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Financial Development and Income Inequality: The Linear versus the Nonlinear Hypothesis

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Abstract

The aim of this paper is to test empirically the theoretical foundations of the linear relationship between financial development and income inequality, which is developed by Galor & Zeira (1993) and Banerjee & Newman (1993), and the nonlinear relationship, which developed by Greenwood & Jovanovic (1990). To this end, we built an international sample of 138 countries over the period (1980-2012). Our results indicate that financial development plays a positive role in reducing the social gap between the poorest and the richest classes. In addition, results show that the retention of the nonlinear hypothesis, developed by Greenwood & Jovanovic (1990), which assumes an inverted U-shaped relationship between financial development and income inequality depends on the banking variables vs. stock market variables and on the countries' income level. Within the meaning of Kuznets (1955), an inverted U-shaped relationship is consistently apparent in high income countries. The U-shaped relationship between economic development and income inequality, in the international sample, is driven exclusively by lower and middle income countries and not by high income countries, where a Kuznets relationship is established. Results also show a sensitivity to the estimation method that we adopted and to the Gini index.

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1. Introduction :

Nowadays, the increase in income inequality matter is attracting more and more attention of worldwide researchers. It is admitted that the income share of the rich increases more than that of the poor. As a result, the gap between these two classes is widening and income inequalities are exacerbated. According to the Organization for Economic Cooperation and Development (OECD) report published in 2014: "In the 34 OECD countries, 10% of the richest population have incomes 9.6 times higher than that of the poorest 10%. This gap was 7.1 times in 1980 and 9.1 times in the 2000s". Another United Nations International Children's Emergency Fund (UNICEF) report (2012) states that "We live in a planet where, overall, the richest quintile receives more than 70% of total revenue compared to a meager 2% for the poorest quintile". According to the United Nations Development Programme (UNDP), the ratio between the average income per capita in 20% of the richest countries and 20% of the poorest increased from 30 in 1960 to 74 in 1997. This widening in income inequality around the world, in the United States, Bangladesh, Bulgaria, China, Russia and many other countries, has led to question the financial system's contribution and what role this system can play to reduce the social gap between the poor and the rich.

Several studies tested the impact of financial development on income inequality. Some have studied this relationship in a panel of countries like the studies of Chu Minh H. & Le Quoc H. (2013), Clarke G. & al. (2013), Jauch S. & Watzka S. (2015), while other studies examined this relationship in a single country. This allowed them to focus either on the time dimension like the study of Jalil A. & Feridun M. (2011), Sehrawat M. & Giri A.K. (2015), or the geography dimension like the study of Liang Z. (2006), Deng H. & Su (2012), Chu Minh H. & Le Quoc H. (2013. However, to our knowledge, no previous studies have taken into account the stock development dimension. They were content to test the impact of financial development on income inequality by referring to banking indicators such as bank loans to private entities, money supply within the meaning of the M2 to GDP ratio and others… This study's contribution, among others, is to test the relationship between financial development and income inequality taking into account and the bank and stock development dimensions.

The economic theory assumes two basic hypotheses to link between financial development and income inequality. This relationship's analysis may be pursued by the linear hypothesis of Galor & Zeira (1993) and Banerjee & Newman (1993) and the nonlinear hypothesis of Greenwood & Jovanovic (1990). The linear curve shape may be increasing or decreasing. It can also take the non-linear form within the meaning of Greenwood & Jovanovic (1990). The non-linear curve shape may be convex, representing a normal U-shaped curve, as it may be concave, representing an inverted U-shaped curve as suggested by Greenwood & Jovanovic (1990). Furthermore, we tested the hypothesis of Kuznets (1955) which suggests an inverted U-shaped relationship between economic growth and income inequality.

In our study, we examined an international sample of 138 countries over the (1980-2012) period and classified them into 4 groups of countries. These groups are low-income countries, middle-income countries, upper-middle income countries and high-income countries. Our results indicate that financial development reduces the social gap between the poorest and the richest classes. In addition, we retained the nonlinear hypothesis of Greenwood & Jovanovic (1990) which assumes an inverted U-shaped relationship between financial development and income inequality. This latter assumption is consistent with Jauch S. & Watzka S. (2015) who used the generalized method of moments (GMM) to examine that relationship. We are discordant with Kuznets (1955). Our results do not suggest an inverted U-shaped relationship between economic development and income inequality rather they suggest a U-shaped normal relationship between economic growth and income inequality, consistent with the results of

Wendel M . & Mansour MS (2015). This hypothesis is true only for high-income countries, especially when we use stock market indicators.

The rest of this article is structured as follows: The second section briefly reviews the theoretical foundations and our research hypotheses. In the third section, we review the literature of the main relevant empirical studies. The fourth section discusses the econometric framework and the main results. Section five concludes.

2. Theoretical foundations and research hypotheses:

Galor & Zeira (1993) and Banerjee & Newman (1993), the founders of the "linear hypothesis", assume that there are two sectors producing a single goods in an economy. These are the skill-intensive sector and the unskilled intensive sector. Individuals are young and old and come to life with an initial amount of wealth. Each individual has two professional options: they benefit from an unskilled job all their lives or they invest in human capital during the first stage of their lives and then get a skilled job in the second stage. The model assumes that individuals are identical, except they are different in the amount of initial wealth. People with a high initial wealth tend to invest in human capital and choose a skilled job in the second stage of their lives, earn more, and then bequeath more. People with less initial wealth should borrow if they want to invest in human capital. However, investment in human capital is indivisible, and borrowing is expensive and restrictive because of financial market underdevelopment. Therefore, not everyone can afford to borrow. People who are unable to borrow remain unqualified for life, earn less and bequeath less. This cycle is repeated at each generation. Therefore, initial wealth determines the gap between rich and poor. Initial wealth coming from an inheritance becomes a key factor in determining initial income inequality. In a country where the credit market is underdeveloped, it would be more difficult to raise funds to finance investments. Galor & Zeira (1993) and Banerjee & Newman (1993) conclude that income inequality negatively relates to the development of the financial sector.

Greenwood & Jovanovic (1990), the founders of the "non-linear hypothesis", developed an intermediation model, explaining a mechanism by which the financial sector development is embedded into income inequality. They assume that every economic agent can pursue one of two investment opportunities: one that is safe, but offers low returns and the other is risky but offers high returns. Before the advent of services and financial intermediation projects, the financial system is not well developed and resources are allocated inefficiently resulting in modest economic growth. Financial intermediaries facilitate the diversification of the investment portfolio of any individual. Only rich people whose wealth equals or exceeds a specified threshold are able to participate in these projects to develop intermediate incomes. The poor need to accumulate wealth for a certain period of time to reach that threshold. The difference in income between rich and poor is growing alongside the expansion of financial structures and a rapid economic growth. In later mature stages of economic development, the financial sector is quite modern and most of those affected have access to financial services. The economy reached a stable and regular status and income inequality begins to shrink. The mentioned above framework is known as the inverted U-shaped theory or the nonlinear hypothesis.

One of the first models linking economic growth and income inequality was developed by Kuznets (1955). The hypothesis formulated by this author established a link between income inequality and economic growth as an inverted U-shaped function. According to this author, increase in inequality is temporary. In the early stages of development, inequalities increase to a maximum and then decrease gradually as the benefits of economic growth spread to all society. Therefore, according to this theory, it is development level that determines inequality level in an economy. Kuznets therefore postulates the existence of an inverted U-shaped curve linking economic growth and income inequality whenever a new

profitable sector emerges. The theory of Kuznets was examined by numerous studies. Since then, the idea of an inverted U-shaped curve was accepted with great empirical consistency (Barro (2000)). Gine & Townsend (2004) empirically found an indirect effect between finance and inequality moderated by growth, using Kuznets curve. Similarly, Beck et al. (2009) found that banking deregulation in the US has decreased income inequality and accelerated economic activity. Deininger & Squire (1998) showed that economic growth had no impact on income distribution (Dollar & Kraay (2002)).

3. A brief review of the empirical literature:

Liang (2006) used the generalized method of moments (GMM) to test the impact of financial development on income inequality in urban China. The author found that easy access to credit improves income distribution in urban areas. However, estimation of the linear and nonlinear hypotheses is not consistent with Greenwood and Jovanovic (1990). Ang (2008) found that financial development and banking density improves income share for the poor in India. This finding does not validate the hypothesis of Greenwood & Jovanovic (1990). Islam F. & Shahbaz M. (2011) examined the impact of financial development on income inequality in Pakistan over the period between 1971 and 2005 applying the Autoregressive Distributed Lag (ARDL) approach. Their findings support the linear hypothesis suggested by Galor & Zeira (1993) and Banerjee (1993) & Newman (1993) and found no evidence of an inverted U-shaped relationship between financial development and income inequality, as suggested by Greenwood & Jovanovic (1990). Jalil A. & Feridun M. (2011) examined annual data on the period stretching from 1978 to 2007 to examine the relationship between financial development and income inequality in China. They found that financial development helps alleviate income inequality. Their findings support the linear hypothesis suggested by Galor & Zeira (1993) and Banerjee & Newman (1993), but they found little evidence to support the inverted U-shaped relationship proposed by Greenwood & Jovanovic (1990). Another study by Baligh N. & Khosrow P. (2012) examined the relationship between financial development and income inequality in Iran over the period between 1973 and 2010. They concluded that financial development reduces income inequality and there is no evidence of a U-shaped relationship between the inverted financial development and income inequality, as suggested by Greenwood & Jovanovic (1990). Su J. & Deng H. (2012) examined the impact of financial development on income distribution and poverty in 21 Chinese provinces over the period 2001 and 2007 using the Generalized Method of Moments (GMM). The authors found no evidence of an inverted U-shaped relationship between financial development and income inequality, as suggested by Greenwood and Jovanovic (1990). Clarke et al. (2013) studied the impact of financial development on income inequality in developed countries. They concluded to the positive impact of financial development on income distribution and found no evidence of an inverted U-shaped relationship as suggested by Greenwood & Jovanovic (1990). Le Quoc H. & Chu Minh H. (2013) investigated a static panel to test the impact of financial development on income inequality in 59 provinces and cities in Vietnam over 4 years (2002, 2004, 2006 and 2008). Their results confirm the linear hypothesis suggesting that development of the financial sector can help to mend the gap of inequality and prove that the development of the financial sector has a positive impact on reducing income inequality. Ali Z. & Noor A. (2014) examined the relationship between development and income inequality for 7 developed countries over the period between 1961 and 2011 using the Generalized Method of Moments (GMM). They concluded that financial development reduces income inequality and there is no evidence of an inverted U-shaped relationship between financial development and income inequality, as suggested by Greenwood and Jovanovic (1990). Mansour M.S & Wendel. M. (2015) studied a static panel to test the relationship between financial development and income inequality in

East Asian countries over the period between 1960 and 2012. They concluded that the relationship between financial development and income inequality is nonlinear and follows the U-shaped normal curve. Their results indicate that financial development helps to reduce income inequality, but once a certain degree of financial development is reached, income inequality increases. Jauch S. & Watzka S. (2015) examined the impact of financial development on income inequality of 138 developed and developing countries using a static panel and the generalized method of moments (GMM). Their results indicate that financial development positively impacts income inequality and reject thus the linear and nonlinear hypotheses suggested by Greenwood & Jovanovic (1990). A recent study by Sehrawat M. & Giri A.K. (2015) examined the relationship between financial development and income inequality in India using the ARDL approach over the period between 1982 and 2012. Their results do not support the non-linear hypothesis of Greenwood and Jovanovic (1990). The results of the ARDL approach indicate that financial development does not reduce income inequality, but it amplifies the gap between rich and poor.

4. Methodology and results:

4.1. Data:

Our study examines a sample of international countries over the period between 1980 and 2012. We tested the impact of several financial development indicators, namely banking and stock market indicators, on income inequality using data taken from "The Standardized World Income Inequality Dataset (SWIID)" [1] created by F. Solt (2014). Our sample includes countries with heterogeneous GDP levels. We classified them into 4 groups of countries according to their income level using the Atlas method of the World Bank (Low Income below $ 975, average income between $ 976 to $ 3,855, upper-middle income from $ 3,856 to 11,905 and high income above $ 11,906). Appendix 1 presents the sample according to GDP.

4.2.The Model:

In this section, we will present our model that will test the relationship between financial development and income inequality. To test the linear hypothesis of Galor & Zeira (1993) and Banerjee & Newman (1993) and the non-linear hypothesis of Greenwood & Jovanovic (1990), we adopt the following regression model:

$$Gini_{it} = \alpha_0 + \alpha_1 FD_{it} + \alpha_2 FD^2_{it} + \alpha_3 GDP_{it} + \alpha_4 GDP^2_{it} + \alpha_5 EDU_{it} + \alpha_6 OUV_{it} + \alpha_7 INF_{it} + \alpha_8 POP_{it} + \alpha_9 DEP_{it} + \beta_i + \varepsilon_{it}$$

Note that all variables are expressed in logarithms, with Gini denoting the Gini coefficient, FD is the financial development indicator (banking and stock market), GDP is GDP per capita, EDU is education level, OPEN is trade openness, INF is inflation rate, POP is total population, DEP represents the government's final consumption expenditure (% of GDP), β represents countries-specific effect and ε is error term. Appendix 2 details the selected variables, their sources and their expected signs.

The linear hypothesis of Galor & Zeira (1993) and Banerjee & Newman (1993) predicts a significant $\alpha_1<0$ and an insignificant α_2, while the nonlinear hypothesis of Greenwood & Jovanovic (1990) predicts a significant $\alpha_1>0$ and a significant $\alpha_2<0$. To test the hypothesis of

[1] This database standardizes several sources of income inequality such as the United Nations University's World Income Inequality Database, the OECD Income Distribution Database, the Socio-Economic Database for Latin America and the Caribbean generated by CEDLAS and the World Bank, Eurostat, the World Bank's PovcalNet, the UN Economic Commission for Latin America and the Caribbean, the World Top Incomes Database, national statistical offices around the World. The total covers 171 countries with 4285 observations (country-years) and an average of 802 observations for five-year.
http://myweb.uiowa.edu/fsolt/swiid/swiid.html

Kuznets (1955), we introduced in our model the variables GDP and GDP^2. The hypothesis of Kuznets (1955) predicts a significant $\alpha_3>0$ and a significant $\alpha_4<0$.

Income inequality can be measured in various ways. The most commonly used indicator is the Gini coefficient. In our study, we used two Gini indices from two different sources, either The Standardized World Income Inequality Database (SWIID) Gini index created by Solt (2014) or the Estimated Household Income Inequality Data Set (EHII) Gini index (2008) created by University of Texas (2008). Financial sector development is measured by several variables, either by banking indicators such as bank credits to the private sector as a percentage of GDP and liquid liabilities (M3) as a percentage of GDP, or by stock market indicators such as market capitalization of listed companies as a percentage of GDP and turnover ratio. GDP is GDP per capita, which represents the level of economic development. We also used GDP^2 to test whether there is an indirect effect within the meaning of Kuznets who assumes the presence of an indirect effect between finance and income inequality when moderated by growth (Clarke et al (2003), Batuo M. K. & al. (2010), Deng H. & Su (2012), Wendel M. & Mansour M. S. (2015)…).

4.3.Main results and their interpretations:

Tables 1 and 2 respectively report the descriptive statistics and correlation coefficients of the variables used in our model. For each variable, we calculated the Mean, Standard deviation, Min and Max. The correlation coefficients between the considered variables are found to be relatively low.

Table 1: Descriptive statistics

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
Gini (SWIID)	3343	3.59	0.39	2.75	17.18
Gini (EHII)	2125	3.72	0.165	3.10	4.09
Credit	3979	3.41	0.96	-0.22	5.73
M3/PIB	1411	3.746	0.60	1.87	5.48
Market_Cap	2089	3.13	1.39	-5.48	6.40
Turnover	1947	2.86	1.64	-4.28	7.38
GDP	4304	25.65	4.05	1.42	36.69
Pop	4554	15.93	1.75	11.07	21.02
Openness	4211	4.22	0.58	1.84	6.27
Inf	3910	1.99	1.42	-13.49	9.64
Sch_enroll	3356	4.02	0.75	0.91	5.07
Gov_expend	4132	2.69	0.39	0.31	4.43

Table 2 : Correlation coefficients

	Gini (SWIID)	Credit	M3/PIB	Market_ Cap	Turnover	GDP	Pop	Openness	Inf	Sch_enroll	Gov_expend
Gini (SWIID)	1.0000										
Credit	-0.1977	1.0000									
M3/PIB	-0.2626	0.7764	1.0000								
Market_ Cap	-0.0644	0.6070	0.4995	1.0000							
Turnover	-0.1811	0.4227	0.4072	0.3529	1.0000						
GDP	0.0013	0.1330	0.0283	0.1225	0.3303	1.0000					

Pop	0.0240	0.0793	-0.0503	0.0502	0.4211	0.4310	1.000				
Openness	-0.0669	0.2141	0.2517	0.2034	-0.1874	-0.1437	-0.5712	1.0000			
Inf	0.1220	-0.4282	-0.3016	-0.4148	-0.1911	-0.2295	0.0818	-0.1473	1.0000		
Sch_enroll	-0.2779	0.5699	0.5847	0.3304	0.3171	0.1038	0.0158	0.2322	-0.1636	1.0000	
Gov_expend	-0.1620	0.2619	0.2222	0.1735	0.1291	-0.1856	-0.2696	0.2108	-0.1395	0.1754	1.0000

Table 3 reports the results of the banking variables which indicate that domestic credits provided to the private sector as a percentage of GDP has a negative and a statistically significant effect of 1% on income inequality, against the variable liquid liabilities (M3) as a percentage of GDP which is not significant. This result indicates that private funds play a positive role in reducing the social gap between the poorest and the richest classes. The results of our stock market indicators show a significant effect of 1% on income inequality. The variable turnover negatively impacts income inequality, consistent with the assumption that financial development helps to reduce income inequality.

Referring to Table 3, the results on squared financial development in terms of banking and stock market development show significant coefficients in all regressions. We recall that if squared financial development is significant, we retain the nonlinear hypothesis. However, if squared financial development is not significant and financial development is significant we retain the linear hypothesis (G. Clarke et al. (2013)). Therefore, we retained the non-linear hypothesis of Greenwood & Jovanovic (1990) which assumes an inverted U-shaped relationship between financial development and income inequality. This result is consistent with the findings of Jauch S. & Watzka S. (2015) who used the generalized method of moments (GMM). Moreover, we found a U-shaped normal nonlinear relationship between financial development and income inequality in regressions 6 and 7 in Table 3. This latter result is consistent with the study of Wendel M. & Mansour M. S. (2015). Furthermore, in disagreement with Kuznets (1955), our results do not suggest an inverted U-shaped relationship between economic development and income inequality but rather a U-shaped normal relationship, consistent with the findings of Wendel M. & Mansour M. S. (2015) with the exception of the second regression which retains the variable M3 / GDP, which is found insignificant.

All results of our control variables are statistically significant and consistent with theory in almost all regressions. With regard to the variable inflation rate, the coefficients are positive and statistically significant at the 5% and 10% levels for the stock market variables. However, when we use the variable M3 / GDP as a financial development indicator, the coefficient is negative and statistically significant. Note that in a context of monetary instability, inflation usually affects the middle-class and poor population more than the rich, because these latter have better access to financial instruments that allow them to hedge their exposure to inflation (Clarke G. & al. (2013)). In other words, inflation affects both social classes and it is the level of deterioration of the purchasing power of the rich and the poor that will impact income inequality. Accordingly, if the purchasing power of the poor deteriorates more than the rich, then income inequalities widen and vice versa. The openness ratio is significant in all regressions at the 1% level. According to the theorem of Stolper W. & Samuelson P. A. (1941), trade openness increases income inequality in a country that has a comparative advantage in producing high-tech goods that require skilled labor and decreases income inequality in a country that has a comparative advantage in producing goods that require abundance in labor. Opening borders often comes with an increase in the wealth of each exchanging country. However, internal inequalities may increase or decrease. In our regressions, we found different mixed results. As for the regressions that model bank development indicators, the results point to a positive and a significant correlation with

income inequality. This result is consistent with that of Meschi & Vivarelli (2009) who found that foreign trade between developing and developed countries led to high levels of income inequality. As for the regressions of the stock market development indicators, we found a negative and a significant sign that is consistent with the study of Duamal (2010). In addition, the coefficient on education rate is negative and statistically significant at the 1% level in all regressions. This can be explained by the fact that an increase in education level implies an increase in skilled labor supply, an increase in skilled workforce salary compared to unskilled workforce salary and an overall reduction in income inequality (Batuo ME (2010)). Moreover, government's final consumption expenditure (% of GDP) significantly and negatively impacts income inequality. We can deduce that wealth redistribution policies through the tax system, social transfers, and government interventions are generally pro-poor in our sample. Finally, the POP variable that reflects total population rate positively and significantly impacts income inequality at a level of 1% with the exception of the second regression that retains the M3 / GDP variable, which is not significant. The more the total population increases, the more the gap between the rich and poor widens. According to Boulier B.L (1975), demographic trends lead to an increase in income inequality. The author also concluded that fertility levels decrease and the growth ratio of the total population leads to a better distribution of income.

Table 3 : The Linear vs the Nonlinear Hypothesis: Results on an international panel data taken from SWIID

The Gini Index (SWIID)								
	Reg 1	*Reg2*	*Reg 3*	*Reg 4*	*Reg5*	*Reg6*	*Reg7*	*Reg8*
Intercept	5.30*** (38.31)	4.04*** 13.30	5.39*** (23.95)	5.10*** (21.26)	4.99*** (37.04)	4.43*** (6.02)	5.49*** (5.49)	5.08*** (21.59)
Credit	-0.25*** (-6.66)	-	-	-	0.17*** (10.95)	-	-	-
M3/PIB	-	-0.01 (-1.04)	-	-	-	-0.33*** (-4.00)	-	-
Market_ Cap	-	-	0.01*** (4.15)	-	-	-	-0.003 (-0.70)	-
Turnover	-	-	-	-0.03*** (-13.07)	-	-	-	-0.02*** (-4.03)
$Credit^2$	-	-	-	-	-0.02*** (-12.94)	-	-	-
$M3/PIB^2$	-	-	-	-	-	0.04*** (3.93)	-	-
Market_ Cap^2	-	-	-	-	-	-	0.003*** (3.63)	-
$Turnover^2$	-	-	-	-	-	-	-	-0.003*** (-3.00)
GDP	-0.77*** (-7.96)	-0.006 (-0.72)	-0.03** (-2.19)	-0.04*** (-2.99)	-0.07*** (-8.24)	0.0004 (0.04)	-0.03** (-2.01)	-0.04*** (-3.09)
GDP^2	0.001*** (7.01)	-0.00003 (-0.16)	0.0005* (1.88)	0.0007*** (2.72)	0.001*** (7.30)	-0.0002 (-0.86)	-0.0004* (1.69)	0.0007*** (2.87)
INF	-0.0004 (-0.19)	- 0.008*** (-3.08)	0.006** (2.09)	0.005* (1.81)	-0.004* (-1.90)	-0.008*** (-3.15)	0.006* (1.91)	0.004 (1.49)
Openness	0.02*** (3.72)	0.05*** (3.57)	-0.03*** (-4.00)	-0.04*** (-5.65)	0.02*** (4.32)	0.06*** (3.92)	-0.03*** (-4.63)	-0.04*** (-5.53)
Sch_enroll	-0.11*** (-25.73)	-0.10*** (--6.91)	-0.22*** (-18.55)	-0.19*** (-14.54)	-0.11*** (-28.80)	-0.10*** (5.26)	-0.23*** (-18.76)	-2.20*** -15.29

Gov_expend	-0.13*** (-14.39)	-0.03** (-2.21)	-0.17*** (-13.29)	-0.10*** (-8.21)	-0.13*** (-15.73)	-0.01 (-1.12)	-0.18*** (-13.43)	-0.09*** (-7.94)
POP	0.013*** (4.77)	0.009 (0.63)	0.01*** (4.64)	0.04*** (11.39)	0.01*** (4.70)	0.01 (0.30)	0.01*** (3.85)	0.04*** (11.47)
N	2184	768	1463	1366	2184	768	1463	1366
R2 (Within)	_	0.13	_	_	_	0.15	_	_
Prob>Chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Method	***GLS***	***RE***	***GLS***	***GLS***	***GLS***	**FE**	***GLS***	***GLS***

Note: GLS is General Least Squares, RE is Random Effects, FE is Fixed Effects. ***, **,* denotes significance level at the 1%, 5% and 10% levels respectively. T-statistics values are presented in parentheses.

Moreover, we tested the impact of financial development on income inequality by group of countries. We classified these countries in terms of GDP, using the World Bank's Atlas method. We obtained four groups of countries. These are low-income countries, middle-income countries, upper-middle income countries and high-income countries. Analyzing the results of our regressions for these groups of countries, we came to retain the nonlinear hypothesis of Greenwood & Jovanovic (1990) that assumes an inverted U-shaped relationship between financial development and income inequality. We rejected the linear hypothesis of Galor & Zeira (1993) because the latter is true only when we use market capitalization as financial development indicator for the upper-middle income countries (see Table 6). The non-linear hypothesis of Greenwood & Jovanovic (1990) is checked in almost the rest of the regressions for all groups of countries. Moreover, we found a U-shaped normal nonlinear relationship between financial development and income inequality. For example, when we use the variable Market_Cap as a stock market development indicator, the relationship between financial development and income inequality is nonlinear and always follows the normal U shape in all country groups except the third group which represents the upper-middle income countries.

The hypothesis of Kuznets (1955) which assumes an inverted U-shaped relationship between economic development and income inequality is rejected for the three groups of countries. These are the low-income, middle-income and upper-middle income countries. This finding is consistent with those of Batuo M. E. & al. (2010), Deng H. & Su J.(2012), Wendel M. & Mansour M. S. (2015). This hypothesis is retained only for high-income countries, especially when we use stock market development indicators (see Table 7). This result is consistent with those of Liang Z. (2006), Clarke G. &.al. (2013). However, we came to the conclusion that the relationship between economic development and income inequality follows a normal U shape in the first three income groups (see Tables 4, 5 and 6). However, two regressions make the exception, namely regression 1 in Table 5, which shows bank credits to private sector as banking development variable and regression 4 in Table 6 which shows Turnover as stock market development variable. This result points to a normal U-shaped relationship between economic development and income inequality, corroborating the work of Wendel M. & Mansour M. S. (2015).

As a summary, we conclude that financial development indicators including bank and stock market indicators plays a positive role in reducing income inequality. We have retained the nonlinear hypothesis of Greenwood & Jovanovic (1990) which assumes an inverted U-shaped relationship between financial development and income inequality. This finding is true whatever the level of income of the selected countries and whatever financial development indicators were used. An exception is the variable market capitalization. The hypothesis of Kuznets (1955) is only retained for the high-income countries group when we use stock

market indicators as financial development variables. The overall results of our control variables are significant, robust and their coefficients are consistent with the theory.

Tableau 4 : The Linear vs the Nonlinear Hypothesis: Results on the Low-Income countries group data taken from SWIID

Gini Index (SWIID)								
	Reg 1	***Reg2***	***Reg 3***	***Reg 4***	***Reg5***	***Reg6***	***Reg7***	***Reg8***
Intercept	11.51*** (9.47)	12.34*** (8.71)	10.96*** (8.26)	16.13*** (7.50)	11.37*** (9.30)	-0.69 (-0.30)	10.47*** (7.78)	14.58*** (7.34)
Credit	0.04* (1.92)	-	-	-	-0.04 (-0.66)	-	-	-
M3/PIB	-	-0.07*** (-2.98)	-	-	-	-0.30*** (-2.86)	-	-
Market_Cap	-	-	0.007 (0.90)	-	-	-	-0.02 (-1.23)	-
Turnover	-	-	-	-0.01 (-1.25)	-	-	-	-0.04** (-2.26)
$Credit^2$	-	-	-	-	0.01 (1.46)	-	-	-
$M3/PIB^2$	-	-	-	-	-	0.03*** (2.69)	-	-
$Market\_Cap^2$	-	-	-	-	-	-	0.008* (1.65)	-
$Turnover^2$	-	-	-	-	-	-	-	0.01* (1.73)
GDP	-0.52*** (-6.17)	-0.48*** (-4.44)	-0.48*** (-6.51)	-0.60*** (-6.49)	-0.52*** (-6.08)	0.08 (0.70)	-0.45*** (-6.10)	-0.48*** (-4.73)
GDP^2	0.009*** (6.00)	0.008*** (3.86)	0.008*** (6.39)	0.01*** (6.21)	0.009*** (5.90)	-0.004 (-1.64)	0.008*** (5.98)	0.008*** (4.37)
INF	0.009 (1.16)	-0.005 (-0.90)	-0.01 (-1.32)	-0.03** (-2.29)	0.008 (1.08)	-0.006 (-1.17)	-0.01 (-1.04)	-0.03** (-2.50)
Openness	0.10*** (2.81)	0.17*** (5.40)	-0.01 (-0.26)	-0.14 (-1.45)	0.11*** (2.93)	0.02 (0.62)	0.01 (0.26)	-0.16* (-1.75)
School_enroll	-0.14*** (-5.14)	-0.06*** (-4.16)	0.03* (1.69)	-0.02 (-0.85)	-0.15*** -5.38	-0.08*** (-2.74)	0.04** (2.15)	-0.01 (-0.39)
Gov_expend	-0.06* (-1.70)	-0.04 (-1.45)	0.02 (0.54)	-0.15** (-2.54)	-0.06* (-1.69)	-0.14*** (-4.64)	0.0004 (0.01)	-0.11** (-1.99)
POP	-0.04 (-1.25)	-0.10*** (-5.37)	-0.03* (-1.84)	-0.16*** (-3.05)	-0.03 (-0.94)	0.38*** (3.96)	-0.03* (-1.65)	-0.16*** (-3.19)
N	200	96	51	38	200	96	51	38
R2 (Within)	0.33	_	_	_	0.34	0.80	_	_
Prob>Chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Method	***RE***	***GLS***	***GLS***	***GLS***	**RE**	**FE**	***GLS***	***GLS***

Note: GLS is General Least Squares, RE is Random Effects, FE is Fixed Effects. ***, **,* denotes significance level at the 1%, 5% and 10% levels respectively. T-statistics values are presented in parentheses.

Tableau 5 : The Linear vs the Nonlinear Hypothesis: Results on the Average-Income countries group data taken from SWIID

Gini Index (SWIID)								
	Reg 1	***Reg2***	***Reg 3***	***Reg 4***	***Reg5***	***Reg6***	***Reg7***	***Reg8***
Intercept	4.02*** (10.61)	7.55*** (11.25)	6.17*** (11.88)	6.33*** (11.03)	5.39*** (5.92)	8.35*** (5.06)	6.94*** (13.20)	4.01*** (6.33)
Credit	0.004 (0.44)	-	-	-	0.01 (0.37)	-	-	-
M3/PIB	-	-0.07* (-1.84)	-	-	-	1.13*** (3.50)	-	-
Market_Cap	-	-	0.01*** (3.01)	-	-	-	-0.003 (-0.55)	-
Turnover	-	-	-	0.005 (0.88)	-	-	-	0.13*** (2.82)
$Credit^2$	-	-	-	-	-0.003 (-0.40)	-	-	-
$M3/PIB^2$	-	-	-	-	-	-0.16*** (-3.60)	-	-
$Market\_Cap^2$	-	-	-	-	-	-	0.008*** (4.02)	-
$Turnover^2$	-	-	-	-	-	-	-	-0.002** (-2.49)
GDP	-0.22 (-1.10)	-0.12*** (-3.22)	-0.06** (-2.23)	-0.09*** (-3.19)	-0.02 (-1.35)	-0.38*** (-3.34)	-0.09*** (-3.43)	-0.05 (-1.45)
GDP^2	0.0005 (1.51)	0.002*** (3.33)	0.001** (2.20)	0.001*** (3.00)	0.0007* (1.90)	0.006*** (3.15)	0.001*** (3.31)	0.001* (1.80)
INF	0.01** (2.52)	0.001 (0.21)	-0.004 (-0.55)	-0.01** (-2.10)	0.012*** (2.95)	0.006 (0.87)	0.001 (0.14)	-0.008* (-1.65)
Openness	0.05*** (3.23)	-0.20*** (-3.54)	-0.05 (-1.63)	-0.02 (-0.81)	0.06*** (3.53)	0.02 (0.55)	-0.07** (-2.48)	-0.006 (-0.32)
School_enroll	-0.006 (-0.32)	0.05** (1.96)	-0.14*** (-8.06)	-0.15*** (-8.10)	0.03 (1.03)	-0.07* (-1.89)	-0.17*** (-8.08)	0.07** (2.26)
Gov_expend	0.03* (1.66)	0.005 (0.14)	0.01 (0.58)	0.01 (0.49)	0.03 (1.49)	-0.11*** (-2.87)	0.005 (0.26)	0.08*** (3.32)
POP	-0.03** (-2.07)	-0.07*** (-1.84)	-0.05*** (-5.26)	-0.03*** (-4.00)	-0.12** (-2.17)	-0.02 (-0.92)	-0.05*** (-5.94)	-0.01 (-0.50)
N	405	144	215	200	405	144	215	200
R2 (Within)	0.08	_	_	_	0.09	0.37	_	0.33
Prob>Chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Method	***RE***	***GLS***	***GLS***	***GLS***	***FE***	***RE***	***GLS***	***RE***

Note: GLS is General Least Squares, RE is Random Effects, FE is Fixed Effects. ***, **,* denotes significance level at the 1%, 5% and 10% levels respectively. T-statistics values are presented in parentheses.

Tableau 6 : The Linear vs the Nonlinear Hypothesis: Results on the Upper-Middle income countries group data taken from SWIID

Gini Index (SWIID)								
	Reg 1	***Reg2***	***Reg 3***	***Reg 4***	***Reg5***	***Reg6***	***Reg7***	***Reg8***
Intercept	6.42*** (9.45)	4.09*** (5.79)	8.31*** (10.79)	8.70*** (10.25)	5.94*** (21.57)	5.43*** (7.25)	5.32*** (10.50)	8.40*** (10.05)
Credit	0.00002 (0.00)	-	-	-	-0.02 (-0.43)	-	-	-
M3/PIB	-	0.02 (0.83)	-	-	-	-0.83*** (-4.04)	-	-
Market_Cap	-	-	0.01*** (4.36)	-	-	-	0.02*** (4.25)	-
Turnover	-	-	-	-0.007* (-1.93)	-	-	-	0.01** (2.12)
$Credit^2$	-	-	-	-	0.01* (1.95)	-	-	-
$M3/PIB^2$	-	-	-	-	-	0.11*** (4.21)	-	-
$Market\_Cap^2$	-	-	-	-	-	-	-0.0002 (-0.21)	-
$Turnover^2$	-	-	-	-	-	-	-	-0.004*** (-3.62)
GDP	-0.03*** (-3.53)	-0.03** (-2.14)	-0.06** (-2.46)	-0.006 (-0.19)	-0.07*** (-4.81)	-0.04** (-2.39)	-0.06** (-2.50)	-0.03 (-0.89)
$G0DP^2$	0.0007*** (3.33)	0.0009* (2.00)	0.001*** (2.86)	0.0006 (1.10)	0.001*** (5.32)	0.001** (2.14)	0.001*** (2.74)	0.0009 (1.62)
INF	-0.002 (-0.73)	0.004 (0.72)	-0.0004 (-0.12)	-0.003 (-0.77)	-0.01*** (-3.03)	0.001 (0.20)	-0.0003 (-0.08)	-0.003 (-0.81)
Openness	0.06*** (3.10)	-0.061* (-1.66)	0.007 (0.32)	0.02 (0.91)	-0.10*** (8.09)	-0.01 (-0.52)	-0.005 (-0.21)	0.02 (1.02)
School_enroll	0.04 (-3.99)	-0.01 (-0.34)	-0.02 (-0.81)	-0.05* (-1.72)	-0.15*** (-7.46)	-0.03 (-0.90)	-0.09*** (-3.64)	-0.04 (-1.38)
Gov_expend	0.04 (1.64)	0.04 (-0.63)	-0.02 (-1.07)	-0.03 (-1.37)	0.02 (1.20)	0.06 (1.08)	-0.01 (-0.47)	0.05* (-1.89)
POP	-0.18*** (-3.99)	-0.002 (-0.08)	-0.22*** (-5.00)	-0.30*** (-6.00)	-0.02*** (-5.53)	0.008 (0.26)	-0.02 (-1.09)	-0.26*** (-5.14)
N	529	174	369	343	529	174	369	343
R2 (Within)	0.09	0.08	0.17	0.17	_	0.17	0.12	0.2
Prob>Chi2	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00
Method	***FE***	***RE***	***FE***	***FE***	***GLS***	***RE***	***RE***	***FE***

Note: GLS is General Least Squares, RE is Random Effects, FE is Fixed Effects. ***, **,* denotes significance level at the 1%, 5% and 10% levels respectively. T-statistics values are presented in parentheses.

Tableau 7 : The Linear vs the Nonlinear Hypothesis: Results on the High Income countries group data taken from SWIID

Gini Index (SWIID)								
	Reg 1	***Reg2***	***Reg 3***	***Reg 4***	***Reg5***	***Reg6***	***Reg7***	***Reg8***
Intercept	3.34*** (25.31)	5.06*** (15.65)	3.60*** (12.64)	3.96*** (11.83)	4.88*** (25.23)	4.27*** (10.85)	3.66*** (12.54)	3.83*** (11.12)
Credit	-0.01*** (-2.79)	-	-	-	-0.29*** (-6.29)	-	-	-
M3/PIB	-	-0.19*** (-13.91)	-	-	-	0.52*** (3.70)	-	-
Market_Cap	-	-	0.003 (0.84)	-	-	-	-0.01* (-1.77)	-
Turnover	-	-	-	0.001 (0.35)	-	-	-	0.001 (0.19)
$Credit^2$	-	-	-	-	0.03*** (5.95)	-	-	-
$M3/PIB^2$	-	-	-	-	-	-0.08*** (-5.20)	-	-
$Market\_Cap^2$	-	-	-	-	-	-	0.003*** (2.60)	-
$Turnover^2$	-	-	-	-	-	-	-	-0.0001 (-0.13)
GDP	0.009 (073)	0.03 (1.47)	0.08*** (4.00)	0.08*** (3.00)	0.007 (0.58)	0.05** (2.39)	0.09*** (4.38)	0.08*** (3.13)
GDP^2	-0.0003 (-1.52)	-0.0009** (-2.10)	-0.001*** (-4.39)	-0.006*** (-3.35)	-0.0003 (-1.38)	-0.001** (-0.001)	-0.001*** (-4.79)	-0.001*** (-3.46)
INF	0.004 (1.25)	-0.03*** (-5.00)	0.002 (0.66)	-0.0004 (-0.10)	0.002 (0.71)	-0.04*** (-5.97)	-0.0001 (-0.04)	-0.001 (-0.28)
Openness	-0.05*** (-6.12)	0.005 (0.29)	-0.08*** (-9.28)	-0.09*** (-10.09)	-0.06*** (-6.74)	-0.03* (-1.72)	-0.09*** (-9.77)	-0.09*** (-9.61)
School_enroll	-0.007 (-0.26)	-0.17*** (-3.01)	-0.04 (-1.37)	-0.05 (-1.45)	-0.004 (-0.16)	-0.23*** (-4.31)	-0.06** (-2.13)	-0.03 (-1.11)
Gov_expend	-0.34*** (-20.95)	-0.34*** (-14.06)	-0.39*** (-19.61)	-0.40*** (-18.73)	-0.31*** (-19.07)	-0.41*** (-15.79)	-0.39*** (-19.23)	-0.40*** (-18.37)
POP	0.02*** (7.70)	0.03*** (4.77)	0.02*** (7.54)	0.01*** (4.46)	0.02*** (7.16)	0.01 (1.56)	0.02*** (6.82)	0.01*** (4.00)
N	1005	324	795	754	1005	324	795	754
R2 (Within)	_	_	_	_	_	_	_	_
Prob>Chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Method	**GLS**	**GLS**	**GLS**	**GLS**	**GLS**	**GLS**	**GLS**	**GLS**

Note: GLS is General Least Squares. ***, **,* denotes significance level at the 1%, 5% and 10% levels respectively. T-statistics values are presented in parentheses.

4.4. Sensitivity Analysis:

One of the contributions of this study is conducting a sensitivity analysis between the results on the relationship of financial development and income inequality, using data taken from the SWIID and the EHII databases. To our knowledge, few studies have addressed the linearity of the relationship between financial development and income inequality and have tested the results of data taken from the two SWIID and EHII bases (See Kai & Hamori,

2009; Asongu, 2013; Asongu & Tchamyou, 2015). When we use the EHII database as a source for the Gini index, we reached different conclusions than using the SWIID base as a source.

The regression results indicate that the coefficient of the squared Market_cap variable is not significant while the coefficient of the Market_cap variable is significant and positive. Accordingly, we can conclude that the relationship between financial development and stock market indicators is linear and increasing, which is different from our interpretations when we use the SWIID database. This result differs from those of Jauch S. & Watzka S. (2015) who used the generalized method of moments (GMM). The hypothesis of Kuznets (1955) which suggests an inverted U-shaped relationship between economic development and income inequality is not retained in all our regressions. GDP^2 coefficient is not significant in all regressions. This result is different from those when we use SWIID as a source.

As for the results by groups of countries, the linear hypothesis of Galor & Zeira (1993) and Banerjee & Newman (1993) is retained for low-income countries, especially when we use the variable bank credits to private sectors as banking development indicator. This hypothesis is not retained when we use stock market indicators. Furthermore, we found that the linear hypothesis is retained for the group of middle-income countries when we use the variable Market_cap as a financial development indicator and retained for the group of high-income countries when we use the variable Turnover as a financial development indicator. However, as for the non-linear hypothesis of Greenwood & Jovanovic (1990), it is only retained for the group of high-income countries, especially when we use the Market_cap variable. This hypothesis is also retained for the group of upper-middle income countries and for the group of high-income countries when we use banking indicators. The hypothesis of Kuznets (1955) is only checked when we introduce banking variables such as financial development indicators.

In summary, when we use EHII database as a source to the Gini index we obtained mixed results. Our competing hypotheses are sensitive to the retained financial development variable, to the selected group of countries, to the estimation technique adopted and to the source of the Gini index.

5. Conclusion and policy implications:

The aim of this study is to test the impact of financial development on income inequality by considering banking development indicators and stock market development indicators. Note that our sample consists of 138 countries examined over a period that runs from 1980 to 2012. We have also classified these countries in terms of GDP by using the World Bank's Atlas method. Thanks to this classification, we obtained 4 groups of countries; these are low-income countries, middle-income countries, upper- middle income countries and high-income countries. Galor & Zeira (1993) and Banerjee & Newman (1993) predicted a negative linear relationship between financial development and income inequality while Greenwood & Jovanovic (1990) suggested an inverted U-shaped nonlinear relationship. Furthermore, we tested the hypothesis of Kuznets (1955) which assumed an inverted U-shaped relationship between economic growth and income inequality.

Our results indicate that financial development reduces the gap between the rich and the poor. Validating the competing hypotheses of Galor & Zeira (1993) and Banerjee & Newman (1993) and Greenwood & Jovanovic (1990) is sensitive to financial development variables, the group of countries, the estimation technique and the source of the Gini index.

Moreover, the results allow us to retain the nonlinear hypothesis of Greenwood & Jovanovic (1990) which assumes an inverted U-shaped relationship between financial development and income inequality. This result is consistent with those of Jauch S. & Watzka S. (2015) who used the generalized method of moments (GMM). To our knowledge, our

study is the only study on the relationship between financial development and income inequality that used the SWIID as a source to the Gini index. In addition, our study is the only study that conducted robustness tests on the used different databases. As for the tests on the hypothesis of Kuznets (1955), our results reject an inverted U-shaped relationship between economic development and income inequality but rather point to a normal U-shaped relationship like the one found by Wendel M. & Mansour M. S. (2015). This hypothesis is retained only for high-income countries, especially when we use stock indicators. The overall results on the control variables of our international sample are generally significant and strong. The obtained coefficients are consistent with the theory.

Gap reducing between social classes Economic Policy leaves authorities with the premise of setting up an effective redistribution policy through a tax system, requiring the rich to assume their share of tax burdens, social transfers and pro-poor government interventions. It is also important to implement policies which promote education and improve skills specially for the low skilled in particular. Accordingly, it is necessary to promote education of disadvantaged areas especially rural areas, and provide infrastructure and favorable teaching conditions. Moreover, promoting the poor's access to financial services, through microfinance institutions, will allow to the class of people to increase their productive assets and increase their income.

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Appendix 1 : Sample by GDP

Sample	*Countries*
Low income	Benin, Burkina Faso, Burundi, Costa Rica, Ethiopia, Gambia, Madagascar, Guinea-Bissau, Haiti, Mozambique, Malawi, Mali, Uganda, Nepal, Niger, Rwanda, Central African Republic, Zimbabwe, Sierra Leone, Tanzania.
Middle income	Armenia, Bangladesh, Bhutan, El Salvador, Cabo Verde, Cameroon, Honduras, Isee Coast, Egypt, Kenya, Georgia, Ghana, Mauritania, India, Indonesia, Nigeria, Lesotho, Morocco, Papua New Guinea, Moldova, Nicaragua , Vietnam, Senegal, Pakistan, Guatemela, Zambia, Tajikistan, Uzbekistan, Swaziland, Sri Lanka, Djibouti, Syria, Ukraine, Seychelles.
Upper-middle income	South Africa, Albania, Algeria, Angola, Belarus, Belize, Azerbaijan, Bulgaria, Botswana, Brazil, Dominica, China, Colombia, Kazakhstan, Ecuador, Fiji, Maldives, Guyana, Iran, Islamic Republic of, Mongolia, Jamaica, Jordonie , Panama, Macedonia, the former Yugoslav Republic, Malaysia, Tunisia, Mauritius, Mexico, Lebanon, Paraguay, Namibia, Libya, Romania, Peru, Thailand, Republic of Yemen.
High income	Austria, Argentina, Australia, Canada, the Bahamas, Belgium Ask, Denmark, Chile, Croatia, state States, Spain, Estonia, France, Russia, Finland, Hungary, Greece, Equatorial Guinea, Iceland, Hong Kong, Ireland, Japan , Israel, Italy, Luxembourg, Malta, Lithuania, New Zealand, Netherlands, Norway, Puerto Rico, Portugal, Poland, United Kingdom, Slovenia, Sweden, Singapore, Trinidad and Tobago, Turkey, Switzerland, Cyprus, Republic of Korea, Uruguay, Slovakia, Venezuela.

Source : World Bank 2015

Appendix 2 : Variables and their sources

Variable	*Definition*	*Expected sign*	*Source*
The Gini index	The Gini coefficient		SWIID Data created by Solt F. (2014) EHII Dateset (2008)
Credit	Bank loans to the private sector as a GDP percentage	**+/-**	World Development Indicators, World Bank (2015)
M3/PIB	Liquid liabilities (M3) as a percentage of GDP	**+/-**	World Development Indicators, World Bank (2015)
Market_Cap	Market capitalization of listed companies (% of GDP)	**+/-**	World Development Indicators, World Bank (2015)
Turnover	Turnover ratio as a percentage of GDP.	**+/-**	World Development Indicators, World Bank (2015)
GDP	GDP (current LCU)	**+/-**	World Development Indicators, World Bank (2015)
POP	Total Population	**+**	World Development Indicators, World Bank (2015)
School_enroll	enrollment in high school (% gross)	**-**	World Development Indicators, World Bank (2015)
INF	Inflation, GDP deflator (% annual)	**+**	World Development Indicators, World Bank (2015)
Openness	Total exports and imports by GDP	**+/-**	World Development Indicators, World Bank (2015)
Gov_expend	Government's final consumption expenditure (% of GDP)	**+/-**	World Development Indicators, World Bank (2015)

Note: All variables are in logarithms