Frontend Innovation And Top Income Inequality: Evidence From Emerging Markets

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Abstract

This paper contributes to the literature on income inequality, by extending existing models to examine the effect of front-end innovation (FEI) on top income inequality. We use a fixed effect panel regression, on annual country level data for twenty four emerging markets, over a twenty four (1995–2018) year period, and find an insignificant correlation between income inequality, and FEI. The instrumental variable estimates however, shows a significant association between measures of FEI and top income shares. Further, we confirm that FEI is weakly related with broad measures of income inequality. Our instrumentation strategy, and robustness checks, suggests that this correlation partly reflects a causality, from FEI to top income inequality. Finally, we show that FEI is necessary for the survival of new ventures, in the crucial early years. Overall, our findings confirm that FEI, is a significant determinant of increases, in entrepreneurial income share.

1. Introduction

It is widely acknowledged that top incomes and wealth shares has been rising in both developed and developing nations in recent decades (Alvaredo, Piketty, Saez, Zucman& Chancel,2017). In emerging markets, factors that drive economic growth have themselves increased income inequality (Zhuang, Kanbur&Rhee,2014; Gasparini, Cruces&Tornarolli,2016). Technological improvements, market oriented reforms, and globalization are the key forces that have accelerated growth, and have simultaneously raised inequality between skilled, and unskilled workers, and also between owners of capital and labor.

In this paper we argue that Front-end innovation (FEI) is one of such factors that impact income inequality in developing countries. For example, the International Finance Corporation (IFC) estimates that in aggregate across developing regions, the credit gap to formal Small and Medium Enterprises (SMEs) was upto one trillion dollars in 2011. Further, only seventeen percent of small firms in Sub Sahara Africa, twenty one percent in the Middle-East, and North Africa, twenty two percent of small firms in South Asia, twenty seven percent of small firms in East Asia, and the Pacific, and only thirty eight percent in Latin America, and the Caribbean have access to formal credit (Abraham&Schmukler,2017).

Although, Financial Market Imperfection (FMI), has long been acknowledged as the reason why small firms cannot access finance in emerging markets (Beck, Demirguc-kunt&Maksimovic, 2005), demand side factors like firm level innovation can control the impact of FMI on small firms access to finance (Berger&Udell, 1995 and 2002; Hellman, Lindsey&Puri, 2008; Peng, 2017). The success of innovation and thus, access to credit for new, and small firms in developing countries depends upon FEI. Because of the central role small firms play in economic development, the relationship between FEI, and small firm access to credit has consequences for income inequality (Bannerjee &Newman, 1993; Santarelli&Tran,2011;Koen, Bertels&Kleinschmidt,2014). This incidence suggests that the few entrepreneurs, who have access to credit in emerging markets, have been able to acquire higher incomes overtime, in relation to FEI.

Front-end Innovation, (FEI) is the process of taking an idea, through a venture development path, which transforms that idea, into a viable project, which would then enable the firm to access credit for expansion. It

is at the core of radical technological change and therefore central to longrun economic growth (Pereira, Ferreira &Lopes, 2017; Gama&Parida, 2017; Jovanovic, 1982; Kazanjian, 1988;Romer,1990).

FEI is distinct from innovation because the front-end is the most important part of the innovation process: decision made during FEI, will determine the innovation options to be considered for commercialization (Pereira,Ferreira&Lopes,2017)

Another difference between FEI[1] and innovation, is that FEI is critical for new firms who are yet to scale and attain commercial viability. It is not essential for large firms as they have already (via FEI) achieved economies of scale during start-up, and established procedures for successive waves of innovation, and new product launches. Additionally, FEI ends with the commercialization of the product which entails scaling, access to credit and developing systems for both. Moreover, FEI is more serious for developing countries, where knowledge about the mechanics of scaling is not widespread, and therefore it impacts upon access to credit, firm survival and income distribution. Hence, successful innovation begins and depends on FEI – this is the link and the distinction between FEI and Innovation.

Despite this connection FEI is relatively little studied in empirical literature, and although the impact of innovation on inequality has been studied extensively. The exact impact of FEI on income inequality is not properly defined in empirical literature. Rather, due to contextual reasons, its effect may be joined together with that of innovation. We seek to precisely investigate whether FEI has an impact on inequality, drawing from the circumstances in emerging markets, where the lack of FEI is increasingly identified as a major driver of small firms' inability to reach commercial viability (Leighland and Roberts, 2007). This is the gap in the literature, and it forms the basis for our hypothesis and therefore, our addition to theory.

We expect the empirical results from this paper, to be consistent with findings by Wlodarczyk (2017) and Antonelli and Gehringer (2017), that innovation can decrease or increase income inequality depending on the measure used. However, we distinguish our paper from theirs by studying the impact of FEI on inequality.

In this paper, we conclude that the rise in top income inequality, is significantly linked to FEI.

The findings in this paper relates to several strands of literature. Firstly, FEI plays a central role in ascertaining the commercial viability of new firms in frontier markets, and thus, access to credit. Access to credit means that small firms can expand and create jobs, FEI therefore has consequences for inequality. Because of this link we extend existing models of inequality by analyzing the impact of FEI on income inequality. Second, we also introduce the following measures of value added for FEI: services, industry and manufacturing. Further, we introduce households and NPISHs final consumption expenditure (% of GDP) and, the statistical capacity score (overall average) as relevant instrumental variables, for FEI in the emerging markets context. Third, our work enriches the literature on small firm finance in developing countries (Beck et al., 2005; Ayyagari et al., 2011; Beck et al., 2007; Kapidani and Luci, 2019) by indicating that FEI is required for small firms to access finance. Fourth, we contribute to the endogenous growth literature (Romer, 1990; Aghion et al., 2015) by revealing that FEI is necessary for technological progress and thus, sustained economic growth and income inequality. Fifth, we contribute to the literature on innovation and entrepreneur/firm income (Akcigit et al., 2017; Gabaix &Landier, 2008, Aghion et al., 2019) by establishing that FEI has a positive influence on

firm/entrepreneurial incomes. Further, firms/inventors that are able to successfully engage in FEI and thus, access credit will reach the top income bracket. Our findings also relates to the literature on skill biased technical change (Permana, Lantu &Suharto, 2018;Caselli, 1999) where highly educated people, who are better skilled to use new technology will receive higher income. We add to this literature by confirming that access to premium education, enables entrepreneurs to acquire the skills needed to engage in FEI and thus, end up in the top income bracket. Finally, our paper confirms that (early stage) small firm survival, (Jones and Kim, 2017;Pereira, Ferreira&Lopes, 2017; Jovanovic, 1982) which is a key factor in development depends upon FEI.

The structure of this paper is as follows. Section two covers the literature review while, section three outlines the methodology, and data used in this study. Section four discusses empirical results and section five provides conclusion.

[1] FEI is experimental and not linear, it is fraught with risks and uncertainty, information asymmetry is a critical component of this phase. Moreover, the firms organizational and managerial competencies are evolving during FEI, and the firm usually can not access finance. Because of its experimental nature, the risks and uncertainty associated with an invention/product, is cleared during FEI, prior to entering the innovation phase. The innovation phase is a continuation of FEI, but with less risk and uncertainty, with access to credit, fully evolved organizational competencies, and information, but on a much larger scale (Pereira, Ferreira&Lopes, 2017; Koen, Bertels & Kleinschmidt, 2014; Jovanovic,1982; Kazanjian,1988).

2. Literature Review

2.1 THEORETICAL FRAMEWORK

There are several studies that provide evidence of the impact of innovation on income inequality. Jones and Kim (2018) develop a theory, where inequality depends upon creative destruction. In the model, researchers create new ideas, and as these new ideas are successfully commercialized through entrepreneurial effort, it results in higher incomes for these entrepreneurs, thus raising inequality. When new methods make previous inventions obsolete, these new ideas restrain entrepreneurial income, and reduces inequality as incumbents are driven out by new entrants.

Likewise, Chu and Cozzi (2018) use a Schumpeterian growth model, to demonstrate the macroeconomic impact of strengthening patent protection, and raising R&D subsidy on income inequality. Strengthening patent protection, raises inequality via higher rates due to economic growth which next raises the asset income of wealthy households only. In contrast, raising R&D subsidy suppress income inequality through a process of creative destruction by reducing asset values, and causing a decrease in asset income. Similarly, Foellmi and Zweimuller (2016) find that inequality affects the incentive to innovate via a market size, and price effect. When innovators have a large productivity advantage over traditional producers, a higher level of inequality tends to raise innovators prices and markups.

Pollak (2014) presents a model whose central idea is that incumbent establishments, protect their competitive position, by innovating at a rate that is high enough to prohibit the entry of new businesses. Subsequently, R&D investment now depends upon the ease of entry in individual markets rather than expected future profits. This development can stall the process of creative destruction and exacerbate income inequality. Similarly, Aghion *et al.,* (2019) use cross state panel data, to demonstrate a significant positive association between innovativeness, and top income inequality in the US. They find that causality runs from innovativeness to top income inequality. Further, when measured by patent per capita innovativeness, on average is responsible for seventeen percent of the total increases in the top one percent income share.

In the same vein, Zweimuller (2000) highlighted the impact of inequality on innovation driven growth. A redistribution from consumers who can afford the goods produced by the most recent innovator, to those who cannot afford it leads to an increase in the economic growth rate. Aghion *et al.* (2015) present a Schumpeterian growth model, which predicts that entrants, and incumbents' innovation raises top income inequality. Entrants innovation increases social mobility. Entry barriers reduces the positive effect of entrants' innovation on top income inequality. Also, Galor and Zeira (1993) developed a model where wealth distribution, plays an important role in economic growth overtime. Further, wealth distribution is a significant influencer of macroeconomic adjustment to aggregate supply, and demand shocks as well as technological innovation.

Gabaix and Landier (2008) propose a simple, competitive and flexible model that attributes the rise in Chief Executive Officer (CEO) pay, to substantial growth in equilibrium firm size. Executives have different levels of managerial talent that are matched to firms competitively. The marginal impact of a CEO talent is assumed to rise with the value of the firm he manages. The dispersion of executive talent distribution appeared to be extremely small at the top. It is this dispersion that yields large disparities in compensation amongst CEOs, as they are magnified by establishment size.

Lloyd-Ellis (1999) present a model where wage inequality rises when the rate of new technology introduction is not equal to the rate of absorption due to the aggressive competition for scarce labour and other resources. This situation causes the wage of highly skilled labor to drive up the cost of innovation therefore, precipitating a decline. Likewise, Rehme (2007) asserts that increases in the number of highly skilled people financed by a rise in taxation, first increases inequality because of additional productivity before reducing inequality in wages and personal factor income. Additionally, internal or process innovation scales moderately faster with firm size than new product innovation. Small firms have comparative advantage in new product development over older firms as older firms already have established product lines to work on. Therefore, new entrepreneurial firms contribute disproportionately to radical innovation (Akcigit&Kerr, 2018).

Caselli (1999) present a model where skill based technological revolutions means that learning investments required by new machines are greater than those needed by existing ones. Hence skill based revolutions trigger the reallocation of capital from slow to fast learning workers, thereby depressing the absolute wages of slow learning workers.

2.2 EMPIRICAL REVIEW

Several empirical papers support the link between innovation and income inequality. Pavcnik and Goldberg (2007) avow that globalization rises contemporaneously with inequality in most developing nations. The reasons why globalization increases inequality is due to trade induced skill based technical change where investment will raise the demand for skilled workers. Also, the outsourcing of intermediate goods production raises the demand for skilled labour. Equally, Herzer and Vollmer (2012) investigated the long run effect of income inequality on per capita income for forty six countries and find that inequality has a long run negative impact on per capita income in both rich and poor countries.

Jaumotte, Lall and Papageorgiou (2013) studied the causes of rising inequality in a panel of fifty one advanced and emerging markets and conclude that technological change significantly impacts inequality. This result is because innovation favors high skilled workers and therefore aggravates inequality especially in developing countries where a significant skills gap exists due to poor access to quality education. Similarly, most aggregate productivity growth among US non farm private businesses comes from incumbents rather than entrants. Moreover, quality improvements and not new products drive most of the growth (Garcia-Marcia, Hseih&Klenow,2019). Risso and Sanchez-Carrera(2019) used a panel data set of seventy four countries over a period of eighteen years to establish a link between inequality and innovation. Long run economic growth reduces income inequality and economic growth depends upon technical change. Further, Acemoglu&Robinson(2012) assert that innovation (R&D activity) will not reach a level that can impact economic growth without the development of economic and political institutions.

Wlodarczyk (2017) discovered that a higher gross domestic expenditure on R&D as a percentage of GDP increases inequality in Europe. While a high number of patent applications suppresses it. Using panel data from twenty nine European countries, Benos and Tsiachtsiras (2019) discovered that innovation reduces personal income inequality. Permana, Lantu and Suharto (2018) used a panel of twenty eight European countries to establish a positive link between innovation, patenting activity and inequality, including the top ten percent share of the richest. They also find a positive link between technological specialization and income inequality. Equally, Akcigit, Grigsby and Nicolas (2017) affirm that innovative places are more socially mobile and successful patentees have a higher labour income. Liu and Lawell(2015) used panel data over a five year period to examine income inequality in China. They reveal that small doses of innovation can diminish inequality while, large doses can expand it. Li, Squire and Zou (1998) analyse data from forty-nine developed and developing countries and find that initial secondary schooling, and capital market imperfection are significant drivers of inequality. By making the poor unable to access credit markets and, invest in education it perpetuates a low and inequitable growth process

In Italy, an average inventors earnings is strongly linked to patent activity. An inventors wage starts rising a few years before patent applications are made to the patenting office, it peaks in the year preceding filing and decreases again (Depalo&Addario,2014). Likewise, Bell, Chetty, Jaravel, Petkova and Van Reenen (2019) prove that the top ten percent of inventors obtain more than twenty two percent of total inventors income. This results imply that even among innovators, income inequality exists as in the general population.

2.2.1 INEQUALITY AND INNOVATION

Hatipoglu (2012) affirm that a decline in inequality, may produce a rise in the number of customers who can buy new products. This change in inequality, can impact an inventor's expected profits and their decisions about R&D expenditure. Conversely, due to a price and market size effect Tselios (2011) avow that, an increase in inequality encourages innovation in the EU.

Although these papers confirm the potential endogeneity problem between innovation, and inequality the dynamic is different in emerging markets. What we know is that a decrease in inequality, is unlikely to influence FEI in emerging markets. The lack of association is because higher economic growth rates, reflects a higher demand for goods and services, which creates the opportunity for innovative driven entrepreneurs (IDEs), to start a business. Subsequently, necessity driven entrepreneurs (NDEs) who form most small firms in emerging markets, are not impacted as these individuals are influenced by poverty, and unemployment rather than demand (Van Stel, Caree&Thurik, 2005).

2.3 HYPOTHESIS

The theoretical, and empirical studies stated above highlights the fact that innovation significantly impacts income inequality. However, even though successful innovation largely depends on FEI (Gama,Parida&Frishammer,2019), the link between FEI, and income inequality in emerging markets is yet to be studied. The foregoing leads us to hypothesize that:

- There is a significant relationship between top income inequality and FEI.
- FEI reduces top income inequality.
- The activity of entrepreneurs who engage in FEI significantly increases top income shares.
- FEI is not significantly correlated with broader measures of income inequality

3. Data And Methdodology

3.1 DATA

Our measures of income inequality[1], Gini Index,pre tax income shares of the top ten and one percent was drawn from the standardized world income inequality database (Frederick Solt,2019), the world inequality database and the world bank database.

Our novel measures of FEI comes from the world bank database. We chose the following measures of value added for FEI: services, industry and manufacturing. The value added component of these sectors were selected because rising creation and diffusion of knowledge is a basis for boosting domestic value added. Local creation and diffusion of knowledge is a key innovation system variable, therefore building local knowledge or innovation is critical for value addition and eventual integration into the global value chain (Egbetokun, Siyanbola&Oyewole, 2011;Lee, Szapiro&Mao, 2018; Minetti, Murro, Rotondi&Zhu, 2019; Reddy, Chundakkadan&Sasidharan,2020). Likewise, FEI enables an entrepreneur to add value to their invention. After value addition the entrepreneur will be able to reach economies of scale and access finance[2]. In the emerging markets context entrepreneurs who engage in FEI will be able to access credit via

commercialization after value addition. (Pereira, Ferreira&Lopes,2017; Cosci,Meliciani&Sabato,2016;Depalo&Addario,2014; Toivanen&Vaananen,2012; Hsu&Ziedonis,2008).

We have selected adjusted savings: education expenditure (% GNI)[3] as a robustness check and an alternative measure for FEI. There are studies that confirm that educated entrepreneurs run innovative ventures (Goedhuys&Sleuwaegen, 2010;Marvel&Lumpkin,2007). However, we consider education a crude measure for FEI because, unequal access to quality education has increased inequality in developing countries, where only the rich continue to access premium education. Thus, instead of education serving as the primary engine for upward mobility it increases inequality instead (IMF,2016).

For this reason we use the value added components of the economy to measure FEI.

- Manufacturing value added, (% of GDP)
- Services value added, (% of GDP)
- Industry (including construction) value added, (% of GDP)
- Adjusted savings:education expenditure (% of GNI) - Alternative measure for FEI

In our sample we see that Brazil, Indonesia and Iran had the highest SVA, MVA and IVA (in 2017, 2002 and 2005) respectively. Indonesia, Nigeria and Kenya had the lowest SVA, MVA and IVA (in 2000, 2010 and 1998). Thailand extended the highest credit (166.5% in 1997) to the private sector by banks while, Ukraine (1.38% in 1996) extended the lowest credit. Malaysia had the lowest inflation rate (-5.99% in 2009) while, Ukraine had the highest (415% in 1995). Hungary had the highest per capita GDP ($16, 151 in 2018) while, Kenya had the lowest ($326 in 1995). Iran had the lowest globalization index (31.59 in 1995&1996) while, Hungary had the highest (81.15 in 2014). Hungary has the highest (54.54% in 2016) and lowest FDI (-41.06% in 2014). Indonesia had the lowest (0.60% from 1995 to 1998) expenditure on education while Morocco had the highest (6.9% in 2005). South Africa and Chile have the highest levels of inequality (top10% and 1%), while Hungary had the lowest income inequality.

The descriptive statistics for all the variables used in this study are presented in Table 2. From our sample, GDP Per capita has increased during our study period, while the top income shares (top1% and 10%) has not changed significantly. In Table 3 we see that mean income inequality (top1% and 10%) on average rose slightly between 1995 and 2015.

Data from select countries[4] (Figures one to four in section six) show the general trend in our four variables of interest (MVA, SVA, IVA and Top1%). In the countries where our data was generated, the top one percent income share rises and falls with the value added[5].

3.2 CONTROL VARIABLES

We extract the remaining control variables from the 2019 KOF Index of globalization, the Center for Systemic Peace, Major Episodes of Political Violence (1946-2018) and the World Bank database. We have used GDP Per Capita (Current US$) because Kuznets (1955) seminal paper argued that as countries develop income disparity first increases, peaks and then decreases with time. Next we include domestic credit to private sector by banks[6] (percent of GDP), because bank finance is the most dominant source of external funds for

Small and Medium Enterprises (SMEs) in developing countries (Beck, Demirguc-Kunt&Maksimovic, 2008). Thus, the banking sector significantly impacts firm level innovation, and helps inventors increase their incomes. The next variable is general government final consumption expenditure (percent of GDP), in order to control for the effect of government size in each country. Empirical studies find that government size is associated with an increase in inequality, in emerging markets (Odedokun&Round, 2004; Anyanwu, 2011). Next we include civil war in our analysis because, emerging markets are normally characterized by civil conflict due to rapid economic growth, poverty and emerging institutions. Moreover, due to disruptions in product and factor markets, increased transaction costs, reduction in social spending, and the general disruption in economic activity, civil conflicts can adversely impact income inequality (Bircan, Bruck &Vothknecht, 2017).

Next we include the globalization index, because the countries in our paper had pursued economic liberalization policies during the study period. The globalization index measures globalization along the economic, social and political dimension as well as Foreign Direct Investment, FDI as a percentage of GDP. Empirical results regarding FDI and inequality is mixed. The IMF (2007) finds that financial globalization especially FDI, is associated with higher inequality in developing countries.While, Jaumotte *et. al*., (2013) find that trade globalization reduces income inequality, and Claus, Martinez-Vaquez and Vulovic (2012) also find that globalization has a positive impact on inequality. We include Inflation because of its relationship with inequality as discussed by Albanesi (2007) and Siami-Namini and Hudson (2019).We end up with a balanced panel of twenty four countries over a twenty four year period (1995-2018).

3.3 THE SAMPLE

The sample consists of twenty four emerging markets (Brazil, Chile, Colombia, Egypt, India, Indonesia, Iran, Kenya, Mexico, Morocco, Malaysia, Nigeria,Romania, Russia, Pakistan, Peru, Philippines, Poland, South Africa, Ukraine, Thailand, Tunisia, Turkey and Hungary) only. Our reasons for focusing solely on emerging markets are twofold. Firstly, FEI is required for small firms to access credit in emerging markets, and these countries have a nuanced basis for FEI and inventions when compared to developed countries. This nuance is due to contextual factors, such as political and economic institutions. Secondly, by focusing on emerging markets which have similar characteristics it is possible to reduce sample heterogeneity. The study period runs from 1995 – 2018[7]. The analysis period provides significant insight about the relationship between inequality and FEI.

However, in contrast to developed countries time-series data on FEI, and income inequality is limited. The data constraint is because traditional measures of innovation such as R&D expenditure and patents are less likely to be observable in small firms (Acemoglu, Aghion&Zilibotti, 2006) and emerging markets (Gorodnichenko&Schnitzer, 2013;Kraemer-Mbula *et al*., 2019). Moreover, governments across middle Africa do not prioritize the collection of innovation data. There are also reservations in the literature regarding the suitability of R&D, as an innovation proxy in emerging markets. Not all innovation is caused by R&D spending, and formal innovation measures are valid for large firms only. Possible alternative quality measures for FEI such as firms using banks to finance investment (% of firms), total SME loans (% GDP), government expenditure on education, total (% of GDP) were not available for at least a quarter[8] of the countries in our sample. Also, traditional measures for innovation such as patent applications, and R&D

spending were mostly nonexistent for countries in middle Africa. Therefore, analysis was confined to countries for which income inequality, and FEI data was available.

3.4 EMPIRICAL STRATEGY/METHODOLOGY

3.4.1 ESTIMATION METHODOLOGY

Our estimation method is comparable to that of Aghion *et. al.* (2019). The resulting model is based on a fixed effect panel regression with standard errors, clustered at the country level. We clustered errors at the country level to allow for the possibility of correlation between the observations within a given country. Clustering is also required to account for situations where observation within each country, are not independently and identically distributed. We take the logs of all measures of FEI and Inequality, GDP Per Capita and bank credit to private sector, and estimate the following equation:

$$\text{Ln}\,(Y_{it}) = \eta + \theta_i + \lambda_t + \alpha_i \ln(FEI_{i(t-3)}) + \beta_2 X_{it} + \varepsilon_{it}$$

Where $_i$ stands for country i, t stands for time period $_t$, Y_{it} is the measure of inequality (in log), η is the constant term, θ_i, λ_t correspond to country and year fixed effects. FEI_{it-3} is the measure of innovativeness at the front-end (in log and lagged) and X are the control variables. The advantage of taking the logs of FEI, and inequality is that α_i can be interpreted as the elasticity of inequality, with respect to innovation. Our measures of FEI were lagged by three years. All equations were estimated using auto-correlation and heteroskedasticity robust standard errors. By including country and time fixed effects, we are eliminating permanent cross-country differences in inequality, and overall changes in inequality.

3.4.2 THE TIME LAG BETWEEN FEI AND TOP INCOME INEQUALITY

The reason for lagging[9] FEI by three years, is because over fifty percent of new firms in developing countries collapse in the first three years (Liedholm, 2002;Beck&Cull,2014, Bowale&Akinlo,2012;Mead&Liedholm,1998). Because the new firm casualty rate peaks in the third year, the few who survive the first three years and beyond are engaging in FEI, and will access institutional finance, which is equivalent to a patent grant in advanced economies. Similarly, in the US the time lag between a patent application, and a patent grant is two and half years on average. Empirical studies also show a significant relationship between patents, and access to venture capital finance especially for new firms (Audretsch,Bonte&Mahagaonkar, 2012; Hsu&Ziedonis,2008; Conti, Thursby&Thursby, 2013). The process is the same in emerging markets[10], where new firm creation is equivalent to a patent application, and access to finance is equivalent to a patent grant. However, in emerging markets the journey form new firm creation till access to credit is FEI. Just like the patent application process enables innnovators to reveal information about their invention, which then makes it eligible for finance. Equally, FEI does the same thing for new firms in emerging markets, and the average time lag between new firm creation, and access to credit in developing countries is three years (Beck&Cull,2014; Liedholm, 2002). In emerging markets, it is expected that an entrepreneurs' income typically starts rising from the point of new venture creation. New venture creation, automatically puts the firm on the path to commercialization because, the innovator is adding value to his product, and readying it to scale, and access finance. This process (FEI) implies that he is

prototyping/commercializing, or already running a large firm but, on a much smaller scale. For these reasons, the entrepreneurs income will rise prior to accessing credit.

3.5 TOP INCOME INEQUALITY AND FEI AT DIFFERENT TIME LAGS

In emerging markets over fifty percent of new firms collapse in the first three years (Liedholm,2002;Beck&Cull,2014;Bowale&Akinlo,2012;Mead&Liedholm,1998), and over ninety percent go bankrupt by the fifth year. The few firms that remain after the third year are engaging in FEI, and will go on to scale and access finance. However, the fewer firms who still exist in the fifth year, and beyond are even more likely to access credit, than those who survive the third and fourth years. Specifically, since the few firms who survive the first five years, and beyond have the highest propensity to (via FEI) access finance, there is the need to extend the analysis up to a seven year lag. The seven year lag gives enough time to explain the dynamic between FEI, and the entrepreneurs income. Moreover, the new firm casualty rate declines from the third year, and onwards. For these reasons, it can be argued that the three year lag on the value added, is not enough to explain the relationship between FEI, and the entrepreneurial income share. To fix this problem, and thus, test the robustness of our results we analyse the impact of alternative lags of FEI on top income inequality (top 1% only). We regress top income inequality (OLS regression) on alternative lags of FEI, and we allow the time lag to vary from three to seven years.

3.6 INSTUMENTAL VARIABLE STRATEGY

As we pointed out in section 2.2.1 inequality can also boost innovation, which underscores the potential endogeneity problems in our model. However, due to the ubiquity of NDEs in emerging markets, we argue that causality runs from FEI to income inequality. Moreover, measurement bias and omitted variable issues can be checked with the appropriate instruments[11]. Our IV strategy, relies on exogenous shocks which significantly raises the incentive for entrepreneurs to access credit (via FEI) for expansion. We introduce novel measures for our instrumental variables[12]: a) statistical capacity score (overall average) which is a metric that is used to assess the capacity of a country's statistical system and, b) the log of "households and NPISHs final consumption expenditure (% of GDP)", which is the market value of all goods and services including durable products purchased by households and non profit institutions at the country level.

3.6.1 THE EXOGENEITY AND TIMING OF THE INSTRUMENTAL VARIABLES

We chose the statistical capacity score because small firms, normally cannot access credit due to a lack of information about the viability of their venture. However, the literature on relationship lending, confirms a robust relationship between innovation, and the availability of information which increases credit access for small firms (Herrera&Minetti,2007; Peng,2017; Petersen &Rajan, 1994 and 1995). Moreover, recent evidence from developing countries, confirm that the availability of information, via the introduction of credit registries improves the efficiency of credit allocation decisions, increases firm level access to finance and financial sector development (Tchamyou, 2019; Tchamyou&Asongu, 2017; Ayyagari, Juarros, Martinez-Peria&Singh,2016). Therefore, the statistical capacity score, is a good metric to gauge the ability of new firms (in terms of the availability of information for lenders who seek to extend credit to new firms) to engage in FEI. The statistical capacity of developing countries is largely funded by external development partners[13],

and is thus, exogenous to a nations' economic situation. We lagged the statistical capacity score by two years because, it is a metric that progresses with technological and economic development (Anderson&Whitford, 2017). The higher the level of technological advancement, the larger the score, and the greater the chances that a small firm will access credit. This process can only happen in time thus, in the emerging markets context the statistical capacity score will have a delayed impact on FEI.

Equally, we selected households and NPISHs final consumption expenditure, as our second instrument, and a robustness check because, a change in household consumption expenditure can produce an increase or decrease in the number of customers who can buy new products (Foellmi&Zweimuller, 2016 and Haptipoglu,2012). This change in market size and price effect can impact the entrepreneurs expected profits, and ultimately the decision to engage in FEI. The households and NPISHs final consumption expenditure, is largely driven by FDI in emerging markets. FDI spurs host country entrepreneurial activity which in turn boosts incomes, and then consumption via job creation (Jaumotte *et al.,*2013). Since FDI occurs when a business from one nation invests in another, it implies that shifts in household consumption expenditure is exogenously determined (Ghebrihiwet, 2019;Reyes,2017). Moreover, the impact of any change in household consumption spending on inequality, crystallizes via FEI and entrepreneurship (Munemo,2018;Durham, 2004). The households and NPISHs final consumption expenditure, is lagged by two years because, entrepreneurs who engage in FEI are usually driven by demand (Hatipoglu,2012). Therefore, the household consumption, should impact the entrepreneurs decision to access credit with a lag. The timing between the start of FEI, and access to credit is also an important determinant of the lags on both instruments (Liedholm, 2002).

Although charges for intellectual property, receipts (BoP, current US$) and spillovers are also good instruments for FEI (Aghion *et al.,* 2015 ; Chu and Cozzi, 2018; Coe, Helpman&Hoffmeister,1997) we did not use them because of their limitations[14] in developing countries. Further, the data is largely unavailable for some African[15] countries in our sample.

[1] Our main measure of inequality is the top 1% while, the top 10% and gini index are alternative measures and robustness checks.

[2] In the context of FEI in emerging markets new firm creation is equivalent to a patent application while, access to credit is comparable to a patent grant in developed countries. The entrepreneur experiences a significant rise in income after access to credit (Depalo&Addario,2014;Toivanen&Vaananen,2012; Hsu&Ziedonis, 2008). Unfortunately, the majority of small firms in developing counties, can not access credit due the inability to engage in FEI. Majority will collapse in the first three years, and out of the few who survive, only a minority will go on to scale and access credit (Wennekers, Van Stel,Thurik&Reynolds, 2005).

[3] Although there is insufficient data on government expenditure on education,total (% of GDP) the authors assert that the adjusted savings: education expenditure (% of GNI) mirrors the pattern of the former and thus, is a reliable measure for education spending in these countries.

[4] Each country (Brazil, Kenya, India and Romania) was selected from a different continent(South America, Africa, Asia and Eastern Europe) in order to understand the underlying trends in FEI and inequality data regardless of location. The data show a similar trend in FEI in emerging markets.

[5] The top one percent income share rises with the value added because, because emerging markets have pursued policies of economic liberalization, which has increased the income disparity between owners of capital, and labor as well as between the skilled and unskilled (Zhuang, Kanbur&Rhee,2014;IMF,2016; Jaumotte *et al., 2013*)

[6] Due to lack of data we used domestic credit to the private sector(% of GDP) for Egypt, India and Kenya

[7] The study time for Permana *et al.,* (2018) is 2003-2014, and for Wlodarczyk (2017) is 2005-2014, and both studies focused on Europe. Emerging markets have limited data.

[8] Nigeria, Pakistan, India, Kenya, Tunisia, Egypt, Morocco among others

[9] The entrepreneurs income increases significantly after the firm has reached economies of scale and is thus, able to access institutional finance - the FEI process. Specifically, significant increases in value addition and education expenditure will precede the innovators rise in income (Herrera&Minetti, 2007; Gama&Parida,2017;Depalo&Addario,2014;Toivanen&Vaananen,2012). https://www.lbs.edu.ng/lbsinsight/why-smes-fail-and-its-impact-on-national-development/

[10] Radical technological change in developing countries is mainly captured by new firm creation, and not intellectual property like patents (Srholec, 2011; Kraemer-Mbula *et al.,* 2019)

[11] The correlation coefficient between both instruments is 0.08

[12] For developing countries, the statistical capacity is usually funded by external development partners https://statisticalcapacitymonitor.org/pdf/Statistical%20Capacity%20Development%20Outlook%202019.pdf. NPISHs are institutions which provides goods and services to households for free or below market prices. They mainly derive their income from grants and donations and are not controlled by the government.

[13] The World Bank, Eurostat, United Nations Development Program, Canada, Switzerland, Italy, United Kingdom, Health Metrics Network, Germany, Japan, Sweden, United Nations Children's Fund, United Nations Population Fund, USA, Food and Agricultural Organisation, International Monetary Fund and the European Free Trade Association among others

[14] Radical technological change is captured by new firms entering the market rather than intellectual property like patents. Moreover, Intellectual property development is discouraged in emerging markets due to

institutional factors like poor legal rights (Vivarelli&Quatraro, 2015; Srholec,2011;Kraemer-Mbula *et al.,* 2019). Developing countries with low entrepreneurial human capital, and a poor business environment will not benefit significantly from spillover effects (Gorg&Greenaway,2004; Durham,2004)

[15] This data is not available for Nigeria among others.

4. Panel Ols Regression Results

In this section, we present the results from our panel regression analysis, of income inequality on FEI. We first report the relationship between top income inequality, (top1%) and FEI. Next, we examine the relationship between FEI, and broad measures (top 10% and gini index) of inequality. Finally, we examine the correlation between FEI and top income shares at various time lags.

4.1 FEI AND TOP INCOME INEQUALITY

Table 4 regresses our measure of income inequality (top 1%) on our measures of FEI with a three year lag. Column one, two, three and four uses MVA, SVA, IVA and Education expenditure respectively as our measures of FEI. The results show that apart from IVA which has a negative coefficient, the coefficient on FEI is always positive and statistically insignificant[1].

We have taken the logs of all measures of FEI, and Inequality so that we can interpret the coefficient of FEI as an elasticity. A one percent increase in IVA reduces inequality by 0.0718 percent. Likewise, one percent rise in the SVA, MVA and education expenditure will increase income inequality by 0.1669, 0.0788 and 0.0571 percent respectively.

4.2 FEI AND BROAD MEASURES OF INCOME INEQUALITY

We now report the results of the same regression from section 4.1 but, using broad measures of inequality as the dependent variable (top 10% and gini index). We report the results of these regressions in tables 5 and 6. We obtain similar results when we use the top 1% income share. Columns one through four reproduces the results for MVA, SVA, IVA and education expenditure for top 10%, and then the gini index (tables 5 and 6). Again for the top10%, apart from IVA which has a negative impact, the results are always positive and insignificant. A one percent increase in IVA will reduce inequality by 0.0285 percent. Equally, a one percent increase in the MVA, SVA and education expenditure will boost income inequality by 0.0246, 0.0999 and 0.0242 percent respectively. Next for the gini index , we see that all four measures of FEI are statistically insignificant. Again, we see that apart from SVA, all other measures of FEI has a positive correlation with inequality. A one percent rise in the SVA, decreases the gini index by 0.0145 percent. While a one percent increase in the MVA, IVA and education expenditure will increase inequality by 0.0628, 0.0158 and 0.0436 percent respectively.

4.3 FEI AND TOP INCOME INEQUALITY AT DIFFERENT LAGS

In this section, we test the robustness of our results to alternative lags for FEI. Table 12, 13 and 14 shows the results of regressing the top I% income share on MVA, SVA, IVA and Education expenditure. The last column

(all lags) in Tables 12, 13 and 14 shows the results of the same regression when all lags are included in a single equation. The time lag between top income inequality, and FEI are allowed to vary from three to seven years. These tables shows that the coefficient on lagged FEI[2], remains significant up till the seventh year. Moreover, the coefficient also rises with each lag. As discussed in section 3.5, this development supports our assertion, that firms which survive beyond the first three years, are engaging in FEI, and will most likely access credit (Liedholm, 2002;Beck&Cull,2014). Equally, in the all lags equations, we see that the coefficient on lagged FEI, although insignificant (except for the seventh lag for SVA in table 13) also increases with time. Again, this finding proves that firms which survive the critical first five years, are engaging in FEI and, will access credit.

4.4 TRUE FEI VERSUS NECESSITY ENTREPRENEURSHIP

The correlations we find so far between our variables of interest - the top 1% and value added - are insignificant across the board. Value added is a good proxy for FEI, for a couple reasons. First, due to the ubiquity of NDEs, a majority of firms in emerging markets remain small, and or never get to access credit (Abraham&Schmukler, 2017). Second, not all value added will impact the economy positively. Infact when firms fail, and or remain small due to the inability to engage in FEI[3] and access credit, this occurrence increases the interest rate on loans, to new firms and thus, raises inequality. For these reasons, the relationship between the value added, and inequality is weak. However, two[4] reasons leads us to conclude, that the correlation between value added and, inequality also include the activity of entrepreneurs who engage in FEI: 1) FEI when measured by MVA, SVA and education expenditure, exert a positive influence on top income inequality; 2) the correlation between income inequality and, FEI is insignificant for all measures of FEI. Which suggests that this association goes beyond the activity of just NDEs.

4.5 RESULTS FROM THE INSTRUMENTAL VARIABLE (IV) ESTIMATION (top 1%)

In table 8, we present the results when we use the statistical capacity score as an instrument. We see that both the IVA and MVA increases the top 1% income share and their impact is significant. While SVA[5] reduces inequality and its impact is not robust. A one percent rise in the IVA and MVA will increase the top income inequality by 1.0663 and 0.8627 percent [6] respectively. While a one percent rise in SVA will reduce top inequality by 62.5138 percent. The impact of education expenditure however, is positive[7] and insignificant. A one percent increase in the education expenditure will increase inequality by 27.5458 percent. This outcome, differs from the panel fixed effect results (table 4) because, the statistical capacity score isolates the impact of entrepreneurs who engage in FEI, on inequality. They are a minority, and an exclusive group, and are distinguished by their ability to scale, and access credit.

These (MVA and IVA) significant results strongly suggests that the activity of innovators, who engage in FEI in the manufacturing, and industry sectors has a robust influence on top income inequality. Again, this outcome is further supported by the positive, and significant[8] impact of our instrument on both the IVA, and MVA in the first stage regression (table 15). This significant, and positive impact implies that the practice of FEI in emerging markets, progresses with the statistical capacity score[9].

Education distinguishes NDE[10] from innovative ones and thus, determines the propensity to engage in FEI. Due to unequal access to quality education by the poor, it creates a situation where only people from the upper classes have access to quality education. Among this exclusive group only the most privileged, and wealthiest between the upper class go on to become innovative entrepreneurs[11], who have the capacity to engage in FEI. Therefore, the activity of this exclusive and minor group of entrepreneurs increases top income shares.

All four FEI coefficients are larger (0.8627, -62.5138, 1.0663 and 27.5458 versus 0.0788, 0.1669, -0.0718 and 0.0571) than their counterparts in table 4. This downward bias[12] in our panel fixed effects model, is due to omitted variables that increase inequality, but negatively impact FEI. Our results confirm the dynamic between FEI and inequality in these countries, and therefore, demonstrate the relevance of our instruments[13]. Our first stage results, from table 16, in the appendix confirm the strength of our instruments. The first stage F- statistic are all higher than ten. The coefficients on our instrument is significant for IVA, and MVA only. The coefficient in the reduced form model, suggests that a one unit rise in the statistical capacity score, will boost the top income share by 0.5 percent.

More details on the IV regressions are reported in the first stage, and reduced form results in the appendix (table 15).

4.5.1 IV REGRESSION RESULTS USING BROAD MEASURES OF INEQUALITY

Table 9 and 10 shows the results of our IV estimation using broad measures (top 10% and gini index) of income inequality. We see that all four measures of FEI have an insignificant[14] impact on the top 10% and gini index. Again the direction of effect for all FEI measures in both the top 1 % (table 8) and 10% regression (table 9) are similar. Apart from the MVA in the gini index equation, all four FEI coefficients from the IV regression are larger than their counterparts in tables 5 and 6. The F - statistic in the first stage regression is above ten which suggests that our instrument is strong. The first stage regressions results, (tables 16 and 17 in the appendix) is the same as the outcome for the top 1% (table 15). We see that the statistical capacity score, has a significant and positive[15] impact on FEI (IVA and MVA). The reduced form results also reveal an insignificant[16] relationship between the statistical capacity score and the broader measures of inequality.

4.5.2 OTHER IV RESULTS - ADDITIONAL ROBUSTNESS CHECKS (top 1% only)

Due to the fact that some emerging markets, in our sample may be more developed than others, the argument that the relationship between FEI and, top income inequality will not be the same across all twenty four countries can be made. To fix this problem, and thus, test the robustness of our results, we split our sample by dropping countries[17] with a higher GDP per capita. We run a panel fixed effects, and IV regression (tables 7 and 11) with only fifteen less developed emerging markets. We confirm that our results, are identical to the outcome in our original panel fixed effects, and IV estimations for the top 1% (tables 4 and 8). Here we report the results of the IV analysis only. MVA and IVA both increase the top income inequality, and are statistically significant[18], while SVA and, education expenditure are not significant. The first stage results indicate that the statistical capacity score has a positive and significant impact[19] on FEI.The

detailed results for the first stage, and reduced form equations are available in table 18 of the appendix. We conclude that the relationship between FEI, and top income inequality is consistent, across all twenty four countries.

4.5.3 SUMMARY OF FINDINGS

The results of our IV, and OLS regressions are largely in line with our hypothesis. First, FEI measured by IVA, and MVA has a significant impact on the top 1% income share. Second, the activity of entrepreneurs who engage in FEI, increases top income inequality. Third, FEI when measured by SVA reduces inequality. Fourth, FEI is not significantly correlated with broad measures of income inequality. Finally, firms that survive the first three years and, beyond are engaging in FEI and will access credit.

4.6 ADDITIONAL FINDINGS AND DISCUSSIONS

We find evidence of the existence of Kuznets curve in our sample (see illustration from tables 4, 5 and 6 in figures 5, 6 and 7). Kuznets (1955) proposed that inequality, may rise with initial increases in GDP Per Capita but decline subsequently. Our results, indicate that the relationship between GDP Per Capita and, inequality is inverted U shaped when the top 10% and, gini index are used to measure inequality. While the relationship between both variables is U shaped, when the top 1%[20] is used to measure inequality. These results indicate that the Kuznets curve exists in emerging markets, for our broad measures of inequality, and vice versa for the top income inequality.

The results from table 8, show that civil war, globalization index, and government consumption expenditure exert the largest[21] magnitude of effect on top income shares. While, FDI and inflation has the smallest impact. We find that markets where most entrepreneurs engage in FEI will have less conflict[22] or MEPV. Equally, government expenditure[23] is efficient where the practice of FEI is widespread. The globalization index[24] also reduces inequality, but its impact is stronger when FEI is significant. FDI increases inequality in sophisticated sectors like manufacturing, and industry where it is harder and, complex for entrepreneurs to scale, and access credit. The opposite occurs in a less sophisticated segment like services[25], where the process of scaling, may be less difficult for entrepreneurs. In African emerging markets, entrepreneurs who operate in the education, healthcare sectors and wholesale, and retail trade find it easier to access credit, when compared to their manufacturing, and industry segment counterparts. Inflation has the smallest magnitude of effect on income inequality. This is partly due to the inverted U shaped relationship between both variables in developing countries, where rising incomes[26] has been able to absorb the negative influence of inflation (Siami-Namini & Hudson, 2019). The relationship between inequality, and domestic credit to the private sector by banks is insignificant. This incidence is because access to credit for small firms, is largely unavailable in emerging markets (Beck, Demirguc-kunt&Levine, 2007).

[1] The panel fixed effects results captures the impact of entrepreneurs who engage in FEI and those who do not. The NDEs are larger than the entrepreneurs who engage in FEI hence, the statistically insignificant result (Wennekers *et al.,*2005; Amoros, Cristi&Minniti,2011). Likewise, the enterprise of IDEs increases inequality.

[2] The direction of effect is positive for education expenditure and SVA and, negative for MVA and IVA. These signs supports the outcome of our IV results which shows that FEI can increase or decrease inequality based on the measure.

[3] NDEs who form the majority of entrepreneurs in emerging markets usually fail and or remain small thus, their impact on inequality is temporary (Amoros&Cristi, 2008).

[4] These results are also consistent for our alternative measures of inequality, the top 10% and gini index.

[5] It is generally difficult to access credit across the board however, It is less hard to access credit for entrepreneurs in the services sector, when compared to manufacturing, construction and industry segments. This fact implies that the services sector is broad, and impacts a wider part of the population hence, the negative sign. SVA include services attached to wholesale and retail trade, education, healthcare, finance, hospitality, banking and insurance among others which has expanded quickly in emerging markets, due to a growing middle class. The service sector, accounts for the largest share of national income in Africa, and Asia emerging markets, and they make up half of the countries in our sample. https://www.adb.org/sites/default/files/publication/31114/developing-service-sector-engine-growth-asia.pdf

[6] IVA and MVA comprise sectors like manufacturing, construction, and mining. These are fairly sophisticated sectors in the emerging markets context thus, the know how about scaling, and access to credit is rare for these segments. Hence, only innovators in the top 1% will be able to scale, and access credit in these areas (Abraham&Schmukler,2017;Stenberg & Wennekers, 2005; Amoros&Cristi,2008). Aghion *et al.,* (2015) also reveal a positive correlation between innovation, and the share of income owned by the top one percent in the U.S. Due to the growing demand for infrastructure and, real estate most new construction globally, will happen in emerging markets (https://www.pwc.com/gx/en/asset-management/publications/pdfs/real-estate-2020-pwc.pdf). Likewise, the manufacturing sector in Africa emerging markets, has not expanded as expected because most firms are unable to reach economies of scale (Liedholm&Mead, 1998; Liedholm,2002)

[7] Education is not a primary engine of upward mobility in developing countries, rather it increases inequality, especially in the developing countries of Asia and Africa, which make up half of the countries in our sample. (IMF,2016 and Jaumotte *et al.,* 2013*).* The literature on skill biased technical change (Permana, Suharto&Lantu, 2018) confirm that the dominant reason for wage inequality is education. Highly educated people, can better use new technologies, and therefore will receive higher wages.

[8] A unit increase in the statistical capacity score raises both MVA and IVA by 0.6 and 0.5 percent respectively.

[9] At the end of FEI, the entrepreneur, produces a business model based on FEI, which include information about the profitability of the venture to bankers. On the supply side, financial institutions must use statistical

information regarding the firm, plus the business model, developed by the innovator to guide decision making. However, this process is uncommon in developing countries, who are still growing their statistical capacity. Therefore, this action is restricted to few entrepreneurs who have the ability to scale (Anderson&Whitford, 2017; Pereira, Ferreira&Lopes, 2017; Beck, Demirguc-kunt&Maksimovic, 2005; Berger&Udell, 2002).

[10] Most entrepreneurs in developing countries are motivated by necessity rather than innovation hence, their impact on inequality is temporary (Amoros *et al.,* 2011; Wennekers *et al., 2005*).

[11] Profiles of innovative entrepreneurs in emerging markets - https://www.entrepreneur.com/article/283272 - https://www.smallstarter.com/get-inspired/10-super-success-african-entrepreneurs-and-how-they-raised-money-to-start-their-businesses/.

[12] Environmental factors in developing countries such as the rule of law and property rights, poor infrastructure, political instability, corruption and other institutional factors which dampen FEI (Beck *et al.,* 2008; Cenni *et al.,* 2015 and Banerjee&Newman, 1993*).*The activity of NDEs also dampens FEI and increases inequality.

[13] Results from the IV regression using both instruments show a similar outcome and, is available upon request from the authors.

[14] The gini index and top 10% are broad measures for FEI compared to the top 1%, it captures the impact of a wider range of entrepreneurs who engage in FEI. A number of empirical studies confirm a less robust relationship between innovation and inequality, especially when the innovators are not in the top one percent or when broader measures of inequality like the top 10% and the gini index is used (Wlodarczyk, 2017; Aghion *et al*., 2019; Antonelli&Gehringer, 2017).

[15] A unit rise in the statistical capacity score raises both MVA, and IVA by 0.6, and 0.5 percent respectively.

[16] A one unit rise in the statistical capacity score, increases the top 10% income share by 0.08% and, decreases the gini index by 0.04%.

[17] Brazil, Chile, Malaysia, Mexico, Russia, Poland, Turkey, Hungary and Romania were dropped from this analysis.

[18] Due to the effect of excluding advanced emerging markets from this sample, the level of significance for FEI (IVA and MVA) dropped to 5% from 1% in the original sample.

[19] A one unit increase in the statistical capacity score, will boost MVA, and IVA by one percent.

[20] The activity of the top 1% will increase income inequality in the long run.

[21] The large coefficients for the civil war, and globalization index is not surprising, considering the fact that only seven countries (Tunisia, Romania, Hungary, Poland, Morocco, Chile and Brazil) out of twenty four, have not experienced any MEPV during the study period. Equally, Apart from Iran, which has been under

international sanctions, every country in our sample has pursued policies of economic liberalization/glocalization. Civil war occurs less and, the globalization index and government expenditure are efficient when the majority of entrepreneurs practice FEI. This incidence implies that the development of institutions, and FEI are related (Cenni *et al.,* 2015;Banerjee&Newman,1993).

[22] Civil war increases top income inequality. But its magnitude is smaller in the IVA, and MVA equations or when FEI is significant.

[23] Government expenditure increases top income inequality. But its magnitude is smaller when FEI is robust. This finding implies that government expenditure is competent when the practice of FEI is pervasive.

[24] SVA has a larger magnitude when compared to MVA and IVA. This is because access to credit is less challenging in a less sophisticated sector like services, so that it can absorb FDI.

[25] Service sector size, and contribution to economic growth is currently the largest in Africa emerging markets https://www.mckinsey.com/featured-insights/middle-east-and-africa/africas-path-to-growth-sector-by-sector. https://www.afdb.org/en/documents/west-africa-economic-outlook-2020-coping-covid-19-pandemic. Likewise, the service sector is the largest contributor to GDP, in Asia emerging markets.

[26] All countries in our sample have at least doubled their GDP per capita, during the study period.

5. Conclusion

In this paper, we present new evidence about the nature of the relationship between front-end innovation and, top income inequality in emerging markets. We found a positive, and significant association between top income inequality, and front-end innovation when we use manufacturing, and industry value added to measure it. We also reveal an insignificant relationship, when we use education expenditure, and services value added to measure front-end innovation. The connection between front-end innovation, and top income inequality gets more robust with longer lags. We further discovered that front-end innovation, is not significantly correlated with broad measures of inequality. Firms that do not collapse in the first five years, has the highest propensity to engage in front-end innovation.

We submit that this association, partly reflects a causal effect from front-end innovation, to top income inequality. Our approach, was to examine the causal effect of front-end innovation, on top income inequality. This initial step, is necessary in order to quantify the impact of front-end innovation on top income inequality. Hence, our paper complements studies in microeconomics, and entrepreneurial development, which seek to discern why only few firms can scale, and access finance in emerging markets, and thus, its impact on income distribution, using value added data. This study can be extended, by analyzing the impact of front-end innovation on poverty, and economic growth in developing countries. Cross country firm level studies, that will explore the impact of front-end innovation, on firm development, and access to finance, is another avenue for continuing this study. Examining the supply side dynamic of front-end innovation, and a theoretical inquiry regarding the front-end of innovation, are also areas of further research.

Declarations

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COMPLIANCE WITH ETHICAL STANDARDS

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Tables

Table 1

Definition of variables

Variable	Description (Source)
Measures of Income Inequality	
Gini Index	Gini coefficient of equivalised income distribution. www.wider.unu.edu/database/wiid. (World Bank database, World Inequality Database and Standardized World Income Inequality database, 2019).
Top i%	Share of pretax national income owned by the top i% (i% being1% and 10 %) of the income distribution. https://wid.world/data (World Inequality Database)
Measures of FEI	
Manufacturing Value Added, (% of GDP)	The net output of the manufacturing sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depletion and degradation of natural resources (World Bank database, 2019)
Industry (including construction) Value Added, (% of GDP)	It comprises value added in mining, manufacturing(calculated as a separate subgroup), construction, electricity, water and gas. (World Bank Database, 2019).
Services Value Added (% of GDP)	They include value added in wholesale and retail trade (including hotels and restaurants), transportation, government, financial and professional services such as education, health-care and real estate. Also imputed are bank service charges, import duties and any statistical discrepancy noted by national compilers, as well as discrepancies arising from re-scaling. (World Bank database, 2019)
Adjusted Savings:Education Expenditure (% of GNI)	Refers to the current operating expenditures in education including wages and salaries and excluding capital investment in building and equipment (World Bank database, 2019)
Control Variables	
GDP Per Capita (Current US$)	GDP divided by midyear population (World Bank database, 2019)
Domestic Credit to Private Sector by Banks (% of GDP)	Financial resources provided to the private sector by deposit taking corporations except central banks (World Bank database, 2019)

Foreign Direct Investment, net inflows (% of GDP)	The net inflows of investment to acquire a long lasting interest in an enterprise operating in an economy other than that of the investor (World Bank database, 2019)
Inflation, GDP Deflator (annual %)	The rate of price change in the economy as a whole (World Bank database, 2019)
Civil War Episodes (MEPV-ACTOTAL)	Total summed magnitude of all (societal and interstate) major episodes of political violence. http://www.systemicpeace.org/inscrdata.html(The Center for Systemic Peace,2018)
Globalization Index	A composite index measuring globalization along social, political and economic dimensions https://kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html (KOF Index of globalization, 2019)
Instruments	
Statistical Capacity Score (Overall Average)	A composite score that is used to assess the capacity of a country's statistical system (World Bank database, 2019)
Households and NPISHs Final Consumption Expenditure (% of GDP)	The market value of all goods and services including durable products (such as cars, washing machines and home computers) purchased by households. It also includes expenditure of non profits serving households at the country level.(World Bank database, 2019)

Table 2

Summary statistics of all variables

	Observations	Mean	Standard Deviation	Minimum	Maximum
Gini index	576	41.68	8.90	24	64.80
Top 1%	576	0.18	0.05	0.07	0.32
Top 10%	576	0.47	0.08	0.25	0.65
Mva	576	17.07	5.01	6.55	31.95
Iva	576	30.45	6.99	13.56	49.64
Sva	576	51.77	5.54	33.37	63.34
Edu_expenditure	576	3.92	1.37	0.6	6.98
Gdp_per_capita	576	4,692	3,880	326	16,151
Creditprivate	576	43.65	28.22	1.38	166.50
Govt_cons_expd	576	14.09	4.33	0.91	27.40
FDI	576	2.78	4.65	-41.06	54.24
Inflation	576	11.12	22.77	-5.99	415.81
Civilwar	576	1.29	2.00	0	9
Global_index	576	63.17	10.24	31.59	86.15
Stat_Cap_Score	576	81.49	10.00	44.44	158.89
HH_Cons_Expd	576	64.09	10.16	40.72	91.23

Note: Summary statistics includes mean, standard deviation, maximum and minimum for all variables for 1995-2018.

Table 3

Descriptive Statistics for Measures of FEI and Inequality in Two Distinct Years

1995	Mean	Standard Deviation	Minimum	Maximum
MVA	19.38	4.81	8.36	30.95
SVA	48.43	6.18	36.98	58.73
IVA	13.23	6.29	13.56	41.80
Education	3.62	1.52	0.6	6.41
Top 1%	0.17	0.06	0.07	0.26
Top 10%	0.46	0.09	0.25	0.61
2015	Mean	Standard Deviation	Minimum	Maximum
MVA	15.58	4.49	9.37	27.37
SVA	54.44	4.65	43.31	62.31
IVA	28.31	6.03	17.30	40.50
Education	4.00	1.36	0.85	6.11
Top1%	0.18	0.05	0.11	0.3
Top 10%	0.47	0.08	0.33	0.65

Table 4

Income Inequality (Top 1%) and FEI - Panel Regression Results

Measure of FEI	Manufacturing Value Added (MVA)	Services Value Added (SVA)	Industrial Value Added (IVA)	Education Expenditure
FEI	0.0788	0.1669	-0.0718	0.0571
	(1.06)	(0.70)	(-0.77)	(1.22)
Lcreditprivate	0.0873**	0.0747*	0.0776*	0.0797*
	(2.12)	(1.80)	(1.90)	(2.01)
lgdppc	-0.0324	-0.1032	-0.0614	-0.0541
	(-0.10)	(-0.31)	(-0.19)	(-0.17)
slgdppc	0.0000	0.0041	0.0015	0.0007
	(0.00)	(0.20)	(0.08)	(0.04)
Civilwar	0.0177	0.0147	0.0155	0.0158
	(1.66)	(1.30)	(1.42	(1.54)
Fdi	0.0005	0.0005	0.0005	0.0004
	(1.39)	(1.51)	(1.33)	(1.06)
Govt_expd	0.0011	-0.0018	-0.0016	-0.0011
	(0.13)	(-0.22)	(-0.21)	(-0.13)
Global_index	0.0037	0.0030	0.0038	0.0038
	(0.71)	(0.60)	(0.76)	(0.73)
Inflation	0.0002	0.0003	0.0003	0.0003
	(0.18)	(0.24)	(0.23)	(0.25)
Within R^2	0.08	0.09	0.09	0.09
Between R^2	0.00	0.04	0.00	0.00
Observations	504	504	504	504

Notes: The data was estimated using panel regression with country and year fixed effects, and standard errors clustered at the country level.* denotes significance at the 10 percent level, while ** and *** denotes significance at the 5 and 1 percent levels respectively; t statistics in brackets are computed with heteroskedasticity and auto-correlation robust standard errors. The dependent(top 1%) and independent (value added and education expenditure are all lagged by three years) variables are in natural logarithm. Time span:1995-2018.

Table 5

Income Inequality (Top 10%) and FEI - Panel Regression Results

Measure of FEI	MVA	SVA	IVA	Education Expenditure
FEI	0.0246	0.0999	-0.0285	0.0242
	(0.43)	(0.77)	(-0.45)	(0.97)
Lcreditprivate	0.0359	0.0303	0.0327	0.0334
	(1.58)	(1.50)	(1.60)	(1.71)
lgdppc	0.0926	0.0572	0.0832	0.0862
	(0.41)	(0.27)	(0.38)	(0.40)
slgdppc	-0.0068	-0.0048	-0.0063	-0.0067
	(-0.49)	(-0.36)	(-0.46)	(-0.50)
Civilwar	0.0025	0.0013	0.0018	0.0019
	(0.28)	(0.18)	(0.27)	(0.29)
Govt_exp	0.0005	-0.0007	-0.0004	-0.0002
	(0.13)	(-0.18)	(-0.10)	(-0.05)
Fdi	0.0006***	0.0007***	0.0006***	0.0006***
	(2.55)	(3.80)	(3.50)	(3.68)
Global_index	0.0027	0.0024	0.0027	0.0028
	(0.96)	(0.89)	(0.97)	(1.01)
Inflation	0.0002	0.0002	0.0002	0.0002
	(0.37)	(0.44)	(0.43)	(0.43)
Within R^2	0.08	0.09	0.08	0.08
Between R^2	0.05	0.00	0.04	0.03
Observations	504	504	504	504

Notes: The data was estimated using panel regression with country and year fixed effects, and standard errors clustered at the country level.* denotes significance at the 10 percent level, while ** and *** denotes significance at the 5 and 1 percent levels respectively; t statistics in brackets are computed with heteroskedasticity and auto-correlation robust standard errors. The dependent(top 10%) and independent (value added and education expenditure are all lagged by three years) variables are in natural logarithm. Time span:1995-2018.

Table 6

Income Inequality (Gini Index) and FEI - Panel Regression Results

Measure of FEI	MVA	SVA	IVA	Education Expenditure
FEI	0.0628	-0.0145	0.0158	0.0436
	(1.13)	(-0.16)	(0.25)	(1.13)
Lcreditprivate	-0.0179	-0.0228	-0.0226	-0.0239
	(-0.54)	(-0.67)	(-0.65)	(-0.66)
lgdppc	0.1490	0.1337	0.1307	0.1312
	(1.06)	(0.90)	(0.84)	(0.86)
slgdppc	-0.0082	-0.0076	-0.0074	-0.0077
	(-0.96)	(-0.84)	(-0.78)	(-0.80)
Civilwar	-0.0093**	-0.0107**	-0.0107**	-0.0109**
	(-2.10)	(-2.20)	(-2.27)	(-2.60)
Fdi	0.0000	-0.0000	-0.0000	-0.0001
	(0.02)	(-0.00)	(-0.00)	(-0.15)
Govt_exp	0.0023	0.0011	0.0012	0.0005
	(0.48)	(0.24)	(0.25)	(0.14)
Global_index	-0.0048**	-0.0059**	-0.0060**	-0.0057**
	(2.32)	(-2.40)	(-2.45)	(-2.59)
Inflation	-0.0015**	-0.0015**	-0.0015**	-0.0014*
	(-2.33)	(-2.24)	(-2.27)	(-1.98)
Within R^2	0.26	0.24	0.24	0.26
Between R^2	0.12	0.09	0.11	0.09
Observations	504	504	504	504

Notes: The data was estimated using panel regression with country and year fixed effects, and standard errors clustered at the country level.* denotes significance at the 10 percent level, while ** and *** denotes significance at the 5 and 1 percent levels respectively; t statistics in brackets are computed with heteroskedasticity and auto-correlation robust standard errors. The dependent(gini index) and independent (value added and education expenditure are all lagged by three years) variables are in natural logarithm. Time span:1995-2018.

Table 7

Income Inequality (top1%) and FEI Robustness Check - Panel Regression Results

Measure of FEI	MVA	SVA	IVA	Education Expenditure
FEI	-0.0680	0.1598	-0.0891	0.0959**
	(-0.77)	(0.49)	(-0.67)	(2.27)
Lcreditprivate	0.0148	0.0191	0.0204	0.0303
	(0.30)	(0.39)	(0.43)	(0.67)
lgdppc	0.3197	0.2618	0.3060	0.3687
	(0.60)	(0.45)	(0.56)	(0.72)
slgdppc	-0.0243	-0.0202	-0.0228	-0.0281
	(-0.71)	(-0.53)	(-0.63)	(-0.85)
Civilwar	0.0044	0.0050	0.0058	0.0074
	(0.49)	(0.52)	(0.65)	(0.95)
Fdi	0.0046	0.0050	0.0046	0.0023
	(0.99)	(1.09)	(1.02)	(0.60)
Govt_exp	0.0033	0.0032	0.0031	0.0419
	(0.37)	(0.36)	(0.33)	(0.42)
Global_index	0.0021	0.0016	0.0021	0.0032
	(0.31)	(0.25)	(0.32)	(0.49)
Inflation	0.0007	0.0006	0.0007	0.0010
	(0.86)	(0.63)	(0.86)	(1.19)
Within R^2	0.05	0.05	0.05	0.07
Between R^2	0.04	0.01	0.00	0.00
Observations	315	315	315	315

Notes: The data (15 less developed emerging markets only) was estimated using panel regression with country and year fixed effects, and standard errors clustered at the country level.* denotes significance at the 10 percent level, while ** and *** denotes significance at the 5 and 1 percent levels respectively; t statistics in brackets are computed with heteroskedasticity and auto-correlation robust standard errors. The dependent(top1%) and independent (value added and education expenditure are all lagged by three years) variables are in natural logarithm. Time span:1995-2018.

Table 8

Income Inequality (top 1%) and FEI using Statistical Capacity Score - IV Result

Measure of FEI	MVA	SVA	IVA	Education Expenditure
FEI	0.8627***	-62.5138	1.0663***	27.5458
	(3.04)	(-0.21)	(2.77)	(0.10)
Lcreditprivate	0.0871**	0.2835	0.0590	-6.2373
	(2.29)	(0.39)	(1.15)	(-0.10)
lgdppc	-0.6909*	12.9062	-1.1462**	7.9332
	(-1.78)	(0.21)	(-2.38)	(0.10)
slgdppc	0.0614**	-0.4940	0.0802***	-0.4834
	(2.44)	(-0.20)	(2.79)	(-0.10)
Civilwar	0.0476***	0.5865	0.0487***	0.9409
	(5.25)	(0.23)	(4.64)	(0.11)
Fdi	0.0037	-0.0103	0.0030	-0.0097
	(0.87)	(-0.17)	(0.98)	(-0.08)
Govt_exp	0.0020	0.6778	0.0231*	-1.7777
	(0.37)	(0.21)	(1.81)	(-0.10)
Global_index	-0.0322***	-0.2754	-0.0230***	-0.1054
	(-6.14)	(-0.23)	(-6.81)	(-0.09)
Inflation	-0.0031*	-0.0816	-0.0042	-0.0059
	(-1.84)	(-0.21)	(-1.49)	(0.06)
R^2	0.30	0.44	0.45	0.58
First Stage F-Stat	23.81	42.35	26.12	56.26
Observations	504	504	504	504

Notes: The data was estimated using panel data 2SLS regressions with country and year fixed effects, and standard errors clustered at the country level.* denotes significance at the 10 percent level, while ** and *** denotes significance at the 5 and 1 percent levels respectively;t/z statistics in parenthesis are computed with heteroskedasticity and auto-correlation robust standard errors. The dependent (top1%) and independent (value added and education expenditure are all lagged by three years) variables are in natural logarithm. The lag between the endogenous variable and the instrument [the statistical capacity score (overall average)] is set to two years. Time span:1995-2018.

Table 9

Income Inequality (top 10%) and FEI using Statistical Capacity Score - IV Result

Measure of FEI	MVA	SVA	IVA	Education Expenditure
FEI	0.1751	-12.6908	0.2165	5.592
	(1.40)	(-0.21)	(1.32)	(0.10)
Lcreditprivate	0.0933***	0.1332	0.0876***	-1.1905
	(5.27)	(0.87)	(3.94)	(-0.10)
lgdppc	0.1758	2.9362	0.0834	1.9266
	(1.00)	(0.23)	(0.39)	(0.12)
slgdppc	-0.0034	-0.1162	0.0004	-0.1140
	(-0.30)	(-0.23)	(0.03)	(-0.12)
Civilwar	0.0110**	0.1204	0.0113**	0.1924
	(2.61)	(0.22)	(2.45)	(0.11)
Govt_exp	-0.0066***	0.1305	-0.1123	-0.3680
	(-2.74)	(0.19)	(-0.45)	(-0.11)
Fdi	0.0003	-0.0025	0.0002	-0.0024
	(0.21)	(-0.19)	(0.15)	(-0.09)
Global_index	-0.0161***	-0.0655	-0.0142***	0.0118
	(-6.53)	(-0.26)	(-9.19)	(0.05)
Inflation	-0.0014	-0.0173	-0.0016	0.0004
	(-1.51)	(-0.21)	(-1.32)	(0.02)
R^2	0.30	0.44	0.46	0.58
First Stage F-Stat	23.81	42.35	26.12	56.26
Observations	504	504	504	504

Notes: The data was estimated using panel data 2SLS regressions with country and year fixed effects, and standard errors clustered at the country level.* denotes significance at the 10 percent level, while ** and *** denotes significance at the 5 and 1 percent levels respectively;t/z statistics in parenthesis are computed with heteroskedasticity and auto-correlation robust standard errors. The dependent (top1%) and independent (value added and education expenditure are all lagged by three years) variables are in natural logarithm. The lag between the endogenous variable and the instrument [the statistical capacity score (overall average)] is set to two years. Time span:1995-2018.

Table 10

Income Inequality (Gini Index) and FEI using Statistical Capacity Score - IV Result

Measure of FEI	MVA	SVA	IVA	Education Expenditure
FEI	-0.0160	1.1650	-0.0198	-0.5133
	(-0.14)	(0.14)	(-0.14)	(-0.08)
Lcreditprivate	0.0473***	0.0437**	0.0479**	0.1652
	(2.80)	(1.94)	(2.46)	(0.11)
lgdppc	0.4569***	0.2034	0.4653***	0.2961
	(3.22)	(0.11)	(2.69)	(0.16)
slgdppc	-0.0193**	-0.0089	-0.0196*	-0.0091
	(-2.13)	(-0.13)	(-1.89)	(-0.08)
Civilwar	0.0006	-0.0107	-0.0006	-0.0173
	(0.15)	(-0.14)	(-0.15)	(-0.08)
Govt_exp	-0.0025	-0.0151	-0.0028	0.0306
	(-0.90)	(-0.16)	(-0.57)	(0.08)
Fdi	-0.0004	-0.0002	-0.0004	-0.0002
	(-0.26)	(-0.07)	(-0.26)	(-0.05)
Global_index	-0.0166***	-0.0120	-0.0168***	-0.0191
	(-6.90)	(-0.34)	(-11.03)	(-0.68)
Inflation	-0.0028***	-0.0014	-0.0028**	-0.0030
	(-2.74)	(-0.13)	(-2.55)	(-1.53)
R^2	0.30	0.44	0.45	0.58
First Stage F-Stat	23.81	42.35	26.12	56.26
Observations	504	504	504	504

Notes: The data was estimated using panel data 2SLS regressions with country and year fixed effects, and standard errors clustered at the country level.* denotes significance at the 10 percent level, while ** and *** denotes significance at the 5 and 1 percent levels respectively;t/z statistics in parenthesis are computed with heteroskedasticity and auto-correlation robust standard errors. The dependent (top1%) and independent (value added and education expenditure are all lagged by three years) variables are in natural logarithm. The lag between the endogenous variable and the instrument [the statistical capacity score (overall average)] is set to two years. Time span:1995-2018.

Table 11

Income Inequality (top 1%) and FEI Robustness Check - IV Result

Measure of FEI	MVA	SVA	IVA	Education Expenditure
FEI	0.3280**	-27.3623	0.4014**	1.7573
	(2.22)	(-0.23)	(2.18))	(0.93)
Lcreditprivate	0.0846	0.5374	0.1051**	-0.3989
	(1.53)	(0.34)	(2.17)	(-0.68)
lgdppc	-0.7302**	6.2779	-0.7065**	0.1462
	(-2.23)	(0.21)	(-2.11)	(0.15)
slgdppc	0.0548**	-0.2909	0.0470**	0.0054
	(2.57)	(-0.20)	(2.19)	(0.10)
Civilwar	0.0296***	0.2077	0.0299***	0.1001
	(4.34)	(-0.27)	(4.12)	(1.18)
Govt_exp	-0.0001	0.3263	0.0062	-0.1468
	(-0.03)	(0.23)	(0.84)	(-0.97)
Fdi	0.0265***	-0.0403	0.0263	-0.0179
	(3.10)	(-0.13)	(3.05)	(-0.35)
Global_index	-0.0161***	-0.0891	-0.0124***	0.0032
	(-6.36)	(-0.27)	(-5.91)	(0.17)
Inflation	-0.0080***	-0.0891	-0.0102***	-0.0081
	(-4.98)	(-0.27)	(-4.65)	(-0.90)
R^2	0.36	0.40	0.52	0.71
First Stage F-Stat	17.01	27.05	33.69	105.25
Observations	504	504	504	504

Notes:The data (15 less developed emerging markets only) was estimated using panel data 2SLS regressions with country and year fixed effects, and standard errors clustered at the country level.* denotes significance at the 10 percent level, while ** and *** denotes significance at the 5 and 1 percent levels respectively;t/z statistics in parenthesis are computed with heteroskedasticity and auto-correlation robust standard errors. The dependent (top1%) and independent (value added and education expenditure are all lagged by three years) variables are in natural logarithm. The lag between the endogenous variable and the instrument [the statistical capacity score (overall average)] is set to two years. Time span:1995-2018.

Table 12

Income Inequality (top 1%) and FEI (MVA) - Additional Robustness Checks - OLS Result

Measure of FEI	MVA	MVA	MVA	MVA	MVA	MVA
Lags of FEI	3	4	5	6	7	All lags
FEI at t-3	-0.1137***					0.2429
	(-2.39)					(1.27)
FEI at t-4		-0.1189**				-0.1170
		(-2.33)				(-0.44)
FEI AT t-5			-0.1239**			0.0202
			(-2.23)			(0.08)
FEI at t-6				-0.1358**		-0.0361
				(-2.24)		(-0.15)
FEI at t-7					-0.1466**	-0.2338
					(-2.28)	(-1.30)
Lcreditprivate	0.1683***	0.1638***	0.1534***	0.1498***	0.1541***	0.1485***
	(7.56)	(6.77)	(6.16)	(5.78)	(5.78)	(5.49)
lgdppc	-0.0528	-0.1127	-0.1922	-0.2476	-0.3711	-0.4101
	(-0.25)	(-0.55)	(-0.81)	(-0.96)	(-1.35)	(-1.49)
slgdppc	0.0143	0.0184	0.0225	0.0258	0.0336*	0.0363**
	(1.07)	(1.32)	(1.52)	(1.62)	(1.98)	(2.14)
Civilwar	0.0317***	0.0304***	0.0293***	0.0293***	0.0318***	0.0313***
	(5.10)	(4.67)	(4.27)	(4.05)	(4.32)	(4.24)
Govt_exp	-0.0132***	-0.0133***	-0.0133***	-0.0132***	-0.0135***	-0.0130**
	(-3.80)	(-3.50)	(-3.21)	(-2.95)	(2.87)	(-2.71)
Fdi	0.0017	0.0016	-0.0013	0.0012	0.0012	0.0013
	(0.62)	(0.58)	(0.45)	(0.43)	(0.40)	(0.42)
Global_index	-0.0053***	-0.0152***	-0.0151***	-0.0149***	-0.0150***	-0.0156***
	(-7.81)	(-7.25)	(-6.79)	(-6.47)	(-6.39)	(-6.60)
Inflation	-0.0001	-0.0004	-0.0015	-0.0027	-0.0036	-0.0034
	(-0.07)	(-0.22)	(-0.70)	(-1.08)	(-1.58)	(-1.47)

R^2	0.31	0.29	0.28	0.28	0.29	0.30
F-Stat	27.04	24.53	21.52	19.31	20.58	15.14
Observations	504	480	456	432	408	408

Notes: The data was estimated using panel data OLS regressions.* denotes significance at the 10 percent level, while ** and *** denotes significance at the 5 and 1 percent levels respectively;t statistics in parentheses was computed with heteroskedasticiy and auto-correlation robust standard errors. The dependent (top 1%) and independent (manufacturing value added - lagged by three to seven years) variables are in natural logarithm. Time span:1995-2018.

Table 13

Income Inequality (top 1%) and FEI (SVA) - Additional Robustness Checks - OLS Result

Measure of FEI	SVA	SVA	SVA	SVA	SVA	SVA
Lags of FEI	3	4	5	6	7	All Lags
t-3	1.1285***					-0.0237
	(9.56)					(-0.07)
t-4		1.1759***				0.0764
		(10.47)				(0.19)
t-5			1.2017***			0.2263
			(10.74)			(0.60)
t-6				1.2122***		0.0860
				(10.58)		(-0.24)
t-7					1.1741***	0.8665***
					(10.41)	(3.27)
Lcreditprivate	0.1566***	0.1606***	0.1527***	0.1486***	0.1492***	0.1522***
	(7.46)	(7.51)	(6.93)	(6.56)	(6.45)	(6.47)
lgdppc	-0.3624*	-0.4451**	-0.5042**	-0.5696**	-0.6698***	-0.6720***
	(-1.97)	(-2.21)	(-2.60)	(-2.74)	(-3.04)	(-3.06)
slgdppc	0.0291**	0.0338***	0.0372***	0.0410***	0.0474***	0.0473***
	(2.54)	(2.93)	(3.06)	(3.15)	(3.45)	(3.45)
Civilwar	0.0236***	0.0225***	0.0218***	0.0224***	0.0245***	0.0234***
	(4.21)	(3.86)	(3.50)	(3.40)	(3.66)	(3.31)
Govt_exp	-0.0239***	-0.0255	-0.0263	-0.0268	-0.0267	-0.0277
	(-6.60)	(-6.88)	(-6.78)	(-6.47)	(-6.23)	(-5.98)
Fdi	0.0022	0.0021	0.0018	0.0016***	0.0018	0.0018
	(0.74)	(0.71)	(0.59)	(0.52)	(0.57)	(0.56)
Global_index	-0.0126***	-0.0123***	-0.0118**	-0.0113***	-0.0115***	-0.0114***
	(-7.27)	(-6.72)	(-6.16)	(-5.59)	(-5.61)	(-5.53)
Inflation	0.0010	0.0016	0.0012	0.0008	0.0001	0.0001
	(0.91)	(1.13)	(0.64)	(0.36)	(0.06)	(0.07)
R^2	0.40	0.40	0.40	0.39	0.41	0.41

F-Stat	50.04	52.47	48.16	42.44	42.36	30.75
Observations	504	480	456	432	408	408

Notes: The data was estimated using panel data OLS regressions.* denotes significance at the 10 percent level, while ** and *** denotes significance at the 5 and 1 percent levels respectively;t statistics in parentheses was computed with heteroskedasticiy and auto-correlation robust standard errors. The dependent (top 1%) and independent (services value added - lagged by three to seven years) variables are in natural logarithm. Time span:1995-2018.

Table 14

Income Inequality (top 1%) and FEI (IVA) - Additional Robustness Checks - OLS Result

Measure of FEI	IVA	IVA	IVA	IVA	IVA	IVA
Lags of FEI	3	4	5	6	7	All Lags
t-3	-0.2666***					0.3322
	(-4.43)					(1.35)
t-4		-0.2886***				-0.1749
		(-4.45)				(-0.50)
t-5			-0.2918***			-0.0658
			(-4.09)			(-0.18)
t-6				-0.2870***		-0.1368
				(-3.76)		(-0.41)
t-7					-0.2781**	0.2180
					(-3.54)	(0.98)
Lcreditprivate	0.1838***	0.1851***	0.1751***	0.1693***	0.1718***	0.1674***
	(8.32)	(7.61)	(6.96)	(6.45)	(6.40)	(5.80)
lgdppc	0.1276	0.0873	0.0401	0.0213	-0.1498	-0.1723
	(0.60)	(0.39)	(0.17)	(0.08)	(-0.53)	(-0.58)
slgdppc	-0.0047***	-0.0072	0.0100	0.0138	0.0220	0.0234
	(0.36)	(0.52)	(0.68)	(0.86)	(1.27)	(1.30)
Civilwar	0.0298***	0.0743***	0.0275***	0.0273***	0.0298***	0.0301***
	(4.75)	(6.63)	(3.90)	(3.63)	(3.87)	(3.89)
Govt_exp	-0.0201***	-0.0212***	-0.0215***	-0.0213***	-0.0211***	-0.0204***
	(-4.94)	(-4.74)	(-4.32)	(-3.87)	(-3.65)	(-3.29)
Fdi	0.0016	0.0015	0.0011	0.0011	0.0011	0.0010
	(0.57)	(0.52)	(0.38)	(0.37)	(0.35)	(0.31)
Global_index	-0.0158***	-0.0156***	-0.0154***	-0.0154***	-0.0157***	-0.0157***
	(-9.55)	(-8.84)	(-8.28)	(-8.03)	(-8.05)	(-7.87)
Inflation	0.0005	0.0009	-0.0000	-0.0015	-0.0024	-0.0023
	(0.47)	(0.53)	(-0.00)	(-0.63)	(-1.12)	(-1.06)
R^2	0.32	0.31	0.30	0.29	0.31	0.31

F-Stat	34.38	32.85	28.26	24.50	25.00	17.17
Observations	504	480	456	432	408	408

Notes: The data was estimated using panel data OLS regressions.* denotes significance at the 10 percent level, while ** and *** denotes significance at the 5 and 1 percent levels respectively;t statistics in parentheses was computed with heteroskedasticiy and auto-correlation robust standard errors. The dependent (top 1%) and independent (industry value added - lagged by three to seven years) variables are in natural logarithm. Time span:1995-2018.

Appendix

Table 15

FEI First Stage IV and Reduced Form Results (top 1%)

Measure of FEI	MVA	SVA	IVA	Education Expenditure	
Measure of Income Inequality					Top 1%
Lcreditprivate	0.0826***	0.0020	0.0931***	0.2321***	0.1571***
	(3.20)	(0.25)	(5.03)	(6.68)	(7.97)
lgdppc	0.5129**	0.2104**	0.8419***	-0.2970	-0.2060
	(2.73)	(2.44)	(5.26)	(-1.03)	(0.95)
slgdppc	-0.0399***	-0.0083	-0.0498***	0.0185	0.0243*
	(-2.99)	(-1.59)	(-5.16)	(1.07)	(1.83)
Civilwar	-0.0183**	0.0088	-0.0159***	-0.0330	0.0330***
	(-3.24)	(3.40)	(-3.32)	(-3.66)	(5.25)
Fdi	0.0025	-0.0002	-0.0014**	0.0004	0.0011
	(1.36)	(-0.62)	(-2.14)	(0.23)	(0.41)
Govt_exp	-0.0180	0.0110***	-0.0343***	0.0640***	-0.0132***
	(-5.09)	(8.76)	(-12.46)	(15.76)	(-4.05)
Global_index	-0.07***	-0.0041***	0.0038**	-0.0045**	-0.0181
	(-2.59)	(-7.84)	(2.62)	(-2.36)	(-10.58)
Inflation	0.0023***	-0.0013***	-0.0029**	-0.0002	-0.0010
	(2.81)	(-3.02)	(-2.59)	(-0.13)	(-0.91)
Stat Cap Score lag2	0.0064***	-0.0001	0.0052***	0.0002	0.0051***
	(5.02)	(-0.22)	(3.88)	(0.10)	(4.41)
R^2	0.30	0.44	0.46	0.58	0.33
Observations	504	504	504	504	528

Notes: First stage (column one, two, three and four) and reduced form results (column five) of the instrument [the statistical capacity score (overall average)].* denotes significance at the 10 percent level, while ** and *** denotes significance at the 5 and 1 percent levels respectively;t/z statistics in parenthesis are computed with heteroskedasticity and auto-correlation robust standard errors. The Statistical capacity score (overall average) is lagged by two years. Time span:1995-2018.

Table 16

FEI First Stage IV and Reduced Form Results (top 10%)

Measure of FEI	MVA	SVA	IVA	Education Expenditure	
Measure of Income Inequality					Top 10%
Lcreditprivate	0.0826***	0.0020	0.0931***	0.2321***	0.1070***
	(3.20)	(0.25)	(5.03)	(6.68)	(9.48)
lgdppc	0.5129**	0.2104**	0.8419***	-0.2970	0.2702**
	(2.37)	(2.44)	(5.26)	(-1.03)	(2.08)
slgdppc	-0.0399***	-0.0083	-0.0498***	0.0185	-0.0107
	(-2.99)	(-1.59)	(-5.16)	(1.07)	(-1.33)
Civilwar	-0.0183***	0.0088***	-0.0159***	-0.0330***	0.0079**
	(-3.24)	(3.40)	(-3.32)	(-3.66)	(2.31)
Fdi	-0.0025	-0.0002	-0.0014**	0.0004	-0.0003
	(-1.36)	(-0.62)	(-2.14)	(0.23)	(-0.25)
Govt_exp	-0.0180***	0.0110***	-0.0343***	0.0640***	-0.0100***
	(-5.09)	(8.76)	(-12.46)	(15.76)	(-5.48)
Global_index	0.0152***	-0.0041***	0.0038**	-0.0045**	-0.0129***
	(10.52)	(-7.84)	(2.62)	(-2.36)	(-12.45)
Inflation	0.0023***	-0.0012***	0.0029**	-0.0002	-0.0009
	(2.81)	(-3.02)	(2.59)	(-0.13)	(-1.44)
Stat Cap Score lag2	0.0064***	-0.0001	0.0052***	0.0002	0.0008
	(5.02)	(-0.22)	(3.88)	(0.10)	(1.26)
R^2	0.30	0.44	0.45	0.58	0.36
Observations	504	504	504	504	528

Notes: First stage (column one, two, three and four) and reduced form results (column five) of the instrument [the statistical capacity score (overall average)].* denotes significance at the 10 percent level, while ** and *** denotes significance at the 5 and 1 percent levels respectively;t/z statistics in parenthesis are computed with heteroskedasticity and auto-correlation robust standard errors. The Statistical capacity score (overall average) is lagged by two years. Time span:1995-2018.

Table 17

FEI First Stage IV and Reduced Form Results (Gini Index)

Measure of FEI	MVA	SVA	IVA	Education Expenditure	
Measure of Income Inequality					Gini Index
Lcreditprivate	0.0826***	0.0020	0.0931***	0.2321***	0.0435***
	(3.20)	(0.25)	(5.03)	(6.68)	(3.54)
lgdppc	0.5129**	0.2104**	0.8419***	-0.2970	0.4471***
	(2.37)	(2.44)	(5.26)	(-1.03)	(3.46)
slgdppc	-0.0399***	-0.0083	-0.0498***	0.0185	-0.0185**
	(-2.99)	(-1.59)	(-5.16)	(1.07)	(-2.32)
Civilwar	-0.0183***	0.0088***	-0.0159***	-0.0330***	-0.0001
	(-3.24)	(3.40)	(-3.32)	(-3.66)	(-0.04)
Fdi	-0.0025	-0.0002	-0.0014**	0.0004	-0.0003
	(-1.36)	(-0.62)	(-2.14)	(0.23)	(-0.170
Govt_exp	-0.0180***	0.0110***	-0.0343***	0.0640***	-0.0022
	(-5.09)	(8.76)	(-12.46)	(15.76)	(-1.02)
Global_index	0.0152***	-0.0041***	0.0038**	-0.0045**	-0.0165
	(10.52)	(-7.84)	(2.62)	(-2.36)	(-12.74)
Inflation	0.0023***	-0.0012***	0.0029**	-0.0002	-0.0025***
	(2.81)	(-3.02)	(2.59)	(-0.13)	(-3.83)
Stat Cap Score lag2	0.0064***	-0.0001	0.0052***	0.0002	-0.0004
	(5.02)	(-0.22)	(3.88)	(0.10)	(-0.50)
R^2	0.30	0.44	0.45	0.58	0.34
Observations	504	504	504	504	528

Notes: First stage (column one, two, three and four) and reduced form results (column five) of the instrument [the statistical capacity score (overall average)].* denotes significance at the 10 percent level, while ** and *** denotes significance at the 5 and 1 percent levels respectively;t/z statistics in parenthesis are computed with heteroskedasticity and auto-correlation robust standard errors. The Statistical capacity score (overall average) is lagged by two years. Time span:1995-2018.

Table 18

FEI First Stage IV and Reduced Form Results (Top 1%) Robustness Check

Measure of FEI	MVA	SVA	IVA	Education Expenditure	
Measure of Income Inequality					Top 1%
Lcreditprivate	0.2023***	0.0141	0.1142***	0.3129***	0.1454***
	(3.70)	(0.87)	(2.84)	(5.46)	(5.98)
lgdppc	0.1388	0.2544*	0.0542	-0.4728	-0.5871**
	(0.41)	(1.82)	(0.20)	(-1.06)	(-2.22)
slgdppc	-0.0180	-0.0124	0.0047	0.0247	0.0426**
	(-0.83)	(-1.40)	(0.28)	(0.88)	(2.49)
Civilwar	-0.0233***	0.0067**	-0.0198***	-0.0444***	0.0236***
	(-3.63)	(2.31)	(-3.97)	(-4.75)	(3.79)
Fdi	-0.0054	-0.0023	-0.0039	0.0243**	0.0236***
	(-0.77)	(-0.89)	(-0.80)	(2.04)	(2.93)
Govt_exp	-0.0256***	0.0122***	-0.0180***	0.0786***	-0.0022
	(-4.02)	(5.89)	(-5.09)	(12.20)	(-1.02)
Global_index	0.0094***	-0.0041***	-0.0014	-0.0092**	-0.0119***
	(4.03)	(-7.84)	(-0.77)	(-2.47)	(-6.44)
Inflation	-0.0007	-0.0010*	0.0050***	-0.0001	-0.0078***
	(-0.43)	(-1.71)	(3.35)	(-0.02)	(-5.25)
Stat Cap Score lag2	0.0113***	-0.0001	0.0092***	0.0021	0.0033**
	(6.93)	(-0.24)	(7.02)	(0.91)	(2.34)
R^2	0.36	0.40	0.52	0.71	0.28
Observations	315	315	315	315	330

Notes: First stage (column one, two, three and four) and reduced form results (column five) of the instrument [the statistical capacity score (overall average)].* denotes significance at the 10 percent level, while ** and *** denotes significance at the 5 and 1 percent levels respectively;t/z statistics in parenthesis are computed with heteroskedasticity and auto-correlation robust standard errors. The Statistical capacity score (overall average) is lagged by two years. This result is for the fifteen less developed emerging markets only. Time span:1995-2018.

Figures

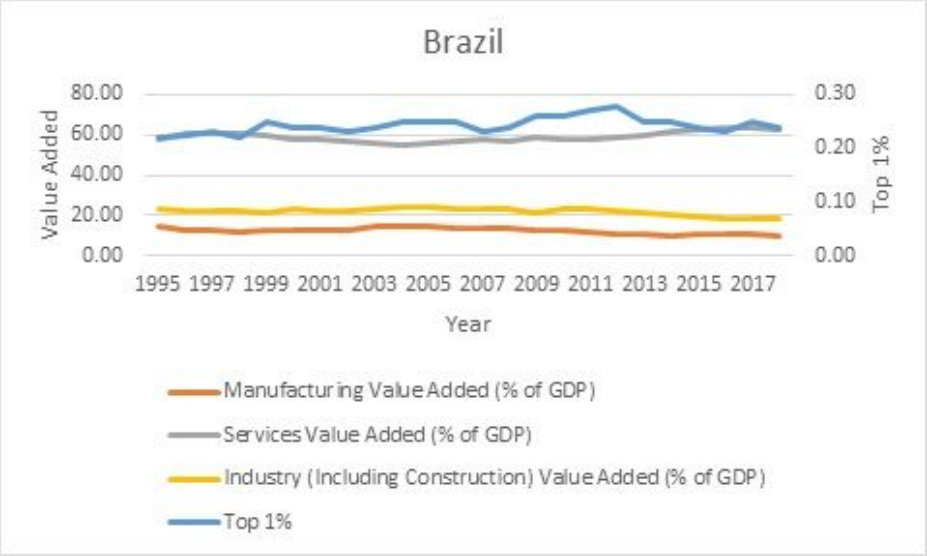

Figure 1

Data from select countries - Brazil

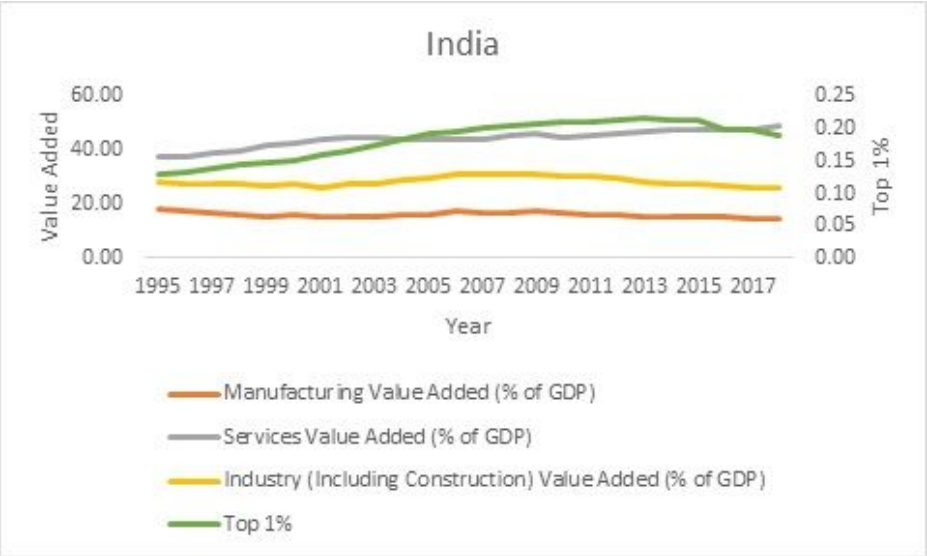

Figure 2

Data from select countries - India

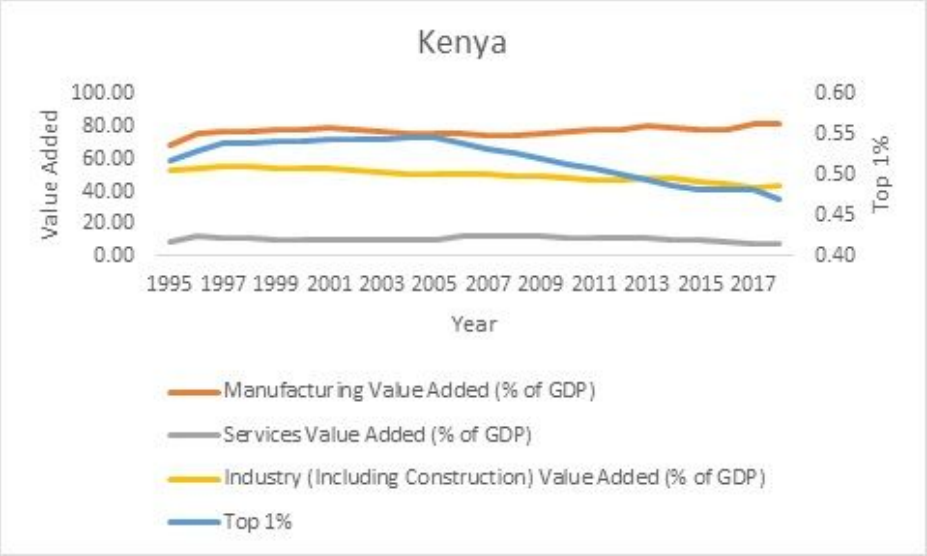

Figure 3

Data from select countries - Kenya

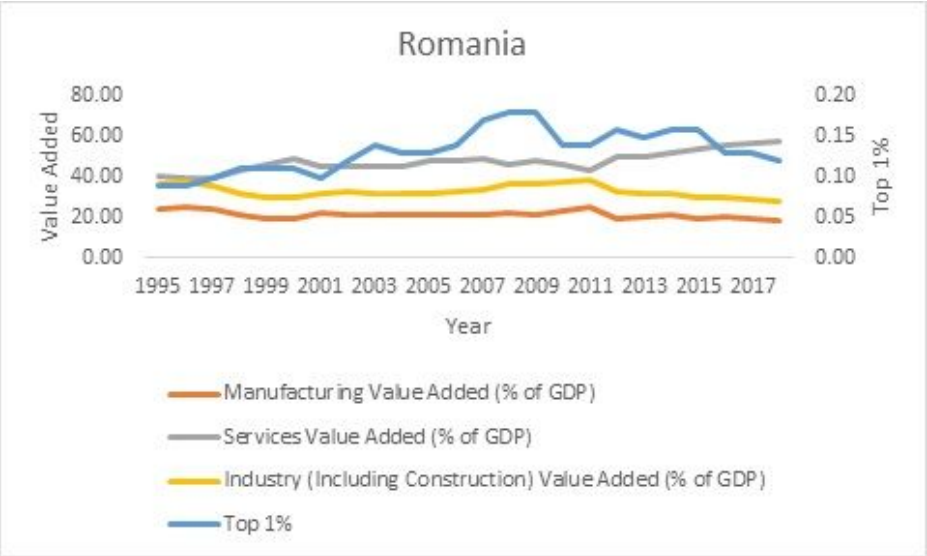

Figure 4

Data from select countries - Romania

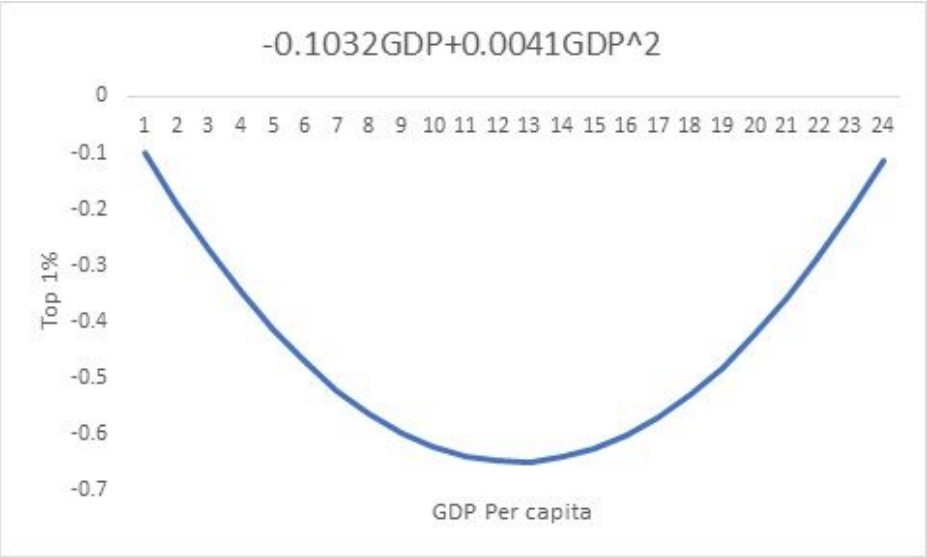

Figure 5

Top income inequality and FEI Inverse Kuznets Curve Illustration. Notes: Inverse Kuznets Curve illustration for SVA as a measure of FEI, 2003-2018. Data was extracted from the panel data fixed effects regression (Table 4)

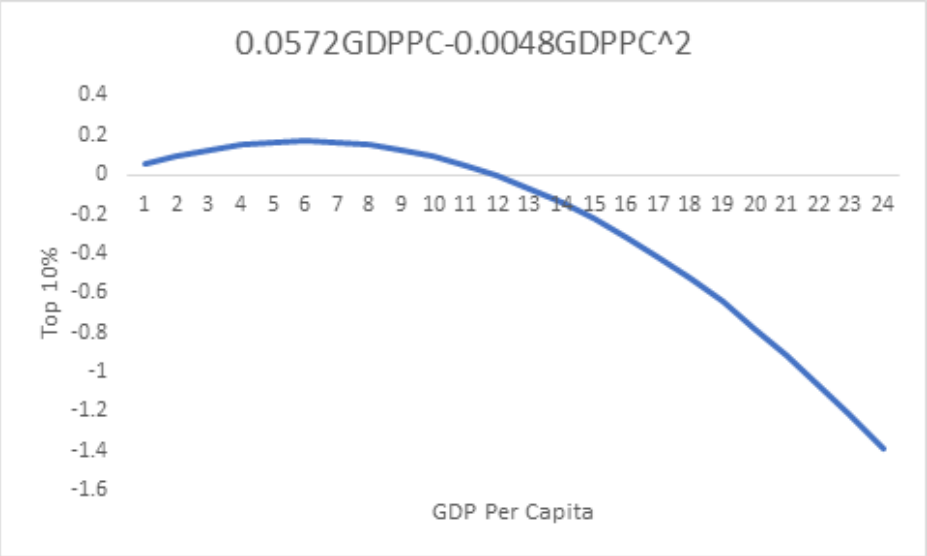

Figure 6

Top income inequality and FEI Kuznets Curve Illustration. Notes: Inverse Kuznets Curve illustration for SVA as a measure of FEI, 1995-2018. Data was extracted from the panel data fixed effects regression (Table 5)

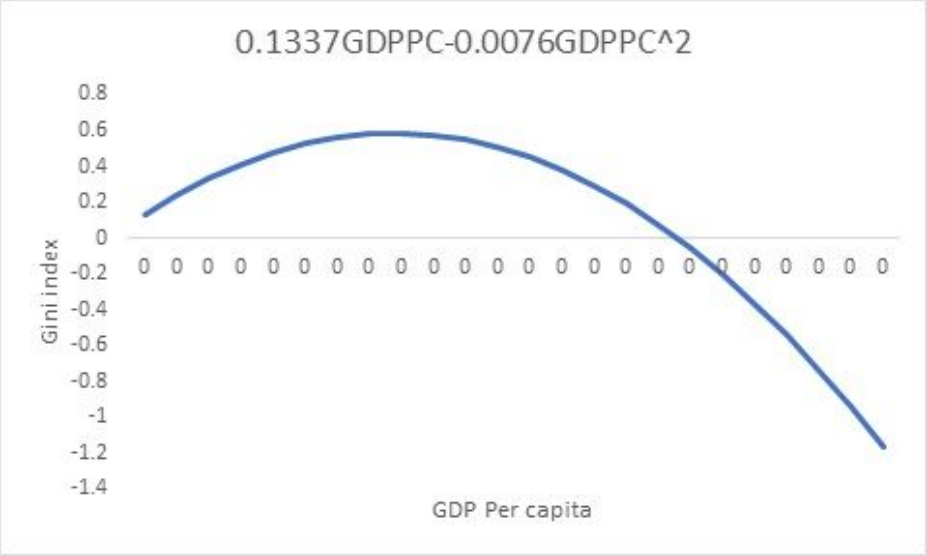

Figure 7

Top income inequality and FEI Kuznets Curve Illustration. Notes: Inverse Kuznets Curve illustration for SVA as a measure of FEI, 1995-2018. Data was extracted from the panel data fixed effects regression (Table 6)