Resources Policy 119 (2026) 105966

Contents lists available at ScienceDirect

Resources Policy

journal homepage: www.elsevier.com/locate/resourpol

Does oil and gas dependence offset the inequality-reducing effects of financial development? A comparative analysis of oil- and gas-dependent and non-dependent economies

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ARTICLE INFO

Keywords:
Resource curse
Financial development
Inequality
Income inequality
Natural resource rents
Oil and gas rents

ABSTRACT

This study investigates the contrasting impact of financial development on inequality in oil and gas-dependent countries compared to more diversified economies. The sample consists of developed and developing countries, with cross-sectional data averaged over the period 2013 to 2019. To ensure the robustness of the results and address potential endogeneity, the analysis employs a Two-Stage Least Squares (2SLS) approach, using creditor legal rights and the depth of credit information as instrumental variables. The findings reveal three main insights. First, oil and gas dependency, despite its direct inequality-reducing effect, weakens the equalizing role of financial development, leading to greater inequality in oil and gas-dependent countries, and this pattern is robust across institutional and income-level groups. Second, the diminished inequality-reducing effect of financial development in oil and gas-dependent countries, especially in higher and middle-institutional-quality, and higher-income countries, is driven by disruptions in the mechanisms through which financial development typically reduces inequality—namely, entrepreneurship and human capital. However, in lower-income, low-institutional-quality economies this pattern is more closely associated with broader resource-curse distortions. Third, beyond the effect of oil and gas dependency, this study contributes to the financial development-inequality literature by empirically documenting that the inequality-increasing and inequality-reducing mechanisms of financial development proposed in the theoretical literature can coexist. These Findings deepen our understanding of the channels through which financial development affects inequality in general and under the resource curse.

1. Introduction

The relationship between financial development and income inequality is a controversial topic in development economics due to competing theoretical predictions and mixed empirical evidence. Nevertheless, a dominant strand of the theoretical literature argues that financial development can help reduce income inequality by expanding access to financial services, facilitating investment in education (Galor and Moav, 2004; Galor and Zeira, 1993), and supporting enterprises (Aghion and Bolton, 1997; Banerjee and Newman, 1993; Greenwood and Jovanovic, 1990; Townsend and Ueda, 2006). This perspective is empirically supported by numerous studies (Beck et al., 2007; Clarke et al., 2006; Hamori and Hashiguchi, 2012; Kappel, 2010; Meniago and Asongu, 2018; Zhang and Naceur, 2019). However, these effects and their underlying mechanisms do not operate uniformly and may be weakened or disrupted in certain contexts, arguably an important reason for the diverging results across countries (see Appendix C for a review of the related literature).

This paper puts forward the hypothesis that financial development has a distinct effect on inequality in oil and gas-dependent countries. Although these countries face a financial resource curse, reflected in lower levels of financial development compared to other economies (Asif et al., 2020; Beck, 2011; Dogan et al., 2020; Nili and Rastad, 2007; Umar et al., 2021), this repressed financial development, in contrast to

This paper is based on the first author's Ph.D. thesis in the Graduate School of Management and Economics, Sharif University of Technology, conducted under the supervision of the second and third authors.

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https://doi.org/10.1016/j.resourpol.2026.105966
Received 13 August 2025; Received in revised form 4 December 2025; Accepted 29 May 2026
Available online 8 June 2026

most countries, does not necessarily promote a more equitable income distribution. Fig. 1 presents scatter plots illustrating the relationship between financial development and inequality, separately for oil and gas-dependent and non-dependent groups, using four financial development measures. The descriptive plots suggest a distinct pattern in the relationship for oil and gas-dependent countries compared to non-dependent ones.

The analysis in this paper is grounded in the literature on financial development and inequality, as well as the resource curse and the adverse consequences of dependence on natural resources. Within the financial development–inequality literature, investment in entrepreneurship and human capital are identified as key channels through which financial development reduces inequality. However, in resource-dependent countries, these channels are weakened or disrupted. Distorted incentives divert entrepreneurial talent into rent-seeking, crowd out productive investment, and diminish incentives for human capital accumulation.

The entrepreneurship mechanism posits that as the economy grows, access to financial services expands, which enables more individuals to start businesses, thereby diversifying income sources and creating new employment opportunities (Greenwood and Jovanovic, 1990). Moreover, financial development weakens credit constraints, enabling more lower-income individuals to engage in entrepreneurial activities and seize opportunities that were previously beyond their reach due to financial barriers (Banerjee and Newman, 1993).

The entrepreneurship channel is a central pathway through which financial development affects inequality. However, in oil and gas-dependent economies this channel is weakened by three mechanisms. First, resource windfalls can divert entrepreneurial talent toward unproductive rent-seeking (Torvik, 2002; Mehlum et al., 2006). In the absence of strong institutional constraints on rent extraction, potential entrepreneurs shift away from productive activity; while robust institutions can prevent this outcome, weak institutions make entrepreneurship less attractive even when finance is not binding (Mehlum et al., 2006). Second, the voracity effect (Lane and Tornell, 1996; Tornell and Lane, 1999) shifts windfall wealth toward powerful groups. Governments may use coercive power to pull resources from the private sector through taxes, embezzlement, or bribes. This slows capital accumulation, weakens investment incentives, and pushes funds into safer but less productive assets. As a result, high return entrepreneurial investment declines.

Third, the weakening of property rights due to rent-seeking, as discussed by Hodler (2006), further disrupts the entrepreneurship mechanism. Windfall wealth can erode property rights in non-resource sectors, particularly as the number of powerful groups increases. In such contexts, potential entrepreneurs would be less motivated, which leads to undermining the entrepreneurship mechanism. Property rights are, in fact, one of the key institutional factors behind low entrepreneurial activity in resource-dependent countries, and if judicial systems are stronger, this adverse effect on entrepreneurship can be avoided (Awoa et al., 2024). Empirical studies have confirmed that in resource-dependent countries, natural resource rents tend to suppress productive entrepreneurship, particularly in settings characterized by weak institutions, limited economic freedom, or pervasive corruption, as shown in the works of Awoa et al. (2022), Medase et al. (2023) and Yao and Li (2023).

Another important and well-known channel through which financial development affects inequality is the human capital channel. The human capital mechanism explains that financial development alleviates credit constraints, enabling broader investment in education. This expansion in access to education allows individuals from lower-income groups to acquire human capital, thereby improving income opportunities and reducing inequality over time. This effect becomes particularly important as the relative role of human capital compared to physical capital as the primary driver of economic growth increases (Galor and Moav, 2004; Galor and Zeira, 1993).

The human capital channel assumes that financial development promotes investment in human capital, thereby reducing inequality. However, in resource-dependent countries, factors such as Dutch disease and the crowding out of entrepreneurship by rent-seeking reduce returns to human capital. Unlike industrialization, which raises demand for skilled labor and encourages education, resource-rich economies often lack a strong industrial base and develop capital-intensive sectors that fail to reduce inequality. Afzal et al. (2023), Blanco and Grier (2012) and Gylfason (2001) find that resource abundance weakens both private and public incentives to invest in human capital.

This study focuses specifically on oil and gas as the primary natural resources of interest. Compared to other resources, oil and gas are highly concentrated both geographically and in terms of control by states or monopolies. As a result, they are more likely to fuel rent-seeking behavior, intensify the voracity effect, and contribute to the erosion of property rights, a pattern widely recognized in the literature on point-based resources (see Badeeb et al., 2017).[1] Cross-country data also show that levels of entrepreneurship and human capital are generally lower in countries heavily reliant on oil and gas (see Figure A- 1 to Figure A- 3 in Appendix A). Accordingly, the commonly observed decreasing effect of financial development on inequality is expected to be undermined in such economies, which may not benefit from the typical inequality-reducing effects of financial development.

In this paper, using cross-sectional data from developed and developing countries, averaged over the period 2013–2019, we examine how oil and gas dependency influences the relationship between financial development and inequality. To address potential endogeneity concerns and ensure identification of causal relationships, we apply a Two-Stage Least Squares (2SLS) approach with instrumental variables drawn from the Law and Finance and Information and Finance literature (Beck et al., 2003; La Porta et al., 1998). These theories provide strong conceptual foundations for selecting valid instruments, including legal rights of creditors and credit information indices, which affect financial development but plausibly influence inequality only through financial channels.

Our results show that in countries where oil and gas rents (as a percentage of GDP) exceed a certain threshold, higher levels of financial development are associated with increased income inequality. To demonstrate this effect, we control for the direct impact of oil and gas dependency on inequality. A high share of oil and gas rents in the economy directly reduces inequality, but its indirect effect through the channel of financial development increases inequality. As a result, in oil and gas-dependent countries where financial development exceeds a certain threshold, the indirect effect through financial development dominates the direct effect, ultimately leading to higher inequality. Hence, the interaction between oil and gas dependency and financial development amplifies inequality, which constitutes the key contribution of this study.

We also test whether the observed difference in the effect of financial development on inequality between oil and gas-dependent and other countries is driven by the breakdown of the two main mechanisms —entrepreneurship and human capital—using proxies such as lagged tertiary enrollment, manufacturing value added (% of GDP), and technology absorption. Our results show that controlling for these mechanisms eliminates the observed difference, which represents another key

[1] Oil and gas are typically concentrated in specific regions and controlled by governments or monopolies, leading to revenue centralization and competition among powerful groups. In contrast, mineral resources are more dispersed and extracted by multiple firms, reducing state control and rent-seeking. Oil and gas extraction also requires large capital and advanced technology, limiting SME participation and concentrating wealth further. Their revenues are large and volatile, with global price shocks generating windfalls that intensify group competition. Given these distinctive features, this paper focuses on oil and gas among natural resources.

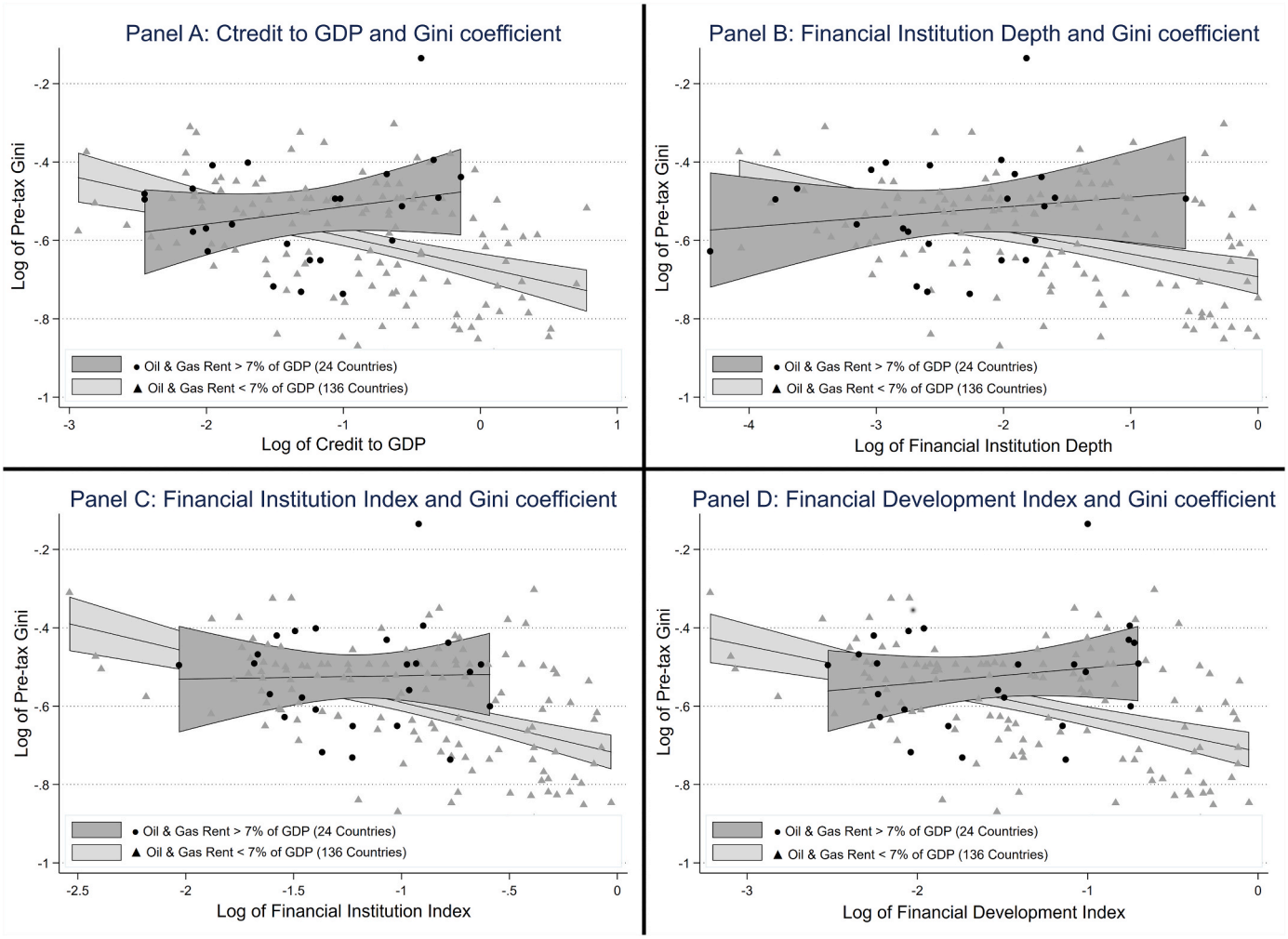

Fig. 1. Financial development and inequality in oil and gas-dependent vs. other countries; average over 2013–2019. **Note:** The figures illustrate a negative relationship between financial development and inequality in non–oil and gas dependent countries, whereas such a relationship is not observed among oil and gas-dependent countries. The vertical axis shows the average log Gini coefficient, and the horizontal axis shows the average log of four financial development indicators, both averaged over the period 2013–2019. Dependence on oil and gas is measured by the ratio of oil and gas rents to GDP, and the 7 percent threshold is the lowest value at which this distinction becomes clearly observable. Oil and gas rents refer to the difference between the value of production at international market prices and total production costs. The financial development indicators used are: Panel A – domestic credit to the private sector by banks (World Bank); Panel B – Financial Institutions Depth Index (credit, pension, mutual funds, insurance as % of GDP); Panel C – Financial Institutions Index (depth, access, efficiency); and Panel D – Financial Development Index, combining institutional and market components (IMF, Panels B–D).

contribution of our study. Prior literature, particularly Rajan and Zingales (2003), links the uneven outcomes of financial development to weak institutional quality and often stops at this general diagnosis. While the failure of entrepreneurship and human capital mechanisms in these contexts can be associated with institutional fragility, our analysis advances this perspective by identifying the specific channels through which institutional quality shapes the relationship between financial development and inequality. Moreover, our heterogeneity analysis suggests that in higher-income and higher-institutional-quality settings this operates mainly through the weakening of entrepreneurial and human-capital channels, in a way that is consistent with a reallocation of talent from productive entrepreneurial activity toward rent-seeking, whereas in low-income, low-institutional-quality countries the pattern instead points to voracity-type dynamics and elite capture of financial resources.

In addition, our results show that the negative effect of financial development on inequality is significant only when using credit to GDP as a measure. For broader indicators, such as financial depth, the financial institutions index, and financial development index, the effect becomes statistically insignificant. This finding aligns with theoretical literature suggesting that financial development operates through both inequality-reducing and inequality-increasing mechanisms.[2] Based on our findings, once we control for the entrepreneurship and human capital mechanisms, which are the channels through which financial development reduces inequality, the effect of financial development on inequality turns positive. In other words, without controlling for these two mitigating mechanisms, the coefficient of financial development becomes statistically insignificant due to the offsetting influence of both types of mechanisms. However, once the mitigating channels are

[2] Inequality-enhancing mechanisms have been discussed in the literature, including the following: financial development can worsen inequality in imperfect credit markets, as the wealthy have easier access to credit and investment opportunities, while the poor remain constrained (Aghion and Bolton, 1997; Beck et al., 2007; Galor and Moav, 2004; Greenwood and Jovanovic, 1990). It may also increase financial instability, which disproportionately affects the poor due to their limited assets (Rajan, 2011). Furthermore, it can accelerate skill-biased technological change, raising demand for skilled labor and reducing opportunities for the unskilled, thereby widening wage gaps (Acemoglu, 2002; Autor et al., 2003).

accounted for, only the positive (inequality-increasing) effect remains.

The remainder of the paper is organized as follows; Section 2 describes the data and variables used in the analysis, explaining the datasets, outlines the econometric methodology, and discusses the identification strategy. Section 3 presents the empirical results and discussion and Finally Section 4 offers a conclusion.

2. Data and methodology

This section introduces the data, details the econometric approach, and elaborates on the identification strategy.

2.1. Data description

In this study, we utilize cross-sectional data from developed and developing countries, averaged over the period 2013 to 2019. Since our variables are fundamentally developmental and the mechanisms under consideration operate over time, we are not interested in short-term changes. Therefore, using average data is appropriate for our analysis.

Income inequality. we employ the pre-tax Gini coefficient, derived from household income data available in the World Inequality Database (WID.world), a prominent resource widely utilized in academic research on income and wealth inequality.[3] The choice of the pre-tax Gini coefficient aims to examine the direct impact of financial development on income inequality by capturing inequality before taxes and transfers, thereby abstracting from the effects of government fiscal policy.

Financial development index. We measure financial development by four indices. First, domestic credit to private sector by banks, which refers to financial resources provided to the private sector by deposit taking corporations (except central banks) and the source of the data is World Bank. Second, Financial Institutions Depth index, which compiles data on bank credit to the private sector in percent of GDP, pension fund assets to GDP, mutual fund assets to GDP, and insurance premiums, life and non-life to GDP. Third, Financial Institutions index, which is an aggregate of Financial Institutions Depth index, Financial Institutions Access index, which compiles data on bank branches per 100,000 adults and ATMs per 100,000 adults, and Financial Institutions Efficiency index, which compiles data on banking sector net interest margin, lending-deposits spread, non-interest income to total income, overhead costs to total assets, return on assets, and return on equity. Fourth, Financial Development index is a relative ranking of countries on the depth, access, and efficiency of their financial institutions and financial markets. It is an aggregate of the Financial Institutions index and the Financial Markets index. Financial Markets index is an aggregate of Financial Markets Depth index, Financial Markets Access index, and Financial Markets Efficiency index. The last three indices are developed and published by the International Monetary Fund (IMF).

Oil and gas dependency index. We employ the index of the "Oil and gas rents to GDP" ratio, which measures the difference between the value of crude oil and natural gas production at world prices and their total costs of production. This metric can effectively capture the economic value generated from oil and gas production relative to the overall size of the economy and highlight the extent to which a country's economy relies on oil and gas resources. A high level of oil and gas rents as a percentage of GDP reflects significant dependency on these resources for several reasons. First, it indicates that a large share of economic activity relies on extraction and sales in this sector, making the economy vulnerable to its performance. Second, government revenues in such countries often heavily depend on oil and gas, which can lead to fiscal instability when global prices fluctuate. Third, high reliance on resource rents is typically associated with limited investment in other sectors, reducing economic diversification and reinforcing the so-called "resource curse," which hampers innovation and broader development. Table 1 presents countries that, based on the average oil and gas rents from 2013 to 2019, were above 10 percent. This index categorizes these countries as highly dependent on oil and gas resources during the mentioned period.

Control variables. We control for several other variables that have been previously identified as determinants of inequality: real GDP per capita and its square, subsidies and other transfers (% of government expense), trade openness, and inflation. All data are sourced from the World Bank. Based on the Kuznets Curve, proposed by economist Simon Kuznets, there is an inverted U-shaped relationship between income inequality and economic development (measured by GDP per capita). This suggests that while economic growth initially exacerbates inequality, it eventually contributes to its reduction as the benefits of development become more widely shared.

To investigate the mechanisms of human capital and entrepreneurship, we utilize data on 'Tertiary Enrollment rate' and 'Manufacturing value added (annual growth)', both sourced from the World Bank. To provide a more nuanced understanding of the impact of entrepreneurship, we also incorporate 'technology absorption' a sub-indicator from the Global Entrepreneurship Index (GEI), published by the Global Entrepreneurship and Development Institute (GEDI), ensuring a comprehensive capture of the entrepreneurial landscape.

To examine heterogeneity across countries with different institutional quality, we use the World Bank's Worldwide Governance Indicators (WGI). The WGI provide comparable measures on six key dimensions of governance (voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption). This dataset is widely used as the benchmark cross-country measure of institutional quality due to its broad coverage, consistent methodology, and reliance on multiple underlying data sources.

Table 1
Countries with oil and gas rents-to-GDP ratios higher than 10%.

Rank	Country Name	Oil and Gas Rents-to-GDP	Rank	Country Name	Oil and Gas Rents-to-GDP
1	Timor-Leste	67%	12	Brunei Darussalam	21%
2	Kuwait	43%	13	Angola	21%
3	Iraq	40%	14	Turkmenistan	19%
4	Libya	39%	15	Gabon	19%
5	Saudi Arabia	31%	16	Algeria	19%
6	Oman	30%	17	United Arab Emirates	18%
7	Congo, Rep.	29%	18	Iran, Islamic Rep.	18%
8	Equatorial Guinea	25%	19	Chad	15%
9	Qatar	24%	20	Venezuela, RB	14%
10	Syrian Arab Republic	22%	21	Kazakhstan	13%
11	Azerbaijan	22%	22	Russian Federation	11%

Source: Authors' calculations based on World Bank time-series data. average over 2013–2019.

[3] Several recent studies have relied on the Standardized World Income Inequality Database (SWIID) for cross-country analyses of income inequality. However, this study employs the World Inequality Database (WID.world), which offers more granular and transparent data, particularly on top income and wealth shares—critical for assessing the distributional effects of financial development. WID.world integrates national accounts, tax records, and household surveys, providing a robust methodological foundation and ensuring cross-country comparability. While SWIID benefits from broader coverage, its reliance on imputation for missing data may introduce uncertainty and limits its accuracy in capturing top income distributions. Moreover, SWIID lacks data for several key oil-dependent countries. Given the goals of this study, WID.world is preferred for its methodological rigor and detailed breakdown of income.

2.2. Empirical model and estimation procedure

We employ the specification of Equation (1) to discern the differential effects of financial development on inequality between oil and gas-dependent and non-dependent countries.

$$Gini_i = \beta_0 + \beta_1 FD_i + \beta_2 D_i + \beta_3 (D_i * FD_i) + \theta X_i + \varepsilon_i \quad (1)$$

Where $Gini_i$ is the pre-tax Gini coefficient, FD_i is the financial development index, and X_i is a set of control variables extracted from the literature which includes GDP per capita and its square to capture the Kuznets hypothesis, subsidy and transfers (% Of government expense) to capture indirect Effects of Fiscal Policy on Inequality, inflation, openness index (trade), as discussed in the data section.

We further add the tertiary enrollment rate, manufacturing value added (% of GDP), and a measure of technology absorption as controls to test whether accounting for these mechanisms changes the estimated effect of financial development on inequality. Countries are stratified into oil and gas-dependent and non-dependent groups using the dummy variable D_i, which is defined based on different thresholds of the ratio of oil and gas rents to GDP.

The coefficient β_1 denotes the direct effect of financial development on inequality, which, based on the mechanisms introduced in the literature, this effect can be either negative or positive. The coefficient β_2 represents the direct effect of oil and gas rents on inequality. The coefficient β_3, associated with the interaction term, illustrates how changes in oil and gas rents influence the relationship between financial development and inequality.

Based on the model, for oil and gas non-dependent countries ($D_{OG} = 0$), equation (1) reduces to $G_0 = \beta_0 + \beta_1 \overline{F} + \theta X$, whereas for oil and gas-dependent countries ($D_{OG} = 1$), it takes the form $G_1 = \beta_0 + \beta_1 \overline{F} + \beta_2 + \beta_3 \overline{F_1} + \theta X$. Therefore, the difference in inequality levels between the two groups of countries will be $G_1 - G_0 = \beta_2 + \beta_3 \overline{F_1}$. Under the assumption that β_2 and β_3 are positive and statistically significant, Fig. 1 illustrates the expected positions of G_0 and G_1 for oil and gas-dependent and non-dependent countries.

In Fig. 2, β_2 represents the average difference in the Gini coefficient between the two groups of countries. The vertical distance between the two lines at any given point corresponds to $\beta_2 + \beta_3 \overline{F_1}$. This visual representation helps to illustrate the differential impact of financial development on inequality between oil and gas-dependent and non-dependent countries.

In addition to the dummy variable, we will also use continuous data on the ratio of oil and gas rents to GDP to examine our hypothesis. For this purpose, we employ the specification of Equation (2) to examine the effect of dependence on oil and gas on the relationship between financial development and inequality:

$$Gini_i = \beta_0 + \beta_1 FD_i + \beta_2 OGR_i + \beta_3 (OGR_i * FD_i) + \theta X_i + \varepsilon_t \quad (2)$$

Where all variables and the model are consistent with the previous one; however, instead of using a dummy variable, we employ a continuous variable of the ratio of oil and gas rents to GDP (OGR_i).

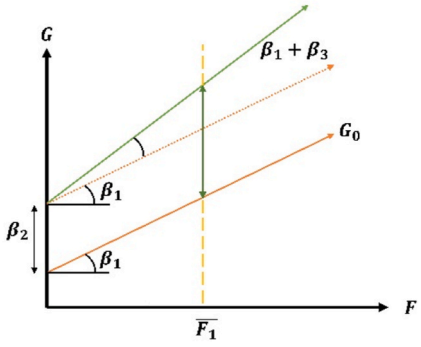

Fig. 2. Hypothetical figure of the Gini coefficient in oil and gas-dependent and non-dependent countries. **Note:** the line labeled G_1 is assumed to represent the relationship between financial development and inequality in oil and gas-dependent countries, while the line labeled G_0 corresponds to non-dependent countries. The vertical distance between the two lines indicates the inequality gap at each level of financial development.

2.3. Identification

To examine the effect of oil and gas dependence on the relationship between financial development and inequality, it is essential to consider the causal effect of financial development on inequality. Therefore, to obtain reliable results, the potential endogeneity arising from reverse causality or unobserved and omitted variables must be properly addressed.

Inequality may hinder financial development through several channels. One key mechanism is the low investment of the poor in health and education, especially in low-income countries, which reduces human capital—a crucial driver of financial development (Galor and Moav, 2004). This, in turn, lowers labor productivity and economic growth, further impeding financial development (Stiglitz, 2012). Inequality may also lead to policies that are harmful to growth and financial development, as it reduces incentives for reforms such as liberalization, subsidy cuts, and globalization (Claessens and Perotti, 2007). On the other hand, some theories argue that inequality can promote financial development by encouraging investment in human capital, innovation, and entrepreneurship, particularly where education is efficient and wage gaps are high (Galor and Zeira, 1993). Hence, a bidirectional relationship between financial development and inequality is plausible and should be considered in the model.

In addition to the issue of reverse causality, omitted variables—such as government interventions, political institutions, geography, and culture—may simultaneously affect financial development and inequality, leading to potential endogeneity in the model. To address the issue of endogeneity, employing instrumental variables is a common approach. These instruments should be strong predictors of financial development, with their only causal impact on inequality operating through financial development.

Several theories propose factors affecting financial development that can be used to solve endogeneity problems. The "Law and Finance" theory, introduced by La Porta et al. (1998, 1997), posits those legal systems supporting investor and creditor rights lead to financial development. They found that common law systems provide the best basis for financial development and economic growth, followed by Scandinavian and German civil law, with French civil law performing the worst. In terms of law enforcement quality, German civil law ranks highest, while French civil law performs poorly. Beck et al. (2003) expanded on this theory with the "Dynamic Law and Finance Theory," arguing that common law systems, due to their flexibility, can adapt to meet the financial sector's needs, supporting financial development. In contrast, French civil law is inflexible and struggles to stimulate financial development.

The "Information and Finance" theory, by Jaffee and Russell (1976) emphasizes the importance of information about borrowers' credit histories for lenders to optimally grant credit and develop the financial sector. Jappelli and Pagano (2002) noted that some countries achieve financial development through legal support for creditors, while others rely on registered credit records. Djankov et al. (2007) studied both the "Law and Finance" and "Information and Finance" theories using data from 129 countries, finding that legal systems and credit information disclosure significantly affect financial development. Common law countries tend to support creditors through legal and enforcement means, while French civil law countries emphasize credit records.

Building on the previously discussed theoretical frameworks, we address endogeneity using instrumental variables derived from the 'Law

and Finance' and 'Information and Finance' approaches. Some empirical studies have used the legal system as an instrumental variable for financial development. Although La Porta et al. (1998) introduced legal system and law quality-related indicators as factors influencing governance quality, the legal system may also affect inequality through alternative channels, such as labor market conditions. To address this issue, we use the index of creditor legal rights and financial information depth as instrumental variables, as they are directly related to the financial sector and are less likely to influence inequality through channels other than financial development.

we use 4 instrumental variables: the Legal Rights Index, the depth of credit information index, Private credit bureau coverage (PCBs) and public credit registries (PCRs). Legal Rights Index measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. It is an indicator developed by the World Bank as part of its Doing Business project.[4] The Depth of Credit Information Index, developed by the World Bank's Doing Business project, measures the availability and transparency of credit information systems in a country.[5] It assesses the distribution of positive and negative credit information on individuals and businesses. Higher scores indicate more developed credit information systems, leading to easier access to credit, lower borrowing costs, and improved financial inclusion. Private credit bureau and public credit registry coverage reports the number of individuals or firms listed by a private credit bureau and public credit registry with current information on repayment history, unpaid debts, or credit outstanding. The number is expressed as a percentage of the adult population. As illustrated in Figure A- 4, Figure A- 5 and Figure A- 6 in Appendix A, the selected instrumental variables exhibit a strong association with the financial development indices.

We use a set of instrumental variables to strengthen identification, with each instrument capturing a different facet of the financial and legal infrastructure. The Legal Rights Index reflects property-rights protection, whereas the Depth of Credit Information and the coverage of private credit bureaus (PCBs) and public credit registries (PCRs) proxy information frictions and lending costs. This multiple-instrument strategy reduces reliance on any single instrument, strengthens the case for exogeneity, and allows us to capture several channels through which institutions affect financial development and, in turn, inequality. Although these instruments are motivated by the Law and Finance and Information and Finance literatures, they may still raise concerns about potential endogeneity, as creditor legal rights could influence inequality directly, for example through labor market institutions, wage-setting mechanisms, or bargaining power. To mitigate these concerns, we focus on instruments that are tightly linked to credit market infrastructure and include a rich set of institutional and policy controls that capture the broader environment as far as possible.

2.4. Instrumental variable approach and robustness checks

We employ the Two-Stage Least Squares (2SLS) estimator to address the endogeneity of financial development indices in our regression model, since endogeneity can lead to biased and inconsistent estimates under Ordinary Least Squares (OLS). To assess the quality and validity of the instrumental variables, in addition to the theoretical justification discussed in the identification section, we implement several standard IV diagnostic tests. First, we use the first-stage test to assess the relevance and strength of the instruments, based on the F-statistics and partial R^2 for the excluded instruments. Second, we apply the endogeneity test, a Durbin–Wu–Hausman-type test, to compare OLS and 2SLS; rejection of exogeneity in this test implies that OLS is inconsistent and supports the use of 2SLS. Third, we use the overidentification test, the Sargan/Hansen test of overidentifying restrictions, to check whether the instruments are uncorrelated with the error term and whether the model is correctly specified; failure to reject the null supports instrument exogeneity and correct specification. In addition, we estimate a set of complementary models using alternative estimation methods to examine the robustness of our results to the choice of estimator and model specification. The test statistics and p-values for all these diagnostics, for each specification, are reported at the bottom of the regression tables in Appendix B.

3. Results and discussion

3.1. The impact of oil and gas dependence on financial development-inequality nexus

As outlined in the data section, we use the ratio of oil and gas rents to GDP to identify oil and gas-dependent countries. Countries with oil and gas rents exceeding a certain threshold are classified as oil and gas-dependent. For instance, in Column 2 of Table 2, countries with oil and gas rents above 1% of GDP are considered dependent, and those below this threshold are classified as non-dependent. Varying the threshold helps us detect the point at which the relationship between financial development and inequality begins to differ across countries. Table 2 presents the estimated coefficients for financial development, a dummy variable indicating oil and gas dependency (based on different thresholds of oil and gas rents to GDP), and the interaction between the two.

Table 2 shows that, for all financial development indicators except the Financial Institutions Index (FII), the interaction between financial development and oil and gas rents is positive and statistically significant from the 7 percent threshold onward. For Financial Institutions Index, the interaction is also positive and significant at 7 percent, and at higher thresholds it remains almost similar in magnitude but becomes marginally insignificant. This repeated pattern of positive and significant interaction coefficients across indicators indicates that, regardless of the metric, oil and gas dependence changes the effect of financial development on inequality, such that among oil and gas-dependent countries, higher financial development is associated with greater inequality.

A further recurring pattern across all four financial development indicators is that the magnitude of the interaction coefficient increases as the threshold rises. This implies that as oil and gas dependence intensifies, the effect of oil and gas rents on the finance–inequality relationship becomes stronger; in other words, the erosion of the beneficial effect of financial development on inequality occurs more strongly.

Although our coefficient of interest, the interaction between financial development and oil and gas rents, behaves as hypothesized across all financial development indicators, the estimates for the standalone financial development coefficient and the oil and gas rents coefficient differ across measures. First, when financial development is measured by Credit to GDP, the coefficient is negative and statistically significant at all thresholds, whereas for the other indicators it is insignificant at lower thresholds and becomes positive at the 19 percent threshold. In the following section, we discuss that the differences in the direct effect of financial development on inequality across indicators stem from the fact that, for the more composite financial development indices, inequality-reducing and inequality-amplifying channels of financial development operate simultaneously and offset one another; These

[4] The Legal Rights Index, part of the World Bank's Doing Business project, assesses the strength of legal institutions in supporting lending and property transactions. It typically includes: (1) Property rights, covering ownership, registration, and protection against uncompensated expropriation; (2) Credit rights, assessing laws on using movable assets as collateral and enforcing credit contracts; and (3) Insolvency procedures, evaluating how effectively the legal system resolves bankruptcy and protects creditor rights.

[5] The Depth of Credit Information Index evaluates credit reporting systems across five dimensions: (1) Coverage, i.e., the share of adults or firms included; (2) Public accessibility of credit data; (3) Existence and operation of credit registries or bureaus; (4) Comprehensiveness of reporting—positive and negative data like repayment history and defaults; and (5) Legal backing for credit data sharing and consumer rights protection.

Table 2
The effect of oil and gas dependency on the impact of financial development on inequality across thresholds for oil and gas rents (% of GDP).

Threshold	1%	4%	7%	10%	13%	9%
Number of oil and gas-dependent countries	51	34	28	21	18	15
Panel A: Credit to GDP						
Credit to GDP	−0.0569**	−0.0516**	−0.0517**	−0.0534**	−0.0531**	−0.0431**
	(0.0251)	(0.0238)	(0.0225)	(0.0222)	(0.0220)	(0.0219)
Dummy* (Oil & Gas rents	−0.00267	−0.00490	−0.0581**	−0.0634**	−0.0638**	−0.0608
(% of GDP))	(0.0202)	(0.0230)	(0.0251)	(0.0289)	(0.0292)	(0.0385)
Credit to GDP* Dummy	0.0538*	0.0593	0.206***	0.213***	0.220***	0.261**
(Oil & Gas rents (% of GDP))	(0.0324)	(0.0486)	(0.0676)	(0.0745)	(0.0782)	(0.110)
Panel B: Financial Depth Index						
Financial Depth Index	0.0180	0.0422	0.0373	0.0559	0.0613	0.0812*
	(0.0500)	(0.0467)	(0.0443)	(0.0435)	(0.0438)	(0.0429)
Dummy (Oil & Gas rents (% of GDP))	0.0181	0.0399*	0.00169	−0.0319	−0.0459	−0.0880
	(0.0172)	(0.0233)	(0.0245)	(0.0306)	(0.0326)	(0.0538)
Financial Depth Index* Dummy	0.0469	−0.0290	0.243*	0.670**	0.906**	1.659***
(Oil & Gas rents (% of GDP))	(0.0468)	(0.0707)	(0.140)	(0.282)	(0.382)	(0.642)
Panel C: Financial Institution Index						
Financial Institution Index	−0.0395	0.00515	−0.0174	−0.00993	−0.00840	0.0216
	(0.0714)	(0.0709)	(0.0664)	(0.0672)	(0.0660)	(0.0635)
Dummy (Oil & Gas rents (% of GDP))	−0.0274	0.00346	−0.0706	−0.0630	−0.0739	−0.0960
	(0.0263)	(0.0401)	(0.0447)	(0.0516)	(0.0618)	(0.105)
Financial Institution Index* Dummy	0.134**	0.0715	0.273**	0.266	0.321	0.457
(Oil & Gas rents (% of GDP))	(0.0616)	(0.107)	(0.132)	(0.165)	(0.230)	(0.396)
Panel D: Financial Development Index						
Financial Development Index	0.0287	0.0744	0.0672	0.0667	0.0727	0.0837*
	(0.0520)	(0.0485)	(0.0455)	(0.0460)	(0.0466)	(0.0457)
Dummy (Oil & Gas rents (% of GDP))	−0.00707	0.0139	−0.0458	−0.0408	−0.0437	−0.0351
	(0.0190)	(0.0275)	(0.0288)	(0.0300)	(0.0303)	(0.0422)
Financial Development Index*	0.111**	0.0736	0.292***	0.282***	0.328***	0.359**
Dummy (Oil & Gas rents (% of GDP))	(0.0530)	(0.0936)	(0.105)	(0.107)	(0.118)	(0.159)

Note: Each panel reports 2SLS estimates of the effect of financial development, the direct effect of oil and gas, and the indirect effect of oil and gas through financial development on the pre-tax Gini coefficient, using each of the four financial development indicators. *The dummy variable equals one for countries above the threshold level of oil and gas rents to GDP, and zero for those below the threshold. Full results and GMM robustness checks are reported in Appendix B: Table B- 1 to Table B- 8.

channels are discussed in detail in Appendix C.

Second, unlike in the Credit to GDP specification, the direct effect of oil and gas rents on inequality is insignificant for the other three indicators. However, as shown in Table 3, replacing the oil and gas dependence dummy with the continuous oil and gas rents variable makes the direct effect of oil and gas rents on inequality negative and statistically significant across the other financial development indicators, so the discrepancy disappears once we exploit richer variation. Before turning to these results, and since for Credit to GDP all three terms—financial development, oil and gas rents, and their interaction—are significant at the 7 percent threshold, we first focus on this indicator to reconstruct Fig. 2 and provide additional insight.

Based on the estimates presented in Table 2, at the 7 percent threshold for oil and gas rents to GDP, the estimated coefficient on Credit to GDP is −0.0517 and the interaction between Credit to GDP and oil and gas dependence is 0.206, which implies that although the direct effect of financial development on inequality is negative, in oil and gas-dependent countries this effect weakens as the level of financial development increases. Eventually, in countries where financial development surpasses a certain threshold, the overall effect turns positive—meaning that financial development leads to greater inequality. Moreover, the coefficient on the dependence dummy is −0.0581, indicating that, when considering only its direct effect, countries where oil and gas rents exceed 7 percent of GDP have a lower average Gini than otherwise similar countries.

Given these results (β_1 = -0.0517, β_2 = −0.0581, β_3 = 0.206), the graph illustrated in Fig. 2 appears in Fig. 3, where the downward-sloping line represents the effect of financial development on inequality in non-resource-dependent countries, and the upward-sloping line illustrates the same effect in oil and gas-dependent countries.

The positive effect of higher Credit to GDP on inequality, reflected in the upward slope, results from the combined impact of its direct effect on inequality and its interaction with oil and gas dependence ($\beta_1 + \beta_3$). As illustrated in Fig. 3, in oil and gas-dependent countries with a level of Credit to GDP below the 28.2 percent threshold, inequality is, on average, lower than in non-dependent countries as oil and gas rents have a direct inequality-reducing effect. However, beyond this threshold, the indirect effect of oil and gas rents through the financial development channel outweighs the direct effect, leading to higher average inequality in these countries compared to other countries. Consequently, higher Credit to GDP ultimately leads to higher levels of inequality in these countries. In our dataset, countries with oil and gas rents above 7 percent of GDP and Credit to GDP above 28.2 percent (that is, where our analysis indicates financial development increases inequality) are Kuwait, the United Arab Emirates, Qatar, Oman, Iran, the Russian Federation, Saudi Arabia, Brunei Darussalam, Trinidad and Tobago, Venezuela, Ecuador, and Kazakhstan.

In addition to the dummy specification, we estimate the model using the continuous "oil and gas rents to GDP" measure (Table 3) and in this specification, as in the dummy specification, the direct effect of Credit to GDP is negative and statistically significant, while the other financial development indices are not statistically significant. As in the previous specification, the interaction between financial development and oil and gas rents is positive and statistically significant across all financial development indices. This supports the earlier finding that oil and gas rents shape the financial development–inequality relationship, such that in oil and gas-dependent countries higher levels of financial development are associated with greater inequality. The direct effect of oil and

Table 3
The effect of oil and gas dependency on the impact of financial development on inequality, using the continuous variable of oil and gas rents to GDP.

	Credit to GDP	Financial Depth Index	Financial Institution Index	Financial Development Index
Financial Index	−0.0545**	0.0424	0.00475	0.0677
	(0.0218)	(0.0467)	(0.0634)	(0.0458)
Oil and Gas Rents (% of GDP)*	−0.151*	−0.0437	−0.404**	−0.165*
	(0.0783)	(0.0883)	(0.186)	(0.0904)
Financial Index* Oil and Gas Rents (% of GDP)	0.625***	2.011**	1.692**	1.235***
	(0.228)	(0.825)	(0.719)	(0.419)
Subsidies and other transfers (% of expense)	−0.188***	−0.200***	−0.198***	−0.198***
	(0.0319)	(0.0343)	(0.0372)	(0.0340)
Log of GDP per capita	0.0617	0.0807*	0.0659*	0.0911**
	(0.0397)	(0.0489)	(0.0396)	(0.0412)
Log of GDP per capita2	−0.00387*	−0.00578*	−0.00464*	−0.00661**
	(0.00233)	(0.00311)	(0.00240)	(0.00257)
Trade	−0.0192	−0.0233**	−0.0227**	−0.0200*
	(0.0131)	(0.0111)	(0.0111)	(0.0108)
Inflation	−0.0273	0.0506	0.0127	0.0469
	(0.0986)	(0.0942)	(0.0986)	(0.0930)
Constant	0.440***	0.380*	0.435***	0.342**
	(0.169)	(0.197)	(0.167)	(0.171)
Observations	150	151	151	151
R-squared	0.395	0.423	0.414	0.439

Note: The table reports 2SLS estimates of the effects of financial development and oil and gas rents (as a share of GDP) on the pre-tax Gini coefficient. *In the estimations presented in this table, oil and gas dependency is included in the model as a continuous variable using the ratio of oil and gas rents to GDP.

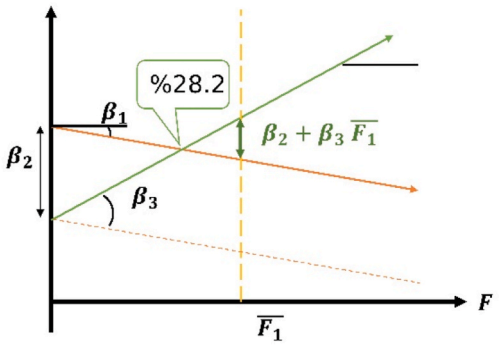

Fig. 3. Hypothetical figure for Gini coefficients based on the results in Table 2, column 4.
Note: The upward-sloping line, based on the estimated coefficients for Credit to GDP in Table 2, reflects the relationship between financial development and inequality in oil and gas-dependent countries, while the downward-sloping line represents the relationship in non–oil and gas-dependent countries.

gas rents on inequality is negative, indicating an inequality-reducing impact; unlike the dummy-based specification, this negative effect is statistically significant in all specifications except the one using the financial depth index.

Although we used the Gini coefficient before taxes and transfers, we also controlled for subsidies and other transfers (% of government expense) because government redistributive policies can indirectly influence inequality through various channels. The coefficient for subsidies and other transfers is consistently negative and highly significant in all specifications, indicating that higher subsidies and transfers reduce inequality. This pattern is intuitive because the target population for budgeted subsidies and transfers is typically low-income households, so an inequality-reducing effect is expected. Controlling for this variable is especially important when the focus is on resource-dependent countries, where a high ratio of natural resources to GDP often provides governments with sufficient revenue to finance supportive policies that can affect inequality. In economies with higher levels of financial development, the tax system is also more likely to be robust enough to sustain redistributive policies, thereby influencing inequality.

In light of the Kuznets hypothesis and because GDP per capita influences both inequality and financial development, we control for the log of GDP per capita and its square to improve the precision of our estimates. The coefficient on log GDP per capita is positive and the coefficient on its square is negative and generally significant. Taken together, these estimates imply an inverted-U pattern consistent with the Kuznets hypothesis, where inequality rises with income at lower levels of development and declines after income passes a turning point. Consistent with this pattern, across specifications 70–90 percent of countries lie on the declining segment, indicating that inequality falls at higher income levels, which lends face validity to the Kuznets-type estimates.

Trade openness shifts the income distribution through prices, technology diffusion, and sectoral reallocation, so omitting it risks confounding the estimated effect of financial development on inequality (Ben-David, 1993; Bergh and Nilsson, 2010; Goldberg and Pavcnik, 2004). Trade and finance co-evolve, since deeper finance supports exporting and importing and openness feeds back into financial deepening, so controlling for trade helps isolate the partial effect of financial development on inequality (Beck et al., 2003; Rajan and Zingales, 2003). Consistent with the literature, in all specifications the coefficient on trade openness is negative with varying significance, implying that greater openness is associated with lower inequality.

Inflation can reshape income and wealth distribution through real debt revaluation and the inflation tax on cash balances, with heterogeneous exposure across households. Borrowers may gain while lenders and cash-holders lose, and the poor are often hit hardest (Albanesi, 2007; Doepke and Schneider, 2006; Easterly and Fischer, 2001), so omitting inflation risks confounding distributional effects. We therefore include inflation as a control to capture these channels. Inflation is not statistically significant in our specifications, which likely reflects the limited cross-country and within-period variation over 2013–2019. We nevertheless control for inflation to mitigate omitted-variable bias, given its potential links to both financial development and inequality. The results remain robust to alternative measures of financial development and to estimation using both 2SLS and GMM.

3.2. Analyzing the effect of controls on entrepreneurship and human capital mechanisms

In the introduction, we discussed that the entrepreneurship and human capital mechanisms are among the most prominent and influential channels identified in the theoretical literature through which financial development reduces inequality. We also argued that in oil and gas-dependent countries, these two mechanisms tend to be weakened or disrupted, which may explain why the impact of financial development on inequality differs in these countries compared to others. In this section, by controlling for these two specific mechanisms, we aim to investigate whether the change in the effect of financial development on inequality in these countries is due to the disruption of the entrepreneurship and human capital mechanisms.

By including the tertiary enrollment rate, we aimed to control for the level of human capital that can significantly contribute to poverty alleviation in impoverished households. We measure the human capital mechanism using the gross tertiary enrollment rate, because our mechanism focuses on how financial development relaxes credit constraints and enables individuals to invest in human capital, thereby escaping poverty traps and attaining higher incomes. Among different levels of education, tertiary education is precisely where private financing constraints are most binding, since university attendance involves substantial tuition, living expenses, and opportunity costs that

depend critically on access to credit and a well-developed financial system. Tertiary enrollment therefore directly captures the margin at which financial development can expand access to higher education and, in turn, improve earnings prospects and affect income inequality.[6]

By simultaneously including two variables, industrial growth and technology adoption rate, we sought to control for the entrepreneurial mechanism, ensuring the economy provides ample opportunities for entrepreneurs. We proxy the entrepreneurial mechanism using the technology absorption index and manufacturing value added, because these variables are more closely related to productive, innovation-oriented entrepreneurship and a modern production structure. Technology absorption captures the ability of firms to adopt new knowledge, technologies, and management practices—activities that typically support the expansion of higher-productivity jobs, the upgrading of skills, and the diffusion of efficiency gains beyond a narrow group of firms. Manufacturing value added (as a share of GDP) reflects the scale of organized, capital-intensive, and relatively formal production, which is more likely to generate stable wage employment and broaden access to the gains from financial development, rather than merely increasing the number of small, low-productivity self-employed businesses. These indicators are therefore better aligned with the entrepreneurial channel through which financial development can reduce inequality, which is the focus of our analysis.[7]

Table 4 presents the impact of financial development and oil and gas dependency on inequality, after controlling for the human capital and entrepreneurship mechanisms. The results indicate that first, the entrepreneurship and human capital mechanisms, as measured by the indices we utilized, are indeed significant and influential channels. Controlling for these mechanisms reveals the underlying effect of financial development on reducing inequality. Specifically, the coefficient of credit to GDP shifts from a significant negative value to an insignificant one, and the coefficients of the other indicators change from insignificant (previously suggesting a mix of negative and positive effects canceling each other out) to significantly positive. In Appendix C, we discussed both the positive and negative mechanisms through which financial development may affect inequality. By controlling for the two key inequality-reducing mechanisms—human capital and entrepreneurship—the influence of the remaining uncontrolled channels through which financial development may increase inequality—such as credit market imperfections and wealth concentration, financial fragility and inequality, and technological change and skill-biased financial development—becomes more pronounced, ultimately resulting in a positive relationship between financial development and inequality.

Second, there is a difference between the estimation results using the credit to GDP, which only measures the amount of credit, and the other three financial development indices. For credit to GDP, controlling for the entrepreneurship and human capital mechanisms does not eliminate

Table 4
The Effect of oil and gas dependency on the impact of financial development on inequality, controlling for entrepreneurship and human capital channels.

	Base Model	Testing Human Capital Channel	Testing Entrepreneurship Channel	Testing Both Channels
Panel A: Credit to GDP				
Credit to GDP	−0.0545[b]	−0.0303	−0.0252	−0.0132
	(0.0218)	(0.0196)	(0.0221)	(0.0219)
Credit to GDP [a] Oil & GasRents(% of GDP)	0.625[c]	0.578[c]	0.626[b]	0.634[b]
	(0.228)	(0.196)	(0.302)	(0.282)
Oil & GasRents(% of GDP)	−0.151[a]	−0.172[c]	−0.237[a]	−0.269[b]
	(0.0783)	(0.0657)	(0.132)	(0.128)
Lag of tertiary enrollment Rate[a]		−0.116[c]		−0.102[c]
		(0.0306)		(0.0356)
Manufacturing, value added (% of GDP)[b]			−0.279	−0.306[a]
			(0.176)	(0.164)
Technology Absorption[c]			−0.145[c]	−0.108[c]
			(0.0374)	(0.0375)
Panel B: Financial Depth Index				
Financial Depth Index	0.0424	0.0653	0.101[b]	0.103[b]
	(0.0467)	(0.0421)	(0.0468)	(0.0435)
Financial Depth Index [a] Oil & GasRents(% of GDP)	2.011[b]	1.620[b]	0.253	0.249
	(0.825)	(0.808)	(1.136)	(1.104)
Oil & GasRents(% of GDP)	−0.0437	−0.0434	0.156	0.120
	(0.0883)	(0.0753)	(0.182)	(0.163)
Lag of tertiary enrollment Rate		−0.130[c]		−0.0962[c]
		(0.0289)		(0.0331)
Manufacturing, value added (% of GDP)			−0.188	−0.208
			(0.152)	(0.142)
Technology Absorption			−0.183[c]	−0.148[c]
			(0.0412)	(0.0402)
Panel C: Financial Institution Index				
Financial Institution Index	0.00475	0.0556	0.105	0.134[b]
	(0.0634)	(0.0564)	(0.0721)	(0.0669)
Financial Institution Index [a] Oil & GasRents (% of GDP)	1.692[b]	1.430[b]	0.887	0.772
	(0.719)	(0.658)	(0.798)	(0.757)
Oil & GasRents(% of GDP)	−0.165[a]	−0.153[b]	−0.0890	−0.117
	(0.0904)	(0.0719)	(0.123)	(0.114)
Lag of Tertiary Enrollment Rate		−0.130[c]		−0.106[c]
		(0.0275)		(0.0325)
Manufacturing, value added (% of GDP)			−0.268[a]	−0.291[b]
			(0.152)	(0.140)
Technology Absorption			−0.146[c]	−0.107[c]
			(0.0377)	(0.0378)
Panel C: Financial Development Index				
Financial Development Index	0.0677	0.110[b]	0.107[b]	0.129[c]
	(0.0458)	(0.0461)	(0.0457)	(0.0474)
Credit to GDP [a] Oil & GasRents(% of GDP)	1.235[c]	1.040[c]	0.771[a]	0.770[b]
	(0.419)	(0.348)	(0.408)	(0.365)
Oil & GasRents(% of GDP)	−0.165[a]	−0.153[b]	−0.0890	−0.117
	(0.0904)	(0.0719)	(0.123)	(0.114)
Lag of Tertiary Enrollment Rate		−0.130[c]		−0.106[c]
		(0.0275)		(0.0325)
Manufacturing, value added (% of GDP)			−0.268[a]	−0.291[b]
			(0.152)	(0.140)
Technology Absorption			−0.146[c]	−0.107[c]
			(0.0377)	(0.0378)

Note. The table reports 2SLS estimates of the effects of financial development and oil and gas rents (as a share of GDP) on the pre-tax Gini coefficient, controlling for the human capital and entrepreneurship channels. The first results column replicates the estimates from Table 3. Column 2 tests the human capital

[6] Among other alternatives, primary and secondary enrollment mainly reflect basic, often compulsory schooling with limited variation and a weaker dependence on financial development. Moreover, compared with composite human capital indicators—such as the Penn World Table human capital index or average years of schooling—the tertiary enrollment rate is conceptually clearer for our purposes. Composite indices bundle several dimensions (education, health, returns to schooling, etc.) into a single measure, making it difficult to identify which specific channel they capture, whereas our mechanism explicitly concerns the financing and expansion of access to higher education.

[7] Alternative measures such as the entrepreneurship rate pool very different forms of entrepreneurial activity, including both opportunity-driven, innovative, growth-oriented ventures and necessity-driven self-employment. In many developing countries, a large share of the measured entrepreneurship rate reflects the latter type—small, informal, low-productivity activities. Such activities are unlikely to operate as a channel through which financial development fosters inclusive growth and reduces inequality, and may instead be closely associated with persistent, structural poverty.

channel, while Column 3 tests the entrepreneurship channel. Column 4 includes both channels simultaneously. The results suggest that these two channels are strong explanatory mechanisms for the inequality-reducing effect of financial development and for the heterogeneity of this effect across country groups—except in the case of credit-to-GDP.

[a] The tertiary enrollment Rate is defined as total enrollment in higher education, regardless of age, expressed as a percentage of the population in the official age group, and typically requires completion of secondary education (Source: World Bank).

[b] Manufacturing value added as a percentage of GDP captures the net output of manufacturing industries (ISIC divisions 15–37) (Source: World Bank).

[c] The technology absorption indicator from Pillar 7 of the Global Entrepreneurship Index reflects the extent to which entrepreneurs can access and apply new technologies, considering infrastructure availability, technology adoption, and education in tech-related skills (Source: Global Entrepreneurship Development Institute). Full results and GMM robustness checks are reported in Appendix B: Table B- 9 to Table B- 12.

the difference between oil and gas-dependent and non-dependent countries. However, this difference disappears or weakens when considering more comprehensive financial development indicators. In fact, if financial development is considered solely as the amount of credit to GDP, the results are fully consistent with the literature on the resource curse. In resource-rich countries, financial resources are often misallocated towards the elite due to weaker governance and higher corruption levels. This phenomenon, known as "elite capture," significantly hampers equitable financial development and exacerbates inequality (Beck, 2011; Bhattacharyya and Hodler, 2014).

For both the financial depth and financial institutions indices, controlling for the channels eliminates the difference between oil and gas-dependent and non-dependent countries. however, for financial development index, while this difference is weakened, it remains. These results support the idea that the difference in the impact of financial development on inequality between oil and gas-dependent and non-dependent countries is due to the disruption of the entrepreneurship and human capital mechanisms in the dependent countries. In fact, to support this idea, we need indices of financial development that partially control for the impact of corruption and the diversion of financial resources, a feature that the narrower Credit to GDP index lacks.

The financial institution depth index includes metrics such as private sector credit, pension fund assets, mutual fund assets, and insurance premiums. Systems with higher levels of these assets typically exhibit greater financial development. This elevated level of development is often associated with a robust regulatory framework and a healthy banking system in which credit is allocated more efficiently.

The financial institution index includes indicators of financial depth, access, and efficiency—where increased access directly contributes to reducing inequality, and improved efficiency does so by mitigating financial market imperfections. Therefore, a high score on these indices ensures that the benefits of financial development are not captured by a specific group. When these indices are used, controlling for entrepreneurship and human capital mechanisms eliminates the difference between oil-dependent and non-oil-dependent countries.

The financial development index encompasses the financial institution depth index and the financial market development index. When the financial market development index is included, controlling for entrepreneurship and human capital mechanisms does not fully eliminate the differences between countries, although the difference is reduced due to the financial institution index. This suggests that financial market development may have different effects on inequality in oil and gas-dependent and non-dependent countries, which warrants further study.

3.3. The impact of oil and gas dependence on the financial development and inequality nexus: heterogeneity by institutional quality and income

In the literature on financial development and inequality, especially for natural resource dependent countries, a central theme is the role of institutional quality in shaping this relationship. In settings with weak institutions, financial development can be captured by powerful groups, which increases inequality (Rajan and Zingales, 2003; Claessens and Perotti, 2007). Our study proposes that in countries that depend on oil and gas revenues, financial development fails to reduce inequality because the main channels that lower inequality in other contexts are undermined. This section tests whether the effect of oil and gas dependence on the financial development–inequality relationship is the same across institutional quality levels. It also examines whether the degree of mechanism erosion varies with institutional quality; in other words, it tests whether erosion of these mechanisms is the transmission channel through which oil and gas dependence affects the financial development–inequality relationship.

To assess institutional heterogeneity, we estimate the marginal effect of oil and gas rents at different percentiles of institutional quality, measured by the Worldwide Governance Indicators (WGI). The model augments Equation (2) with interactions among financial development, oil and gas rents, and institutional quality, using a continuous measure of oil and gas rents to GDP. Evaluating the marginal effects at the 25th, 50th, and 75th percentiles of institutional quality allow for testing institutional heterogeneity and identifying how the marginal impact of oil and gas rents changes with institutional quality ($\partial ME/\partial WGI$). Since the number of oil and gas-dependent countries is limited within each institutional quality group, this percentile-based approach helps maintain estimation precision and provides a more balanced and meaningful comparison across institutional regimes. The results (Table 5, Panel A

Table 5
Assessing institutional-quality heterogeneity in the overall effect and in the degree of mechanism attenuation for the oil–gas impact on the finance–inequality relationship.

Panel A. Marginal effect of oil and gas rents on the financial development and inequality relationship at the 25th, 50th, and 75th percentiles of institutional quality (WGI)

	Credit to GDP	Financial Depth Index	Financial Institution Index	Financial Development Index
ME_p25	0.576*	2.330***	0.891	0.695
	(0.315)	(0.849)	(0.551)	(0.445)
ME_p50	0.644***	2.193***	1.178**	0.951***
	(0.234)	(0.690)	(0.538)	(0.351)
ME_p75	0.745**	1.989**	1.603**	1.331***
	(0.299)	(0.923)	(0.654)	(0.471)
Institutional heterogeneity test	0.137	−0.275	0.574	0.513
($\partial ME/\partial WGI$)	(0.331)	(0.898)	(0.416)	(0.477)

Panel B. Marginal effects after controlling for entrepreneurship and human-capital mechanisms at the 25th, 50th, and 75th percentiles of institutional quality (WGI)

ME_p25	1.680***	1.774	2.091*	1.388**
	(0.398)	(1.367)	(1.194)	(0.671)
ME_p50	1.119***	0.344	0.783	0.346
	(0.356)	(1.169)	(0.942)	(0.976)
ME_p75	0.290	−1.773	−1.154	−1.197
	(0.721)	(1.299)	(1.536)	(1.977)
Slope_ WGI	−1.121	−2.861***	−2.617*	−2.085
Institutional heterogeneity test	(0.693)	(1.077)	(1.572)	(1.552)

Note: The table reports the marginal effect of oil and gas rents on the financial development–inequality relationship as a function of institutional quality. Using a 2SLS model that includes interactions between financial development, oil and gas rents to GDP, and institutional quality, we evaluate this effect at the 25th, 50th, and 75th percentiles of the WGI among oil-dependent countries. Group-specific estimates and their standard errors are obtained from linear combinations of the estimated coefficients, and robust standard errors are reported. Full results, explanations of the estimates, and coefficient interpretation are provided in Appendix B; Table B- 13 to Table B- 16.

and also see Table B- 13 to Table B- 16)) show that the marginal effect of oil and gas rents remains positive and statistically significant across all institutional levels, while the heterogeneity test indicates that there is no statistically significant difference in the effect of oil and gas dependence on the financial development–inequality relationship across different levels of institutional quality. This implies that, regardless of the level of institutional quality, dependence on oil and gas undermines the inequality-reducing effect of financial development.

We also test whether the degree of mechanism attenuation varies with institutional quality. To do so, we add the human capital and entrepreneurship mechanisms and interact each mechanism with oil and gas rents and with the Worldwide Governance Indicators (Table 5, Panel B and also see Table B- 13 to Table B- 16). Overall, we find evidence of heterogeneity in the attenuation of mechanisms as the transmission channel of the oil and gas effect on the financial development and inequality nexus.

The results show that in countries with high and medium institutional quality, erosion of the entrepreneurship and human-capital channels is an important transmission mechanism for the oil and gas effect on the finance–inequality relationship: once these mechanisms are controlled for, the coefficient on the interaction between oil and gas rents and financial development becomes small and statistically insignificant. In other words, the weakening effect of oil and gas rents on the relationship between financial development and inequality essentially disappears. This pattern is consistent with an interpretation in which, in relatively well-governed, resource-rich economies, talented individuals increasingly choose rent-seeking over productive entrepreneurship because the expected return to operating in rent-intensive sectors is higher. This is closely related to the mechanism in Torvik (2002) and Mehlum et al. (2006), where high-ability agents decide whether to become productive entrepreneurs or rent-seekers, and their choice depends on the size of resource rents and the relative payoff to productive activity. Crucially, this mechanism can operate even when formal institutions are reasonably strong, because rent-seeking may take legal and institutionalized forms—such as lobbying, preferential access to public contracts, regulatory rents, and large state-backed projects—rather than overt corruption. In such settings, financial development can end up financing and rewarding rent-seeking activities more than broad-based, productivity-enhancing entrepreneurship, thereby undermining the inequality-reducing role that finance might otherwise play.

By contrast, in low-institutional-quality countries, controlling for the mechanisms makes the interaction larger and statistically stronger for all financial development measures (except financial depth, which remains roughly unchanged) which indicates that the destructive effect of oil and gas dependence on this relationship operates through other channels. Indeed, in low-quality environments, entrepreneurship and human-capital mechanisms may have been partially offsetting the adverse transmission, so removing their influence reveals a larger negative effect. In oil and gas-dependent countries with weak institutions, we interpret this as evidence that the voracity effect and weakened property rights is more important. In the Lane and Tornell (1999) framework, powerful groups (oligarchs, political factions, regional elites, military or security institutions) compete over the control of resource rents instead of channeling them into productive investment. This competition generates instability, implicit taxation or expropriation, weak and unpredictable rules, and a generally hostile environment for long-term investment, including entrepreneurship. Such dynamics, and weakened property rights, are typically more pronounced where institutions are weak, enforcement is limited, and the political or legal cost of predation is low. However, when we compare these oil and gas-dependent countries to non-dependent peers with similarly weak institutions, the entrepreneurial mechanism is already poorly functioning in both groups; hence, the difference in the financial development–inequality nexus cannot primarily be attributed to an additional deterioration of entrepreneurship in the oil and gas-dependent group. Rather, the crucial distinction is that in oil and gas-dependent, low-institutional-quality economies there is moreRentsto capture and stronger, more entrenched power structures. The presence of large oil and gas rents strengthens these groups and intensifies their contest over both fiscal and financial resources. As a result, financial development in these settings is more likely to be captured by powerful elites and used to reinforce their position, so that credit expansion and financial deepening tend to exacerbate income inequality instead of mitigating it.

For the human-capital mechanism, the interpretation is closely linked to the state of entrepreneurship. In oil and gas-dependent economies, the production structure is typically dominated by large, resource-based, capital-intensive industries, while the entrepreneurial sector remains relatively weak. As a result, these economies generate limited demand for skilled labor: the prevalence of resource-linked "big industry" and the underdevelopment of small and medium-sized enterprises mean that higher education does not translate into broad-based opportunities for high-skilled employment. This pattern arises even in countries with relatively strong institutions, so the human-capital channel also acts as a transmission mechanism through which oil and gas rents weaken the inequality-reducing role of financial development in those settings. By contrast, in low-institutional-quality countries, elite capture and corruption remain more important, so that the human-capital mechanism plays a more limited explanatory role relative to direct capture of fiscal and financial resources by powerful groups.

We also examine income-level heterogeneity in the effect of oil and gas dependence on the relationship between financial development and inequality and in the degree of mechanism attenuation. As discussed by Greenwood and Jovanovic (1993), the relationship between financial development and inequality can differ across stages of development, raising the concern that if oil and gas-dependent countries are mostly low income, they might fall in a range where financial development is associated with higher inequality. To address this, we split countries into high and low-income groups using a single dummy, since finer splits would undermine precision given the limited number of oil and gas-dependent countries.

Our results show that the marginal effect of oil and gas rents on the financial development and inequality relationship is statistically significant only among high-income countries and is insignificant among low-income countries (Table 6). This indicates that the oil and gas effect is not merely a reflection of development stage. The pattern is consistent with a mechanism-based interpretation: financial development reduces inequality when the human-capital and entrepreneurship channels operate effectively; in oil and gas-dependent economies these channels are eroded, and this erosion is detectable only where the channels are otherwise strong—namely, in high-income countries. Adding the mechanisms sharpens this insight. Similar to the institutional-quality heterogeneity results, once we control for the mechanisms, the oil and gas rents effect in high-income countries shrinks and becomes statistically insignificant, whereas in low-income countries the interaction becomes larger. Taken together, these findings support the view that in high-income settings the transmission of the oil and gas rents effect runs through the erosion of entrepreneurship and human capital, while in low-income settings other channels (e.g., corruption or elite capture) are more salient and the entrepreneurship and human-capital mechanisms may even partially offset the adverse effect.

4. Conclusion and policy recommendation

This study examines the effect of oil and gas dependency on the relationship between financial development and income inequality. The analysis uses cross-sectional data from developed and developing countries, averaged over the period 2013–2019, and applies a Two-Stage Least Squares (2SLS) approach to address potential endogeneity. The results reveal that in countries where oil and gas rents (as a percentage of GDP) exceed a certain threshold, higher levels of financial development are associated with greater income inequality. Our

Table 6
Marginal effect of oil-and-gas rents on the financial development–inequality relationship in low- and high-income countries.

Panel A. Marginal effects of effect of oil and gas dependence on the relationship between financial development and inequality at the low and high-income countries				
VARIABLES	Credit to GDP	Financial Depth Index	Financial Institution Index	Financial Development Index
ME_Low Income	0.211	0.385	−0.288	−0.697
	(0.500)	(1.480)	(0.752)	(1.016)
ME_High Income	0.639***	2.050**	1.043*	0.845**
	(0.241)	(0.902)	(0.591)	(0.394)
Marginal effect difference (High – Low income)	0.428	1.665	1.331**	1.542*
	(0.492)	(1.475)	(0.557)	(0.905)
Panel B. Marginal after controlling for entrepreneurship and human-capital mechanisms at the low and high-income countries				
ME_Low Income	2.177***	2.594	1.647	1.414
	(0.807)	(1.703)	(1.106)	(1.207)
ME_High Income	0.657	−1.554	−0.537	0.222
	(0.462)	(1.334)	(1.574)	(1.057)
Marginal effect difference (High – Low income)	−1.520*	−4.148*	−2.184	−1.193
	(0.917)	(2.153)	(1.516)	(1.588)

Note. The table reports the marginal effect of oil and gas rents on the financial development-inequality relationship, defined as the cross-partial $\partial^2 \text{Gini}/(\partial \text{CtoG} \partial \text{OG})$. Countries are split into low- and high-income groups via a dummy; group-specific effects are estimated with interactions in the 2SLS model. The high–low difference is assessed with a Wald test, with robust standard errors. Full results, explanations of the estimates, and coefficient interpretation are provided in Appendix B; Table B- 17 to Table B- 20.

findings suggest that while a higher share of oil and gas rents in the economy directly reduces inequality, its indirect effect through financial development leads to greater inequality.

Moreover, our findings show that the different impact of financial development on inequality in oil and gas-dependent countries, compared to others, can be attributed to the disruption of key channels such as entrepreneurship and human capital development. When we consider broader financial development indices—such as financial depth, financial institutions, and the overall financial development index—controlling for entrepreneurship and human capital mechanisms eliminates the difference between oil and gas-dependent and non-dependent countries. However, when financial development is measured solely by the credit to GDP, this difference persists. This suggests that in these countries, due to the lack of institutional infrastructure, credit expansion without adequate regulatory frameworks and anti-corruption mechanisms leads to the capture of financial resources by powerful elites.

Several factors contribute to the disruption of entrepreneurship and human capital mechanisms. Rent-seeking behavior and weakened property rights deteriorate the conditions for entrepreneurship, diverting talent and resources away from productive economic activities. The voracity effect, wherein different groups compete for control of resource wealth, further exacerbates this misallocation. Additionally, human capital development suffers due to the Dutch disease, which discourages industrialization and economic diversification.

Based on these results, in oil and gas-dependent countries the primary focus of financial development should shift from simply increasing the credit to GDP toward improving the quality of financial institutions, that is, moving toward higher levels of more advanced dimensions of financial development. This includes strengthening prudential regulation and bank supervision, enhancing transparency and corporate governance in banks, expanding access to financial services for households and small and medium-sized enterprises, developing credit information infrastructure and collateral systems, and diversifying the range of financial institutions, deepening capital markets by increasing stock market size and liquidity and fostering the development of government and corporate bond markets. Taken together, these measures represent qualitative financial development rather than mere quantitative expansion. Without such qualitative improvements, a rapid increase in credit in oil and gas-dependent countries is likely to be captured by elites and to exacerbate income inequality. Simultaneously, strengthening policies that foster innovative entrepreneurship and increase demand for human capital can help oil and gas-dependent countries benefit from the inequality-reducing potential of financial development in much the same way as non–resource-dependent economies.

Finally, our heterogeneity results show that the weakening effect of oil and gas dependence on the inequality-reducing role of financial development largely disappears in countries with medium or high institutional quality and income once entrepreneurial and human-capital mechanisms are controlled for, but persists in low-income, low-institutional-quality countries, where channels such as corruption and elite capture remain more important. This suggests two broad types of policy recommendations:

In high-dependence, low-income, medium to strong-institution countries, improving the business environment and creating better conditions for the growth of productive entrepreneurship, small and medium-sized enterprises, and sectors that generate demand for skilled labor can help offset the adverse impact of oil and gas rents on the finance–inequality relationship. A crucial part of this agenda can be pursued through the financial system itself: if financial development is explicitly oriented toward facilitating investment in higher education and productive activities, it can regain its inequality-reducing role. This requires, for example, targeting financial instruments (credit, guarantees, growth funds) toward innovative, export-oriented, non-resource sectors that create skilled jobs rather than toward state-connected or resource-based firms, and allocating a transparent, rules-based share of oil and gas revenues to scholarships, student loans, and skill-development programs.

In high-dependence, low-income, weak-institution countries, aggressive financial deepening without prior institutional reform is likely to worsen inequality, because elite capture, rent-seeking, and corruption dominate credit allocation. Policy should therefore prioritize basic institutional reforms, strengthening the rule of law, enforcing property rights, fighting corruption, improving budget transparency, and ensuring independent supervision of banks, while avoiding rapid credit expansion and focusing instead on simple, easily monitored forms of financial inclusion and on more efficient, rules-based financial intermediation.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this manuscript, AI was used for language polishing (readability and word choice, and sentence-level rephrasing) to express the authors' point with maximum clarity and minimal words. Apart from this language editing, AI was not used in any other part of the manuscript or for any other purpose. The authors reviewed and edited all content, and the first author made the final edits and takes full responsibility for this version of the manuscript.

CRediT authorship contribution statement

Mahboubeh Davoudi: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. **Masoud Nili:** Conceptualization, Formal analysis, Supervision, Writing – review & editing. **Seyed Ali Madanizadeh:**

Conceptualization, Formal analysis, Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

We thank seminar participants at the Graduate School of Management and Economics (GSME), Sharif University of Technology, Tehran, Iran, where earlier versions of this paper were presented. We are grateful to Mohammad Vesal (Associate Professor of Economics, GSME, Sharif University of Technology), Amineh Mahmoudzadeh (Assistant Professor of Economics, GSME, Sharif University of Technology), Seyed Farshad Fatemi (Associate Professor of Economics, GSME, Sharif University of Technology), Gholamreza Keshavarz Haddad (Associate Professor of Economics, GSME, Sharif University of Technology), Hassan Dargahi (Associate Professor of Economics, Shahid Beheshti University, Tehran, Iran), and Seyed Mohammad Hosseini (Assistant Professor of Economics, Institute for Management and Planning Studies, Tehran, Iran) for helpful comments and suggestions. We also thank Mehran Behnia (Ph.D. candidate, University of California, Riverside) for helpful comments and support. All remaining errors are our own. (Affiliations as of August 2025.)

Appendix D. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.resourpol.2026.105966.

Appendix A. Variable relationships and exploratory charts

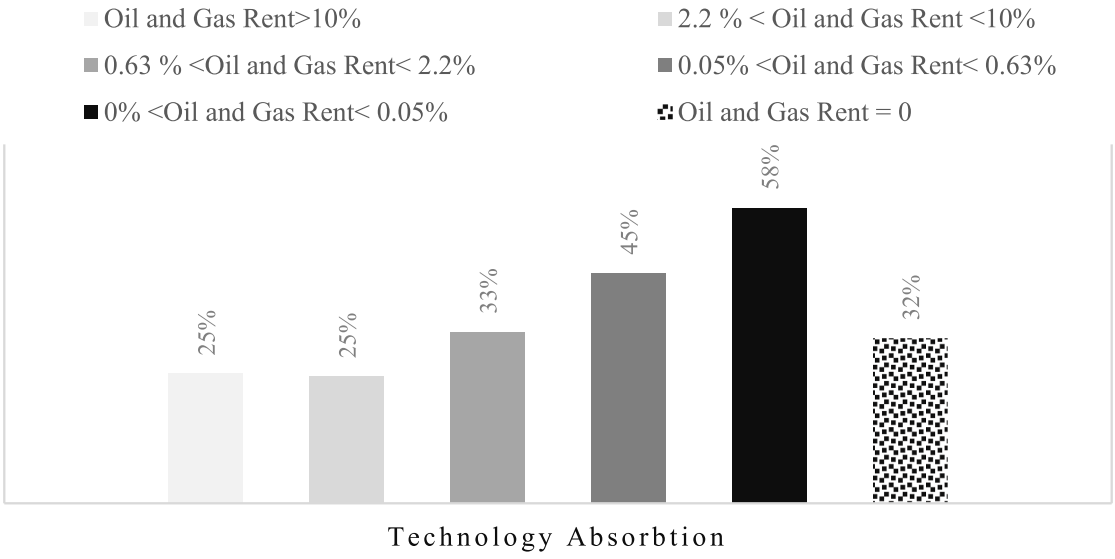

Fig. ure A- 1. Technology absorption and oil and gas rents (% of GDP)
Note: The figure displays the average technology absorption for 131 countries, grouped into quintiles based on oil and gas rents to GDP. The first 5 bars from the left represent quintile groups and the bar on the right represents countries with zero oil and gas rents, for which the average is calculated based on 41 countries. Among oil and gas-dependent countries, technology absorption declines as oil and gas rents to GDP increases. Technology Absorption data are sourced from the Global Entrepreneurship Development Institute. Technology absorption, pillar 7 in the Global Entrepreneurship Index (GEI), measures the level of technology absorption in a country's entrepreneurial ecosystem. It assesses the extent to which entrepreneurs in a country are able to access and utilize new technologies to enhance their businesses and create new opportunities. This pillar includes indicators such as the availability of technology infrastructure, the level of technology adoption by businesses, and the quality of education and training in technology-related skills.

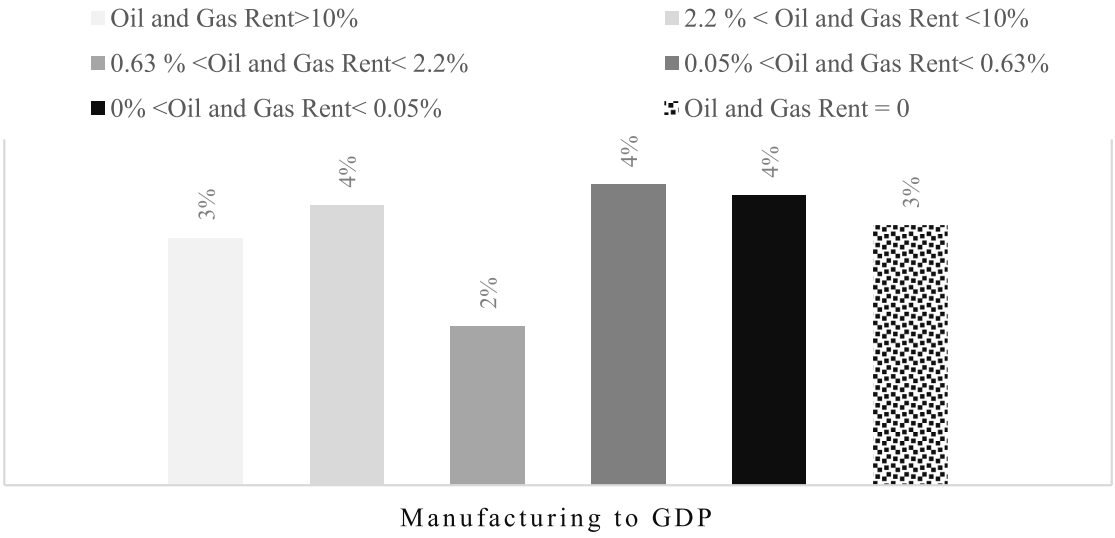

Fig. ure A- 2. Manufacturing value added (% of GDP) and oil and gas rents (% of GDP)
Note: The figure displays the average manufacturing, value added (% of GDP) for 158 countries, grouped into quintiles based on oil and gas rents to GDP. The first 5 bars from the left represent quintile groups and the bar on the right represents countries with zero oil and gas rents, for which the average is calculated based on 58 countries. Manufacturing, value added (% of GDP) refers to industries belonging to ISIC divisions 15-37. Data are sourced from the World Bank (World Development Indicators).

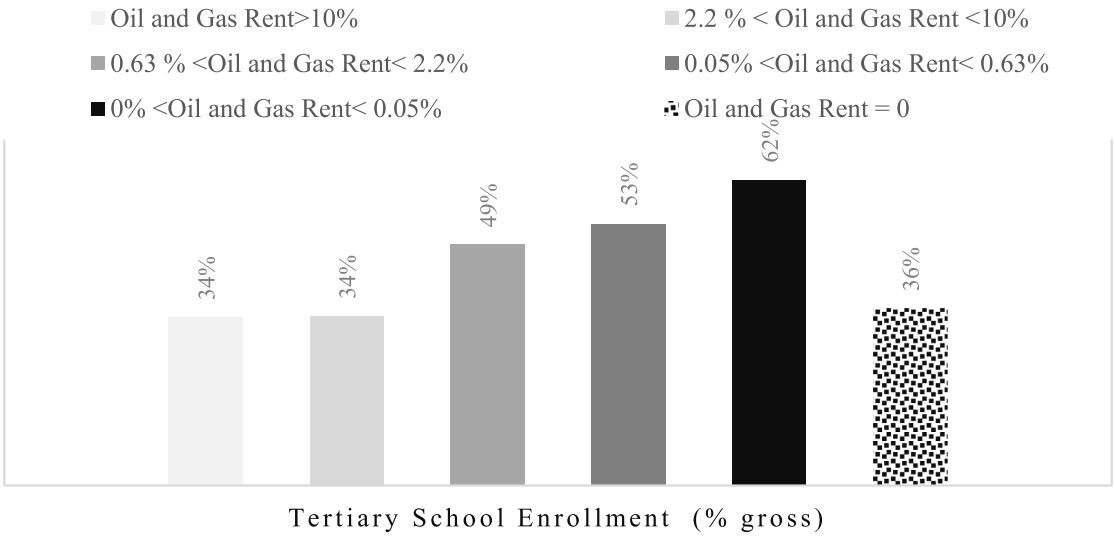

Fig. ure A- 3. Tertiary school enrollment (% gross) and oil and gas rents (% of GDP)
Note: The figure displays the average tertiary school enrollment for 143 countries, grouped into quintiles based on oil and gas rents to GDP. The first 5 bars from the left represent quintile groups and the bar on the right represents countries with zero oil and gas rents, for which the average is calculated based on 48 countries. The chart shows that countries with greater oil and gas dependence have lower levels of tertiary school enrollment. Tertiary school enrollment is the gross enrollment ratio, meaning the total number of students enrolled in tertiary education, regardless of age, divided by the population in the official tertiary-age group, where tertiary education refers to post-secondary programs (college or university) that normally require completing secondary school. Data are sourced from the World Bank (World Development Indicators).

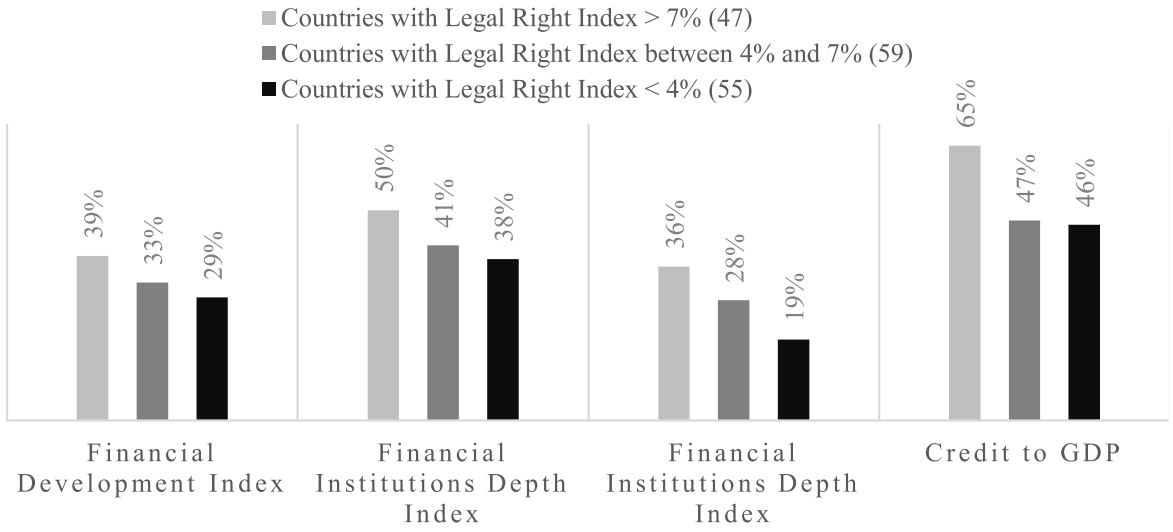

Fig. ure A- 4. Financial development and the legal rights index of creditor
Note: The figure reports averages for four financial development measures across three country groups defined by the strength of creditor legal rights. Numbers in parentheses in the legend indicate the number of countries in each group. On average, stronger legal rights are associated with higher financial development. Legal Rights Index measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. Data are sourced from the World Bank (World Development Indicators).

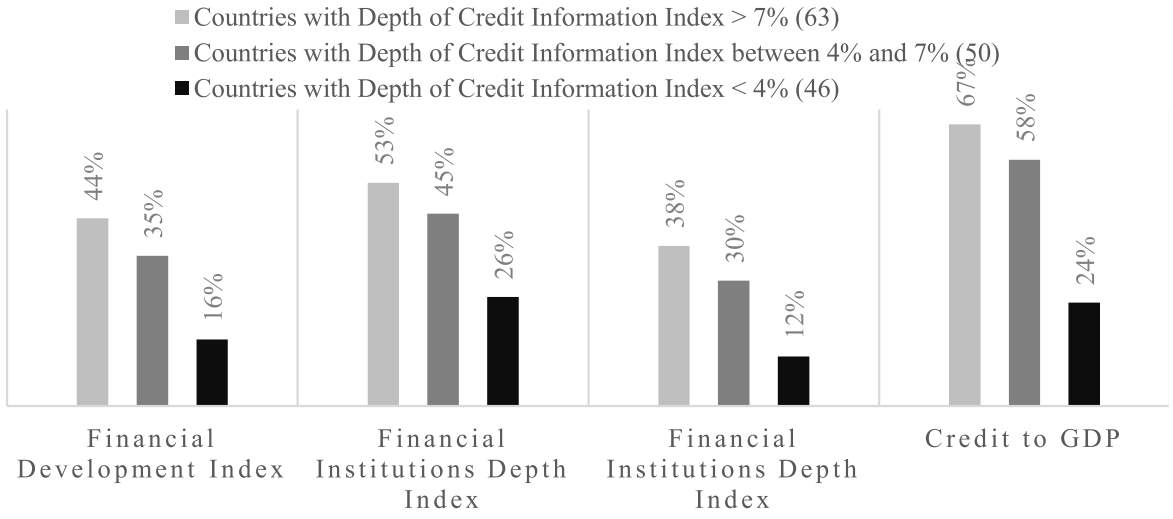

Fig. ure A- 5. The relationship between financial development and credit information indices; depth of credit information index
Note: The figure reports averages for four financial development measures across three country groups defined by depth of credit information index. Numbers in parentheses in the legend indicate the number of countries in each group. In countries with greater depth of credit information, the financial sector is more developed. The depth of credit information index measures rules and practices affecting the coverage, scope and accessibility of credit information available through either a credit bureau or a credit registry. Data are sourced from the World Bank (World Development Indicators).

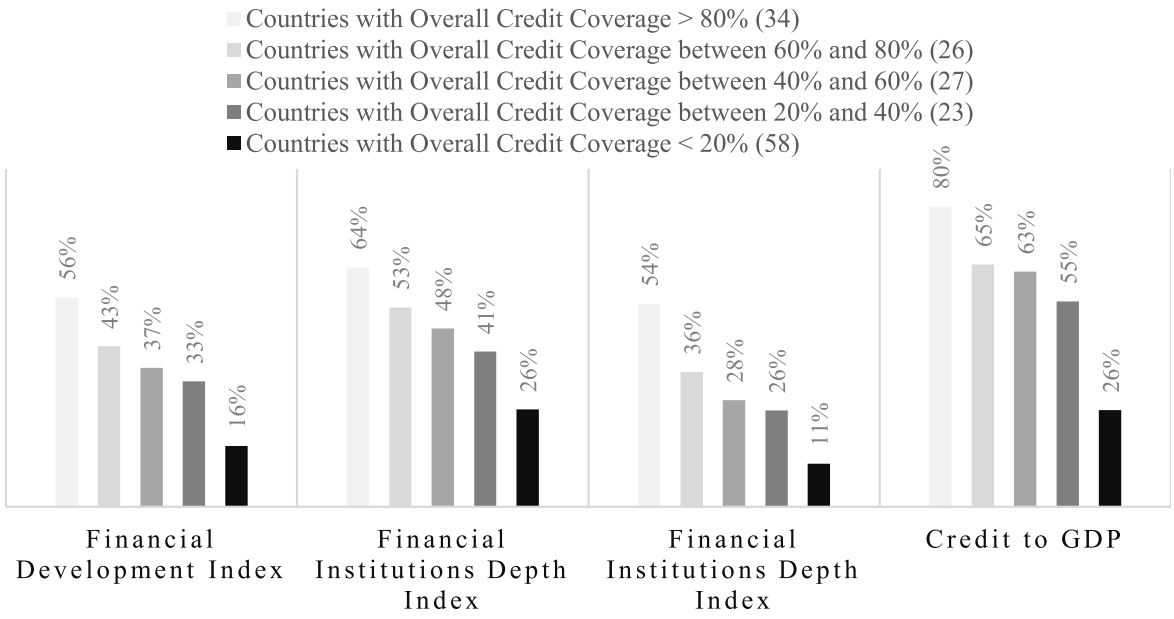

Fig. ure A- 6. The relationship between financial development and credit information indices; overall credit coverage

Note: The figure reports averages for four financial development measures across five country groups defined by overall credit coverage. Numbers in parentheses in the legend indicate the number of countries in each group. In countries with greater overall credit coverage, the financial sector is more developed. Overall credit coverage is defined as the maximum of Private Credit Bureau Coverage and Public Credit Registry Coverage, capturing the dominant channel of credit information and avoiding understatement when one system predominates. Credit coverage reports the number of individuals and firms listed in a public or private credit registry with current information on repayment history, unpaid debts, or credit outstanding. The number is expressed as a percentage of the adult population. Data are sourced from the World Bank (World Development Indicators).

Appendix B. Estimation results

Table B- 1Effect of oil and gas dependency on the relationship between credit-to-GDP and inequality, 2SLS.

Threshold for Dummy	1%	4%	7%	10%	13%	19%
Number of oil and gas-dependent countries	51	34	28	21	18	15
Credit to GDP (CtoG)	−0.0569**	−0.0516**	−0.0517**	−0.0534**	−0.0531**	−0.0431**
	(0.0251)	(0.0238)	(0.0225)	(0.0222)	(0.0220)	(0.0219)
Dummy variable (D)*	−0.00267	−0.00490	−0.0581**	−0.0634**	−0.0638**	−0.0608
	(0.0202)	(0.0230)	(0.0251)	(0.0289)	(0.0292)	(0.0385)
CtoG * D	0.0538*	0.0593	0.206***	0.213***	0.220***	0.261**
	(0.0324)	(0.0486)	(0.0676)	(0.0745)	(0.0782)	(0.110)
subsidies and other transfers	−0.204***	−0.196***	−0.189***	−0.190***	−0.186***	−0.183***
(% of expense)	(0.0301)	(0.0302)	(0.0312)	(0.0315)	(0.0340)	(0.0342)
Log of GDP per capita	0.0417	0.0511	0.0644	0.0643	0.0662*	0.0700*
	(0.0413)	(0.0416)	(0.0394)	(0.0395)	(0.0397)	(0.0401)
Log of GDP per capita2	−0.00252	−0.00316	−0.00405*	−0.00402*	−0.00415*	−0.00445*
	(0.00242)	(0.00242)	(0.00231)	(0.00231)	(0.00234)	(0.00239)
Trade	−0.0213	−0.0208	−0.0202	−0.0198	−0.0200	−0.0185
	(0.0130)	(0.0128)	(0.0130)	(0.0130)	(0.0131)	(0.0126)
Inflation	−0.0359	−0.0325	−0.0451	−0.0579	−0.0564	−0.00119
	(0.107)	(0.100)	(0.102)	(0.102)	(0.102)	(0.101)
Constant	0.515***	0.480***	0.432**	0.433**	0.424**	0.404**
	(0.175)	(0.176)	(0.168)	(0.168)	(0.169)	(0.171)
Observations	150	150	150	150	150	150
R-squared	0.371	0.361	0.399	0.395	0.395	0.403
Diagnostic and robustness tests**						
First-stage F (CtoG)	112.71	146.03	97.58	78.87	72.84	122.54
First-stage F (CtoG*D)	191.02	302.16	52.59	72.58	94.76	293.01
Shea's partial R^2 (CtoG/CtoG*D)	0.7195/0.9081	0.7075/0.9290	0.6959/0.8886	0.6996/0.8890	0.6994/0.9393	0.7041/0.9442
Endogeneity test (DW–H p-value)	0.007	0.0038	0.0038	0.0013	0.0010	0.0062
Overid. test (Hansen J p-value)	0.1115	0.1524	0.3751	0.2436	0.2627	0.1399

Note: The table reports the 2SLS estimates of the effect of oil and gas rents (% of GDP) on the relationship between credit-to-GDP and the pre-tax Gini coefficient, evaluated across thresholds for oil and gas dependency (% of GDP).

*The dummy variable equals one for countries above the threshold level of oil and gas rents to GDP, and zero for those below the threshold.

**First-stage F-statistic (CtoG) and (CtoG*D) report the F-statistics from the first-stage regressions for the two endogenous regressors; values well above 10 indicate that

the excluded instruments are sufficiently strong. Shea's partial R^2 (CtoG/CtoG*D) reports the instrument-specific partial R-squared for each endogenous variable, i.e., the share of its variation explained by the excluded instruments conditional on the other covariates. The endogeneity test (DW–H p-value) reports the p-value of a robust Durbin–Wu–Hausman test of the exogeneity of CtoG and CtoG*D; the small p-values in all columns reject the null of exogeneity and justify the use of 2SLS. The overidentification test (Hansen J p-value) reports the p-value of a robust overidentification test of the joint exogeneity of the instruments; the relatively large p-values mean that we do not reject the null of instrument validity in any specification.

Diagnostic and robustness tests indicate that the instruments are strong (large first-stage F-statistics and high Shea's partial R^2 for CtoG and CtoG*D), that these regressors are indeed endogenous (small DW–H p-values, justifying the use of 2SLS), and that we do not reject the joint exogeneity of the instruments (Hansen J p-values).

Table B- 2
Effect of oil and gas dependency on the relationship between financial depth index and inequality, 2SLS.

Threshold for Dummy	1%	4%	7%	10%	13%	19%
Number of oil and gas-dependent countries	51	34	28	21	18	15
Financial Institution Depth Index	0.0180	0.0422	0.0373	0.0559	0.0613	0.0812*
(FIDI)	(0.0500)	(0.0467)	(0.0443)	(0.0435)	(0.0438)	(0.0429)
Dummy variable (D)*	0.0181	0.0399*	0.00169	−0.0319	−0.0459	−0.0880
	(0.0172)	(0.0233)	(0.0245)	(0.0306)	(0.0326)	(0.0538)
FIDI * D	0.0469	−0.0290	0.243*	0.670**	0.906**	1.659***
	(0.0468)	(0.0707)	(0.140)	(0.282)	(0.382)	(0.642)
subsidies and other transfers	−0.214***	−0.202***	−0.205***	−0.206***	−0.192***	−0.191***
(% of expense)	(0.0323)	(0.0329)	(0.0336)	(0.0340)	(0.0360)	(0.0360)
Log of GDP per capita	0.0615	0.0684	0.0747*	0.0861*	0.0957**	0.113**
	(0.0480)	(0.0460)	(0.0447)	(0.0443)	(0.0457)	(0.0449)
Log of GDP per capita^2	−0.00427	−0.00487*	−0.00523*	−0.0061**	−0.0067**	−0.007***
	(0.00303)	(0.00289)	(0.00281)	(0.00278)	(0.00290)	(0.00286)
Trade	−0.0249**	−0.0256**	−0.0261**	−0.0259**	−0.0259**	−0.0228**
	(0.0108)	(0.0106)	(0.0107)	(0.0107)	(0.0110)	(0.0109)
Inflation	−0.00956	0.0124	0.0276	0.0143	0.0204	0.0976
	(0.109)	(0.0931)	(0.0955)	(0.0988)	(0.103)	(0.0975)
Constant	0.447**	0.423**	0.402**	0.365**	0.326*	0.253
	(0.194)	(0.187)	(0.183)	(0.181)	(0.186)	(0.183)
Observations	151	151	151	151	151	151
R-squared	0.392	0.385	0.394	0.419	0.427	0.450
Diagnostic and robustness tests						
First-stage F (FIDI)	271.56	284.99	247.75	219.70	222.84	224.63
First-stage F (FIDI *D)	165.26	116.21	139.81	161.10	233.61	261.97
Shea's partial R^2 (FIDI/FIDI *D)	0.9257/0.9688	0.9194/0.9675	0.9097/0.9735	0.8984/0.9206	0.8994/0.9384	0.9007/0.9239
Endogeneity test (DW–H p-value)	0.9628	0.7122	0.6438	0.1639	0.4102	0.6636
Overid. test (Hansen J p-value)	0.2680	0.4588	0.8090	0.6486	0.6161	0.3482

Note: The table reports the 2SLS estimates of the effect of oil and gas rents (% of GDP) on the relationship between financial institution depth index and the pre-tax Gini coefficient, evaluated across thresholds for oil and gas rents (% of GDP).

*The dummy variable equals one for countries above the threshold level of oil and gas rents to GDP, and zero for those below the threshold.

Diagnostic and robustness tests indicate that the instruments are very strong: first-stage F-statistics for FIDI and FIDI*D are well above the conventional threshold of 10, and Shea's partial R^2 is close to one in all specifications. The Durbin–Wu–Hausman endogeneity test (DW–H p-value) does not reject the exogeneity of FIDI and FIDI*D, implying that OLS and 2SLS estimates are statistically similar and that the results are robust to the estimation method. The overidentification test (Hansen J p-value) does not reject the joint exogeneity of the instruments in any specification, supporting their validity.

Table B- 3
Effect of oil and gas dependency on the relationship between financial institution index and inequality, 2SLS.

Threshold for Dummy	1%	4%	7%	10%	13%	19%
Number of oil and gas-dependent countries	51	34	28	21	18	15
Financial Institution Index	−0.0395	0.00515	−0.0174	−0.00993	−0.00840	0.0216
(FII)	(0.0714)	(0.0709)	(0.0664)	(0.0672)	(0.0660)	(0.0635)
Dummy variable (D)*	−0.0274	0.00346	−0.0706	−0.0630	−0.0739	−0.0960
	(0.0263)	(0.0401)	(0.0447)	(0.0516)	(0.0618)	(0.105)
FII * D	0.134**	0.0715	0.273**	0.266	0.321	0.457
	(0.0616)	(0.107)	(0.132)	(0.165)	(0.230)	(0.396)
subsidies and other transfers	−0.213***	−0.202***	−0.201***	−0.200***	−0.190***	−0.193***
(% of expense)	(0.0361)	(0.0373)	(0.0375)	(0.0375)	(0.0389)	(0.0379)
Log of GDP per capita	0.0547	0.0555	0.0640	0.0646	0.0694*	0.0753*
	(0.0417)	(0.0413)	(0.0398)	(0.0396)	(0.0397)	(0.0401)
Log of GDP per capita^2	−0.00358	−0.00387	−0.00427*	−0.00434*	−0.00467*	−0.0052**
	(0.00250)	(0.00247)	(0.00237)	(0.00236)	(0.00241)	(0.00246)
Trade	−0.0236**	−0.0254**	−0.0253**	−0.0252**	−0.0252**	−0.0238**
	(0.0110)	(0.0109)	(0.0110)	(0.0110)	(0.0112)	(0.0111)
Inflation	−0.00865	0.00723	−0.0163	−0.00835	−0.00561	0.0534
	(0.102)	(0.0974)	(0.103)	(0.104)	(0.106)	(0.0952)
Constant	0.475***	0.470***	0.440***	0.437***	0.416**	0.389**
	(0.174)	(0.174)	(0.169)	(0.168)	(0.168)	(0.170)
Observations	151	151	151	151	151	151

(*continued on next page*)

Table B- 3 (*continued*)

Threshold for Dummy	1%	4%	7%	10%	13%	19%
R-squared	0.396	0.382	0.390	0.386	0.389	0.399
Diagnostic and robustness tests						
First-stage F (FII)	282.62	271.17	268.07	264.89	359.98	331.68
First-stage F (FII *D)	651.76	397.40	887.42	515.09	835.09	843.64
Shea's partial R^2 (FII/FII *D)	0.8341/0.9470	0.8096/0.9378	0.8103/0.9682	0.8048/0.9635	0.8053/0.9686	0.8118/0.9708
Endogeneity test (DW–H p-value)	0.1803	0.2262	0.2008	0.2179	0.2002	0.3654
Overid. test (Hansen J p-value)	0.4607	0.2311	0.6779	0.5152	0.1835	0.3463

Note: The table reports the 2SLS estimates of the effect of oil and gas rents (% of GDP) on the relationship between financial institution index and the pre-tax Gini coefficient, evaluated across thresholds for oil and gas rents (% of GDP).
*The dummy variable equals one for countries above the threshold level of oil and gas rents to GDP, and zero for those below the threshold.
Diagnostic and robustness tests confirm that the instruments based on FII are very strong: first-stage F-statistics for FII and FII*D are far above the conventional threshold of 10 in all specifications, and Shea's partial R^2 is consistently high (around 0.8–0.97), indicating substantial explanatory power. The Durbin–Wu–Hausman endogeneity test (DW–H p-value) does not reject the exogeneity of FII and FII*D, implying that OLS and 2SLS estimates are statistically similar and that the results are robust to the estimation method. The overidentification test (Hansen J p-value) likewise never rejects the joint exogeneity of the instruments, supporting their overall validity.

Table B- 4
Effect of oil and gas dependency on the relationship between financial development index and inequality, 2SLS.

Threshold for Dummy	1%	4%	7%	10%	13%	19%
Number of oil and gas-dependent countries	51	34	28	21	18	15
Financial Development Index (FDI)	0.0287	0.0744	0.0672	0.0667	0.0727	0.0837*
	(0.0520)	(0.0485)	(0.0455)	(0.0460)	(0.0466)	(0.0457)
Dummy variable (D)*	−0.00707	0.0139	−0.0458	−0.0408	−0.0437	−0.0351
	(0.0190)	(0.0275)	(0.0288)	(0.0300)	(0.0303)	(0.0422)
FDI * D	0.111**	0.0736	0.292***	0.282***	0.328***	0.359**
	(0.0530)	(0.0936)	(0.105)	(0.107)	(0.118)	(0.159)
subsidies and other transfers	−0.221***	−0.211***	−0.206***	−0.206***	−0.193***	−0.195***
(% of expense)	(0.0313)	(0.0321)	(0.0330)	(0.0334)	(0.0359)	(0.0358)
Log of GDP per capita	0.0673	0.0750*	0.0868**	0.0876**	0.0958**	0.0985**
	(0.0435)	(0.0433)	(0.0402)	(0.0403)	(0.0409)	(0.0411)
Log of GDP per capita2	−0.00479*	−0.00553**	−0.00626**	−0.00630**	−0.0068***	−0.0070***
	(0.00272)	(0.00271)	(0.00249)	(0.00250)	(0.00256)	(0.00259)
Trade	−0.0224**	−0.0229**	−0.0220**	−0.0224**	−0.0221**	−0.0201*
	(0.0107)	(0.0106)	(0.0105)	(0.0105)	(0.0108)	(0.0105)
Inflation	0.00745	0.0273	0.0220	0.0257	0.0349	0.0760
	(0.101)	(0.0923)	(0.0959)	(0.0961)	(0.0978)	(0.0925)
Constant	0.431**	0.404**	0.361**	0.357**	0.323*	0.308*
	(0.179)	(0.179)	(0.167)	(0.168)	(0.170)	(0.171)
Observations	151	151	151	151	151	151
R-squared	0.413	0.402	0.425	0.422	0.427	0.431
Diagnostic and robustness tests						
First-stage F (FDI)	572.98	660.87	566.54	581.20	753.36	581.82
First-stage F (FDI *D)	731.55	387.25	846.36	649.81	1019.94	456.15
Shea's partial R^2 (FDI/FDI *D)	0.9201/0.9742	0.9121/0.9805	0.9064/0.9819	0.9059/0.9819	0.9054/0.9914	0.9063/0.9883
Endogeneity test (DW–H p-value)	0.3541	0.0534	0.0906	0.1283	0.1030	0.0909
Overid. test (Hansen J p-value)	0.5716	0.4219	0.5321	0.3706	0.3806	0.2418

Note: The table reports the 2SLS estimates of the effect of oil and gas rents (% of GDP) on the relationship between financial development index and the pre-tax Gini coefficient, evaluated across thresholds for oil and gas rents (% of GDP).
*The dummy variable equals one for countries above the threshold level of oil and gas rents to GDP, and zero for those below the threshold.
Diagnostic and robustness tests indicate that the instruments based on FDI are very strong: first-stage F-statistics for FDI and FDID are far above the conventional threshold of 10 in all specifications, and Shea's partial R^2 is very high (around 0.90–0.99), indicating substantial explanatory power in the first stage. The Durbin–Wu–Hausman endogeneity test (DW–H p-value) is below the 10 percent level in most specifications, so the null of exogeneity is rejected and there is evidence that FDI and FDID are endogenous, making the 2SLS estimates more appropriate than OLS. The overidentification test (Hansen J p-value) does not reject the joint exogeneity of the instruments in any specification, supporting their overall validity.

Table B- 5
Effect of oil and gas dependency on the relationship between credit to GDP and inequality, GMM.

Threshold for Dummy	1%	4%	7%	10%	13%	19%
Number of oil and gas-dependent countries	51	34	28	21	18	15
Credit to GDP (CtoG)	−0.0602**	−0.0514**	−0.0586***	−0.0634***	−0.0637***	−0.0509**
	(0.0245)	(0.0231)	(0.0227)	(0.0224)	(0.0223)	(0.0221)
Dummy variable (D)*	−0.0159	−0.00983	−0.0537**	−0.0648**	−0.0653**	−0.0393
	(0.0191)	(0.0211)	(0.0242)	(0.0282)	(0.0276)	(0.0327)
CtoG * D	0.0546*	0.0586	0.187***	0.187***	0.188***	0.180***
	(0.0300)	(0.0414)	(0.0451)	(0.0479)	(0.0426)	(0.0512)
subsidies and other transfers	−0.211***	−0.199***	−0.191***	−0.193***	−0.191***	−0.187***

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Table B- 5 (*continued*)

Threshold for Dummy	1%	4%	7%	10%	13%	19%
(% of expense)	(0.0297)	(0.0298)	(0.0292)	(0.0293)	(0.0315)	(0.0318)
Log of GDP per capita	0.0465	0.0523	0.0552	0.0527	0.0548	0.0672*
	(0.0401)	(0.0411)	(0.0384)	(0.0385)	(0.0385)	(0.0386)
Log of GDP per capita2	−0.00270	−0.00322	−0.00344	−0.00324	−0.00336	−0.00416*
	(0.00235)	(0.00240)	(0.00223)	(0.00223)	(0.00224)	(0.00227)
Trade	−0.0259**	−0.0256**	−0.0234*	−0.0234*	−0.0241*	−0.0223*
	(0.0127)	(0.0129)	(0.0130)	(0.0131)	(0.0131)	(0.0127)
Inflation	0.0332	−0.0144	−0.0475	−0.0683	−0.0663	0.0270
	(0.0953)	(0.0952)	(0.0977)	(0.0973)	(0.0989)	(0.105)
Constant	0.496***	0.477***	0.472***	0.482***	0.473***	0.412**
	(0.169)	(0.173)	(0.163)	(0.164)	(0.164)	(0.164)
Observations	150	150	150	150	150	150
R-squared	0.361	0.357	0.389	0.379	0.377	0.387
Diagnostic and robustness tests						
First-stage F (CtoG)	112.71	146.03	97.58	78.87	72.84	122.54
First-stage F (CtoG *D)	191.02	302.16	52.59	72.58	94.76	293.01
Shea's partial R^2 (CtoG/CtoG *D)	0.7195/0.9081	0.7075/0.9290	0.6959/0.8886	0.6996/0.8890	0.6994/0.9393	0.7041/0.9442
Endogeneity test (DW–H p-value)	0.0277	0.0078	0.0010	0.0017	0.0013	0.0033
Overid. test (Hansen J p-value)	0.1115	0.1524	0.3751	0.2436	0.2627	0.1399

Note: The table reports the GMM estimates of the effect of oil and gas rents (% of GDP) on the relationship between credit to GDP and the pre-tax Gini coefficient, evaluated across thresholds for oil and gas rents (% of GDP).

*The dummy variable equals one for countries above the threshold level of oil and gas rents to GDP, and zero for those below the threshold.

Diagnostic and robustness tests indicate that the CtoG-based instruments are very strong: first-stage F-statistics for CtoG and CtoG*D are all well above the conventional threshold of 10 (ranging from about 50 to nearly 300), and Shea's partial R^2 is high (around 0.72 for the instruments and 0.89–0.94 for the endogenous regressors), confirming substantial first-stage explanatory power. The Durbin–Wu–Hausman endogeneity test (DW–H p-value) is below 5 percent in all specifications, so the null of exogeneity is rejected and there is strong evidence that CtoG and CtoG*D are endogenous, making the 2SLS estimates preferable to OLS. At the same time, the overidentification test (Hansen J p-value) does not reject the joint exogeneity of the instruments in any specification, supporting their validity.

Table B- 6

Effect of oil and gas dependency on the relationship between financial depth index and inequality, GMM.

Threshold for Dummy	1%	4%	7%	10%	13%	19%
Number of oil and gas-dependent countries	51	34	28	21	18	15
Financial Institution Depth Index	0.0244	0.0540	0.0421	0.0609	0.0659	0.0798*
(FIDI)	(0.0503)	(0.0466)	(0.0449)	(0.0435)	(0.0442)	(0.0429)
Dummy variable (D)*	0.00744	0.0313	−0.00855	−0.0454	−0.0517	−0.0662
	(0.0159)	(0.0200)	(0.0225)	(0.0309)	(0.0328)	(0.0460)
FIDI * D	0.0649	−0.00951	0.258*	0.782***	0.974**	1.469***
	(0.0445)	(0.0683)	(0.136)	(0.302)	(0.393)	(0.554)
subsidies and other transfers	−0.210***	−0.199***	−0.200***	−0.201***	−0.187***	−0.185***
(% of expense)	(0.0323)	(0.0325)	(0.0334)	(0.0331)	(0.0352)	(0.0344)
Log of GDP per capita	0.0698	0.0814*	0.0797*	0.0889**	0.0977**	0.111**
	(0.0479)	(0.0462)	(0.0448)	(0.0444)	(0.0460)	(0.0451)
Log of GDP per capita2	−0.00489	−0.00576**	−0.00560**	−0.00636**	−0.00696**	−0.0078***
	(0.00303)	(0.00292)	(0.00283)	(0.00280)	(0.00292)	(0.00287)
Trade	−0.0249**	−0.0263**	−0.0271**	−0.0270**	−0.0277**	−0.0249**
	(0.0110)	(0.0108)	(0.0109)	(0.0109)	(0.0112)	(0.0111)
Inflation	0.0470	0.0391	0.0573	0.0208	0.0327	0.0947
	(0.104)	(0.0925)	(0.0965)	(0.101)	(0.106)	(0.0945)
Constant	0.417**	0.374**	0.383**	0.358**	0.321*	0.265
	(0.193)	(0.188)	(0.183)	(0.181)	(0.187)	(0.183)
Observations	151	151	151	151	151	151
R-squared	0.387	0.383	0.391	0.420	0.426	0.449
Diagnostic and robustness tests						
First-stage F (FIDI)	271.56	284.99	247.75	219.70	222.84	224.63
First-stage F (FIDI *D)	165.26	116.21	139.81	161.10	233.61	261.97
Shea's partial R^2 (FIDI/FIDI *D)	0.9257/0.9688	0.9194/0.9675	0.9097/0.9735	0.8984/0.9206	0.8994/0.9384	0.9007/0.9239
Endogeneity test (DW–H p-value)	0.9783	0.9333	0.8053	0.3121	0.3528	0.9092
Overid. test (Hansen J p-value)	0.2680	0.4588	0.8090	0.6486	0.6161	0.3482

Note: The table reports the GMM estimates of the effect of oil and gas rents (% of GDP) on the relationship between financial institution depth index and the pre-tax Gini coefficient, evaluated across thresholds for oil and gas rents (% of GDP).

*The dummy variable equals one for countries above the threshold level of oil and gas rents to GDP, and zero for those below the threshold.

Diagnostic and robustness tests indicate that the FIDI-based instruments are very strong: first-stage F-statistics for FIDI and FIDI*D are all far above the conventional threshold of 10 (above 100 in every specification), and Shea's partial R^2 is very high (around 0.90–0.97), confirming substantial first-stage explanatory power. The Durbin–Wu–Hausman endogeneity test (DW–H p-value) is large in all columns, so the null of exogeneity cannot be rejected and OLS and 2SLS estimates are statistically similar, suggesting that the results are robust to the estimation method. The overidentification test (Hansen J p-value) likewise does not reject the joint exogeneity of the instruments in any specification, supporting their overall validity.

Table B- 7
Effect of oil and gas dependency on the relationship between financial institution index and inequality, GMM.

Threshold for Dummy	1%	4%	7%	10%	13%	19%
Number of oil and gas-dependent countries	51	34	28	21	18	15
Financial Institution Index (FII)	−0.0541	0.00168	−0.0277	−0.0235	−0.0191	0.0174
	(0.0691)	(0.0685)	(0.0641)	(0.0656)	(0.0653)	(0.0634)
Dummy variable (D)*	−0.0367	−0.00382	−0.0753*	−0.0717	−0.0945*	−0.143
	(0.0252)	(0.0358)	(0.0399)	(0.0461)	(0.0562)	(0.0977)
FII * D	0.144***	0.0857	0.279**	0.283**	0.389*	0.631*
	(0.0537)	(0.0907)	(0.111)	(0.142)	(0.208)	(0.360)
subsidies and other transfers	−0.204***	−0.194***	−0.194***	−0.193***	−0.183***	−0.188***
(% of expense)	(0.0358)	(0.0366)	(0.0366)	(0.0367)	(0.0378)	(0.0367)
Log of GDP per capita	0.0570	0.0590	0.0627	0.0630	0.0667*	0.0748*
	(0.0410)	(0.0410)	(0.0394)	(0.0393)	(0.0393)	(0.0391)
Log of GDP per capita2	−0.00369	−0.00410*	−0.00415*	−0.00419*	−0.00448*	−0.00518**
	(0.00246)	(0.00246)	(0.00235)	(0.00235)	(0.00238)	(0.00239)
Trade	−0.0241**	−0.0265**	−0.0265**	−0.0268**	−0.0273**	−0.0260**
	(0.0113)	(0.0112)	(0.0113)	(0.0113)	(0.0115)	(0.0114)
Inflation	0.0176	0.0127	−0.0107	−0.00865	−0.0144	0.0576
	(0.0996)	(0.0962)	(0.101)	(0.102)	(0.105)	(0.0958)
Constant	0.465***	0.455***	0.445***	0.442***	0.428***	0.392**
	(0.171)	(0.173)	(0.167)	(0.166)	(0.166)	(0.165)
Observations	151	151	151	151	151	151
R-squared	0.393	0.380	0.388	0.384	0.386	0.395
Diagnostic and robustness tests						
First-stage F (FII)	282.62	271.17	268.07	264.89	359.98	331.68
First-stage F (FII *D)	651.76	397.40	887.42	515.09	835.09	843.64
Shea's partial R^2 (FII/FII *D)	0.8341/0.9470	0.8096/0.9378	0.8103/0.9682	0.8048/0.9635	0.8053/0.9686	0.8118/0.9708
Endogeneity test (DW–H p-value)	0.1964	0.3121	0.1479	0.1268	0.0933	0.1606
Overid. test (Hansen J p-value)	0.4607	0.2311	0.6779	0.5152	0.1835	0.2643

Note: The table reports the GMM estimates of the effect of oil and gas rents (% of GDP) on the relationship between financial institution index and the pre-tax Gini coefficient, evaluated across thresholds for oil and gas rents (% of GDP).
*The dummy variable equals one for countries above the threshold level of oil and gas rents to GDP, and zero for those below the threshold.
Diagnostic and robustness tests indicate that the FII-based instruments are very strong: first-stage F-statistics for FII and FII*D are far above the conventional threshold of 10 in all specifications, and Shea's partial R^2 is high (around 0.80–0.97), confirming substantial first-stage explanatory power. The Durbin–Wu–Hausman endogeneity test (DW–H p-value) is generally large—only one specification has a p-value slightly below 10 percent—so the null of exogeneity cannot be rejected in most cases, and OLS and 2SLS estimates are broadly similar. The overidentification test (Hansen J p-value) does not reject the joint exogeneity of the instruments in any specification, supporting their validity.

Table B- 8
Effect of oil and gas dependency on the relationship between financial development index and inequality, GMM.

Threshold for Dummy	1%	4%	7%	10%	13%	19%
Number of oil and gas-dependent countries	51	34	28	21	18	15
Financial Development Index (FDI)	0.0287	0.0744	0.0672	0.0667	0.0727	0.0837*
	(0.0520)	(0.0485)	(0.0455)	(0.0460)	(0.0466)	(0.0457)
Dummy variable (D)*	−0.00707	0.0139	−0.0458	−0.0408	−0.0437	−0.0351
	(0.0190)	(0.0275)	(0.0288)	(0.0300)	(0.0303)	(0.0422)
FDI * D	0.111**	0.0736	0.292***	0.282***	0.328***	0.359**
	(0.0530)	(0.0936)	(0.105)	(0.107)	(0.118)	(0.159)
subsidies and other transfers	−0.221***	−0.211***	−0.206***	−0.206***	−0.193***	−0.195***
(% of expense)	(0.0313)	(0.0321)	(0.0330)	(0.0334)	(0.0359)	(0.0358)
Log of GDP per capita	0.0673	0.0750*	0.0868**	0.0876**	0.0958**	0.0985**
	(0.0435)	(0.0433)	(0.0402)	(0.0403)	(0.0409)	(0.0411)
Log of GDP per capita2	−0.00479*	−0.00553**	−0.00626**	−0.00630**	−0.0068***	−0.0070***
	(0.00272)	(0.00271)	(0.00249)	(0.00250)	(0.00256)	(0.00259)
Trade	−0.0224**	−0.0229**	−0.0220**	−0.0224**	−0.0221**	−0.0201*
	(0.0107)	(0.0106)	(0.0105)	(0.0105)	(0.0108)	(0.0105)
Inflation	0.00745	0.0273	0.0220	0.0257	0.0349	0.0760
	(0.101)	(0.0923)	(0.0959)	(0.0961)	(0.0978)	(0.0925)
Constant	0.431**	0.404**	0.361**	0.357**	0.323*	0.308*
	(0.179)	(0.179)	(0.167)	(0.168)	(0.170)	(0.171)
Observations	151	151	151	151	151	151
R-squared	0.413	0.402	0.425	0.422	0.427	0.431
Diagnostic and robustness tests						
First-stage F (FDI)	572.98	660.87	566.54	581.20	753.36	581.82
First-stage F (FDI *D)	731.55	387.25	846.36	649.81	1019.94	456.15
Shea's partial R^2 (FDI/FDI *D)	0.9201/0.9742	0.9121/0.9805	0.9064/0.9819	0.9059/0.9819	0.9054/0.9914	0.9063/0.9883
Endogeneity test (DW–H p-value)	0.3741	0.0347	0.0733	0.0817	0.3046	0.3346
Overid. test (Hansen J p-value)	0.5716	0.4219	0.5321	0.3706	0.3806	0.2418

Note: The table reports the GMM estimates of the effect of oil and gas rents (% of GDP) on the relationship between financial development index and the pre-tax Gini coefficient, evaluated across thresholds for oil and gas rents (% of GDP).

*The dummy variable equals one for countries above the threshold level of oil and gas rents to GDP, and zero for those below the threshold.
Diagnostic and robustness tests indicate that the FDI-based instruments are very strong: first-stage F-statistics for FDI and FDID are far above the conventional threshold of 10 in all specifications, and Shea's partial R^2 is very high (around 0.91–0.99), confirming substantial first-stage explanatory power. The Durbin–Wu–Hausman endogeneity test (DW–H p-value) is below 10 percent in about half of the specifications, so in those cases the null of exogeneity is rejected and there is evidence that FDI and FDID are endogenous, making the 2SLS estimates preferable to OLS. At the same time, the overidentification test (Hansen J p-value) does not reject the joint exogeneity of the instruments in any specification, supporting their overall validity.

Table B- 9
Effect of oil and gas dependency on the relationship between credit to GDP and inequality, controlling for channels.

	Base Model	Testing Education Channel	Testing Entrepreneurship Channel	Testing Both Channels
Credit to GDP (CtoG)	−0.0545**	−0.0303	−0.0252	−0.0132
	(0.0218)	(0.0196)	(0.0221)	(0.0219)
Oil and gas rents (% of GDP) (OG)	−0.151*	−0.172***	−0.237*	−0.269**
	(0.0783)	(0.0657)	(0.132)	(0.128)
CtoG * OG	0.625***	0.578***	0.626**	0.634**
	(0.228)	(0.196)	(0.302)	(0.282)
subsidies and other transfers (% of expense)	−0.188***	−0.138***	−0.128***	−0.103***
	(0.0319)	(0.0340)	(0.0390)	(0.0380)
Log of GDP per capita	0.0617	0.0958**	0.000166	0.0594
	(0.0397)	(0.0417)	(0.0482)	(0.0559)
Log of GDP per capita^2	−0.00387*	−0.00529**	0.000418	−0.00269
	(0.00233)	(0.00240)	(0.00290)	(0.00327)
Trade	−0.0192	−0.0235*	−0.0133	−0.0163
	(0.0131)	(0.0127)	(0.0124)	(0.0125)
Inflation	−0.0273	0.0198	0.0645	0.0918
	(0.0986)	(0.0935)	(0.114)	(0.101)
Lag of tertiary enrollment Rate		−0.116***		−0.102***
		(0.0306)		(0.0356)
Manufacturing, value added (% of GDP)			−0.279	−0.306*
			(0.176)	(0.164)
Technology Absorption			−0.145***	−0.108***
			(0.0374)	(0.0375)
Constant	0.440***	0.268	0.656***	0.395*
	(0.169)	(0.179)	(0.204)	(0.238)
Observations	150	148	124	124
R-squared	0.395	0.463	0.469	0.508
Diagnostic and robustness tests				
First-stage F (CtoG)	68.70	61.48	48.21	48.42
First-stage F (CtoG *OG)	121.31	117.58	356.72	339.68
Shea's partial R^2 (CtoG/CtoG *OG)	0.7137/0.9328	0.7016/0.9259	0.6991/0.9446	0.6960/0.9450
Endogeneity test (DW–H p-value)	0.0015	0.0025	0.0405	0.0726
Overid. test (Hansen J p-value)	0.5209	0.1157	0.0323	0.0022

Note: The table reports the 2SLS estimates of the effect of oil and gas rents (% of GDP) on the relationship between credit-to-GDP and the pre-tax Gini coefficient, using the continuous measure of oil and gas rents (% of GDP) and controlling for entrepreneurship and human capital channels.
First-stage F-statistics and Shea's partial R^2 indicate that the CtoG-based instruments are very strong in all specifications. The Durbin–Wu–Hausman test points to endogeneity of CtoG and CtoG*OG. The Hansen J test does not reject the overidentifying restrictions in columns (1)–(2), and we treat these as our main IV specifications. In columns (3)–(4), the Hansen J test rejects the overidentifying restrictions, so we interpret these regressions as providing only suggestive evidence on the role of the education and entrepreneurship channels rather than fully identified IV estimates.

Table B- 10
Effect of oil and gas dependency on the relationship between financial institution depth index and inequality, controlling for channels.

	Base Model	Testing Education Channel	Testing Entrepreneurship Channel	Testing Both Channels
Financial Institution Depth Index (FIDI)	0.0424	0.0653	0.101**	0.103**
	(0.0467)	(0.0421)	(0.0468)	(0.0435)
Oil and gas rents (% of GDP) (OG)	−0.0437	−0.0434	0.156	0.120
	(0.0883)	(0.0753)	(0.182)	(0.163)
FIDI * OG	2.011**	1.620**	0.253	0.249
	(0.825)	(0.808)	(1.136)	(1.104)
subsidies and other transfers (% of expense)	−0.200***	−0.145***	−0.119***	−0.0970**
	(0.0343)	(0.0349)	(0.0388)	(0.0377)
Log of GDP per capita	0.0807*	0.125***	0.0102	0.0635
	(0.0489)	(0.0470)	(0.0495)	(0.0524)
Log of GDP per capita^2	−0.00578*	−0.00761***	−0.000801	−0.00348
	(0.00311)	(0.00287)	(0.00317)	(0.00319)
Trade	−0.0233**	−0.0267**	−0.0164	−0.0182*
	(0.0111)	(0.0109)	(0.0106)	(0.0105)
Inflation	0.0506	0.0705	0.112	0.127
	(0.0942)	(0.0881)	(0.0925)	(0.0825)
Lag of tertiary enrollment Rate		−0.130***		−0.0962***
		(0.0289)		(0.0331)
Manufacturing, value added (% of GDP)			−0.188	−0.208

(*continued on next page*)

Table B- 10 (*continued*)

	Base Model	Testing Education Channel	Testing Entrepreneurship Channel	Testing Both Channels
			(0.152)	(0.142)
Technology Absorption			−0.183***	−0.148***
			(0.0412)	(0.0402)
Constant	0.380*	0.164	0.622***	0.385*
	(0.197)	(0.195)	(0.204)	(0.220)
Observations	151	150	126	126
R-squared	0.423	0.482	0.500	0.529
Diagnostic and robustness tests				
First-stage F (FIDI)	247.53	248.89	287.30	292.95
First-stage F (FIDI *D)	203.68	207.25	951.41	895.81
Shea's partial R^2 (FIDI/FIDI *D)	0.9139/0.9610	0.9128/0.9609	0.9153/0.9548	0.9160/0.9548
Endogeneity test (DW–H p-value)	0.6664	0.4839	0.5956	0.6851
Overid. test (Hansen J p-value)	0.7432	0.4038	0.0992	0.0134

Note: The table reports the 2SLS estimates of the effect of oil and gas rents (% of GDP) on the relationship between financial institution depth index and the pre-tax Gini coefficient, using the continuous measure of oil and gas rents (% of GDP) and controlling for entrepreneurship and human capital channels.
First-stage F-statistics and Shea's partial R^2 indicate that the FIDI-based instruments are very strong in all specifications. The Durbin–Wu–Hausman test yields large p-values, so we do not reject the exogeneity of FIDI and FIDI*D and OLS and 2SLS estimates are broadly similar. The Hansen J test does not reject the overidentifying restrictions in columns (1)–(2), and we treat these as our main IV specifications. In columns (3)-(4), the Hansen J test rejects the overidentifying restrictions, so we interpret this regression as providing only suggestive evidence rather than a fully identified IV estimate.

Table B- 11
Effect of oil and gas dependency on the relationship between financial institution index and inequality, controlling for channels.

	Base Model	Testing Education Channel	Testing Entrepreneurship Channel	Testing Both Channels
Financial Institution Index (FII)	0.00475	0.0556	0.105	0.134**
	(0.0634)	(0.0564)	(0.0721)	(0.0669)
Oil and gas rents (% of GDP) (OG)	−0.404**	−0.348**	−0.156	−0.135
	(0.186)	(0.167)	(0.247)	(0.229)
FII * OG	1.692**	1.430**	0.887	0.772
	(0.719)	(0.658)	(0.798)	(0.757)
subsidies and other transfers (% of expense)	−0.198***	−0.154***	−0.143***	−0.123***
	(0.0372)	(0.0366)	(0.0400)	(0.0381)
Log of GDP per capita	0.0659*	0.0974**	−0.0205	0.0302
	(0.0396)	(0.0400)	(0.0437)	(0.0501)
Log of GDP per capita2	−0.00464*	−0.00592**	0.000939	−0.00171
	(0.00240)	(0.00231)	(0.00264)	(0.00291)
Trade	−0.0227**	−0.0259**	−0.0154	−0.0171
	(0.0111)	(0.0113)	(0.0108)	(0.0112)
Inflation	0.0127	0.0465	0.0989	0.124
	(0.0986)	(0.0929)	(0.0988)	(0.0871)
Lag of tertiary enrollment Rate		−0.125***		−0.0990***
		(0.0288)		(0.0336)
Manufacturing, value added (% of GDP)			−0.229	−0.246*
			(0.150)	(0.139)
Technology Absorption			−0.167***	−0.135***
			(0.0392)	(0.0395)
Constant	0.435***	0.269	0.744***	0.516**
	(0.167)	(0.173)	(0.185)	(0.213)
Observations	151	150	126	126
R-squared	0.414	0.473	0.490	0.521
Diagnostic and robustness tests				
First-stage F (FII)	298.70	277.84	339.59	327.06
First-stage F (FII *D)	548.32	532.23	6120.36	5721.63
Shea's partial R^2 (FII/FII *D)	0.8130/0.9670	0.8169/0.9674	0.7822/0.9732	0.7913/0.9737
Endogeneity test (DW–H p-value)	0.2437	0.9144	0.5328	0.8220
Overid. test (Hansen J p-value)	0.4035	0.0907	0.1044	0.0108

Note: The table reports the 2SLS estimates of the effect of oil and gas rents (% of GDP) on the relationship between financial institution index and the pre-tax Gini coefficient, using the continuous measure of oil and gas rents (% of GDP) and controlling for entrepreneurship and human capital channels.
First-stage F-statistics and Shea's partial R^2 indicate that the FII-based instruments are very strong in all specifications. The Durbin–Wu–Hausman test yields large p-values, so we do not reject the exogeneity of FII and FII*D. The Hansen J test does not reject the overidentifying restrictions in columns (1)–(3), and we treat these as our main IV specifications. In column (4), the Hansen J test rejects the overidentifying restrictions, so we interpret this regression as providing only suggestive evidence rather than a fully identified IV estimate.

Table B- 12
Effect of oil and gas dependency on the relationship between financial development index and inequality, controlling for channels.

	Base Model	Testing Education Channel	Testing Entrepreneurship Channel	Testing Both Channels
Financial Development Index (FDI)	0.0677	0.110**	0.107**	0.129***
	(0.0458)	(0.0461)	(0.0457)	(0.0474)
Oil and gas rents (% of GDP) (OG)	−0.165*	−0.153**	−0.0890	−0.117
	(0.0904)	(0.0719)	(0.123)	(0.114)
FDI * OG	1.235***	1.040***	0.771*	0.770**
	(0.419)	(0.348)	(0.408)	(0.365)
subsidies and other transfers (% of expense)	−0.198***	−0.150***	−0.138***	−0.116***
	(0.0340)	(0.0344)	(0.0382)	(0.0365)
Log of GDP per capita	0.0911**	0.133***	0.0215	0.0842
	(0.0412)	(0.0414)	(0.0457)	(0.0520)
Log of GDP per capita2	−0.00661**	−0.00846***	−0.00185	−0.00520*
	(0.00257)	(0.00248)	(0.00285)	(0.00313)
Trade	−0.0200*	−0.0221**	−0.0114	−0.0126
	(0.0108)	(0.0106)	(0.0108)	(0.0107)
Inflation	0.0469	0.0752	0.105	0.127
	(0.0930)	(0.0880)	(0.0947)	(0.0827)
Lag of tertiary enrollment Rate		−0.130***		−0.106***
		(0.0275)		(0.0325)
Manufacturing, value added (% of GDP)			−0.268*	−0.291**
			(0.152)	(0.140)
Technology Absorption			−0.146***	−0.107***
			(0.0377)	(0.0378)
Constant	0.342**	0.136	0.592***	0.318
	(0.171)	(0.175)	(0.191)	(0.220)
Observations	151	150	126	126
R-squared	0.439	0.502	0.505	0.540
Diagnostic and robustness tests				
First-stage F (FID)	552.20	558.31	469.90	466.43
First-stage F (FID *D)	652.18	665.17	460.70	459.96
Shea's partial R^2 (FDI/FDI *D)	0.9086/0.9843	0.9124/0.9844	0.9096/0.9781	0.9149/0.9781
Endogeneity test (DW–H p-value)	0.2049	0.8525	0.4008	0.7684
Overid. test (Hansen J p-value)	0.4576	0.1120	0.1656	0.0080

Note: The table reports the 2SLS estimates of the effect of oil and gas rents (% of GDP) on the relationship between financial development index and the pre-tax Gini coefficient, using the continuous measure of oil and gas rents (% of GDP) and controlling for entrepreneurship and human capital channels.
First-stage F-statistics and Shea's partial R^2 indicate that the FDI-based instruments are very strong in all specifications. The Durbin–Wu–Hausman test yields large p-values, so we do not reject the exogeneity of FDI and FDI*D. The Hansen J test does not reject the overidentifying restrictions in columns (1)–(3), and we treat these as our main IV specifications. In column (4), the Hansen J test rejects the overidentifying restrictions, so we interpret this regression as providing only suggestive evidence rather than a fully identified IV estimate.

Table B- 13
Institutional quality-based heterogeneity tests for the effect of oil and Gas dependence on the relationship between Credit to GDP and inequality

	Baseline model with WGI	Baseline model with comparable sample	Testing Both Channels with WGI
Credit to GDP (CtoG)	−0.0495**	−0.0485*	−0.00975
	(0.0209)	(0.0257)	(0.0229)
Oil and gas rents (% of GDP) (OG)	−0.184**	−0.331	−0.842**
	(0.0862)	(0.243)	(0.364)
Worldwide Governance Indicators	−0.0144	−0.0123	−0.00133
(WGI)	(0.0117)	(0.0170)	(0.0188)
CtoG * OG	0.676***	0.902***	0.862**
	(0.229)	(0.333)	(0.439)
CtoG * OG * WGI	0.137	0.119	−1.121
	(0.331)	(0.355)	(0.693)
subsidies and other transfers	−0.183***	−0.178***	−0.0861**
(% of expense)	(0.0326)	(0.0404)	(0.0377)
Log of GDP per capita	0.0594	0.0820	0.0155
	(0.0441)	(0.0524)	(0.0569)
Log of GDP per capita2	−0.00349	−0.00477	−0.000105
	(0.00268)	(0.00330)	(0.00344)
Trade	−0.0168	−0.0136	−0.0188
	(0.0131)	(0.0146)	(0.0126)
Inflation	−0.0401	0.0616	0.0660
	(0.102)	(0.123)	(0.108)
Technology Absorption			−0.121***
			(0.0440)
Manufacturing, value added			−0.561***
(% of GDP)			(0.197)
Lag of tertiary enrollment Rate			−0.0932**
			(0.0405)
Mechanism * OG, Mechanism * OlG * WGI	.	.	.
Constant	0.425**	0.320	0.581**

(*continued on next page*)

Table B- 13 (*continued*)

	Baseline model with WGI	Baseline model with comparable sample	Testing Both Channels with WGI
	(0.183)	(0.216)	(0.242)
Observations	150	124	124
R-squared	0.408	0.393	0.509
Marginal effects of oil and gas dependence on the relationship between Credit to GDP and inequality at the 25th, 50th, and 75th percentiles of institutional quality (WGI)			
ME_p25	0.576*	0.815*	1.680***
	(0.315)	(0.489)	(0.398)
ME_p50	0.644***	0.875**	1.119***
	(0.234)	(0.370)	(0.356)
ME_p75	0.745**	0.962***	0.290
	(0.299)	(0.317)	(0.721)
Slope_ WGI	0.137	0.119	−1.121
Institutional heterogeneity test	(0.331)	(0.355)	(0.693)

Note. The first column reports the baseline specification augmented with Worldwide Governance Indicators (WGI) and its interactions with financial development and oil and gas-dependence, testing whether the effect of resource dependence on the financial development–inequality relationship varies with institutional quality. To preserve comparability, the second column re-estimates this model on the restricted sample used in column 3. The third column adds the human-capital and entrepreneurship mechanisms and interacts each mechanism with Oil and Gas rents and with WGI to quantify attenuation and to test whether the degree of attenuation varies with institutional quality (via the M × OG and and M× OG× WGI terms).

Interpretation of marginal effects: The specification includes the interactions CtoG × OG and CtoG × OG × WGI, so the (local) effect of financial development on inequality is $\frac{\partial Gini}{\partial CtoG} = \beta_{CtoG} + \beta_{CtoGOG}\,\mathrm{OG} + \beta_{CtoGOG\_wgi}(\,\mathrm{OG} \times wgi)$.

The incremental effect of oil-and-gas rents on this slope-that is, the change in the effect of credit-to-GDP on the Gini coefficient per one-unit increase in Oil and Gas rents is the cross-partial $\frac{\partial^2\,\mathrm{Gini}}{\partial \mathrm{CtoG}\partial \mathrm{OG}} = \beta_{CtoGOG} + \beta_{CtoGOG\_wgi} wgi$.

We report this quantity at the 25th, 50th, and 75th percentiles of WGI (denoted ME_oil_p25, ME_oil_p50, and ME_oil_p75), which indicate how oil and gas dependence modifies the financial development-inequality relationship at low, median, and high institutional quality, respectively. The coefficient β_{CtoGOG_wgi} (reported as Slope_WGI) captures the sensitivity of this marginal effect to institutional quality: a one-unit increase in WGI changes the marginal effect by β_{CtoGOG_wgi}. **The same explanation applies to the next three tables.**

Column 1 shows that oil and gas dependence significantly moderates the CtoG–inequality relationship regardless of institutional quality, indicating no institutional-quality heterogeneity in the "overall effect". By contrast, Column 3, with the mechanisms controlled for and allowing heterogeneity in those mechanisms (rather than an average effect), the previously negative impact of oil–gas rents on the CtoG–inequality relationship disappears. This indicates that, in such countries, the transmission channel is the weakening of entrepreneurship and human-capital mechanisms. By contrast, in countries with weak institutional quality, controlling for these mechanisms actually strengthens the oil and gas effect on the relationship, suggesting stronger channels such as corruption and resource capture by powerful groups. In sum, while oil and gas dependence attenuates the effect of financial development on inequality in countries with high, medium, and low institutional quality, the operative channels may vary.

The diagnostic tests for baseline model with WGI indicate that the instruments are strong (first-stage F-statistics of 76.2, 244.4, and 230.4 and high Shea's partial R^2 of 0.72, 0.94, and 0.92 for CtoG, CtoG * OG, and CtoG * OG * WGI), that these regressors are indeed endogenous (DW–H p-values = 0.0009 and 0.0002, justifying the use of 2SLS), and that we do not reject the joint exogeneity of the instruments (Hansen J p-value = 0.227).

First-stage F-statistics and Shea's partial R^2 for baseline model with WGI indicate that the CtoG-based instruments are very strong for all three endogenous regressors (CtoG, CtoG*OG, *and* CtoG*OG*WGI): Shea's partial R^2 ranges from about 0.72 to 0.94. The endogeneity tests (robust score and regression tests) strongly reject the null that these variables are exogenous ($p < 0.01$), so 2SLS is preferred to OLS in this specification. The overidentification test (Hansen J, $p = 0.23$) does not reject the overidentifying restrictions, supporting the joint exogeneity and overall validity of the instruments.

Table B- 14
Institutional quality-based heterogeneity tests for the effect of oil and Gas dependence on the relationship between financial institution depth and inequality

	Baseline model with WGI	Baseline model with comparable sample	Testing Both Channels with WGI
Financial institution depth (FIDI)	0.0478	0.0598	0.145***
	(0.0465)	(0.0537)	(0.0408)
Oil and gas rents (% of GDP) (OG)	−0.0929	0.0151	−0.461
	(0.0726)	(0.271)	(0.396)
Worldwide Governance Indicators	−0.0138	−0.00186	−0.00187
(WGI)	(0.0113)	(0.0158)	(0.0145)
FIDI * OG	2.129***	1.876*	−0.314
	(0.706)	(1.109)	(1.154)
FIDI * OG * WGI	−0.275	−0.0598	−2.861***
	(0.898)	(1.140)	(1.077)
subsidies and other transfers	−0.196***	−0.180***	−0.0905**
(% of expense)	(0.0340)	(0.0425)	(0.0376)
Log of GDP per capita	0.0657	0.0927	0.0596
	(0.0499)	(0.0613)	(0.0513)
Log of GDP per capita2	−0.00459	−0.00656	−0.00386
	(0.00320)	(0.00409)	(0.00317)
Trade	−0.0220**	−0.0195	−0.0178*
	(0.0110)	(0.0128)	(0.0104)
Inflation	0.0257	0.111	0.129
	(0.0968)	(0.102)	(0.0924)
Technology Absorption			−0.142***
			(0.0442)

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Table B- 14 (*continued*)

	Baseline model with WGI	Baseline model with comparable sample	Testing Both Channels with WGI
Manufacturing, value added			−0.374**
(% of GDP)			(0.156)
Lag of tertiary enrollment Rate			−0.0787**
			(0.0372)
Mechanism * OG, Mechanism * OlG * WGI	.	.	.
Constant	0.417**	0.315	0.455*
	(0.201)	(0.243)	(0.244)
Observations	151	126	126
R-squared	0.429	0.418	0.530
Marginal effects of oil and gas dependence on the relationship between financial institution depth and inequality at the 25th, 50th, and 75th percentiles of institutional quality (WGI)			
ME_p25	2.330***	1.919	1.774
	(0.849)	(1.587)	(1.367)
ME_p50	2.193***	1.889	0.344
	(0.690)	(1.219)	(1.169)
ME_p75	1.989**	1.845*	−1.773
	(0.923)	(1.072)	(1.299)
Institutional heterogeneity test	−0.275	−0.0598	−2.861***
(∂ME/∂WGI)	(0.898)	(1.140)	(1.077)
Observations	151	126	126

Note. The explanation of the estimates and coefficients is as in Table B- 13. In column (1), with 151 observations, the marginal effect of oil and gas rents on the financial institution depth–inequality link is positive and statistically significant at all three institutional-quality quantiles (p25, p50, p75). To preserve comparability, the second column re-estimates this model on the restricted sample used in column 3; as expected, precision weakens while point estimates remain similar: at p25, the effect becomes significant only from about the 23% level upward ($p \sim 0.227$); at p50, it is significant at about the 12.1% level ($p = 0.121$) but not at 10%; and at p75, it is significant at 10% ($p \sim 0.085$). In short, shrinking the sample leaves coefficients roughly unchanged, but higher variance in the smaller sample raises the significance thresholds. In column (3), the coefficient on oil–gas rents for the FIDI–inequality relationship is marginally significant ($p < 0.20$) in both low- and high-institutional-quality groups, and heterogeneity is confirmed. Analogous to the Credit to GDP results, this table shows that, once mechanisms are controlled for and allowed to vary with institutional quality, the adverse oil–gas effect in high and medium-quality settings operates through the weakening of entrepreneurship and human-capital channels, whereas in low-quality settings stronger alternative channels likely dominate.

Diagnostic tests indicate that the instruments are very strong (first-stage F-statistics of 284.7, 587.7, and 165.5 and high Shea's partial R^2 of 0.91, 0.94, and 0.94 for FIDI, FIDIOG, and FIDIOG_wgi), that we do not detect endogeneity of these regressors (DW–H p-values ≈ 0.86, implying that OLS and 2SLS estimates are statistically similar), and that we do not reject the joint exogeneity of the instruments (Hansen J p-value = 0.298).

First-stage F-statistics and Shea's partial R^2 for baseline model with WGI indicate that the FIDI-based instruments are very strong for all three endogenous regressors (FIDI, FIDI*OG, *and* FIDI*OG*WGI): Shea's partial R^2 ranges from about 0.91 to 0.94. The endogeneity tests (robust score and regression tests) yield very large p-values (around 0.86), so we do not reject the null that these variables are exogenous, and OLS and 2SLS estimates are therefore statistically similar. The overidentification test (Hansen J, $p \approx 0.30$) does not reject the overidentifying restrictions, supporting the joint exogeneity and overall validity of the instruments in this specification.

Table B- 15
Institutional quality-based heterogeneity tests for the effect of oil and Gas dependence on the relationship between financial institution index and inequality

	Baseline model with WGI	Baseline model with comparable sample	Testing Both Channels with WGI
financial institution index (FII)	0.0606	0.114	0.161**
	(0.0621)	(0.0845)	(0.0737)
Oil and gas rents (% of GDP) (OG)	−0.234	0.0402	−0.351
	(0.169)	(0.321)	(0.468)
Worldwide Governance Indicators	−0.0211*	−0.00748	0.00189
(WGI)	(0.0109)	(0.0148)	(0.0175)
FII * OG	1.310**	0.944*	0.181
	(0.559)	(0.549)	(1.027)
FII * OG * WGI	0.574	0.857*	−2.617*
	(0.416)	(0.499)	(1.572)
subsidies and other transfers	−0.201***	−0.188***	−0.116***
(% of expense)	(0.0369)	(0.0432)	(0.0392)
Log of GDP per capita	0.0670	0.0950**	0.00611
	(0.0421)	(0.0480)	(0.0520)
Log of GDP per capita2	−0.00458*	−0.00694**	−0.000795
	(0.00261)	(0.00322)	(0.00318)
Trade	−0.0192*	−0.0150	−0.0165
	(0.0110)	(0.0123)	(0.0112)
Inflation	0.0232	0.160	0.0871
	(0.100)	(0.108)	(0.0919)
Technology Absorption			−0.135***
			(0.0448)
Manufacturing, value added			−0.436***
(% of GDP)			(0.161)
Lag of tertiary enrollment Rate			−0.0845**
			(0.0385)
Mechanism * OG, Mechanism * OG * WGI	.	.	.
Constant	0.394**	0.290	0.489**
	(0.176)	(0.197)	(0.227)

(*continued on next page*)

Table B- 15 (*continued*)

	Baseline model with WGI	Baseline model with comparable sample	Testing Both Channels with WGI
Observations	151	126	126
R-squared	0.433	0.438	0.523
Marginal effects of oil and gas dependence on the relationship between financial institution index and inequality at the 25th, 50th, and 75th percentiles of institutional quality (WGI)			
ME_p25	0.891	0.318	2.091*
	(0.551)	(0.717)	(1.194)
ME_p50	1.178**	0.747	0.783
	(0.538)	(0.583)	(0.942)
ME_p75	1.603**	1.381**	−1.154
	(0.654)	(0.557)	(1.536)
Institutional heterogeneity test	0.574	0.857*	−2.617*
(∂ME/∂WGI)	(0.416)	(0.499)	(1.572)
Observations	151	126	126

Note. The explanation of the estimates and coefficients is as in Table B- 13. In column (1), with 151 observations, the marginal effect of oil and gas rents on the financial institution index-inequality link is positive at all three institutional-quality quantiles (marginal at about the 10.6% level for p25 (0.891, se = 0.551)). To preserve comparability, the second column re-estimates this model on the restricted sample used in column 3. Point estimates are similar but precision weakens: p75 remains significant at 5%, whereas p50 (0.747, se = 0.583) is only significant around the 20% level ($p \sim 0.20$) and p25 (0.318, se = 0.717) would require ≈66% ($p \sim 0.66$), so statistically insignificant. Results in column 3 are similar to the findings for the Credit to GDP and FIDI indices (Table B- 13 and Table B- 14).
First-stage F-statistics and Shea's partial R^2 for baseline model with WGI indicate that the FII-based instruments are very strong for all three endogenous regressors (FII, FII*OG, and FII*OG*WGI): Shea's partial R^2 ranges from about 0.80 to 0.97. The endogeneity tests (robust score and regression tests) yield large p-values (around 0.61–0.64), so we do not reject the null that these variables are exogenous, and OLS and 2SLS estimates are therefore statistically similar. The overidentification test (Hansen J, $p \approx 0.36$) does not reject the overidentifying restrictions, supporting the joint exogeneity and overall validity of the instruments in this specification.

Table B- 16
Institutional quality-based heterogeneity tests for the effect of oil and Gas dependence on the relationship between financial development index and inequality

	Baseline model with WGI	Baseline model with comparable sample	Testing Both Channels with WGI
financial development index (FDI)	0.0911**	0.123**	0.128***
	(0.0459)	(0.0552)	(0.0480)
Oil and gas rents (% of GDP) (OG)	−0.122	−0.00715	−0.298
	(0.0994)	(0.225)	(0.425)
Worldwide Governance Indicators	−0.0176*	−0.00260	0.00536
(WGI)	(0.0107)	(0.0156)	(0.0173)
FII * OG	1.069***	1.021***	−0.134
	(0.357)	(0.351)	(1.261)
FII * OG * WGI	0.513	0.725	−2.085
	(0.477)	(0.568)	(1.552)
subsidies and other transfers	−0.197***	−0.180***	−0.107***
(% of expense)	(0.0341)	(0.0399)	(0.0363)
Log of GDP per capita	0.0957**	0.133**	0.0367
	(0.0461)	(0.0543)	(0.0566)
Log of GDP per capita2	−0.00665**	−0.00947***	−0.00257
	(0.00295)	(0.00366)	(0.00346)
Trade	−0.0166	−0.0120	−0.0140
	(0.0108)	(0.0123)	(0.0109)
Inflation	0.0419	0.161	0.0981
	(0.0971)	(0.101)	(0.0929)
Oil and gas rents (% of GDP)	−0.122	−0.00715	−0.298
	(0.0994)	(0.225)	(0.425)
Governance Indicators	−0.0176*	−0.00260	0.00536
	(0.0107)	(0.0156)	(0.0173)
Technology Absorption			−0.131***
			(0.0451)
Manufacturing, value added			−0.448***
(% of GDP)			(0.165)
Lag of tertiary enrollment Rate			−0.0849**
			(0.0384)
Mechanism * OG, Mechanism * OG * WGI	.	.	.
Constant	0.295	0.159	0.317
	(0.187)	(0.215)	(0.243)
Observations	151	126	126
R-squared	0.451	0.456	0.540
Marginal effects of oil and gas dependence on the relationship between financial development index and inequality at the 25th, 50th, and 75th percentiles of institutional quality (WGI)			
ME_p25	0.695	0.492	1.388**
	(0.445)	(0.610)	(0.671)
ME_p50	0.951***	0.855**	0.346
	(0.351)	(0.405)	(0.976)
ME_p75	1.331***	1.391***	−1.197
	(0.471)	(0.391)	(1.977)

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Table B- 16 (*continued*)

	Baseline model with WGI	Baseline model with comparable sample	Testing Both Channels with WGI
Institutional heterogeneity test	0.513	0.725	−2.085
(∂ME/∂WGI)	(0.477)	(0.568)	(1.552)
Observations	151	126	126

Note. The explanation of the estimates and coefficients is as in Table B- 13. Columns (1) and (2) mirror the results in Table B- 13 to Table B- 15. Column (3) also shows similar changes in coefficient magnitudes, although heterogeneity is confirmed only at the 20% level.
First-stage F-statistics and Shea's partial R^2 indicate that the FDI-based instruments are very strong for all three endogenous regressors (FDI, FDI*OG, *and* FDI-*OG*WGI): Shea's partial R^2 ranges from about 0.91 to 0.99. The endogeneity tests (Durbin–Wu–Hausman) yield large p-values (around 0.55–0.59), so we do not reject the exogeneity of FDI, FDI*OG, and FDI*OG*WGI, and OLS and 2SLS estimates are therefore statistically similar. The overidentification test (Hansen J, $p \approx 0.49$) does not reject the overidentifying restrictions, supporting the joint exogeneity and overall validity of the instruments in this specification.

Table B- 17
Income-based heterogeneity tests for the effect of oil and Gas dependence on the relationship between credit to GDP and inequality.

	Baseline model	Baseline model with comparable sample	Testing Both Channels
Credit to GDP (CtoG)	−0.0466**	−0.0362	−0.0106
	(0.0226)	(0.0261)	(0.0248)
Oil and gas rents (% of GDP) (OG)	−0.0893	−0.116	−0.698**
	(0.0993)	(0.200)	(0.347)
D_{High} (dummy variable: high-income = 1, otherwise 0)	0.0216	0.0314	0.0352
	(0.0204)	(0.0230)	(0.0215)
CtoG* OG	0.211	0.235	2.177***
	(0.500)	(0.680)	(0.807)
CtoG* OG *D	0.428	0.461	−1.520*
	(0.492)	(0.562)	(0.917)
subsidies and other transfers	−0.184***	−0.175***	−0.0954**
(% of expense)	(0.0319)	(0.0382)	(0.0383)
Log of GDP per capita	0.0620	0.0738	0.0530
	(0.0413)	(0.0481)	(0.0588)
Log of GDP per capita^2	−0.00439*	−0.00527*	−0.00321
	(0.00246)	(0.00282)	(0.00364)
Trade	−0.0179	−0.0140	−0.0157
	(0.0132)	(0.0142)	(0.0129)
Inflation	0.00291	0.103	0.0894
	(0.105)	(0.127)	(0.117)
	(0.0204)	(0.0230)	(0.0215)
Technology Absorption			−0.0730*
			(0.0442)
Manufacturing, value added			−0.537***
(% of GDP)			(0.197)
Lag of tertiary enrollment Rate			−0.112***
			(0.0420)
Mechanism * OG, Mechanism * OG * Dummy (High Income = 1)	.	.	.
Constant	0.457***	0.400*	0.462*
	(0.177)	(0.209)	(0.247)
Observations	150	124	124
R-squared	0.415	0.418	0.562
Marginal effects of effect of oil and Gas dependence on the relationship between credit to GDP and inequality at the low and high-income countries			
ME_Low Income	0.211	0.235	2.177***
	(0.500)	(0.680)	(0.807)
ME_High Income	0.639***	0.696**	0.657
	(0.241)	(0.301)	(0.462)
Marginal effect difference	0.428	0.461	−1.520*
(High – Low income)	(0.492)	(0.562)	(0.917)
Observations	150	124	124

Note. Column (1) augments the baseline with a high-income indicator $D_{High} \in \{0,1\}$ and its interactions with financial development ($CtoG$) and oil and gas rents (OG) to test whether the oil and gas-dependence effect on the financial development-inequality link varies by income group. For comparability, column (2) re-estimates this model on the restricted sample used in column (3). Column (3) adds the entrepreneurship and human-capital mechanisms and interacts each mechanism with OG and D_{High} (via $M \times OG$ and $M \times OG \times D_{High}$) to quantify attenuation and to test whether attenuation differs across income groups.
Interpretation of marginal effects. The specification includes $CtoG \times OG$ and $CtoG \times OG \times D_{High}$. We take derivatives with respect to the continuous variables and evaluate at $D_{High} = 0/1$. The effect of financial development on inequality is $\frac{\partial Gini}{\partial CtoG} = \beta_{CtoG} + \beta_{CtoGOG} OG + \beta_{CtoGOG \times High}\left(OG \times D_{High}\right)$. Thus, for low-income countries ($D_{High} = 0$): $\beta_{\text{CtoG}} + \beta_{\text{CtoGOG}}\, OG$; for high-income countries $(D_{High} = 1) : \beta_{\text{CtoG}} + \left(\beta_{\text{CtoGOG}} + \beta_{\text{CtoGOG} \times D_{High}}\right) OG$. The difference between groups at a given OG is $\beta_{CtoGOG \times High} OG$.

The incremental effect of oil-and-gas rents on this slope (the cross-partial) is $\frac{\partial^2 Gini}{\partial CtoG \partial OG} = \beta_{CtoGOG} + \beta_{CtoGOG \times D_{High}} D_{High}$. We report this as ME_Low Income $= \beta_{\text{CtoGOG}}$ for $D_{High} = 0$ and ME_High Income $= \beta_{CtoGOG} + \beta_{CtoGOG \times High}$ for $D_{High} = 1$. The coefficient $\beta_{\text{CtoGOG} \times D_{High}}$ (reported as Marginal effect difference) captures income-group heterogeneity: ME_High Income − ME_low Income $= \beta_{CtoGOG \times High}$. The same logic applies in column (3) when mechanisms are included and interacted; changes in

ME_High Income and ME_low Income relative to columns (1) - (2) quantify attenuation through the entrepreneurship and human-capital channels. **The same explanation applies to the next three tables.**

Baseline results show a significant oil and gas effect only in high-income countries, with no statistically detectable heterogeneity across income groups. Once we control for entrepreneurship and human-capital mechanisms, the high-income effect vanishes, but for low-income countries the oil and gas effect strengthens and becomes significant, consistent with these mechanisms accounting for the high-income result and alternative channels (e.g., corruption/elite capture) driving the low-income result. The result also indicates significant heterogeneity in attenuation: the weakening via entrepreneurship and human capital is greater in high-income countries and absent or reversed in low-income settings.

First-stage F-statistics and Shea's partial R^2 indicate that the CtoG-based instruments are very strong for all three endogenous regressors (CtoG, CtoG*OG, *and* CtoG*OG*D_{High}): Shea's partial R^2 ranges from about 0.70 to 0.86. The endogeneity tests (robust score and regression tests) yield very small p-values ($p = 0.0015$ and $p = 0.0002$), so we reject the null that these variables are exogenous and 2SLS is preferred to OLS in this heterogeneity specification. The overidentification test (Hansen J, $p \approx 0.34$) does not reject the overidentifying restrictions, supporting the joint exogeneity and overall validity of the instruments.

Table B- 18
Income-based heterogeneity tests for the effect of oil and gas dependence on the relationship between financial institution depth index and inequality.

	Baseline model	Baseline model with comparable sample	Testing Both Channels
financial institution depth index	0.0566	0.106*	0.166***
(FIDI)	(0.0516)	(0.0542)	(0.0434)
Oil and gas rents (% of GDP) (OG)	0.0221	0.338	−0.362
	(0.119)	(0.207)	(0.339)
D (dummy variable: high-income	0.0316	0.0378*	0.0433**
= 1, otherwise 0)	(0.0197)	(0.0213)	(0.0202)
FIDI*OG	0.385	−2.641	2.594
	(1.480)	(2.264)	(1.703)
FIDI*OG*D	1.665	3.560*	−4.148*
	(1.475)	(1.904)	(2.153)
subsidies and other transfers	−0.198***	−0.173***	−0.0923**
(% of expense)	(0.0337)	(0.0404)	(0.0359)
Log of GDP per capita	0.0861	0.112**	0.103**
	(0.0524)	(0.0557)	(0.0515)
Log of GDP per capita2	−0.00678**	−0.00881**	−0.00739**
	(0.00344)	(0.00368)	(0.00333)
Trade	−0.0215*	−0.0153	−0.0127
	(0.0117)	(0.0125)	(0.0103)
Inflation	0.0789	0.194*	0.190**
	(0.0945)	(0.106)	(0.0912)
Technology Absorption			−0.116***
			(0.0434)
Manufacturing, value added			−0.331**
(% of GDP)			(0.148)
Lag of tertiary enrollment Rate			−0.103***
			(0.0370)
Mechanism * OG, Mechanism * OG *D	.	.	.
Constant	0.386*	0.276	0.286
	(0.209)	(0.225)	(0.212)
Observations	151	126	126
R-squared	0.445	0.471	0.617
Marginal effects of effect of oil and gas dependence on the relationship between credit to GDP and inequality at the low and high-income countries			
ME_Low Income	0.385	−2.641	2.594
	(1.480)	(2.264)	(1.703)
ME_High Income	2.050**	0.920	−1.554
	(0.902)	(1.005)	(1.334)
Marginal effect difference	1.665	3.560*	−4.148*
(High – Low income)	(1.475)	(1.904)	(2.153)
Observations	151	126	126

Note. The explanation of the estimates and coefficients is as in Table B- 17. In column (3), the oil and gas effect on the financial institution depth index and inequality relationship (with mechanisms controlled) is significant at the 13% and 20% level, and heterogeneity in the degree of attenuation is confirmed. Results and coefficient interpretation mirror Table B-17. Unlike Credit to GDP, for the financial depth index we observe income-group heterogeneity in the oil and gas effect on the financial depth –inequality relationship even without controlling for mechanisms.

First-stage F-statistics and Shea's partial R^2 indicate that the FIDI-based instruments are very strong for all three endogenous regressors (FIDI, FIDI*OG, *and* FIDI-*OG*D_{High}): Shea's partial R^2 lies between about 0.91 and 0.94. The endogeneity tests (robust score and regression tests) yield very large p-values (around 0.96–0.97), so the null of exogeneity for these variables is not rejected, and OLS and 2SLS estimates are essentially similar in this heterogeneity specification. The overidentification test (Hansen J, $p \approx 0.66$) does not reject the overidentifying restrictions, supporting the joint exogeneity and overall validity of the instruments.

Table B- 19
Income-based heterogeneity tests for the effect of oil and gas dependence on the relationship between financial institution index and inequality.

	Baseline model with dummy on high income	Baseline model with comparable sample	Testing Both Channels
Financial institution index (FII)	0.0827	0.122	0.200***
	(0.0690)	(0.0809)	(0.0758)
Oil and gas rents (% of GDP)	0.0346	0.167	−0.474
(OG)	(0.197)	(0.271)	(0.433)
D (dummy variable: high-income = 1, otherwise 0)	0.0229	0.0300	0.0405*
	(0.0197)	(0.0217)	(0.0213)
FII*OG	−0.288	−0.622	1.647
	(0.752)	(0.925)	(1.106)
FII*OG* D	1.331**	1.453**	−2.184
	(0.557)	(0.597)	(1.516)
subsidies and other transfers	−0.200***	−0.194***	−0.126***
(% of expense)	(0.0360)	(0.0415)	(0.0363)
Log of GDP per capita	0.0711*	0.0780*	0.0434
	(0.0388)	(0.0422)	(0.0497)
Log of GDP per capita2	−0.00592**	−0.00664**	−0.00401
	(0.00242)	(0.00264)	(0.00311)
Trade	−0.0201*	−0.0154	−0.0116
	(0.0112)	(0.0119)	(0.0111)
Inflation	0.108	0.205*	0.182*
	(0.106)	(0.116)	(0.0932)
Technology Absorption			−0.0953**
			(0.0440)
Manufacturing, value added			−0.405***
(% of GDP)			(0.156)
Lag of tertiary enrollment Rate			−0.110***
			(0.0394)
Mechanism * OG, Mechanism * OG * Dummy (High Income = 1)	.	.	.
Constant	0.434***	0.396**	0.513**
	(0.166)	(0.182)	(0.209)
Observations	151	126	126
R-squared	0.455	0.467	0.591
Marginal effects of effect of oil and gas dependence on the relationship between credit to GDP and inequality at the low and high-income countries			
ME_Low Income	−0.288	−0.622	1.647
	(0.752)	(0.925)	(1.106)
ME_High Income	1.043*	0.830	−0.537
	(0.591)	(0.664)	(1.574)
Marginal effect difference	1.331**	1.453**	−2.184
(High – Low income)	(0.557)	(0.597)	(1.516)
Observations	151	126	126

Note. The explanation of the estimates and coefficients is as in Table B- 17. Similar to financial institutions depth, the results show income-group heterogeneity in the oil and gas rents effect on the financial institution index and inequality relationship in the baseline (without mechanism controls). After adding the mechanisms, heterogeneity is only marginally significant ($p \approx 0.15$).
First-stage F-statistics and Shea's partial R^2 indicate that the FII-based instruments are very strong for all three endogenous regressors (FII, FII*OG, and FII*OG×High2): Shea's partial R^2 ranges from about 0.80 to 0.94. The endogeneity tests (robust score and regression tests) yield relatively large p-values (around 0.28–0.33), so we do not reject the null that these variables are exogenous, and OLS and 2SLS estimates are therefore statistically similar in this heterogeneity specification. The over-identification test (Hansen J, $p \approx 0.44$) does not reject the overidentifying restrictions, supporting the joint exogeneity and overall validity of the instruments.

Table B- 20
Income-based heterogeneity tests for the effect of oil and gas dependence on the relationship between financial development index and inequality.

	Baseline model	Baseline model with comparable sample	Testing Both Channels
Financial development index (FDI)	0.104**	0.133**	0.157***
	(0.0493)	(0.0533)	(0.0540)
Oil and gas rents (% of GDP) (OG)	0.0728	0.212	−0.418
	(0.152)	(0.223)	(0.338)
D (dummy variable: high-income = 1, otherwise 0)	0.0246	0.0314	0.0394*
	(0.0197)	(0.0220)	(0.0214)
FDI*OG	−0.697	−1.201	1.414
	(1.016)	(1.282)	(1.207)
FDI*OG*D	1.542*	1.803*	−1.193
	(0.905)	(1.045)	(1.588)
subsidies and other transfers	−0.200***	−0.187***	−0.117***
(% of expense)	(0.0333)	(0.0384)	(0.0348)
Log of GDP per capita	0.0992**	0.110**	0.0963*
	(0.0429)	(0.0462)	(0.0546)
Log of GDP per capita2	−0.00778***	−0.00869***	−0.00716**

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Table B- 20 (*continued*)

	Baseline model	Baseline model with comparable sample	Testing Both Channels
	(0.00273)	(0.00294)	(0.00350)
Trade	−0.0176	−0.0120	−0.00805
	(0.0110)	(0.0118)	(0.0110)
Inflation	0.113	0.213*	0.175*
	(0.104)	(0.114)	(0.0994)
Technology Absorption			−0.0693
			(0.0432)
Manufacturing, value added			−0.420**
(% of GDP)			(0.164)
Lag of tertiary enrollment Rate			−0.110***
			(0.0380)
Mechanism * OG, Mechanism * OG * Dummy (High Income = 1)	.	.	.
Constant	0.332*	0.281	0.318
	(0.178)	(0.194)	(0.226)
Observations	151	126	126
R-squared	0.464	0.479	0.592
Marginal effects of effect of oil and gas dependence on the relationship between credit to GDP and inequality at the low and high-income countries			
ME_Low Income	−0.697	−1.201	1.414
	(1.016)	(1.282)	(1.207)
ME_High Income	0.845**	0.602	0.222
	(0.394)	(0.430)	(1.057)
Marginal effect difference	1.542*	1.803*	−1.193
(High – Low income)	(0.905)	(1.045)	(1.588)
Observations	151	126	126

Note. The explanation of the estimates and coefficients is as in Table B- 17.
Diagnostic tests indicate no evidence of weak instruments (first-stage F-statistics of 475.2, 1218.6, and 434.2, with Shea's partial R^2 of 0.91, 0.97, and 0.97 for FDI, FDIOG, and FDIOG×High2), no evidence of endogeneity of the instrumented regressors (DW–H p-values ≈ 0.44 and 0.36), and no rejection of the overidentifying restrictions (Hansen J p-value = 0.455), supporting the validity of the 2SLS specification.
First-stage F-statistics and Shea's partial R^2 indicate that the FDI-based instruments are very strong for all three endogenous regressors (FDI, FDI*OG, and FDI*OG×High2): Shea's partial R^2 ranges from about 0.91 to 0.97. The endogeneity tests (robust score and regression F) yield relatively large p-values (around 0.36–0.44), so we do not reject the null that these variables are exogenous, and OLS and 2SLS estimates are therefore statistically similar in this heterogeneity specification. The overidentification test (Hansen J, p ≈ 0.46) does not reject the overidentifying restrictions, supporting the joint exogeneity and overall validity of the instruments.

Appendix C. Literature review on financial development and inequality nexus

This section surveys theory and evidence on financial development and inequality. The literature divides into: (i) inequality-decreasing mechanisms; (ii) inequality-increasing mechanisms and (iii) conditional views in which a third factor governs the sign and magnitude. We adopt the conditional perspective.

A. Theories suggesting financial development decreases inequality

1. Entrepreneurship mechanism. This mechanism posits that as the economy grows, access to financial services expands, enabling more individuals to start businesses, thereby diversifying income sources and creating new employment opportunities. Financial development is closely tied to economic growth, creating a feedback loop where improved financial intermediation reduces the costs of credit allocation and expands access to financial services. As financial markets develop, they provide the necessary resources for entrepreneurial activities, allowing more individuals, including those from lower-income groups, to participate in productive ventures, gradually reducing income inequality as more people benefit from economic opportunities (Greenwood and Jovanovic, 1990). Moreover, financial development removes credit constraints, which disproportionately affect lower-income individuals. Access to financial resources becomes a prerequisite for transitioning into entrepreneurship or higher-return occupational choices. Breaking down barriers to credit enables individuals who were previously constrained to invest in businesses and seize economic opportunities, enhancing social mobility and creating a more equitable distribution of income over time (Banerjee and Newman, 1993).

The entrepreneurship mechanism is one of the strongest channels through which financial development affects inequality. Numerous empirical studies have demonstrated that access to financial resources is critical for entrepreneurship and the growth of small and medium-sized enterprises (Aghion et al., 2007; Evans and Jovanovic, 1989). Additionally, recent studies provides robust evidence of a causal relationship between entrepreneurship and reduced income inequality (Bonaparte and Kumar, 2024; Mohamad et al., 2021). These findings emphasize the central role of the entrepreneurship mechanism in channeling the effects of financial development on inequality.

2. Human capital accumulation mechanism. This mechanism explains that financial development reduces inequality by alleviating credit constraints and enabling greater investment in education and skills. Credit constraints disproportionately affect lower-income individuals, limiting their ability to invest in human capital. By easing these constraints, financial development allows disadvantaged groups to pursue education and acquire skills, enhancing income opportunities and distributing human capital more evenly across the population (Galor and Zeira, 1993). As economies transition from reliance on physical capital to human capital as the primary driver of growth, financial development becomes essential in addressing credit barriers. By improving access to financial resources, it fosters human capital accumulation and ensures that the benefits of economic growth

are shared more equitably, reducing disparities and promoting long-term social and economic equity (Galor and Moav, 2004).

The human capital mechanism is also one of the key and widely accepted channels through which financial development affects income inequality. De Gregorio (1996) highlights how financial development fosters human capital investment by addressing credit constraints, with empirical evidence showing a positive relationship between private credit to GDP and school enrollment rates in OECD and developing countries (1980s–1990s). On the other hand, several studies emphasize the role of human capital in reducing income inequality by expanding education access and improving skills (Castelló-Climent and Doménech, 2021, 2021, 2021; Lee and Lee, 2018; Viaene and Zilcha, 2003). These findings underscore the pivotal role of the human capital channel in driving the impact of financial development on inequality.

3. Financial inclusion mechanism. This mechanism works through expanding financial inclusion, which reduces inequality by gradually increasing access to financial services. It incorporates previously excluded individuals, especially those from low-income groups, into the financial system, providing them with the tools to save, invest in productive activities like small businesses, and manage economic risks more effectively. Over time, this increased access not only enhances their economic resilience but also creates opportunities for improving income, leading to lower disparities in society (Townsend and Ueda, 2006). Additionally, this mechanism supports systemic redistribution of resources. By broadening access to credit, financial development facilitates a gradual reallocation of wealth across income groups. This market-driven process facilitates broader economic participation, allowing low-income individuals to contribute to and benefit from economic growth, ultimately fostering greater equity and inclusivity (Aghion and Bolton, 1997).

Empirical studies demonstrate that financial inclusion significantly reduces income inequality by expanding access to financial services, enhancing economic participation, and fostering income-generating opportunities, particularly in developing countries (Beck et al., 2007; Omar and Inaba, 2020).

B. Theories suggesting that financial development exacerbates inequality

1. Credit market imperfections and wealth concentration. Financial development, particularly when defined as credit expansion, can increase inequality if credit markets are imperfect, as the wealthy have better access to credit and can invest in high-return projects, further increasing their wealth. Meanwhile, poorer individuals face barriers to accessing credit, limiting their opportunities and perpetuating income inequality, leading to a cycle where the rich get richer and the poor remain poor (Aghion and Bolton, 1997; Beck et al., 2007; Galor and Moav, 2004; Greenwood and Jovanovic, 1990). Meniago and Asongu (2018), by studying 46 African countries from 1996 to 2014, highlight that simple credit expansion may worsen inequality if market imperfections like high transaction costs and information asymmetries persist. These findings align with the Credit Market Imperfections Mechanism.
2. Financial fragility and inequality. Financial development can cause financial instability, affecting the poor disproportionately. Rapid financial growth can outpace regulations, leading to crises that hit the poor hardest, as they have fewer assets and greater vulnerability. This results in increased inequality, as the poor struggle to recover while the wealthy, with diversified assets, better withstand the shocks (Rajan, 2011). Some empirical studies have demonstrated that financial development, while potentially reducing inequality, can have adverse effects if it leads to financial instability or crises due to weak regulatory frameworks (Beck et al., 2007; Jeanneney and Kpodar, 2011).
3. Technological change and skill-biased financial development. Financial development facilitates technological advancements by providing capital for research and development, supporting innovation and the adoption of new technologies (Aghion et al., 2005; Rajan and Zingales, 1998). This process enables economies to transition toward more sophisticated production methods and higher productivity levels, often requiring skilled labor. As technological change progresses, it tends to favor skilled workers, leading to increased income inequality. Skilled workers benefit from high-paying job opportunities created by new technologies, while unskilled workers face job displacement and reduced demand for their labor. This dynamic exacerbates the wage gap, perpetuating income inequality as financial development accelerates the adoption of skill-biased technologies (Acemoglu, 2002; Autor et al., 2003).

C. Theories on variables shaping the financial development-inequality relationship

Several theories suggest that specific variables can influence the relationship between financial development and income inequality.

1. Level of economic and financial development. The level of economic development plays a pivotal role in shaping the relationship between financial development and inequality, as Greenwood and Jovanovic (1990) propose. Their model suggests a non-linear, inverted-U relationship, where at lower levels of economic development, financial systems predominantly benefit the wealthy, amplifying inequality. In contrast, at higher levels of economic development, financial systems become more inclusive, enabling broader access and reducing inequality. This underscores how the stage of economic development fundamentally determines whether financial development exacerbates or mitigates inequality. Kim and Lin (2011), analyzing data from 65 countries (1960–2005), empirically validate Greenwood and Jovanovic's (1990) inverted U-shaped theory, revealing that financial development initially increases inequality but eventually reduces it after crossing a critical threshold. Similarly, Zhang and Naceur (2019), using data from 143 countries (1960–2011), observe that financial deepening benefits high-income countries while potentially increasing inequality in low-income ones, supporting the idea of development stages affecting the finance-inequality relationship. Meniago and Asongu (2018) also confirm the Kuznets hypothesis, finding an inverted U-shaped connection between financial development and inequality, consistent with Greenwood and Jovanovic's (1990) framework.
2. Institutional quality. The quality of institutions influences how financial development affects income inequality. Strong institutions ensure that financial development benefits a broad segment of society, providing inclusive access to financial services and reducing inequality. Conversely, weak institutions can lead to elite capture, where financial development disproportionately benefits the wealthy and powerful, increasing inequality (Acemoglu and Johnson, 2005; Rajan and Zingales, 2003). Law et al. (2014), using data from 81 countries (1985–2010) and a threshold regression model, find that institutional quality plays a critical role in the finance-inequality relationship. Financial development reduces income inequality only when institutional quality exceeds a certain threshold; otherwise, it has little to no effect. Zhang and Naceur (2019) also show that strong institutions enhance the inequality-reducing effects of financial development.

3. Inflation. High inflation distorts financial intermediation by exacerbating credit market imperfections, such as information asymmetries and transaction costs. It makes financial intermediaries more risk-averse, restricting credit access primarily to wealthier individuals while excluding the poor. Additionally, high inflation erodes the usefulness of money assets and leads to policy distortions in the financial structure, limiting the sector's ability to allocate resources effectively. These effects are particularly pronounced in lower-income countries with less-developed financial markets, ultimately increasing inequality (Boyd et al., 2001). Barugahara (2012), using data from 60 countries (1980–2009), finds that financial development reduces inequality at low inflation levels, but as inflation rises, its impact diminishes, and at high inflation, financial development no longer alleviates inequality due to distorted credit allocation and inefficiencies.
4. Country risk. Country risks, particularly economic risk, play a significant role in shaping the relationship between financial development and income inequality. In high economic risk environments, financial development primarily benefits the wealthy, magnifying inequality. Conversely, reducing economic risks can lead to more inclusive financial development, potentially lowering inequality. However, financial and political risks behave differently, as their reduction does not necessarily ensure more equitable outcomes, often benefiting the rich disproportionately. Chiu and Lee (2019), using data from 59 countries (1985–2015) find that the impact of financial development on inequality varies by country risk and income levels. In high-income countries, stable economic and financial conditions enable financial development to reduce inequality. However, in low-income countries, financial development often exacerbates inequality unless economic and financial risks are mitigated. Interestingly, while reducing political risk can improve stability, it may paradoxically increase inequality, as elites are better positioned to capture financial benefits in politically stable environments.

The summary of theories on the impact of financial development on inequality indicates that there are mechanisms that can both reduce and increase inequality simultaneously. This has led to empirical studies yielding diverse findings on the relationship between financial development and inequality. Some studies, such as those by Beck et al. (2007), Zhang and Naceur (2019), Meniago and Asongu (2018), Hamori and Hashiguchi (2012), and Kappel (2010), find a negative relationship, suggesting that financial development reduces inequality by expanding access to financial services and improving resource allocation. Others, including Law et al. (2014), Nikoloski (2013), Kim and Lin (2011) and Clarke et al. (2006), support an inverted U-shaped relationship, where financial development initially increases inequality before reducing it as the financial system matures. In contrast, studies such as Haan and Sturm (2017) and Seven and Coskun (2016) report a positive relationship, indicating that financial development may exacerbate inequality, particularly in the absence of inclusive institutions or equitable access. Empirical literature aligns with theoretical perspectives, indicating that financial development can reduce inequality when political and economic institutions are strong, GDP per capita is high, and inflation is low. However, unfavorable conditions in any of these variables can reverse the relationship, leading to increased inequality.

Data availability

A replication package (processed data/Stata code) is shared via a private Mendeley Data link; it will be public with a DOI upon acceptance.

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