016) and serves as the threshold variable where the threshold is given by the parameter γ. $I(.)$ is the indicator function which takes the value 1 when the condition in the parenthesis is satisfied and 0 otherwise. The vector $X_{i,t}$ includes: the growth rate of real per capita GDP, because low growth is associated with greater income inequality (Piketty, 2014); the rate of inflation, because inflation adds to economic uncertainty and can depress both average incomes and the incomes of the poor (Romer and Romer, 1999); the ratio of foreign trade to GDP, because theory and much empirical evidence supports the view that trade liberalization is poverty-alleviating in the long run and on average (Winters et al., 2004); and the ratio of government final consumption to GDP, because the median voter theory of government size predicts that greater inequality leads to greater demand for redistribution and larger government (Meltzer and Richard, 1981), and the growth of the working population because large available supplies of labor will maintain downward pressure on wages until much of that supply has been absorbed (Lewis, 1954). Data on GDP per capita growth, foreign trade, government consumption, and inflation are from the World Bank's World Development Indicators (WDI) database.

The modelling strategy allows the role of finance to differ depending on whether FD_{it} is below or above some level of γ. We estimate Eq. (1) using the GMM method of Seo and Shin (2016) which allows for endogenous regressors and threshold variables and uses Arellano and Bond (1991) type instruments. The method proceeds in two steps: (i) for a selected parameter value of γ, estimates of $\theta = (\emptyset, \beta_1, \beta_2)$ are obtained by Arellano-Bond GMM; (ii) step (i) is repeated for γ's belonging in a strict subset of the support of FD, resulting in a different $\hat{\theta}_{GMM}$ for each selected γ. The γ which minimizes the GMM-type objective function and its corresponding $\hat{\theta}_{GMM}$ are the optimal estimated parameters. We estimate the model using an unbalanced panel of annual data for 72 developed and developing economies for the period 1980-2015, with the data organized into five-year non-overlapping averages and time dummies. We use five-year averages because annual macroeconomic data are noisy, especially for data on income inequality, because the annual income inequality data in the SWIID are imputed for years for which no information was available in the underlying databases, and to abstract from business cycle influences. Finally, we use four lags as instruments. In the Appendix, Table A.1 provides more explanation of the variables, gives the data sources and provides summary descriptive statistics and Table A.2 lists the countries include in the data sample.

3. Results

The first column of Table 1 presents the results from the estimation of model (1) for full sample of countries. The upper part of the table displays the estimated financial development threshold and the corresponding 95% confidence interval. The middle part shows the regime-dependent coefficients of financial development on income inequality. Specifically, $\hat{\beta}_1$ and $\hat{\beta}_2$ denote the marginal effect of financial development on income inequality in the low (high) financial development regime, i.e. when financial development is below (above) the estimated threshold

value. The coefficients of the control variables are presented in the lower part of the table.

Table 1. Non-linear dynamic threshold estimation of financial development and income inequality—dependent variable: Gini coefficient

	All countries	High-income countries	Lower-income countries
Threshold	16.7000***	17.2000***	21.3900***
	(2.850)	(2.2550)	(1.7020)
Financial development			
$\hat{\beta}_1$	16.2962***	14.2200***	21.9978***
	(0.2462)	(0.4350)	(3.7548)
$\hat{\beta}_2$	-0.8155**	-0.6155**	-0.6520***
	(0.2966)	(0.2966)	(0.0613)
Growth of GDP per capita	0.8529***	0.7007***	0.6883***
	(0.0050)	(0.0531)	(0.0642)
Government consumption	0.0011***	0.1531**	-0.0011***
	(0.0000)	(0.0518)	(0.0000)
Trade openness	0.0532	0.0037**	-0.5705**
	(0.0460)	(0.0285)	(0.2387)
Growth of working population	0.0888***	-0.0364***	0.1435
	(0.0067)	(0.0543)	(0.9990)
Inflation	-0.0001***	0.0001***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)
Observations	504	185	319
Hansen test (p-value)	0.780	1.000	0.920
AR(1) (p-value)	0.002	0.020	0.001
AR(2) (p-value)	0.545	0.828	0.885

Notes: The Hansen test (p-value) is the test of the null hypothesis that the over-identifying restrictions are valid. AR(1) and AR(2) are the Arellano-Bond test (p-values) for the absence of autocorrelation of the error terms at first- and second order, respectively. Standard errors in parenthesis. ***, **, and * indicate statistical significance at the 1, 5, and 10% levels respectively.
Source: Author estimates.

We report three key findings. First, the estimated financial development thresholds as well as the marginal effects of financial development on income inequality strongly support the view that, on average, the level of financial development is greater than the optimal level in terms of any beneficial impact in reducing income inequality. The optimal threshold level of the financial development index is 16.7% on the index scale of 0 to 1, where the mean level of the index of financial development in our sample is 0.36—i.e., average financial development is more than double the optimal level on this measure. Second, there is evidence of the existence of an inverted ‘‘U-shaped’’ relationship between finance and income inequality: when the level of financial development of the average country is below the threshold, a 1point increase in the

index of financial development will increase income inequality by 0.163%; and if it is above the threshold then a 1point increase in financial development will lower income inequality by 0.008%. Third, the positive impact of financial development on inequality is much larger quantitatively when it is below the estimated threshold than the negative impact when it is above the threshold. In columns 2 and 3 we show that these results hold when we split our sample into high- and lower-income countries according to the World Bank's country income classification scheme.[3] In our sample, the average level of financial development for high-income countries is 0.57, whereas for developing countries it is 0.23. The results indicate that the average high-income country is well above the optimum level of financial development (17.2%) whereas the average lower-income country is broadly in line with the optimal threshold (21.4%) suggesting that as this latter group develops further, their financial sectors should grow broadly in line with GDP. For both groups of countries, the positive effect of a larger than optimal level of financial development is more significant quantitatively than the negative effect from a level of financial development below optimal—i.e., the impact is not asymmetric for either group or it may be preferable to opt for policies that promote financial development.

Of the remaining covariates, the growth of the working population and inflation are associated with an increase in the Gini coefficient (i.e. greater income inequality), and some evidence that openness to international trade reduces income inequality, which are broadly in line with expectations. However, the growth of GDP per capita and the share of government consumption in GDP are both associated with increases in inequality.

4. Concluding remarks

We examined the relationship between financial development and income inequality in a panel dataset using a dynamic panel threshold model that allows for non-linear threshold effects with endogenous regressors and threshold variables. We found that the estimated financial development threshold and the marginal effects of financial development on income inequality support the view that, on average, the level of financial development is greater than the optimal level in terms of any beneficial impact in reducing income inequality. However, the impact of increasing financial development on income inequality is not asymmetric, with the benefits of very high financial development growing smaller and not being mirrored by the steep increase in costs experienced below the threshold. The cost of financial development below the threshold may also cause a "trap" whereby financial development increases inequality and there is therefore no incentive to increase financial development.

[3] The World Bank's classification scheme for 2015 defined high-income economies are those with a GNI per capita of $12,476 or more.

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Appendix

Table A.1. Data sources and descriptive statistics

	Source	Mean	Median	St. deviat.	Minimum	Maximum
Gini coefficient	Solt (2009)	46.404	46.450	6.041	29.900	68.380
Real GDP growth	WDI	3.481	3.431	2.357	-5.048	11.866
Index of total financial development	Svirydzenka (2016)	0.363	0.308	0.233	0.046	0.948
GDP per capita (constant 2010 US dollars)	WDI	16,043	5,853	19,884	286	106,479
Ratio to GDP of exports plus imports	WDI	71.581	57.862	52.113	13.942	401.022
Ratio to GDP of government final consumption expenditure	WDI	15.185	14.555	5.412	4.136	55.200
Annual % change in consumer prices (inflation)	WDI	28.877	6.226	181.054	-0.442	2692.442
Annual % growth of working populations (age 15 -65 years)	WDI	1.902	1.969	1.231	-1.515	7.259

Note: WDI=World Bank.

Source: World Development Indicator database

Table A.2. Countries in the data sample

High-income countries:

Australia, Austria, Barbados, Belgium, Canada, Chile, Denmark, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, Korea, Lu xembourg, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, United Kingdom, United States, Uruguay.

Other countries:

Algeria, Argentina, Bangladesh, Bolivia, Botswana, Brazil, Colombia, Costa Rica, Cote d'Ivoire, Dominican Republic, Ecuador, Egypt, Fiji, Ghana, Guatemala, Honduras, India, Indonesia, Iran, Jordan, Kenya, Madagascar, Malawi, Malaysia, Mauritius, Mexico, Morocco, Nepal, P akistan, Panama, Paraguay, Peru, Philippines, Rwanda, Sierra Leone, South Africa, Sri Lanka, Tanzania, Thailand, Tunisia, Turkey, Ugand a, Venezuela, Zambia.

Note: Countries are classified according to the World Bank's income classification scheme for 2015 in which high-income countries are those with a GNI per capita of $12,476 or more.