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FINANCIAL SECTOR DEVELOPMENT AND INEQUALITY: IS THERE A FINANCIAL KUZNETS CURVE?

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Abstract: The existing empirical knowledge in the area of financial sector development and income inequality finds evidence for the theoretical work which posits a simple, linear relationship between the two variables. In this article, we subject the extant empirical knowledge to close scrutiny and point out to a potential dynamic and endogenous relationship between financial sector development and inequality. By using dynamic multivariate panel data analysis on a carefully selected data set of income inequality data for developed and developing countries spanning the period 1962–2006, we find robust empirical evidence for the existence of an inverted U-curve relationship between financial sector development and income inequality. In that token, we confirm the theoretical stipulations of Greenwood and Jovanovic (1990) for an inverted U-curve relationship between the financial sector and income inequality. Copyright © 2012 John Wiley & Sons, Ltd.

Keywords: financial sector development; inequality; growth

1 INTRODUCTION

The recent global financial crisis has challenged the view that extending financial products to lower socioeconomic strata indiscriminately is good both for alleviating poverty and for lowering income inequality. If anything, this strategy has contributed to the biggest crisis since the Great Depression and jeopardized the advances made in poverty eradication over the last few years. Thus, shedding more light onto the inequality–finance–growth nexus is important, not only as an empirical question but also for implementing effective policies that could accelerate the process of poverty alleviation. According to Bourguignon (1991), the alleviation of poverty comes from two intertwined sources: economic growth (which is usually associated with lowering poverty) and changes in income inequality, which could be widening following the developmental trajectory. Consequently, in the early phase of economic development, even with rapid economic growth, the joint

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effect of the inequality–growth impact upon poverty could still be negligible. Given the importance of the issue, by now, some analysts have found some evidence on the relationship between financial sector development and inequality, which favours the view that financial sector development is associated with a tighter income distribution (Clarke *et al*., 2006; Beck *et al*., 2007).

We subject the existing empirical evidence and theoretical predictions to close scrutiny and empirically estimate the relationship between financial sector development and inequality. In that respect, the article responds to the suggestions put forth by Demirguc-Kunt and Levine (2009) and represents the first attempt to provide an empirical framework that assesses the dynamic and endogenous relationship between finance, growth and inequality. Following the theoretical arguments of Greenwood and Jovanovic (1990) and Galor and Moav (2004), we find overwhelming evidence for an inverted U-curve relationship between the two variables. The mechanism through which the finance–inequality nexus is carried out is described by Greenwood and Jovanovic (1990). In particular, at low levels of economic development, few people use financial intermediaries because of high fixed costs relative to their income, thus resulting in slower growth and a more equal distribution of income. Over time, as financial intermediaries develop and as economic opportunities expand, the recipients of finance enjoy greater returns, resulting in higher growth and higher inequality. When an economy reaches maturity, more people use financial intermediaries—a process that maximizes growth and reduces inequality.

Our contribution to the extant knowledge in the area is twofold: (i) we critically examine the existing theoretical and empirical literature *vis-à-vis* the inequality–financial development–growth nexus, while also pointing to some of its shortcomings; and (ii) we re-estimate the relationship using an improved and cleaner data set on inequality, while also applying appropriate econometric techniques that deal with the problems of endogeneity and unobserved heterogeneity. Although we focus on non-linearities related to finance, inequality and growth, it is important to note that non-linearities between inequality and other social variables have already been established in related social disciplines. In an influential argument, Kuznets (1963) evidenced that the relationship between inequality and process of development follows an inverted U-curve relationship. A similar argument has been put forth by Chong (2001) on the relationship between democracy and inequality. There are various forces that may be responsible for this type of relationship, and we take a closer look at them in the remainder of the article, highlighting the broader implications of this research.

The article is organized as follows. Section 2 takes stock of the existing theoretical articles and critically examines the extant empirical work. Section 3 describes the data. Our results and conclusions are presented in Sections 4 and 5, respectively.

2 THEORETICAL CHANNELS AND EMPIRICAL EVIDENCE

The extant theoretical predictions point to a conflicting relationship between financial sector development and inequality. In that respect, three major strands of literature could be identified. Originating from a buoyant growth literature, the first strand of literature posits a negative linear relationship between financial sector development and inequality. The proponents of this view claim that further deepening and widening of the financial sector could allow lower socioeconomic strata to borrow and invest in their human capital (either through furthering their education or through starting entrepreneurial

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activities)—something that is difficult and costly when credit markets are imperfect. The outcome of this process may allow the gap between the rich and the poor to be abridged, while also leading to higher growth rates.

Two major articles that belong to this strand stand out. Galor and Zeira (1993) developed a theoretical growth model that depends entirely on human capital investment, which is in turn determined by the nature of capital markets. In a situation where borrowing is difficult, those who inherit large amounts of wealth will have better access to human capital than those who do not, further perpetuating the intergenerational inequality. In their model, an economy with higher income inequality and capital market imperfection will maintain its inequality and will grow less than a similar economy with an equitable distribution of income. Banerjee and Newman (1993) constructed a three-sector model in which two of the technologies require indivisible investment. Because of capital market imperfections, only rich agents can borrow enough to run these indivisible, high-return technologies. Similarly to the case of Galor and Zeira (1993), here as well, the initial distribution of income in a situation with capital market imperfections has implications for the evolution of income distribution and the growth potential of a country. Belonging to the same strand of literature, Aghion and Bolton (1997) and Bardhan (2000) emphasized the importance of financial sector development in financing entrepreneurial activities.

The second strand of literature is represented by Greenwood and Jovanovic (1990), who posit an inverted U-curve relationship between the financial sector and inequality. They examine the growth–inequality dynamic in a model where finance affects dynastic access to higher expected return projects. In the early stages of development, financial markets are virtually non-existent and the economy grows slowly. With time, a financial superstructure begins to form, but given the high fixed costs of joining the financial intermediaries, it is the rich who exclusively benefit from joining them. When the economy reaches the intermediate stage of the growth cycle, savings rates and income inequality both increase. As the economy transitions towards maturity, more and more people join the financial intermediaries, hence increasing growth and reducing inequality. In the final stage of development, the distribution of income across agents stabilizes, the savings rate falls and the economy's growth rate converges. A similar argument is put forth by Townsend and Ueda (2006), who underline the importance of financial system in identifying high return investment as critical for both economic growth and changes in inequality.

Finally, the last strand of literature posits a positive linear link between the two variables. Rajan and Zingales (2003), conjectured that, in the absence of well-developed institutions, it may only be the rich who may benefit from the development of the financial sector. Even when the financial sector becomes more developed, the rich may still prevent firms from getting access to credit, and they may still encourage the financial sector to channel funds towards the rich, further increasing the gap between the rich and the poor. Finally, Hendel *et al*. (2005) showed that in situations where government programs make borrowing or lower tuition more affordable, high-ability persons become educated and leave the uneducated pool, driving down the wage for unskilled workers and raising the skill premium, thus increasing the levels of income inequality.

Following this literature review, three hypotheses on the inequality–finance nexus emerge, which we empirically examine in the subsequent sections.

Hypothesis 1

There is a short- and medium-run negative linear relationship between financial sector development and inequality.

DOI: 10.1002/jid

Hypothesis 2
There is an inverted U-curve relationship between financial sector development and inequality in the short and the medium run.

Hypothesis 3
There is a positive linear link between financial sector development and inequality in the short and the medium run.

To date, there have been some efforts to empirically estimate the relationship between financial sector development and inequality. According to Demirguc-Kunt and Levine (2009), the emerging bulk of empirical research points tentatively towards the conclusion that improvements in financial contracts, markets and intermediaries expand economic opportunities, reduce persistent inequality and tighten the distribution of income. Beck *et al*. (2007) put forth a seminal article, which has estimated the effect of financial sector development on changes in poverty and inequality. They show that positive changes (i.e. increases) in financial sector development lead to negative changes in both poverty and income inequality. More interesting to us is the article of Clarke *et al*. (2006), which estimates the relationship between inequality and finance in levels. Using ordinary least squares (OLS) on averaged data and random effects on a panel data set, they show that there is a simple linear relationship between financial sector development and inequality, when different proxies for financial sector are used.[1]

3 DATA AND ESTIMATION METHOD

3.1 Data and Model

To estimate the effect of financial sector development on inequality, we use the Gini coefficient (the most widely used measure of inequality). One of the main problems associated with the Gini coefficient is its quality and availability. These issues have already been addressed numerous times (Deininger and Squire, 1998). Faced with this problem, we opted for using the most comprehensive data set on inequality data—the United Nation's WIDER data set. It is the most comprehensive data set of inequality data (measured in Gini), which also contains data based on a variety of measures (consumption and income), levels of aggregation (urban, rural and regional) and different characteristics of the labour force (working age, employed and unemployed). Given the cornucopia of different data points in the WIDER data set, we decided to use an algorithm described by Mickiewicz and Gerry (2008) to clean the data set so as to derive high-quality Gini data based solely on income.[2] In addition, we have

[1]However, they do find some weak evidence for the inverted U-curve relationship between finance and inequality in the short and medium terms.
[2]Mickiewicz and Gerry (2008) first retained income-based data and eliminated all data based on consumption measures as well as all data points not based on a representative coverage of the whole population. Where possible, they preferred data emanating from studies based on the Canberra group definition, where income includes production, barter and other non-cash income. The income in question is disposable income, not gross income (therefore incorporating the impact of redistributive policies of the government). In addition, the preferred method identifies households as the appropriate sampling units, adjusted with equivalence scales. If two results based on a similar method were available, they took the source that was more recent and that covered a longer time series. Finally, a supplementary criterion used to purge the data was the quality ranking of studies, available from the WIDER data set, which grossly confirms the criteria enumerated earlier.

DOI: 10.1002/jid

conducted a secondary transformation of the Gini coefficient to make it an unbounded variable.[3] However, in the robustness checks, we also experiment with Gini data that have not been transformed.

The recent literature on the relationship between financial sector development and economic growth has developed several indicators to use as proxies for the development of the financial sector. In this article, we use credit to the private sector by financial intermediaries (also known as private credit) over gross domestic product (GDP). In its essence, the indicator comprises credit given to private firms and households from by banks and non-bank financial intermediaries (but excludes central banks as lenders and government and state-owned enterprises as borrowers). In addition, this measure is a good proxy for the extent to which private sector agents have access to financial intermediation (as in Greenwood and Jovanovic, 1990) or access to loans (as in Banerjee and Newman, 1993; Galor and Zeira, 1993). This proxy has also been used in the literature, which has analysed the effect of financial sector development on growth, noting that growth is faster in countries with wider and deeper financial sectors (Beck *et al*. 2000; Levine *et al*. 2000).

Similarly to Clarke *et al*. (2006), we experiment with a secondary measure of financial sector development (bank assets – claims on the non-financial domestic sector by deposit money banks / GDP). Given that this measure includes loans to government and state-owned enterprises, we believe that it may interfere with some of the redistributive channels and their effect on inequality. Hence, it is a less clean measure of financial sector development than private credit.

Table 1[4] provides a useful summary of the main variables used in our empirical analysis. A glance at the financial sector development variable reveals that we have covered countries with a variety of financial sector development (credit to the private sector ranges from 4% to more than 200% of GDP). In addition, Table 2 provides useful correlation statistics of the variables used in the model.

Building on Clarke *et al*. (2006), we propose the following model to estimate the relationship between financial sector development (FIN) and inequality (INEQ).[5]

$$\text{INEQ } i,t = \alpha + \beta \text{INEQ i},t-1 + \gamma \text{ FIN i},t + \delta \text{ FIN}^2 i,t + \zeta \text{X } i,t + \text{T } i,t + e\, i,t$$

As previously indicated, inequality is measured in Gini, whereas the proxy variable for financial sector development is credit to the private sector in percent of GDP. In addition to the financial sector variables, we include several variables to control for other factors that may influence inequality as well as time period dummies. Specifically, we include the

[3]We have conducted a secondary transformation of the Gini data, as described by Reuveny and Li (2003). According to them, the usual practice is to transform a bounded variable (such as the Gini coefficient) into an unbounded one. We transform the bounded Gini into an unbounded variable by using the following transformation equation (Gini / (100 – Gini)).

[4]The following countries were included in the data set: Argentina, Armenia, Australia, Austria, Barbados, Belarus, Belgium, Bolivia, Botswana, Bulgaria, Canada, Chile, China, Colombia, Costa Rica, Croatia, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, El Salvador, Estonia, Finland, France, Gabon, Georgia, Germany, Greece, Guatemala, Honduras, Hungary, Ireland, Israel, Italy, Japan, Kazakhstan, Kenya, Kyrgyzstan, Latvia, Lesotho, Lithuania, Luxembourg, Macedonia, Malta, Mauritius, Mexico, Moldova, Nepal, Netherlands, New Zealand, Nicaragua, Norway, Panama, Paraguay, Peru, Poland, Portugal, Romania, Russia, Serbia and Montenegro, Slovakia, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Tajikistan, Turkey, Ukraine, United Kingdom, United States, Uzbekistan, Venezuela and Zambia.

[5]There are, however, differences between our model and the one devised by Clarke *et al*. (2006). For example, we also include an autoregressive term to capture the persistence in inequality and to better model the dynamic relationship between finance and inequality.

DOI: 10.1002/jid

Table 1. Summary statistics

Variable	Observations	Mean	SD	Min	Max
Gini	161	33.10223	9.677166	19.72	61.5
Credit to private sector (% GDP)	161	68.61739	41.98921	4.38302	218.001
GDP per capita (Purchasing Power Parity [PPP], constant 2000 USD)	161	20 553.42	10 826.04	1463.11	66 548
Government expenditure (% GDP)	161	18.16922	4.762499	4.79403	29.0974
Inflation (%)	161	10.12115	22.46385	0.126662	219.46
Industry value added (% GDP)	161	31.40407	6.206674	17.1921	59.3364
Freedom House Index	161	1.732919	1.114038	1	6
Polity IV Index	161	17.41366	3.925502	3	20
Modern sector (Industry + Services value added in % GDP)	161	94.12941	5.434334	60.7476	100.098

Source: WIDER, World Development Indicators, International Financial Statistics, Freedom House, Polity IV.

linear and the squared terms of the log of GDP per capita to control for a direct "Kuznets effect" of economic development on income inequality, independent of financial intermediary development. Data on GDP per capita (in purchasing power parity, constant 2000 USD) come from the World Development Indicators.

In addition to these measures, we include several other control variables: inflation rate, institutional development and government spending in percent of GDP. We include inflation rate, conjecturing that monetary instability hurts the poor and the middle class relatively more than the rich because the latter have better access to financial instruments that allow them to hedge their exposure to inflation. We therefore expect inflation to have a positive coefficient. For this exercise, inflation is defined as the percentage change in annual CPI, and it is taken from IMF's International Financial Statistics.

In addition, we include measures of government consumption and the quality of institutions. We expect inequality to be lower in countries with better institutions (i.e. more democratic countries), as they tend to redistribute more towards the poor and the middle classes, hence making the income distribution tighter. We use two measures of institutional development—Freedom House Index and Polity IV.

It is, however, less clear whether government consumption will increase or decrease income inequality. For example, if most redistribution through the tax transfer system is towards low-income groups, government consumption may result in greater equality. However, it could also have the opposite effect if rich households use their political power to exploit the poor. Data on government consumption (in percent of GDP) are taken from the World Development Indicators.

Kuznets (1963) suggested that income inequality might depend on the sectoral structure of the economy. Thus, we include a variable representing the share of value added accounted for the services and industry (as opposed to agriculture). In addition, we also control for the industry value added to stipulate the income-equalizing effect of the industrial sector. As with most of the previously mentioned variables, data for the modern sector (sum of industry and services value added) and for the industry value added are taken from the World Development Indicators.

DOI: 10.1002/jid

Table 2. Correlation between the main variables used in the model

	Log of Gini	Credit to private sector	Log of GDP per capita	Government expenditure	Inflation	Industry value added	Democracy	Polity	Modern sector
Log of Gini	1.00000								
Credit to private sector	−0.36860	1.00000							
Log of GDP per capita	−0.68310	0.65560	1.00000						
Government expenditure	−0.58940	0.24240	0.43860	1.00000					
Inflation	0.16650	−0.23840	−0.21380	−0.11650	1.00000				
Industry value added	−0.04010	−0.15670	0.05680	−0.00850	0.18350	1.00000			
Freedom House Index	0.65920	−0.51290	−0.75700	−0.42880	0.31300	0.11130	1.00000		
Polity IV	−0.39570	0.27110	0.45150	0.27690	−0.21220	0.06790	−0.69490	1.00000	
Modern sector	−0.48490	0.51560	0.86230	0.38000	−0.18150	0.19150	−0.63790	0.45480	1.00000

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In conducting the analysis, we use a panel data approach (hence we exploit the time and cross-sectional aspect of the data). Given the gaps in the inequality data, we compress the data set by summarizing it in 5-year periods, thus arriving at nine 5-year periods (from 1962 until 2006).[6] A more serious problem that we encounter is the endogeneity of some of the regressors. The issue of the endogeneity of financial sector variables has previously been raised by some empirical researchers working in this area (Clarke *et al*., 2006). Given the cross-sectional nature of our data set, we also encounter a possible problem of unobserved heterogeneity. Finally, research attempts to date have pointed to a significant reverse causality between inequality and financial sector development.[7] Provided the nature of the problems that we face, we opt for using the system generalized method of moments (GMM), which has been proven as the most superior econometric method in dealing with problems such as endogeneity of regressors, unobserved heterogeneity and reversed causality. We use a system GMM technique where lagged values of the endogenous independent variables are used as instruments.[8] In addition, we couple this standard approach by using exogenous instruments for financial sector development, which in this case correspond to the types of legal origin.[9] There has been some criticism voiced over the use of legal origins as instruments for financial sector development, pointing to a possible direct effect of some of the colonial/legal origins on initial inequality. Although it might be the case that legal/colonial origins may have had some effect on initial land inequality, their effect on inequality in subsequent periods (t + 1) solely works through the financial system. Given this argument, the usage of our instruments becomes clear and does not violate the instruments' orthogonality principle.

With the advancement of technology and research, a variety of econometric techniques have become available to deal with the issue of the endogeneity of one (or many) of the regressors in an econometric specification. To deal with these problems, studies have come up with variety of research methods, out of which instrumental variable approach (Instrumental Variable [IV] or Two stage least squares [2SLS]) is perhaps the simplest one, although not without a certain level of criticism. Gerry *et al*. (2008), argued that the appropriateness of the 2SLS as a general solution of the endogeneity problem is, at best, questionable. Fortunately, with the adoption of new econometric software packages and better data sets, economists and political scientists have been able to take advantage of the GMM in dealing with the issues of endogeneity and unobserved heterogeneity (Holtz-Eakin *et al*., 1988; Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell

[6]There are a few other, more subtle reasons for using 5-year averages of the data. Both income inequality and financial sector development data evolve slowly over time; hence, averaging them over 5-year period will reveal more about the dynamic relationship between them. Moreover, as indicated by Forbes (2000), averaging the data decreases some of the serial correlation because of business cycles. Finally, averaging inequality data in a panel setting has been common practice in a few relatively widely cited works (Forbes 2000; Persson and Tabellini, 1991; Deininger and Squire 1998; Voitchovsky 2005).

[7]The empirical research up to date points to a significant reverse causality between inequality and financial sector development (something that is also corrected using system GMM; Haber, 2007; Haber and Perotti, 2008; Perotti and von Thaddent, 2006).

[8]As indicated in Tables 3 and 4, we use lags of the following regressors as instruments for themselves: inequality, financial sector development and level of economic development. The other variables are controls and hence are treated as exogenous or pre-determined (as per Roodman, 2006).

[9]This set of instruments for financial sector development was first proposed by La Porta *et al*. (1998). Several articles have shown that the differences in legal origins are significantly correlated with the financial sector development, perhaps because different legal traditions put different levels of emphasis on the right of property owners or because some systems are more adaptable to exogenous changes than others (Beck *et al*. 2001).

DOI: 10.1002/jid

Table 3. GMM regression results: transformed Gini

Variable	Model 1 system GMM	Model 2 system GMM	Model 3 system GMM	Model 4 system GMM	Model 5 pooled OLS	Model 6 panel fixed effects
Transformed Gini (lagged)	0.738 (0.114)***	0.771 (0.088)***	0.718 (0.096)***	0.765 (0.080)***	0.798 (0.055)***	0.361 (0.105)***
Financial sector development	0.005 (0.002)***	0.005 (0.002)***	0.005 (0.002)***	0.005 (0.002)***	0.001 (0.001)	0.0002 (0.001)
Financial sector development squared	−0.00002 (9.21e−06)**	−0.00002 (9.45e−06)**	−0.00002 (9.43e−06)**	−0.00002 (9.56e−06)**	−3.45e−06 (4.94e−06)	2.44e−06 (7.83e−06)
Log of GDP per capita (PPP)	1.74 (0.845)*	1.809 (0.871)**	1.24 (0.917)	1.46 (0.936)	0.663 (0.397)*	0.154 (1.351)
Log of GDP per capita (PPP) squared	−0.095 (0.042)*	−0.101 (0.044)**	−0.072 (0.045)	−0.085 (0.045)*	−0.038 (0.021)*	−0.013 (0.069)
Government expenditure	−0.011 (0.010)	−0.008 (0.008)	−0.011 (0.009)	−0.007 (0.008)	−0.006 (0.003)	−0.009 (0.009)
Inflation	0.0009(0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	−0.0002 (0.0003)	−0.0005 (0.0003)*
Industry value added	0.0003(0.006)	0.002 (0.004)			0.001 (0.003)	−0.0004 (0.004)
Modern sector (Industry + Services)			0.011 (0.013)	0.008 (0.012)		
Freedom House Index	0.037(0.038)		0.050 (0.032)		0.015 (0.022)	−0.005 (0.029)
Polity IV		−0.006 (0.007)		−0.008 (0.007)		
Constant	−8.111 (4.107)**	−8.18 (4.15)**	−6.50 (4.20)	−7.027 (4.21)*	−3.054 (1.87)	−0.456 (6.642)
No. observations	161	161	161	161	161	161
No. groups	52	52	52	52	52	52
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2					0.92	0.87
No. instruments	51	51	51	51		
Hansen test	0.301	0.321	0.347	0.168		
AR(1)	0.017	0.012	0.011	0.01		
AR(2)	0.178	0.189	0.175	0.1		

All estimates in models 1–4 are based on dynamic panel data estimation, one-step GMM, using the dependent variable, the financial sector development and the level of economic development (log of GDP per capita) as instruments for the equations in differences and levels and dummies for legal origin (British, French, Germanic or Scandinavian) as the exogenous instruments in the levels equations. All models are estimated with robust standard errors; p values reported for AR(1) and AR(2) tests.
***Significance at 1% level.
**Significance at 5% level.
*Significance at 10% level.

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Table 4. GMM regression results: Gini-dependent variable

Variable	Model 1 system GMM	Model 2 system GMM	Model 3 system GMM	Model 4 system GMM	Model 5 pooled OLS	Model 6 panel fixed effects
Gini (lagged)	0.776 (0.104)***	0.816 (0.076)***	0.757 (0.091)***	0.810 (0.010)***	0.812 (0.058)***	0.368 (0.107)**
Financial sector development	0.107 (0.043)**	0.105 (0.046)**	0.107 (0.044)**	0.104 (0.045)**	0.026 (0.025)	0.001 (0.033)
Financial sector development squared	−0.0004 (0.0001)**	−0.0004 (0.0002)**	−0.0004 (0.0002)**	−0.0004 (0.0002)**	−0.00006 (0.0001)	0.00006 (0.0001)
Log of GDP per capita (PPP)	45.25 (18.90)**	46.76 (19.65)**	34.060 (19.64)*	38.805 (19.96)*	14.45 (9.18)	2.85 (29.88)
Log of GDP per capita (PPP) squared	−2.42 (0.954)**	−2.55 (0.966)**	−1.96 (0.977)*	−2.18 (1.002)**	−0.832 (0.487)*	−0.248 (1.528)
Government expenditure	−0.214 (0.193)	−0.136 (0.162)	−0.209 (0.178)	−0.116 (0.156)	−0.131 (0.087)	−0.199 (0.194)
Inflation	0.019 (0.026)	0.023 (0.025)	0.022 (0.026)	0.026 (0.025)	−0.006 (0.006)	−0.012 (0.006)*
Industry value added	−0.006 (0.12)	0.053 (0.097)			0.036 (0.071)	−0.033 (0.118)
Modern sector (Industry + Services)			0.242 (0.284)	0.179 (0.248)		
Freedom House Index	0.914 (0.790)		1.170 (0.915)		0.323 (0.521)	−0.010 (0.597)
Polity IV		−0.148 (0.157)		−0.181 (0.152)		
Constant	−202.72 (92.31)**	−206.69 (95.62)**	−165.090 (92.121)*	−179.75 (94.35)*	−55.54 (43.72)	21.67 (145.25)
No. observations	161	161	161	161	161	161
No. groups	52	52	52	52	52	52
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2					0.93	0.89
No. instruments	51	51	51	51		
Hansen test	0.4	0.403	0.384	0.177		
AR(1)	0.009	0.007	0.006	0.005		
AR(2)	0.164	0.175	0.163	0.181		

All estimates in models 1–4 are based on dynamic panel data estimation, one-step GMM, using the dependent variable, the financial sector development and the level of economic development (log of GDP per capita) as instruments for the equations in differences and levels and dummies for legal origin (British, French, Germanic or Scandinavian) as the exogenous instruments in the levels equations. All models are estimated with robust standard errors; p values reported for AR(1) and AR(2) tests.
***Significance at 1% level.
**Significance at 5% level.
*Significance at 10% level.

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and Bond, 1998). The difference and system GMM estimators can be seen as part of a broader historical trend in econometric practice towards estimators that make fewer assumptions about the underlying data-generating process and use complex techniques to isolate useful information (Roodman, 2006). A good application of this method in dealing with some of the issues enumerated earlier is available in the study of Heid *et al*. (2012).

4 RESULTS AND DISCUSSION

Table 3 contains the main results of the article. Model 1 is our basic model. In model 2, we use Polity IV as a proxy for institutional development. As per Clarke *et al*. (2006), in models 3 and 4, we experiment with including the modern sector. Finally, models 5 and 6 re-estimate our base model while using pooled OLS (model 5) and fixed-effects panel estimator (model 6). We run these models as a robustness check for the coefficient of the autoregressor. As indicated by Bond (2002), the OLS and fixed-effects results should represent the upper and lower bound, respectively, for the coefficient of the autoregressor.

The results that emerge from these estimations could be summarized as follows. We find strong and robust evidence for the inverted U-curve relationship between financial sector development and income inequality. The rest of the control variables (in terms of sign and magnitude of their coefficients) correspond to the theoretical predictions, although they remain mute *vis-à-vis* their significance. More specifically, (i) we find strong evidence of a dynamic relationship in the model,[10] and (ii) we find some evidence of the existence of the Kuznets effect *vis-à-vis* economic development (albeit at a 10% level of significance). However, surprisingly, we do not find the rest of our control variables to be significant although most of them (except of industry value added) have the expected signs. The insignificance of some of the explanatory variables is not surprising. For example, the reasons why some of the institutional variables are mute have been well documented (Commander and Nikoloski, 2012). The lack of significance of the rest of the variables is less obvious but nevertheless understandable. For example, the modern sector includes both industry and service sector value added, which many times act in opposite direction *vis-à-vis* income inequality, finally resulting in a statistically insignificant coefficient. Finally, the inclusion of some of the period dummies may have decreased the significance of some of the explanatory variables.

So far, we have concentrated on determining which variables are significant and whether they fit the theoretical predictions, without mentioning anything about the size of the coefficients. The coefficients' sizes, however, cannot be interpreted linearly because the dependent variable is a non-linear transformation of the Gini. To assess the size of the coefficients, we first compute the baseline Gini by setting all variables in model 1 of Table 4 to their respective means. We then raise credit to the private sector and the squared term by one standard deviation at a time and compute the Gini again. The results suggest that an increase of one standard deviation in credit to the private sector (ceteris paribus) will increase inequality by 4.85 Gini points. Subsequently, an increase of one standard deviation in the squared term (*ceteris paribus*) will be associated with a decrease in the Gini of 8.26 points.

[10]Evidence of a dynamic relationship in inequality modelling has been previously shown by Calderon and Chong (2001), and Ranjan (2001).

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It is also useful to note the turning point of the quadratic curve. In this case, the turning point occurs at the point where the credit to the private sector reaches approximately 114% of GDP (the 95% CI around the argent ranges from 88.90 to 148.49). Some of the countries that are located around this turning point include Austria and Thailand (right above the turning point) and South Korea, France and Germany (right below the turning point). In addition, the group of countries well above the turning point comprises, *inter alia*, Malta, Sweden, Canada, Switzerland and Japan, whereas the group of countries well below the turning point comprises China, Estonia, Latvia, Ukraine, Hungary and Croatia.

Our results are quite different to the panel section results of Clarke *et al*. (2006). There are a couple of reasons for the apparent difference: (i) we use a new and improved data set compared with the one of Clarke *et al*. (2006),[11] and (ii) we use a state-of-the-art econometric method that deals more efficiently with problems such as endogeneity or unobserved heterogeneity. It is also worth noting that we experiment by using bank assets as a proxy for financial sector development; however, our results are not as robust. One of the reasons for these results is the fact that bank assets are not a very good proxy for financial sector development (they include data on credits to governments and state-owned enterprises, which may also mask additional channels through which government spending, finance and inequality are connected).[12]

It is further important to note that our results are consistent not only with Greenwood and Jovanovic (1990) but also with Galor and Moav (2004). Considering both physical and human capital accumulation, Galor and Moav (2004) illustrate that the relationships among finance, inequality and growth change during development. They make two key assumptions: (i) the marginal propensity to save increases with income, and (ii) the rate of return on physical capital accumulation is greater than the return on human capital during the early stages of economic development, reversing in the later stages of development. During the early stage of development, therefore, inequality promotes growth by channelling resources towards individuals with a higher marginal propensity to save. In the later stages of economic development, dispersed human capital is essential for growth. Although the poor would like to borrow to invest in human capital accumulation, credit market imperfections inhibit their economic opportunities. At this later stage, inequality hurts growth because for the same average income per capita in the economy, and greater inequality implies that fewer people can afford education, resulting in slower growth. Financial imperfections exert a particularly pernicious effect on inequality at higher levels of development, as human capital becomes increasingly important.

Hence, in a way, Galor and Moav (2004) united the arguments put forth by Greenwood and Jovanovic (1990), Banerjee and Newman (1993) and Galor and Zeira (1993)—and they are further confirmed by our empirical article. In the initial developmental period, saving in physical capital accumulation is essential for growth; thus, the increase in the savings rate induced by the nascent financial sector (and with that, increase in inequality) is almost unavoidable. However, this does not rule out the importance of the human development channel through which finance influences

[11]It has to be noted that we also experiment with the data set of Clarke *et al.* (2006); that is, we try to match their data points with ours as closely as possible, and while using their data set with our estimation methodology, we fail to replicate their results.

[12]For the same reason, we do not experiment with using M2 as a proxy for the financial sector development.

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inequality. The finance–inequality story through the human development channel may well happen, but only in the later developmental stages. The human development channel occurs when human capital becomes the main driver of growth, when income reaches a sufficient level, when credit constraints gradually diminish and when more people can take advantage of the availability of financial services (Galor and Moav, 2004). This unambiguously points to a non-linear relationship between the two variables.

As a robustness check, we conducted the same analysis but on an untransformed Gini. The results are reported in Table 4 and are quite similar to our results for the transformed Gini. Namely, the autoregressive term is positive and significant (at 1% level of significance). Moreover, the value of the autoregressive term lies between the autoregressive term obtained using OLS (which represents the upper bound) and that using fixed effects (which represents the lower bound). The financial sector development variable is positive and significant, whereas the squared term is negative and significant. Our results are robust in including different control variables, hence confirming the inverted U-curve hypothesis devised by Greenwood and Jovanovic (1990). In addition, we find some evidence of the existence of the Kuznets curve.

As a secondary robustness check, we also experiment with using education (secondary enrolment net and gross rates) as one of the control variables. This will also allow for controlling for some of the channels through which finance could affect inequality (as argued by Galor and Zeira, 1993). The variable seems insignificant without affecting the robustness of our main results.

5 CONCLUSION

The new data set on financial sector development devised by the World Bank has allowed for studying of the relationship between financial sector development and other economic and social variables, among them inequality. However, up to this point, a careful empirical study that would address the dynamic and endogenous relationship between growth, inequality and finance has been lacking.

Given this background, this article addresses the need for a better understanding of the finance–growth–inequality nexus. It uses a comprehensive data set for developed and developing countries spanning the period between 1962 and 2006. It also applies system GMM that deals with issues of endogeneity, unobserved heterogeneity and reversed causality to test anew the relationship between finance and inequality. In that respect, the article provides overwhelming evidence of an inverted U-curve relationship between financial sector development and inequality.

However, there are caveats attached to our research. The measure of inequality that we use, for example, has been heavily criticized in the past. However, because of the lack of data, additional analysis using more disaggregated inequality data would be very difficult to accomplish, and aggregate cross-country comparisons frequently rely on broad indicators of financial depth rather than specific measures of the degree to which households and firms use financial services. Despite this, however, the empirical strategy pursued in this article has allowed for a better understanding of the inequality–finance–growth nexus on the aggregate level.

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