

Li, Xiang; Su, Dan

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# Does Capital Account Liberalization Affect Income Inequality?\*

XIANG LI†, ‡ and DAN SU§

†Halle Institute for Economic Research, Kleine Maekerstrasse 8, Halle (Saale), 06108, Germany (e-mail: [xiang.li@iwh-halle.de](mailto:xiang.li@iwh-halle.de))

‡Martin Luther University Halle-Wittenberg, Universitaetsplatz 10, Halle (Saale), 06108, Germany (e-mail: [xiang.li@iwh-halle.de](mailto:xiang.li@iwh-halle.de))

§University of Minnesota, 321 19th Ave S, Minneapolis, Minnesota 55455, USA (e-mail: [suxxx478@umn.edu](mailto:suxxx478@umn.edu))

## Abstract

By adopting an identification strategy of difference-in-difference estimation combined with propensity score matching between liberalized and closed countries, this paper provides robust evidence that opening the capital account is associated with an increase in income inequality in developing countries. Specifically, capital account liberalization, in the long run, is associated with a reduction in the income share of the poorest half by 2.66–3.79% points and an increase in that of the richest 10% by 5.19–8.76% points. Moreover, directions and categories of capital account liberalization matter. The relationship is more pronounced when liberalizing inward and equity capital flows.

## I. Introduction

For policymakers worldwide, one of the top concerns is the current debate on how and to what extent a country, especially a developing country, should liberalize its capital account. Therefore, a clear understanding of the related impacts is essential. Specifically, capital account liberalization is the external aspect of financial liberalization and indicates policies that are designed to reduce the constraints of cross-border capital flows into or from foreign economies. Compared with the large body of studies investigating the consequences of capital account liberalization for economic growth and financial instability, works on its distributional consequences are much less common. In recent decades, a simultaneous increase in income inequality and capital account liberalization has emerged as a significant phenomenon. A first glance at the trends of capital account openness and income inequality suggests a positive correlation. Figure 1 shows that income inequality developed in tandem with capital account openness during the period 1970–2015.<sup>1</sup> However, the theoretical

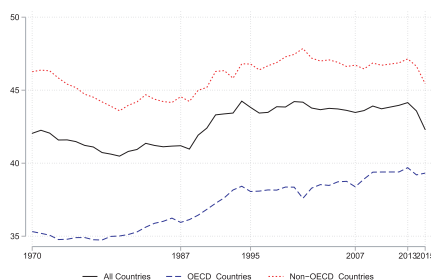
JEL Classification numbers: F38; D63.

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[Correction added on 9th October 2020, after first online publication: Projekt Deal funding statement has been added.]

<sup>1</sup>The correlation coefficient between the Gini coefficient and the Chinn-Ito capital account openness measure is 0.86, and it is statistically significant with a *P*-value of less than 0.001.

## (a) Gini Coefficient



## (b) Capital Account Openness

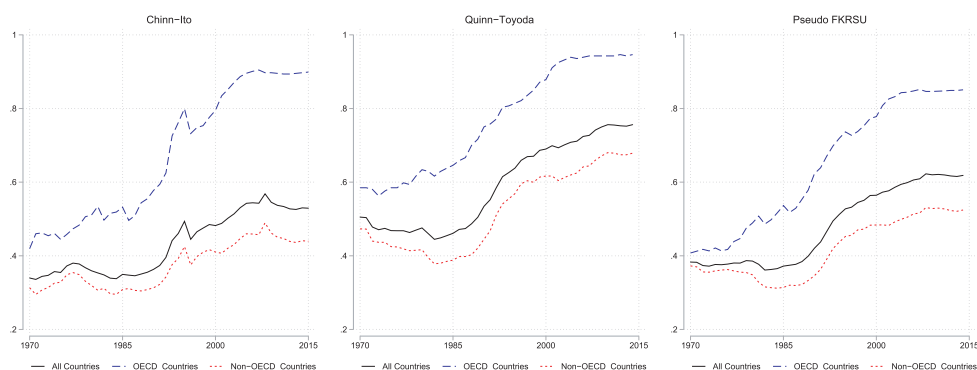


Figure 1. Time series of gini coefficient and capital account openness by country groups

Notes: The Gini coefficient is from the EHII database. The OECD countries here does not include Lithuania which became a member in 2018.

hypothesis on the relationship is ambiguous, and much empirical work needs to be done.

This study investigates the relationship between capital account liberalization and income inequality. Specifically, it assesses whether and how domestic income inequality changes with the liberalization of cross-border capital flows. Hence, this study focuses on inequality within rather than between countries even though global inequality (i.e. worldwide income distribution) is important.<sup>2</sup> The key findings are threefold. First, capital account liberalization is associated with an increase in income inequality in developing countries; however, the relationship is insignificant for developed economies. Moreover, the association is stronger over the long term than over the short term: opening the capital account is associated with a short-term rise of 0.07–0.30 standard deviations in the overall Gini coefficient and as large as 0.32–0.62 standard deviations over the following 10 years. Second, the increase in income inequality is attributable to the considerable increase in the income share of the rich groups and the decrease in that of the poor groups after capital account liberalization. The magnitude of increase in the income share of rich groups is higher than the decrease seen among the poor groups: there is a decrease in the income

<sup>2</sup> Our choice of focus is based on two reasons. The first pertains to the difficulty of constructing a global inequality index from representative worldwide income data and the second is that we are interested to see whether there are different findings of capital account liberalization with respect to heterogeneity among countries.

share of the poorest half by 2.66–3.79% points and an increase in that of the richest 10% by 5.19–8.76% points over the long term. Third, in terms of the different dimensions of capital account liberalization, we find that both directions and categories are significant. The strong association with increased income inequality arises mainly from inward capital account liberalization rather than from outward liberalization; moreover, the relationship is the most pronounced in the liberalization of the international equity market while liberalizing foreign direct investment (FDI) shows a much smaller and statistically insignificant relationship with income inequality. All of these findings do not depend on the selection of specific indicators of capital account liberalization or income inequality. We demonstrate the robustness of our findings by using Gini coefficients and income shares from other databases and other capital account liberalization indicators, and the results do not change qualitatively and are quantitatively even stronger in some specifications.

This study makes four substantive contributions to the literature that links external financial liberalization to income inequality. First, we provide evidence of an association between opening the capital account and the income shares of different income groups. Previous studies have largely used the nationwide Gini index as the dependent variable, and thus the use of income share data in this study not only provides overall distributional results but also captures which group changes the most. Second, we construct a new capital account liberalization index based on existing ones and identify exact liberalizing years for each country based on various capital account openness indicators. By regressing on the other capital account openness indicators, we extend the data of Fernández *et al.* (2016), including granular data for different directions and categories of capital account liberalization. Next, we date the exact liberalizing year for each country and construct a dataset that complements a difference-in-difference (DID) analysis. Specifically, the liberalizing year is identified when there is a substantial change in the average degree of capital account openness in the 10 years before and after, especially when the average openness value changes from negative to positive. Third, we employ the DID approach combined with propensity score matching (PSM) to estimate the relationship between opening the capital account and income inequality within a 20-year window. Thus, we mitigate endogeneity concerns of conventional panel fixed effects models, as the DID method aims to construct a quasi-experiment by selecting two groups of similar countries and randomly liberalizing the capital account of the treated group while keeping that of the control group closed. Thus, we can cautiously interpret the findings of this study one step closer to causality. Fourth, we distinguish between the heterogeneous results of various dimensions of capital account liberalization, which can help narrow the discussion on specific opening policies.

The rest of this paper is organized as follows. Section II reviews the relevant literature. Section III describes the data and variables. Section IV describes the two empirical model specifications. Section V presents the estimation results. Section VI concludes.

## II. Literature review

The interaction between finance and income distribution is necessary to understand the economic impacts of financial policies and manage the social tensions of inequality. Building on the literature, we first define three nested key terms: financial development, financial

liberalization, and capital account liberalization. We then discuss possible transmission mechanisms between capital account liberalization and income inequality and state our contributions by summarizing relevant studies and novelty of this study.

First, the term financial development is a broad concept. It involves the establishment and expansion of financial institutions, instruments, and markets. Most studies on financial development focus on domestic financial markets. Theoretically, Becker and Tomes (1979), Galor and Zeira (1993), and Banerjee and Newman (1993) show that financial market imperfections impede risk sharing; thus, easing credit constraints and providing the poor access to financial markets can improve equalized distribution. By contrast, Greenwood and Jovanovic (1990) suggest a nonlinear relationship between finance and income inequality. In the early stages of financial development, inequality is likely to increase because richer agents have less information friction on risky investments; however, as the financial sector matures and becomes more extensive, inequality reduces because more participants have access to the financial market. Generally speaking, empirical studies have measured financial development by examining how efficiently the financial system fuels the economy. Indicators of financial development most commonly used in the literature include the gross domestic product (GDP) share of liquidity liabilities such as M2 (Li, Squire and Zou, 1998; Milanovic, 2005; Hamori and Hashiguchi, 2012), the GDP share of credit to the non-financial sector (Clarke, Xu and Zou, 2006; Beck, Demirgüç-Kunt and Levine, 2007; Hamori and Hashiguchi, 2012), and stock market capitalization (Baiardi and Morana, 2018; Asteriou, Dimelis and Moudatsou, 2014; Das and Mohapatra, 2003).<sup>3</sup>

Second, financial liberalization is defined as various measures adopted to ease the constraints of financial development, and it is often used interactively with financial reform. Financial liberalization involves internal policies to ease controls in domestic financial markets and external policies that allow the development of cross-border financial markets. Most empirical studies on financial liberalization use the index constructed by Abiad, Detragiache and Tresselt (2010), which summarizes *de jure* changes in credit controls, interest rate controls, entry barriers for banks, regulation, privatization and restrictions on international financial transactions. Using this index, Agnello, Mallick and Sousa (2012), Delis, Hasan and Kazakis (2013), and Li and Yu (2014) find that financial liberalization reduces income inequality, but its composition matters, and different categories of financial liberalization can have different impacts. Jaumotte, Lall and Papageorgiou (2013) and Zhang and Naceur (2019), however, compare the role of financial liberalization with that of trade liberalization and financial access and find that financial liberalization increases income inequality.

Third, capital account liberalization is the external aspect of financial liberalization, and we use this term interchangeably with financial globalization. Compared with domestic financial liberalization such as lifting interest rate controls and credit controls, capital account liberalization specifically indicates a reduction in cross-border capital flows and investment constraints into or from foreign economies. As the global financial market has become more integrated over recent decades, studies on financial globalization have become more common. The literature on the impact of financial globalization focuses on

<sup>3</sup> In terms of the extensive dimension of financial development, studies such as Mookerjee and Kalipioni (2010) and Neaime and Gaysset (2018) use the number of commercial bank branches per 100,000 inhabitants and barriers to financial inclusion as proxies for financial access and find that greater access to bank branches reduces income inequality.

economic growth (Bekaert, Harvey and Lundblad, 2005; Prasad *et al.*, 2005; Kose, Prasad and Terrones, 2009) and financial stability (Berger *et al.*, 2016; Cubillas and González, 2014), and its distributional consequences have thus been underinvestigated until recently.

Several channels could link capital account liberalization to income inequality, but with ambiguous predictions for the sign of the correlation. First, when international capital flows into high-skill industries, opening the capital account would increase wages for high-skilled workers relative to low-skilled workers, thus raising income inequality. This contrasts with the implications of the Stolper–Samuelson theorem (Stolper and Samuelson, 1941), according to which low-skilled workers' wages would increase in developing countries with trade openness because these countries are relatively abundant in low-skilled workers. The Stolper–Samuelson theorem assumes that neither labour nor capital can flow freely across borders. When the movement of cross-border capital flows is allowed, the implication of a reduction in inequality weakens. Second, capital account liberalization can affect income inequality by changing access to financial resources and the depth of financial services for different income groups. These channels imply that the composition of capital flows matters. For instance, there is evidence that FDI is more inclined to flow into high-skilled sectors and that this tends to increase inequality (Choi, 2006; Acharyya, 2011; Wu and Hsu, 2012; Jaumotte *et al.*, 2013). Meanwhile, Herzer and Nunnenkamp (2013) find that FDI reduces income inequality over the long run while the short-run effect can be positive, and some studies show that foreign bank lending is likely to be associated with improved financial access for the poor, which reduces inequality (Fund, 2007). Therefore, whether capital account liberalization is associated with an increase or a decrease in income inequality remains an empirical question.

In this study, the research question concerns whether and how capital account liberalization, which is distinguished by the direction and category of capital flows, is associated with income inequality. The relevant literature has ignored this issue until recently, and the existing findings are inconclusive. Fund (2007), Jaumotte *et al.* (2013) and Asteriou *et al.* (2014) find that capital account openness is associated with increased inequality. They argue that the dis-equalizing impact increases the premium on high-skilled labour and possibly returns to capital and that this is more significant in developed countries. In contrast, Dorn, Fuest and Potrafke (2018) employ an instrumented variable approach and find a robust and positive link between globalization and the Gini coefficient in the case of transition economies vs. advanced economies, but they measure globalization in terms of trade, FDI, and social and political globalization and do not consider external finance globalization. Both Jaumotte and Osorio (2015) and Zhang and Naceur (2019) argue that external financial liberalization policies are related to higher inequality, and Das and Mohapatra (2003) find that income inequality increases subsequent equity market liberalization.

Other studies find that the relationship between capital account liberalization and inequality is conditional. Furceri and Loungani (2018) provide evidence that the positive impact of capital account liberalization on income inequality is greater for countries with weak financial institutions and low financial development and in periods following financial turmoil. Furceri, Loungani and Ostry (2019) find that capital account liberalization increases inequality by reducing the share of labour income, particularly for industries with greater dependence on external finance, higher natural layoff rates and higher elasticity of

substitution between capital and labour. De Haan and Sturm (2017) conclude that financial liberalization increases income inequality depending on levels of financial development and political institutions. Similarly, Bumann and Lensink (2016) find that capital account liberalization lowers income inequality after a critical threshold of financial development is reached.

This study contributes to the literature in several ways. First, we adopt both the Gini coefficient and income share data of different groups to measure income inequality. The Gini coefficient is a broad indicator and provides little information on the structure of income inequality or the gap between different income groups; thus, measuring the income share with respect to the income level is necessary (Piketty and Zucman, 2014). Most extant studies use the conventional Gini coefficient, although there are a few exceptions. For instance, Das and Mohapatra (2003), Jaumotte *et al.* (2013), Kim and Lin (2011), Han, Liu and Zhang (2012), Kirschenmann, Malinen and Nyberg (2016), Mah (2013) and Cabral, García-Díaz and Mollick (2016) use the metric of quintile or decile income shares and the income share of the poorest or richest groups to measure income inequality. However, the datasets used in these studies lack international coverage or are restricted to limited years. Using income share data for more countries and years, this study examines which income groups show the largest increase or decrease in income share in relation to capital account liberalization and how such relationships are different between income groups.

Second, this study distinguishes between various perspectives on capital account liberalization. As stated in Asteriou *et al.* (2014), the composition of financial flows is significant for the net effect of globalization on inequality. Building on the new capital account liberalization measure proposed by Fernández *et al.* (2016), we examine how the liberalization–inequality correlation differs between the liberalization of equities, bonds, FDI and other capital. We also distinguish between inward and outward capital account liberalization. This study is, therefore, the first to investigate the association between different categories of capital account liberalization and income inequality, thereby having practical implications for policymakers in designing a roadmap of capital account opening.

Third, this study contributes by mitigating endogeneity concerns in the relationship between capital account liberalization and income inequality using a DID model. In addition to the generalized method of moments (GMM) estimation technique used in the panel data model to mitigate the endogeneity of the capital account openness variable, we construct a DID dataset by identifying the exact year of capital account liberalization when a country has experienced a substantial change from a closed capital account to a more liberalized one and by pairing the treated countries with control countries similar to the treated ones before liberalization. This methodology allows us to compare the change in income inequality between cases with capital account liberalization and those without liberalization based on a quasi-natural experiment. Similarly, the philosophy of identifying episodes of capital account liberalization and conducting DID analysis is applied in Larrain (2014) and Furceri *et al.* (2019), and our methods differ from theirs in the following respects. First, we use regressions to identify liberalization years, which show a significant change in capital account liberalization from an average negative value of capital account openness 10 years before to an average positive value of capital account openness 10 years after, instead of using simple criteria such as differences greater than two standard deviations in annual capital account openness. Second, as we are interested in the long-run relationship,

this requires considering capital account liberalization episodes of longer than 10 years to compare the change in average income inequality 10 years before and after liberalization; the studies above, by contrast, focus on short- to medium-term effects occurring within the 5 years following liberalization. Third, while the above works do not match treated groups with appropriate control groups over a 20-year window, we combine the DID setting with the PSM method and construct a quasi-natural experiment of capital account liberalization. Fourth, while the above works do not distinguish between directions and categories of capital account openness, we document different years of inward and outward liberalization and those of the liberalization of the equity market, the bond market, FDI and other investments.

### III. Data

This section describes our datasets and the construction of key and control variables. The key variables are measures of income inequality and capital account liberalization. For income inequality, we use both the Gini coefficient and the income share of different groups. For capital account liberalization, we use capital account openness indicators in the panel fixed effects model and the identified year of capital account liberalization in the DID model. Table 1 presents the data sources and summary statistics of the variables used in this study.<sup>4</sup>

#### Income inequality

The most conventional measure of income inequality is the Gini coefficient. A Gini coefficient ranges from 0 to 100 with 0 representing perfect equality and 100 representing perfect inequality. The Gini coefficients used in this study are taken from the Estimated Household Income Inequality (EHII) database compiled by the University of Texas Inequality Project (UTIP). We choose the EHII dataset over other Gini coefficient datasets such as the World Income Inequality Database (WIID, maintained and updated by UNU-WIDER), the Standardized World Income Inequality Database (SWIID), and the World Bank's PovcalNet because the latter are flawed. The WIID succeeds the dataset compiled by Deininger and Squire (1996) and is commonly used in empirical studies on income inequality, but includes mixed data (i.e. gross vs. net, household vs. individual, and income vs. expenditure data) and less frequent observations. As noted by Gimet and Lagoarde-Segot (2011), merely extrapolating values or extending the data interval based on Deininger and Squire (1996) would create serial dependencies in measurement errors. SWIID data and the World Bank's PovcalNet lack consistency and comparability. The SWIID is a revision of the WIID; however, some studies, in particular Jenkins (2015), pose serious questions about the imputation model that underpins the SWIID and suggest that using SWIID data may result in bias despite its broad coverage. Similarly, the global coverage of PovcalNet comes at the cost of lower comparability. As the World Bank warns, it was developed solely for the public replication of the World Bank's poverty measures; therefore, using PovcalNet to track income distribution can be challenging.

The EHII dataset circumvents these problems by deriving the econometric relationship between the Deininger–Squire Gini coefficient and a Theil-index-based measure of the

<sup>4</sup>The number of countries considered for inequality measurements by year is shown in the appendix in Table A9.



TABLE 1  
Variable summary statistics and data sources

	N	Mean	SD	Min	Max	Definition	Source
KA Chinn-Ito	6926	0.45	0.36	0.00	1.00	<i>De jure</i> overall capital account liberalization index	Chinn and Ito (2008)
KA Quinn-Toyoda	5134	0.60	0.30	0.00	1.00	<i>De jure</i> overall capital account liberalization index	Quinn and Toyoda (2008)
KA Original FKRSU	2100	0.63	0.34	0.00	1.00	<i>De jure</i> overall capital account liberalization index	Fernández <i>et al.</i> (2016)
KA original FKRSU-inward	2100	0.64	0.32	0.00	1.00	<i>De jure</i> inward capital account liberalization index	Fernández <i>et al.</i> (2016)
KA Original FKRSU-Outward	2098	0.61	0.39	0.00	1.00	<i>De jure</i> outward capital account liberalization index	Fernández <i>et al.</i> (2016)
KA original FKRSU-equity	2080	0.62	0.39	0.00	1.00	<i>De jure</i> capital account liberalization index of equity market	Fernández <i>et al.</i> (2016)
KA Original FKRSU-Bond	1833	0.62	0.39	0.00	1.00	<i>De jure</i> capital account liberalization index of bond market	Fernández <i>et al.</i> (2016)
KA original FKRSU-direct investment	2099	0.61	0.40	0.00	1.00	<i>De jure</i> capital account liberalization index of direct investment	Fernández <i>et al.</i> (2016)
KA Original FKRSU-Other Investment	2097	0.63	0.34	0.00	1.00	<i>De jure</i> capital account liberalization index of other investment	Fernández <i>et al.</i> (2016)
KA Pseudo FKRSU	4837	0.49	0.25	0.00	0.90	<i>De jure</i> overall capital account liberalization index	Extension based on regressions using data from Fernández <i>et al.</i> (2016), Chinn and Ito (2008) and Quinn and Toyoda (2008)
KA Pseudo FKRSU-inward	4837	0.51	0.24	0.00	0.91	<i>De jure</i> inward capital account liberalization index	Fernández <i>et al.</i> (2016)
KA Pseudo FKRSU-Outward	4837	0.47	0.27	0.00	0.89	<i>De jure</i> outward capital account liberalization index	Fernández <i>et al.</i> (2016)
KA Pseudo FKRSU-equity	4837	0.51	0.24	0.06	0.90	<i>De jure</i> capital account liberalization index of equity market	Fernández <i>et al.</i> (2016)
KA Pseudo FKRSU-bond	4837	0.48	0.26	0.02	0.93	<i>De jure</i> capital account liberalization index of bond market	Fernández <i>et al.</i> (2016)

*continued*

TABLE 1  
(Continued)

	N	Mean	SD	Min	Max	Definition	Source
KA Pseudo FKRSU-direct investment	4837	0.50	0.22	0.02	0.94	<i>De jure</i> capital account liberalization index of direct investment	Fernández <i>et al.</i> (2016)
KA Pseudo FKRSU-other investment	4837	0.49	0.26	0.08	0.90	<i>De jure</i> capital account liberalization index of other investment	Fernández <i>et al.</i> (2016)
KA De Facto	6492	2.38	10.66	0.05	240.75	(total external asset+total external liability)/GDP	Lane and Milesi-Ferretti (2007)
KA De Facto-Equity	6446	0.29	3.10	-0.01	82.39	(total external equity asset+total external liability)/GDP	Lane and Milesi-Ferretti (2007)
KA De Facto-Debt	6515	1.42	4.74	0.00	98.65	external equity liability/GDP	Lane and Milesi-Ferretti (2007)
KA De Facto-FDI	6526	0.53	3.15	-0.15	90.79	(total external debt asset+total external liability)/GDP	Lane and Milesi-Ferretti (2007)
Gini EHII	4074	42.57	7.29	20.58	62.85	(total FDI asset+total FDI liability)/GDP	Estimated household income inequality (EHII)
Gini WIID	1594	36.99	8.98	19.40	73.25	Gini coefficient	World income inequality database (WIID)
Gini SWIID	5092	45.20	6.65	22.68	69.84	Gini coefficient	Standardized world income inequality database (SWIID)
Gini WDI	1404	39.26	9.56	21.00	65.80	Gini coefficient	World development indicators (WDI)
Income share of the bottom 50% (WDI)	3114	18.22	7.45	3.71	45.24	Income share of the bottom 50% group	World inequality database (WDI)
Income share of the middle-40% (WDI)	3114	39.15	6.11	14.43	51.16	Income share of the middle 40% group	World inequality database (WDI)
Income share of the Top 10% (WDI)	3126	42.67	13.05	13.28	79.87	Income share of the top 10% group	World inequality database (WDI)
Income share of the 1st quintile share (WIID)	1393	6.65	2.24	0.92	14.10	Income share of the 1st 20% group	World income inequality database (WIID)
Income share of the 2nd quintile share (WIID)	1373	11.52	2.48	2.27	17.20	Income share of the 2nd 20% group	World income inequality database (WIID)

*continued*

TABLE 1  
(Continued)

	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>Definition</i>	<i>Source</i>
Income share of the 3rd quintile share (WIID)	1371	15.92	2.25	5.18	20.20	Income share of the 3rd 20% group	World income inequality database (WIID)
Income share of the 4th quintile share (WIID)	1371	22.07	1.50	13.67	25.50	Income share of the 4th 20% group	World income inequality database (WIID)
Income share of the 5th quintile share (WIID)	1406	43.81	7.90	28.20	77.96	Income share of the 5th 20% group	World income inequality database (WIID)
GDP per capita	7793	0.01	0.02	0.00	0.14	GDP per capita (constant 2010 million US\$)	World development indicators (WDI)
Inflation	6759	0.36	5.02	−0.36	244.11	Inflation, consumer prices	World development indicators (WDI)
Private credit	6939	0.40	0.37	0.00	3.12	Domestic credit to private sector/GDP	World development indicators (WDI)
Unemployment	4096	8.27	6.42	0.05	59.50	Unemployment, total (% of total labor force) (national estimate)	World development indicators (WDI)
Money supply	6242	47.50	46.23	0.27	977.01	Broad money (% of GDP)	World development indicators (WDI)
Education	6956	96.82	23.04	2.83	221.99	School enrollment, primary (% gross)	World development indicators (WDI)
Government consumption	7113	16.46	7.89	0.00	156.53	General government final consumption expenditure (% of GDP)	World development indicators (WDI)
Urbanization	10075	52.55	25.50	2.85	100.00	Urban population (% of total)	World development indicators (WDI)
Age dependency	9113	70.29	20.35	16.45	120.75	Age dependency ratio (% of working-age population)	World development indicators (WDI)
Trade openness	7422	82.49	54.16	0.02	860.80	Trade (% of GDP)	World development indicators (WDI)
Polity2	7139	1.23	7.36	−10.00	10.00	Institutional quality	Polity IV
Corruption	4447	3.05	1.34	0.00	6.00	Corruption	International country risk guide (ICRG)

industrial sector pay dispersion<sup>5</sup> by controlling the manufacturing employment-to-total-population ratio and other variables. Thus, EHII data account for missing inequality observations by replicating the Deininger–Squire dataset with estimated measures of household income inequality.<sup>6</sup> The EHII dataset also has wide coverage in terms of both years and the number of countries. The data were updated in September 2018 and have 4,550 non-missing observations of 153 countries for 1963–2015. While EHII data have been widely used in other social sciences, they do not have much uptake in economics<sup>7</sup>, but exceptions include Herzer and Nunnenkamp (2013), Herzer, Hühne and Nunnenkamp (2014), and Figini and Görg (2011), and we are among the first to use the most updated version of the EHII data that extend the year coverage to 2015. We compare these databases in detail and show the correlation between the Gini coefficients of various datasets in the appendix in Table A1. While each database has its advantages and disadvantages, to the best of our knowledge, the EHII database is the most comprehensive and comparable source of income Gini coefficients; therefore, we employ it in our baseline analysis and use data from other sources in our robustness checks.

The time series of the EHII Gini coefficient in Figure 1 shows that income inequality is higher in non-OECD<sup>8</sup> countries than in OECD countries and that their trends differ by period. From 1970 to 1987, the Gini coefficients of non-OECD countries were declining, whereas those of OECD countries were rising, albeit from a much lower level. From 1987 to 1995, both groups of countries experienced a deterioration in income inequality; however, OECD countries remained stable from 1995 while non-OECD countries could not stabilize until the early 2000s. From 2007 to 2013, income inequality remained stable in non-OECD countries but increased steadily in OECD countries. After 2013, income inequality declined in both groups.

However, reducing the whole income distribution to a single Gini index value can be too simplified to capture the overall distribution structure (Piketty and Zucman, 2014). In addition to the Gini index, we use income share data from the World Inequality Database (WID), which was first developed by Piketty and Zucman (2014) and later expanded to include the evolution of the national income structure in the long run. Compared to the other income share database, namely, the WIID, WID data offer broader geographic and time coverage, especially for non-OECD countries. The WID data include 3,114 non-missing observations for 112 countries for 1970–2015 of the income share of the bottom 50%, middle 40% and top 10% while the WIID data include 1,371 non-missing observations for 93 countries for the same period, although with more granular data for the income share of the first to fifth quintile groups. We also use more granular but smaller coverage income share data from the WIID in our robustness checks.

<sup>5</sup> Industrial sector pay dispersion data are from the UTIP-UNIDO (United Nations Industrial Development Organization).

<sup>6</sup> The construction process of the EHII Gini coefficient is described in detail in Galbraith and Kum (2005) and Gimet and Lagoarde-Segot (2011).

<sup>7</sup> We thank the anonymous referees for highlighting this point.

<sup>8</sup> The OECD stands for the Organization for Economic Cooperation and Development. OECD countries here do not include Lithuania, which became a member in 2018.

### Capital account liberalization

Capital account liberalization is the key explanatory variable in this study. We employ three different *de jure* capital account openness indicators from Chinn and Ito (2008) (Chinn-Ito hereafter), Quinn and Toyoda (2008) (Quinn-Toyoda hereafter), and Fernández *et al.* (2016) (FKRSU hereafter) to capture government policy on cross-border capital flows. All of the indicators are constructed based on the International Monetary Fund's (IMF's) *Annual Report on Exchange Arrangements and Exchange Restrictions* (AREAER), which describes legal restrictions on international capital transactions in place in each country. Each indicator has its pros and cons as a measure of capital account liberalization and for the purpose of identifying liberalizing years in this study. We describe them below and use all three indicators in our empirical analysis to show that the results do not depend on a specific capital account liberalization indicator.

The *KAOPEN* index developed by Chinn and Ito (2008) is constructed as the first standardized principal component of  $k_1$ ,  $k_2$ ,  $SHAREk_3$  and  $k_4$ , where  $k_1$  is the dummy variable indicating the absence of multiple exchange rates,  $k_2$  is the dummy indicating the absence of restrictions on current account transactions,  $SHAREk_3$  is the share of a 5-year window in which capital controls were not in effect ( $k_3$  is a dummy indicating the absence of restrictions on payments of capital transactions), and  $k_4$  is the dummy indicating the absence of requirements to surrender export proceeds. The advantage of the Chinn-Ito index lies in its comprehensive coverage of countries and time periods (i.e. 182 countries from 1970 to 2015); however, there are two concerns. First, three of the four components ( $k_1$ ,  $k_2$  and  $k_4$ ) are financial current account instead of the capital account. Second, the 5-year moving average of the  $SHAREk_3$  may subvert the procedure for accurately dating the capital account liberalization year and thus affect later DID estimates. As Chinn and Ito (2002) argue, however, the incorporation of  $k_1$ ,  $k_2$  and  $k_4$  is based on merit and can be interpreted as the intensity of capital controls because countries may still restrict the flow of capital by limiting transactions on current account or through other systems such as multiple exchange rates and requirements to surrender export proceeds even when the capital transaction is not controlled, and restrictions on the financial current account ensure that the private sector does not circumvent capital account restrictions. Thus, we continue to use the aggregated Chinn-Ito index in the main analysis, but we present and discuss the dynamic panel estimates using each of the four subcomponents and the DID estimates using the original  $k_3$  (without smoothing over the years) in identifying the liberalizing year in appendix Section A5.

The Quinn-Toyoda index is based on a simple textual analysis of text published in the AREAER, which reports on laws used to govern international financial transactions. This approach measures both the existence (or absence) of restrictions and the magnitude of those restrictions starting from the lowest level (by contrast,  $k_1$  to  $k_4$  in the Chinn-Ito index are dichotomous). The original Quinn-Toyoda index consists of CAP and CUR, which respectively represent openness to capital flows and proceeds from the international trade of goods and services. We only use the CAP, as we focus on the liberalization of capital transactions, and we already have the Chinn-Ito index to account for possible capital transactions made under the category of financial current account.<sup>9</sup> The advantage of the

<sup>9</sup> Specifically, the 'Quinn-Toyoda' index in this study refers to the CAP component of the original Quinn-Toyoda index.

Quinn-Toyoda index lies in its simplicity and preciseness in capturing capital account openness, which contributes to the dating of capital account liberalization years. Limitations include its more limited coverage of developing countries and updating difficulties, which result in lesser availability for recent years, although the authors have made several efforts and expanded the coverage to 126 countries for 1970–2014.<sup>10</sup>

The FKRSU dataset provides more granularity by distinguishing the directions and categories of capital flows, unlike the other two indicators. It contains capital control information for 10 types of assets: money markets, bonds and other debt securities, equities, collective investments, financial credits, derivatives, commercial credit, guarantees, sureties and financial back-up facilities, real estate transactions, and direct investments. To distinguish the direction of capital flows, Fernández *et al.* (2016) use the buyer's or seller's tax residence information and whether a transaction represents a purchase, sale or issuance. In this study, we use the aggregated capital controls of each of the four kinds of assets: equities; bonds; direct investments; and other investments, which is the average of the remaining seven types of assets<sup>11</sup>, the aggregated capital controls for the overall capital outflow and inflow, and the most aggregated capital control of the entire capital account. As the AREAER provides sub-categorical information instead of a single type of capital transactions from 1995, the original FKRSU dataset is only available for 100 countries for 1995–2015. As we show below, a large proportion of capital account liberalization happened in the 1970s and 1980s; from 1995 onwards, the FKRSU index is most limited in comparing impacts before and after liberalization. Thus, we follow Bekaert *et al.* (2016) in extending the data back to 1970 using the fitted values based on estimates from a regression of the original FKRSU series on the Chinn-Ito index and the Quinn-Toyoda CAP and CUR indices. We conduct the regressions separately for OECD countries and non-OECD countries, and country fixed effects are controlled in each regression. The regressions perform well in generating the pseudo-FKRSU indicators,<sup>12</sup> and all of the explanatory variables are statistically significant. The specific estimation and the comparison between the original and pseudo-FKRSU data are presented in the appendix.<sup>13</sup>

We use all three measures of capital account openness in the baseline analysis and transform values between 0 and 1, with higher values representing more capital account openness, to facilitate the interpretation of results. They are significantly and positively correlated, with a correlation coefficient of at least 0.82 between the Quinn-Toyoda and Chinn-Ito indices and of as high as 0.96 between the Quinn-Toyoda and pseudo-FKRSU indices.<sup>14</sup> Figure 1 displays the time series of average capital account openness for all of the countries, for OECD countries, and for non-OECD countries captured by each of

<sup>10</sup> We thank Prof. Dennis Quinn for providing us with the most updated data, which were not publicly available when we were conducting this study.

<sup>11</sup> We decide to use this classification because it is generally used in the national Balance of Payments (BOP) Tables and we do not use all 10 categories to reduce the difficulty in deriving informational findings and mitigate possible multicollinearity problems in the regressions.

<sup>12</sup> The adjusted R-square is 0.80 for the OECD samples and 0.91 for the non-OECD samples, and the within R-square, which is net of country fixed effects, is 0.46 for the OECD samples and 0.42 for the non-OECD samples.

<sup>13</sup> However, the possibility of measurement error should be noted, though we believe that the pseudo-FKRSU works well. This is reflected in the larger standard error found in the pseudo-FKRSU estimates than in the Chinn-Ito and Quinn-Toyoda estimates shown in section V. Further details are discussed in appendix section A2.

<sup>14</sup> We report the correlation in the appendix in Table A3.

the three indices. A similar trend can be observed using different indicators: from 1970 to 1985, OECD countries gradually liberalized their capital accounts while developing countries were strengthening capital controls. Both groups began a rapid process of capital account liberalization until the end of the 1990s, after which they slowed liberalization with some reversals and maintained a stable level of capital account openness after the 2007–08 global financial crisis. Although the liberalization trends are similar, the openness of capital accounts in OECD countries is much higher than that in non-OECD countries.

We also employ the original FKRSU index (starting from 1995 without imputation) and a *de facto* indicator to measure capital account openness in the robustness checks. The *de facto* index gauges the actual scale of cross-border capital flows, which may present a different pattern from the *de jure* index especially when the capital control policy is ineffective or its implementation is weak. We use the *de facto* capital account liberalization measure based on Lane and Milesi-Ferretti (2007). Specifically, we adopt the ratio of the sum of total external assets and total external liabilities to GDP and its components of the ratio of total equity flows, total debt flows and total FDI flows to GDP. The correlation between each *de jure* capital account openness measure and the *de facto* indicator is much lower than that between the *de jure* measures but still significantly positive with coefficients ranging from 0.17 to 0.31.<sup>15</sup>

Based on the *de jure* index of capital account liberalization, we can identify the exact year in which a country substantially liberalized its capital account (i.e. converting it from a closed account to a liberalized one). Admittedly, capital account liberalization is not a one-time event but rather a continuous process. However, in certain years, governments were determined to liberalize their capital accounts and removed many constraints on international capital flows. These years mark a substantial shift in capital account liberalization and can form strong before-and-after contrasts, which we see as a quasi-experiment that suits a DID analysis (described in detail in the next section).

We mainly follow Braun and Raddatz (2007) with some supplements and revisions to find liberalizing years using each of the three capital account openness indicators. Methodologically, we use regressions to identify the year showing a substantial change of the 10-year average in the 20-year window centred around that year.<sup>16</sup> Due to space limitations, we present specific methods and tables reporting the identified year for each country based on each of the three indicators in appendix section A3.

### Control variables

Following the recent literature on finance and income inequality (Asteriou *et al.*, 2014; Johansson and Wang, 2014; Seven and Coskun, 2016), in all estimations shown below, we

<sup>15</sup> We report the correlation in the appendix in Table A3.

<sup>16</sup> The use of a 10-year average and a 20-year window is consistent with Braun and Raddatz (2007). Moreover, it is justified from two perspectives. First, as we need to take reversals and the possibility of re-imposing capital controls into consideration, a shorter window may misidentify those fleeting liberalizations as real liberalizations. Meanwhile, a longer window may result in more smooth changes in long-term averages and under-count liberalizations. Second, the average coverage of the capital account liberalization measures (i.e. Chinn-Ito, Quinn-Toyoda, and FKRSU indices) for each country is 40 years. Thus, a longer time window will result in smaller valid samples in identification, and a shorter window will produce more scattered liberalization periods for each country (some of them possibly misidentified), making it more difficult to find appropriate control groups in the subsequent DID analysis.

control for a set of conventional variables including GDP per capita, the square of GDP per capita, inflation, trade openness, education, the age dependency ratio, government consumption, private credit, money supply and unemployment. However, to relieve concerns that the main findings may be based on selective control variables, we report additional results with no controls or with basic macroeconomic controls only (i.e. GDP per capita and its squared term and inflation) in Tables A11–A14 in the appendix.

In addition, studies show that institutional quality and corruption are also useful determinants of income inequality (Lin and Fu, 2016; Chong and Gradstein, 2007; Li, Xu and Zou, 2000; Gupta, Davoodi and Alonso-Terme, 2002). To measure institutional quality and corruption, we use *Polity2* from the Polity IV datasets and the corruption index from the International Country Risk Guide (ICRG) database published by the Political Risk Services (PRS) Group. However, these two additional variables start from a recent year (1984) and are not available for the 1970s and early 1980s, when many instances of capital account liberalization happened. Including them in the regression, thus, results in much fewer observations and lowers the credibility of estimates of the DID analysis, which requires ten years of data before and after liberalization. Therefore, we do not control them in the baseline analysis but use them in the robustness checks.

## IV. Empirical methodology

### Panel fixed effects model

We first apply the conventional panel fixed effects model with the following specification:

$$Inequality_{i,t} = \alpha_0 + \beta_0 Inequality_{i,t-1} + \beta_1 Capital\ Account\ Liberalization_{i,t} + \Gamma X_{i,t} + \phi_i + \epsilon_{i,t} \quad (1)$$

where  $i$  is the country and  $t$  is the year. For the dependent variable  $Inequality_{i,t}$ , we use both the Gini coefficient and the income share of different groups, and we control for its lagged term to account for possible persistence. In the panel fixed effects model,  $CapitalAccountLiberalization_{i,t}$  represents the capital account openness indicators, and we use the Chinn-Ito, Quinn-Toyoda and pseudo-FKRSU indicators in the baseline regressions and the original FKRSU and *de facto* openness indicators in the robustness checks. We also employ the finer subcategory indicators of the pseudo-FKRSU dataset to investigate the role of the different dimensions of capital account liberalization on income inequality. In  $X_{i,t}$ , we include control variables such as GDP per capita and its squared term, inflation, private credit, unemployment, money supply, education, government consumption, urbanization, the age dependency ratio and trade openness. Finally, we control for country fixed effects.

As it is a dynamic panel model, OLS estimates using fixed effects can be biased. We thus estimate equation (1) using the GMM proposed by Arellano and Bond (1991) and Blundell and Bond (1998). We treat the capital account openness indicator as endogenous and the lagged dependent variable as predetermined, and we use their lagged terms as instrumental variables. In choosing between the difference GMM and system GMM, we use the latter in the baseline analysis because there could be weak instrument issues for difference equations when lagged levels are only weakly correlated with the subsequent



first differences. This is more likely when the panel units are relatively large and the periods considered are short, and thus adding level equations can correct for potential bias using difference equations only. However, as pointed out by Roodman (2009), instrument proliferation problems are more serious for the system GMM. An increasing number of instruments may induce overfitted endogenous variables, imprecise estimates of the optimal weighting matrix and downward bias in two-step standard errors, and weaken the Hansen test of instrument validity. Thus, it is necessary to reduce the instrument count and carefully interpret the Hansen test results in adopting the GMM. In this study, we acknowledge the flawed statistics of GMM estimations and abide by the rules suggested in Roodman (2009): we conduct Windmeijer correction, collapse and limit the lag depth of the instruments, report the number of groups and instruments, and apply a second-order serial correlation test and the Sargan and Hansen test of the joint validity of instruments. Specifications and interpretations are described in the respective GMM estimations in section V.

Coefficient  $\beta_1$  bears the highest interest. When the dependent variable is the Gini coefficient, a significantly positive  $\beta_1$  indicates that capital account liberalization is associated with an increase in income inequality and vice versa. When the dependent variable is the income share, a significantly positive  $\beta_1$  indicates that capital account liberalization is associated with an increase in the income share of a certain group and vice versa.

### DID model

Taking advantage of the identified years of capital account liberalization, we can simulate a quasi-randomized experiment and conduct a DID analysis. The standard DID specification is as follows:

$$\begin{aligned} Inequality_{i,T} = & \gamma_0 POST_T + \gamma_1 TREATED_{i,T} + \gamma_2 POST_T \times TREATED_{i,T} + \Lambda X_{i,T} \\ & + \phi_i + \epsilon_{i,T} \end{aligned} \quad (2)$$

The coefficient of interest is  $\gamma_2$  on the interaction term of  $POST_T$  and  $TREATED_{i,T}$ . Vector  $X_{i,t}$  contains a group of control variables that are the same as those in the panel fixed effects model.  $\phi_i$  is the country fixed effect, which can be used to control for a range of omitted variables.

We want to establish the long-term relationship between opening the capital account and inequality while reducing the influence of short-term dynamics on the estimation. Therefore, we use the 10-year average of all variables before and after capital account liberalization. Specifically, for each treated country  $x$  that liberalized its capital account in year  $xt$  and each of its control countries  $xj_1, xj_2, \dots, xj_n$ , we take the averages of two periods,  $[xt - 10, xt)$  and  $[xt, xt + 10)$ . Thus, the value of variable  $POST_T$  is 0 for the average of period  $[xt - 10, xt)$  and 1 for the average of period  $[xt, xt + 10)$ . We identify the treated countries as those having experienced a capital account liberalization event, and their value of  $TREATED_{i,T}$  is 1. The key question is to find the best control groups for each treated country (i.e. countries with  $TREATED_{i,T} = 0$ ).

We adopt two approaches following Levchenko, Ranci  re and Thoenig (2009). First, we clean and select treated countries. When the countries have two periods of capital account liberalization (i.e. experiencing a reversal after the first round of liberalization), we treat them as two separate observations if the gap between the two liberalization periods is

more than 10 years and remove such cases if the reversal happened within 10 years. We also require that capital account liberalization periods last longer than 10 years. As the identification of a significant breakpoint near edge years can be unstable, we remove the case when the identified liberalization year lies within the first 2 years of the country sample. We also omit cases for which the capital account is always open, leaving countries that have liberalized their capital accounts from a closed state and those retaining a closed capital account throughout the sample period. We then generate the variable *LIB*, which takes a value of 1 for the former and 0 for the latter. We consider countries that experienced capital account liberalization as the treated countries where variable *TREATED* equals 1 if  $LIB = 1$ .

Second, we find the group of control countries for each treated country using two approaches: the broad approach and the PSM approach. For the former, for each treated country  $x$  that liberalized its capital account in year  $xt$ , we use two criteria to determine control countries  $xj1, xj2, \dots, xjn$ . First, their capital accounts should be closed during the 20-year window  $(t-10, t+10)$ , including countries whose capital accounts are always closed (i.e.  $LIB = 0$ ) and those that experienced capital account liberalization (i.e.  $LIB = 1$ ) but with a year of liberalization  $j$  later than  $xt + 10$  or earlier than  $xt - 10$ . The second criterion is that they should be OECD countries if the treated country is an OECD country or non-OECD countries if the treated country is a non-OECD country.

Under the broad approach, limiting the control countries to those with closed capital accounts in the same period and belonging to either the same OECD or non-OECD group of treated countries can help easily pair the treated country with many control countries. However, the control country can still be different from the treated one. The PSM method thus allows us to select the most similar countries from the control groups drawn from the above broad approach.

Specifically, we use the following steps to conduct PSM. First, we estimate the propensity score defined as the conditional probability of receiving capital account liberalization treatment for each country  $i$  in year  $t$  given characteristics  $Y$  from a logit model:

$$pscore_{i,t} = Pr(OPEN_{i,t} = 1 | Y) \quad (3)$$

where  $OPEN_{i,t}$  equals 1 if the capital account of country  $i$  is open during year  $t$ . For countries whose capital accounts have always been closed,  $OPEN_{i,t}$  takes a value of 0. For treated countries that have experienced a shift from a closed capital account to a liberalized capital account, the value of  $OPEN_{i,t}$  is 1 if  $t$  lies in the liberalization period and 0 otherwise.  $Y$  represents a group of covariates. We follow Levchenko *et al.* (2009) and use the logarithm of GDP per capita (*LGDP*), the standard deviation of GDP per capita growth for the past five years (*VOLATILITY*), trade openness (*TRADE*), and the chief executive's number of years in office (*YRSOFFC*).<sup>17</sup> These variables are significant determinants of capital account liberalization according to the literature. We favour this parsimonious specification because the purpose of this step is not to predict liberalization as precisely as possible but to obtain a distribution of propensity scores that allows us to match the treated and potential control countries.

<sup>17</sup> The first three variables are from the WDI, and *YRSOFFC* comes from the World Bank's Databases of Political Institutions.

Again, we estimate the OECD and non-OECD countries separately. Thus, we obtain the propensity scores of capital account liberalization for each country  $i$  in year  $t$ . To confirm the balancing hypothesis, the statistical test reported in the appendix in Figure A3 shows that all of the covariates are insignificantly different between the matched treated and control countries, and the standardized percentage bias across the four covariates is roughly 0 for the matched countries and much larger for the unmatched ones.

Next, we keep the propensity scores of the 5 years before capital account liberalization for each treated country and potential control countries identified using the broad method. Then, we construct the control group for each treated country using a proximity measure based on the propensity score. Specifically, we compute the proximity between liberalized country  $i$  and another potential control country  $j$  as the average of the squared difference between  $pscore_{i,t}$  and  $pscore_{j,t}$  for the 5-year period before capital account liberalization.<sup>18</sup> Finally, we order control countries  $j$  according to their proximity to country  $i$  and use the five most proximate countries as the control countries for each treated country.<sup>19</sup> To better illustrate the process of finding our control groups using broad matching and PSM, we provide a concrete example in appendix section A4 and report the full PSM matching results for each country in the supplementary data.

However, it should be noted that we cannot say that the estimates based on PSM-DID dominate those based on broad matching DID. First, the restrictive requirements of the PSM process substantially reduce the number of observations, which is only one-fifth of that through broad matching. Second, although PSM does a good job of finding similar groups of treated and control groups, the long list of control variables in the regression is also effective in generating reliable results for the broad matching sample under the condition that other determinants are similar or remain unchanged. From the later estimations, we observe that the control variables are all almost significant in the broad matching sample while many are insignificant in the PSM sample. Therefore, it is useful to interpret the DID results using both broad matching and PSM samples.

## V. Empirical results

### Capital account liberalization and the gini coefficient

We first discuss short-term dynamics between capital account liberalization and the Gini coefficient with estimates of the panel fixed effects model. Table 2 reports the results of estimating equation (1) with the Gini coefficient as the dependent variable.

Odd columns report the results from the fixed effects model and even columns report those from the system-GMM model. We use all three capital account liberalization indices (the Chinn-Ito, Quinn-Toyoda and pseudo-FKRSU) as shown in the column titles; this is to show that the main findings do not depend on the selection of specific indicators. Moreover, we estimate separately for the subsamples of non-OECD and OECD countries, which are shown in the first and last six columns.

<sup>18</sup>  $proximity_{i,j} = \frac{1}{5} \sum_{t=t_i-4}^{t_i} (pscore_{j,t} - pscore_{i,t})^2$ , where  $t_i$  is the liberalization year of treated country  $i$ .

<sup>19</sup> Also, we can follow the *first neighbor* method by keeping the nearest country only so that each treated country has only one control country. The results obtained when using the one-for-one method have much fewer observations but are robust with the five-for-one method. To save space we do not include these tables in the paper, but they are available upon request.

TABLE 2  
Capital account liberalization and gini coefficients: panel model

	Non-OECD Countries						OECD Countries					
	Chinn-Ito		Quinn-Toyoda		Pseudo FKRSU		Chinn-Ito		Quinn-Toyoda		Pseudo FKRSU	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
KA index	0.632** (0.292)	0.405*** (0.100)	0.831* (0.493)	1.617** (0.633)	1.231** (0.556)	1.305** (0.579)	-0.012 (0.183)	-0.062 (0.360)	0.541 (0.334)	0.261 (0.862)	0.356 (0.303)	0.083 (0.603)
	0.565*** (0.034)	0.868*** (0.023)	0.662*** (0.028)	0.881*** (0.029)	0.722*** (0.025)	0.918*** (0.029)	0.839*** (0.031)	0.948*** (0.035)	0.832*** (0.032)	0.931*** (0.042)	0.833*** (0.022)	0.934*** (0.043)
GDP per capita	-0.253*** (0.083)	-0.010 (0.011)	-0.142 (0.218)	-0.165* (0.096)	0.169 (0.190)	-0.101 (0.079)	0.040** (0.016)	-0.015 (0.021)	0.035 (0.040)	-0.016 (0.021)	0.040* (0.021)	-0.017 (0.019)
GDP per capita square	3.843*** (1.440)	0.431*** (0.148)	3.566 (11.952)	5.994 (6.078)	-14.381 (10.386)	2.656 (4.674)	-0.241** (0.114)	0.128 (0.176)	-0.260 (0.530)	0.096 (0.156)	-0.288* (0.156)	0.128 (0.151)
Inflation	0.074** (0.035)	0.119*** (0.013)	0.093** (0.043)	0.146*** (0.018)	0.131*** (0.038)	0.150*** (0.016)	0.271** (0.115)	0.431*** (0.043)	0.291* (0.143)	0.466*** (0.054)	0.283*** (0.103)	0.496*** (0.060)
Private credit	-0.752 (0.619)	-0.131** (0.056)	-0.726 (0.707)	-0.142 (0.250)	-1.596*** (0.615)	-0.125 (0.184)	0.512*** (0.144)	0.365** (0.140)	0.570*** (0.174)	0.386*** (0.144)	0.533*** (0.188)	0.379*** (0.135)
Unemployment	0.059*** (0.018)	0.023*** (0.003)	0.065*** (0.020)	0.040*** (0.010)	0.046*** (0.017)	0.028*** (0.010)	0.036* (0.018)	0.024 (0.017)	0.032 (0.021)	0.021** (0.009)	0.034** (0.016)	0.033* (0.016)
Money supply	1.857** (0.759)	0.051 (0.069)	0.874 (0.940)	0.100 (0.303)	2.171*** (0.811)	0.058 (0.253)	-0.034* (0.019)	0.012 (0.012)	-0.041 (0.076)	0.011 (0.016)	-0.038 (0.047)	0.011 (0.013)
Education	0.012 (0.008)	-0.006*** (0.002)	0.017* (0.009)	-0.001 (0.005)	0.013* (0.008)	-0.002 (0.004)	0.002 (0.007)	0.011** (0.004)	0.001 (0.009)	0.011** (0.004)	0.002 (0.010)	0.015*** (0.002)
Government consumption	-0.065*** (0.023)	0.007* (0.004)	-0.029 (0.030)	-0.004 (0.014)	-0.039 (0.025)	0.010 (0.009)	0.007 (0.018)	-0.002 (0.017)	0.006 (0.021)	-0.011 (0.017)	0.007 (0.016)	-0.004 (0.018)
Urbanization	3.468* (2.037)	-0.265** (0.101)	-0.022 (2.171)	-0.900 (0.637)	1.822 (1.887)	-0.703* (0.357)	-0.360 (1.134)	-0.364 (0.819)	-0.420 (1.972)	-0.200 (0.615)	-0.266 (1.530)	0.013 (0.724)
Age dependency	-0.009 (0.014)	0.002** (0.001)	-0.020 (0.017)	0.001 (0.004)	0.004 (0.014)	-0.001 (0.003)	0.015 (0.010)	0.007 (0.010)	0.022 (0.017)	0.013 (0.016)	0.021* (0.012)	0.007 (0.013)
Trade openness	-0.008* (0.004)	-0.003*** (0.000)	-0.006 (0.005)	-0.005** (0.002)	-0.007 (0.004)	-0.005*** (0.001)	-0.008*** (0.003)	-0.004*** (0.001)	-0.009** (0.004)	-0.004*** (0.001)	-0.008*** (0.003)	-0.004*** (0.001)
												<i>continued</i>

continued

TABLE 2  
(Continued)

	Non-OECD Countries						OECD Countries					
	Chinn-Ito			Quinn-Toyoda			Chinn-Ito			Quinn-Toyoda		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Observations	771	771	659	659	650	650	569	569	563	563	561	561
Number of countries	71	71	44	44	44	44	21	21	21	21	21	21
Estimation model	FE	GMM	FE	GMM	FE	GMM	FE	GMM	FE	GMM	FE	GMM
R-Square	0.572		0.585		0.673		0.869		0.870		0.869	
Number of instruments		69		29		32		20		20		20
AR(1)		0.007		0.008		0.007		0.001		0.002		0.001
AR(2)		0.272		0.256		0.129		0.650		0.717		0.602
Sargan test		0.562		0.765		0.297		0.876		0.253		0.899
Hansen test		0.485		0.447		0.419		0.453		0.386		0.808
Increase in # standard deviation of Gini associated with an one standard deviation increase in KA index												
	0.039	0.025	0.043	0.084	0.049	0.052						
Increase in # standard deviation of Gini associated with a complete capital account liberalization												
	0.116	0.074	0.152	0.296	0.225	0.239						

Notes: We have included a constant term in the estimation, their coefficients are omitted here to save space. To have a concise expression, the GDP per capita and its squared term are multiplied by 1000, and the money supply and urbanization are divided by 100. The GMM estimates refer to system GMM estimates. Standard errors are shown in parentheses. \*  $P < 0.10$ , \*\*  $P < 0.05$ , \*\*\*  $P < 0.01$ .

As stated in section IV, the GMM estimation has been criticized for its weak instrument variable (Roodman, 2009) and sensitive results. We apply a two-step system GMM estimation and conduct Windmeijer correction for the two-step standard errors. To better evaluate and interpret the results, we describe our criteria for generating the GMM estimates as follows. First, the coefficients of the lagged dependent variable should lie between coefficients from the pooled OLS and fixed effects models.<sup>20</sup> Second, the null hypothesis of second-order autocorrelation should be rejected. Third, the model should pass the Hansen and Sargan over-identification test. The Hansen test is robust but may be weakened by many instruments, so we also conduct the Sargan test, which is not robust but not weakened by many instruments. Fourth, we collapse the instruments to combine instruments through addition into smaller sets and limit the lag depth to avoid having too many instruments. We limit the number of instruments to be less than or close to the number of groups (countries in this study) and take Hansen test statistics away from 1 but larger than 0.20 as a safe sign.

The results differ between developed and developing economies. Liberalizing the capital account tends to be associated with higher income inequality only in developing economies, as the coefficients of capital account liberalization are positive and significant in both fixed effects and GMM estimates for the non-OECD subsample, but statistically insignificant for the OECD subsample. In terms of magnitudes, the fixed effects estimates of capital account liberalization for the OECD subsample are lower than one-third of those for the non-OECD subsample, and the GMM estimates for the OECD subsample are less than one-tenth of those for the non-OECD subsample. In addition, the results shown in Table A10 in the appendix, which are from an interaction specification of each variable interacted with a dummy indicating non-OECD countries, also reject the equality of capital account coefficients between OECD and non-OECD countries (except for fixed effect estimates when we use the Quinn-Toyoda index to measure capital account liberalization). This reiterates Eichengreen (2001), who argues that developing countries are more likely to suffer the negative effects of capital mobility on income distribution due to weak institutions or regulations. Besides, as shown by Figure 1 and liberalizing years shown in the data file, OECD countries had capital account openness for a longer period and experienced liberalization earlier than non-OECD countries. For our sample period, that is, post-1970, it is more appropriate to use non-OECD countries to study capital account liberalization. Additionally, we have fewer observations for the developed economies. Thus, we focus on non-OECD countries and only report their results in the following analysis.

Specifically, the results given in columns (1)–(6) of Table 2 imply that a one standard deviation increase in capital account openness (0.37 for Chinn-Ito, 0.29 for Quinn-Toyoda, and 0.26 for pseudo-FKRSU) is associated with a rise of 0.03–0.08 standard deviations of the Gini coefficient for developing countries while a complete capital account liberalization (i.e. KA Index increases from 0 to 1) is associated with an increase of 0.07–0.30 standard deviations of the Gini coefficient in short-term dynamics. However, we should be cautious in interpreting the results shown in column (3), as the coefficient of the Quinn-Toyoda index is only statistically significant at the 10% significance level.

<sup>20</sup> We do not report the pooled OLS results in the table to save space, but coefficients of the lagged dependent variable are usually larger in pooled OLS than fixed effects models. Thus, coefficients of lagged dependent variables from the fixed effect models form the lower bound, and the respective GMM estimates of serial correlation should be higher than this.

Among the other controls, inflation and unemployment are the only two variables that show consistent statistical significance with  $p$ -values of less than 0.05 across all specifications for the non-OECD subsample. Their estimates suggest that lower unemployment rates and lower inflation rates are associated with less income inequality. For the OECD subsample, the estimates of inflation, private credit and trade openness show consistency and statistical significance across all specifications, and they suggest that more credit to the private sector and less trade openness, in addition to higher inflation rates, are associated with an increase in income inequality in developed economies. The remaining control variables, that is, GDP per capita and its square term, money supply, education, government consumption, urbanization and age dependency, do not appear to be robustly significant determinants of Gini coefficients, as their estimates are noisy in both subsamples.

Next, we investigate the long-term impact of capital account liberalization on the Gini coefficient using estimates from the DID model, which allows us to compare the average Gini coefficient 10 years before and after financial liberalization for the paired treated and control countries with similar characteristics. Table 3 presents the DID estimates for the non-OECD countries. The odd and even columns differ in their matching methods: the odd columns report the results using the sample based on broad matching, and the even columns report the results using the sample based on PSM. Columns (1)–(2), (3)–(4) and (5)–(6) present the estimates using different capital account liberalization indices (Chinn-Ito, Quinn-Toyoda and pseudo-FKRSU respectively) to identify the treated countries and postliberalization years.

Again, we find an association between capital account liberalization and increased inequality for developing economies, as the interaction terms of *POST* and *TREATED* are positive and significant across all specifications and matching methods, although the significance obtained when using the Quinn-Toyoda index is weaker, as it only arises with a  $P$ -value of less than 0.1. Specifically, the following three main results are found.<sup>21</sup> First, our methods of matching control groups and assigning pseudo-post-treatment years work well because the falsified treatment shows an insignificant impact for the control groups; meanwhile, the real treatment shows a significant impact for the treated group. Second, the 95% confidence intervals are all above zero for the treated countries, indicating that liberalizing capital account is associated with higher inequality. Moreover, the economic significance of the impact is considerable: a capital account liberalization event is associated with an increase in the Gini coefficient by an average value ranging from 1.77 to 3.37 over 10 years, which is equivalent to 0.32 to 0.62 standard deviations of the Gini coefficient observed in the sample.

### Capital account liberalization and income share

In addition to the increase in the Gini coefficient, we find that capital account liberalization is associated with a decrease in the income share of the poor and an increase in the income share of the rich. We replace the dependent variable with income shares for the bottom 50%, middle 40%, and top 10%, and rerun the analysis using the panel and DID models.

<sup>21</sup> A visualized version of the findings can be found in Figure A4 in the appendix, which shows the average marginal effects of liberalizing a country's capital account with 95% confidence intervals.

TABLE 3  
Capital account liberalization and gini coefficients: difference-in-difference model

	Chinn-Ito		Quinn-Toyoda		Pseudo FKRSU	
	(1) Broad match	(2) PSM match	(3) Broad match	(4) PSM match	(5) Broad match	(6) PSM match
<i>DepVar: Gini-EHII</i>						
POST × TREATED	1.746*** (0.509)	3.133** (1.324)	0.978* (0.510)	0.478* (0.184)	1.311** (0.555)	1.121*** (0.241)
POST	0.241* (0.146)	0.233 (1.000)	0.291* (0.170)	1.407*** (0.269)	0.467*** (0.173)	1.470*** (0.171)
TREATED	1.706*** (0.532)	−1.049 (1.515)	0.285 (0.475)	1.284 (2.199)	1.556*** (0.538)	0.280 (2.397)
GDP per capita	−2.309*** (0.332)	0.694 (0.684)	−1.677*** (0.386)	−0.419 (0.297)	−2.528*** (0.351)	−1.054*** (0.016)
GDP per capita square	96.290*** (23.266)	−13.715 (26.107)	38.821 (26.277)	4.695 (6.008)	57.499*** (21.302)	20.859** (6.271)
Inflation	−0.186*** (0.028)	−0.146 (0.193)	−0.155*** (0.029)	−0.057*** (0.005)	−0.159*** (0.041)	−0.105** (0.027)
Private credit	−1.366 (0.918)	0.985 (2.520)	−1.610 (1.211)	−8.931 (8.495)	−1.856* (1.072)	−5.575** (1.926)
Unemployment	0.082*** (0.026)	0.068 (0.101)	0.064 (0.039)	0.147 (0.113)	0.066** (0.033)	0.053 (0.047)
Liquidity	0.052*** (0.010)	−0.046 (0.029)	0.061*** (0.011)	0.056 (0.071)	0.058*** (0.012)	0.048* (0.020)
Education	0.031*** (0.007)	0.010 (0.033)	0.013 (0.010)	0.085 (0.043)	0.006 (0.011)	0.081** (0.026)
Government consumption	−0.068* (0.041)	0.026 (0.135)	−0.058 (0.061)	−0.199*** (0.031)	−0.183*** (0.060)	−0.116*** (0.004)
Urbanization	0.366*** (0.034)	−0.093 (0.063)	0.204*** (0.044)	0.013 (0.068)	0.234*** (0.040)	0.013* (0.006)
Age dependency	0.078*** (0.017)	0.039 (0.053)	−0.007 (0.019)	0.038 (0.031)	−0.020 (0.020)	0.036* (0.014)
Trade openness	−0.072*** (0.008)	−0.023 (0.017)	−0.027*** (0.010)	−0.002 (0.006)	−0.055*** (0.009)	0.012** (0.003)
Observations	744	96	494	84	497	91
R <sup>2</sup>	0.886	0.725	0.898	0.955	0.884	0.953
Country-FE	YES	YES	YES	YES	YES	YES

Notes: We have included a constant term in the estimation; their coefficients are omitted here to save space. To have a concise expression, the GDP per capita and its squared term are multiplied by 1000. Standard errors are shown in parentheses. \* $P < 0.10$ , \*\* $P < 0.05$ , \*\*\* $P < 0.01$ .

Similarly, we estimate the specification using all three capital account liberalization indices and both the fixed effects model and system GMM model.

As shown in the upper panel of Table 4, the coefficients of capital account openness are significantly negative for the bottom 50% (although with weaker statistical significance in the system GMM estimates), insignificant for the middle 40%, and significantly positive for the richest 10%. An average liberalization (a one standard deviation increase in the respective indicator) is associated with a 0.04 to 0.30 standard deviation reduction in the income share of the bottom 50% and a 0.05 to 0.18 standard deviation increase in



TABLE 4  
*Capital account liberalization and income share*

DepVar: Income Share	Bottom 50%			Middle 40%			Top 10%											
	Chinn-Ito	Quinn-Toyoda	Pseudo FKRUSU	Chinn-Ito	Quinn-Toyoda	Pseudo FKRUSU	Chinn-Ito	Quinn-Toyoda	Pseudo FKRUSU									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Panel A: Dynamic Panel Estimates																		
KA Index	-1.363*** (0.363)	-1.425* (0.754)	-0.920* (0.494)	-6.534* (3.674)	-2.018*** (0.672)	-3.337* (1.858)	-0.353 (0.362)	-1.386* (0.682)	-0.412 (0.511)	-2.386 (1.559)	-0.713 (0.684)	3.702 (3.277)	2.480*** (0.742)	3.079** (1.112)	2.134** (1.023)	7.597** (3.374)	3.947*** (1.415)	9.853* (3.145)
L-DepVar	0.588*** (0.048)	0.666*** (0.170)	0.623*** (0.048)	0.669** (0.270)	0.592*** (0.049)	0.747*** (0.161)	0.376*** (0.063)	0.686** (0.265)	0.369*** (0.066)	0.390*** (0.180)	0.364*** (0.066)	0.620* (0.332)	0.302*** (0.060)	0.559*** (0.190)	0.298*** (0.064)	0.746*** (0.232)	0.283*** (0.064)	0.406* (0.219)
Observations	259	259	243	243	243	243	259	259	243	243	243	243	265	265	218	218	218	218
Control Variables	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Number of Countries	26	26	24	24	24	24	26	26	24	24	24	24	27	27	24	24	24	24
Estimation Model	FE	FE	FE	GMM	FE	GMM	FE	GMM	FE	GMM	FE	GMM	FE	GMM	FE	GMM	FE	GMM
R-Square	0.769		0.753		0.760		0.548		0.543		0.544		0.600		0.670		0.676	
Number of Instruments		26		23		24		26		24		24		27		24		23
AR(1)		0.013		0.113		0.012		0.080		0.062		0.056		0.052		0.034		0.182
AR(2)		0.334		0.182		0.260		0.340		0.332		0.544		0.252		0.621		0.155
Sargan Test		0.960		0.992		0.940		1.000		0.781		0.985		0.977		0.845		0.990
Hansen Test		0.875		0.741		0.940		0.989		0.914		0.901		0.959		0.392		0.419
Change in # standard deviations of income share associated with a one standard deviation increase in KA index																		
	-0.076	-0.080	-0.043	-0.307	-0.073	-0.121							+0.070	+0.087	+0.051	+0.180	+0.072	+0.180
Change in # standard deviations of income share associated with a complete capital account liberalization																		
	-0.226	-0.236	-0.152	-1.081	-0.334	-0.552							+0.207	+0.257	+0.178	+0.634	+0.329	+0.823
Panel B: DID Estimates																		
POST × TREATED	-1.967*** (0.393)	-2.273*** (1.035)	-2.439*** (0.642)	-2.779*** (0.750)	-2.698*** (0.671)	-2.617* (1.124)	-1.227** (0.504)	-1.800*** (0.173)	-3.833*** (0.719)	-2.962** (0.915)	-3.702*** (0.898)	-3.780*** (0.752)	3.195** (1.236)	4.073** (0.929)	6.272*** (1.279)	5.740*** (1.551)	6.400*** (1.387)	6.397** (1.778)
POST	0.037 (0.119)	-0.385 (1.653)	-0.168 (0.166)	-0.141 (0.604)	-0.045 (0.127)	-1.174 (1.151)	0.117 (0.125)	-0.728 (0.821)	-0.084 (0.186)	-0.245 (0.768)	-0.044 (0.170)	-1.184 (0.832)	-0.154 (0.166)	1.113 (1.339)	0.251 (0.332)	0.386 (1.312)	0.088 (0.263)	2.359 (1.902)
TREATED	-3.020*** (0.532)	-6.157 (5.503)	-1.927*** (0.555)	5.933 (6.017)	-4.365*** (0.552)	-0.980 (3.346)	-2.247* (1.097)	-7.851 (7.318)	-1.395** (0.622)	-0.067 (3.274)	-2.632*** (0.738)	-4.674 (3.328)	5.266*** (1.883)	14.007 (12.564)	3.322*** (1.106)	0.130 (7.057)	7.197*** (1.140)	5.650 (6.485)
Observations	585	70	284	50	308	57	585	70	284	50	308	57	585	70	284	50	308	57
R <sup>2</sup>	0.948	0.981	0.936	0.934	0.955	0.892	0.909	0.983	0.940	0.923	0.935	0.887	0.935	0.983	0.941	0.938	0.953	0.902
Control Variables	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Matching Method	Broad	PSM	Broad	PSM	Broad	PSM	Broad	PSM	Broad	PSM	Broad	PSM	Broad	PSM	Broad	PSM	Broad	PSM
Country-FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: We have included a list of control variables and a constant term in the estimation; their coefficients are omitted here to save space. Control variables are the same as those shown in Tables 2 and 3: GDP per capita, GDP per capita square, inflation, private credit, unemployment, money supply, education, government consumption, urbanization, age dependency, and trade openness. The GMM estimates refer to system GMM estimates. Standard errors are shown in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

the income share of the top 10% (with weaker statistical significance when we use the pseudo-FKRSU in the system GMM estimates). The corresponding association between a full liberalization and the income share of the poorest half is a decrease of 0.92–6.53% points (equivalent to 0.15 to 1.08 standard deviations), and that with the income share of the richest 10% is an increase of 2.13–9.85% points (equivalent to 0.18 to 0.82 standard deviations). Concerning the average income shares of the bottom 50% and top 10% income groups, which are 15.91% and 46.71%, respectively, the impact is considerable. Moreover, the statistical significance of GMM estimates is stronger for the income share of the top 10% than that for the bottom 50%, as the latter only stands out at the 10% significance level. These results imply that capital account liberalization is associated with an increase in the income share of the rich and a decrease in that of the poor in developing economies.

Next, we present estimates of the long-term relationship between capital account liberalization and the income share based on the DID model in the lower panel of Table 4.<sup>22</sup> Consistent with the findings obtained from the panel fixed effects model, DID estimates also suggest that capital account liberalization is associated with a decrease in the income share of poorer groups and an increase in the income share of richer groups and thus increased income inequality. Different from results obtained from the dynamic panel fixed effects model, results obtained from the DID model suggest that capital account liberalization is also significantly associated with a reduction in the income share of the middle group, and its long-run association with income share is only positive for the top 10%. Moreover, the gaps between estimates of the poor and rich groups are more significant. As valid proof of classifying the treated and control groups, the postliberalization effect is insignificant for the control groups and the 95% confidence intervals only lie within the same above-zero or below-zero region for the treated groups. Overall, effects estimated from the sample based on PSM and those obtained based on broad matching are similar, with the former being slightly stronger. Specifically, the results suggest that a capital account liberalization event is associated with a reduction in the income share of the poorest 50% group of 2.66 to 3.79% points, equivalent to 0.44 to 0.63 standard deviations, and a reduction in the income share of the middle 40% group of 2.53–4.96% points, equivalent to 0.40 to 0.78 standard deviations, but an increase in that of the richest 10% of 5.19–8.76% points, equivalent to 0.43 to 0.73 standard deviations.

### **Discussion: directions and categories of capital account liberalization**

Taking advantage of the disaggregated FKRSU indicators, we can identify capital account liberalization for different categories of capital transactions as well as inward and outward capital flows. Using the same method for the aggregated FKRSU capital account liberalization index, we extend the indicators back to 1970 and then identify the breakthrough year for each specific subcategory of capital transactions. Specifically, we are interested to see whether the results of inward and outward capital account liberalization and of erasing the transaction restrictions of equities, bonds, direct investments and other investments

<sup>22</sup> We also visualize the results in Figure A5 in the appendix by plotting the marginal effect of capital account liberalization on income shares with 95% confidence intervals.

are different. Subsequently, we apply DID estimation using the new *TREAT* and *POST* identified based on the capital account liberalization indicators of different dimensions.<sup>23</sup>

Table 5 presents the estimates of inward and outward capital account liberalization on the Gini coefficients and the income shares of different groups. To conserve space, we only present the DID estimates based on broad matching, and the estimates combined with PSM are shown in the appendix in Table A17. We can see that the coefficients of the interaction term are only significant in odd columns of inward capital account liberalization, and they are significantly positive for the association with the Gini coefficient (although only at the 10% significance level) and the income share of the top 10% while significantly negative for the income share of the bottom 50% and middle 40%. Thus, our crucial finding is that the association with increased income inequality, as reflected by the increase of the Gini coefficients, increase in the income share of the rich and decrease in the income share of the poor, mainly originates from the liberalization of inward capital flows; meanwhile, outward capital account openness has an insignificant relationship with income inequality, suggesting that the allocation of foreign capital in the domestic economy is associated with an exaggeration of inequality. Specifically, compared to similar countries that ban foreign capital inflows, the countries display a higher Gini coefficient by 1.04 points, lower income shares for the bottom 50% and middle 40% by 2.82 and 3.64% points, respectively, and a higher income share for the top 10% by 6.46% points for the 10 years since allowing for inward foreign capital flows.

Similarly, Table 6 shows estimates of the relationship between capital account liberalization in terms of the different transaction categories and income inequality based on broad matching, and the estimates based on PSM are shown in the appendix in Table A18. The transaction type plays an important role. First, among the four types of capital transactions, the liberalization of FDI is not significantly associated with an adverse change in inequality while the liberalization of the equity market, bond market and other investments appears to be associated with increased inequality. Among the estimates of FDI liberalization, the coefficients of interest are insignificant notwithstanding that the dependent variables are Gini coefficients or income shares. Second, the largest increase in Gini coefficients (1.08 points) results from the liberalization of the equity market, followed by the liberalization of other investments (0.94 points) and the bond market (0.92 points). However, this finding should be interpreted with caution, as it only holds at the 10% significance level. Third, the most rich-biased association is found from the liberalization of the international equity market, which is associated with an increase in the income share gap between the richest 10% and the remaining 90% by roughly 8.53% points while estimates of liberalizing the bond market and other investments are 6.95 and 5.71% points respectively. The insignificant impact of FDI seems to contrast with the findings of Choi (2006), Acharyya (2011), Wu and Hsu (2012), and Jaumotte et al. (2013), who suggest a significantly positive relationship between FDI and income inequality; however, this could be reconciled because we use *de jure* measurements of FDI liberalization while these studies use actual values of FDI flows, which have more portfolio capital characteristics, and greenfield investments have given way to mergers and acquisitions as argued in Mody and Murshid (2005). In

<sup>23</sup> Corresponding results of the dynamic panel model based on indicators of different directions and categories of capital account liberalization are shown in the appendix in Tables A15 to A16.

TABLE 5  
Discussion: inward and outward capital account liberalization (DID-broad matching)

DepVar:	Gini-EHII		Bottom 50%		Middle 40%		Top 10%	
	(1) Inward	(2) Outward	(3) Inward	(4) Outward	(5) Inward	(6) Outward	(7) Inward	(8) Outward
POST × TREATED	1.038* (0.558)	0.591 (0.553)	-2.824*** (0.672)	-1.164 (1.499)	-3.636*** (0.888)	-3.515 (2.226)	6.459*** (1.380)	4.680 (2.859)
POST	0.361** (0.169)	0.402** (0.175)	-0.040 (0.120)	-1.635*** (0.335)	-0.066 (0.158)	-1.821*** (0.383)	0.106 (0.246)	3.455*** (0.638)
TREATED	1.947*** (0.548)	2.040*** (0.549)	-5.013*** (0.555)	3.393** (1.365)	-2.902*** (0.733)	3.344** (1.625)	7.914*** (1.140)	-6.738** (2.604)
Observations	539	536	353	342	353	342	353	342
R <sup>2</sup>	0.886	0.892	0.952	0.729	0.929	0.693	0.949	0.742
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
Country-FE	YES	YES	YES	YES	YES	YES	YES	YES

Notes: We have included a list of control variables and a constant term in the estimation; their coefficients are omitted here to save space. Control variables are the same as those shown in Tables 2 and 3: GDP per capita, GDP per capita square, inflation, private credit, unemployment, money supply, education, government consumption, urbanization, age dependency, and trade openness. Standard errors are shown in parentheses. \* $P < 0.10$ , \*\* $P < 0.05$ , \*\*\* $P < 0.01$ .

TABLE 6  
Discussion: capital account liberalization of different categories of capital transactions (DID-broad matching)

Dep Var:	Gini-EHII				Bottom 50%				Middle 40%				Top 10%			
	(1) Equity	(2) Bond	(3) FDI	(4) Other	(5) Equity	(6) Bond	(7) FDI	(8) Other	(9) Equity	(10) Bond	(11) FDI	(12) Other	(13) Equity	(14) Bond	(15) FDI	(16) Other
POST × TREATED	1.080* (0.586)	0.924* (0.539)	0.434 (0.551)	0.935* (0.529)	-4.957*** (0.680)	-3.486*** (0.708)	-0.758 (1.317)	-2.413*** (0.681)	-3.566*** (0.859)	-3.468*** (0.966)	-1.922 (1.410)	-3.297*** (0.904)	8.525*** (1.353)	6.954*** (1.505)	2.681 (2.524)	5.709*** (1.415)
POST	0.442** (0.207)	0.389** (0.172)	0.537*** (0.186)	0.373** (0.170)	-0.095 (0.153)	-0.081 (0.124)	-1.343*** (0.357)	-0.061 (0.127)	0.208 (0.193)	-0.005 (0.169)	-1.861*** (0.383)	-0.032 (0.168)	-0.114 (0.303)	0.086 (0.264)	3.203*** (0.685)	0.093 (0.263)
TREATED	1.939*** (0.596)	2.056*** (0.540)	2.662*** (0.625)	1.837*** (0.524)	-2.962*** (0.526)	-3.896*** (0.542)	-0.222 (1.191)	-4.380*** (0.554)	-1.936*** (0.664)	-2.457*** (0.739)	0.303 (1.276)	-2.540*** (0.736)	4.897*** (1.046)	6.353*** (1.151)	-0.082 (2.283)	6.920*** (1.152)
Observations	419	521	543	519	260	323	357	333	260	323	357	333	260	323	357	333
R <sup>2</sup>	0.895	0.893	0.879	0.892	0.969	0.957	0.688	0.951	0.952	0.936	0.668	0.932	0.968	0.953	0.704	0.949
Control Variables	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country-FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: We have included a list of control variables and a constant term in the estimation; their coefficients are omitted here to save space. Control variables are the same as those shown in Tables 2 and 3: GDP per capita, GDP per capita square, inflation, private credit, unemployment, money supply, education, government consumption, urbanization, age dependency, and trade openness. Standard errors are shown in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

addition, we are interested in the long-run relationship while these other studies focus on the short term, and Herzer and Nunnenkamp (2013) show that the relationship between FDI and income inequality could be positive over the short term and negative over the long run.

These results have three implications. First, the relationship between increased income inequality and inward capital account liberalization reiterates past findings in the literature that international capital tends to flow into high-skilled labour or sectors, suggesting that policymakers should be cautious of augmented skill-biased inequality from capital inflows. Second, liberalized international equity markets are less likely to expand financial access for the poor, but offer more intensive benefits for those who are already rich. Third, direct investments, which tend to be long term and more stable than the rest, are more likely to display benefits of financial integration as predicted by neoclassical economic growth theory, as they do not show significant correlations with higher inequality.

### Robustness checks

We conduct various robustness checks and report the results in appendix section A6. Here, we simply summarize the findings. First, we use the non-imputed original *de jure* FKRSU, which starts in 1995, and the *de facto* indicator that captures actual cross-border capital flows as well as its dis-aggregation into three types of assets (i.e. equity, debt, and FDI) from Lane and Milesi-Ferretti (2007) in the dynamic panel regressions. The results show that the coefficients of the original FKRSU indicators are positive although only significant at the 10% significance level. The coefficients of the overall *de facto* indicator, which is the ratio of total external liabilities and total assets to GDP, are insignificant. This diverges from the results obtained from *de jure* capital account liberalization and implies that the difference between *jural* and actual capital account openness may explain the inconclusiveness of existing studies. However, the categorical results show that not every kind of actual cross-border capital flow is unrelated to income inequality. To account for possible multicollinearity issues of the *de facto* openness of different categories, we estimate both specifications that control them separately and that include them in the same regression. After accounting for Bonferroni correction, the actual debt and FDI have an insignificant relationship with income inequality, but the *de facto* cross-border flows of equities are significantly and positively associated with income inequality. These results are consistent with findings provided in the discussion and confirm that liberalizing the international equity market is associated with greater inequality.

Second, we employ alternative measures of the Gini coefficients and income share and show that the main findings do not depend on specific measures of income inequality. We re-estimate the DID specification using the other three Gini coefficients from the WDI, SWIID, and WIID and the more granular income share data (i.e. the first 20% to fifth 20%) from the WIID as dependent variables. The coefficients of the interaction term between the treated group and the postliberalization dummies are significantly positive when the dependent variables are the Gini coefficients from different databases. The statistical significance weakens (with *P*-values larger than 0.05) when we use the pseudo-FKRSU index to identify the liberalizing year and when we use the Gini coefficient from the WIID. The economic significance of using the WDI Gini coefficients is even larger than that found in the baseline

results: opening the capital account is associated with an increase in Gini coefficients by 2.12–4.09% points. Although the results obtained from the pseudo-FKRSU sample are insignificant for the richer income groups, the estimates provide robust evidence that capital account liberalization is significantly associated with a decrease in the income share of the poorest 20% income group by 0.34–1.30% points and of the second poorest 20% income group by 0.71–1.07% points.

Third, we additionally control for the country's institutional quality and corruption. Studies have shown that institutional quality and corruption are associated with income inequality. We use *Polity2* from the Polity IV dataset, which captures regime authority characteristics with a higher value indicating a more democratic political regime and higher institutional quality, and the corruption index from the ICRG database.<sup>24</sup> These two additional variables are limited and not controlled in the baseline analysis because they are only available for more recent years from 1984 while many capital account liberalizations happened in the 1970s and 1980s; therefore, we lost substantially valuable observations and are unable to use them in the DID estimation, which requires 10 years of data before and after liberalization. When estimating the dynamic panel fixed effects model with additional controls of institutional quality and corruption, we add them in both linear and nonlinear ways to account for a possible U-shaped relationship as shown in Li *et al.* (2000). For institutional quality and corruption, we find that democratic regimes seem to be associated with higher Gini coefficients, and corruption shows a U-shaped relationship with the Gini coefficients; meanwhile, they do not have a consistent association with income shares. More importantly, the main conclusions that capital account liberalization is associated with higher income inequality and specifically with higher Gini coefficients, smaller income shares for the bottom 50%, and a larger income share for the top 10% do not change, although the statistical significance is weaker in the system GMM estimates.

## VI. Conclusion

The relationship between capital account liberalization and income inequality has been gaining increasing attention in recent years. This has opened a relatively new area of study in financial globalization besides its relationship with economic growth and financial stability. However, the existing findings are inconclusive. This study thus uses two empirical strategies, a dynamic panel fixed effects model and a DID model, to revisit this question. Our findings suggest that capital account liberalization is associated with greater income inequality in developing economies.

First, we document that changing the capital account from fully closed to fully liberalized in developing countries is associated with a rise of 0.07–0.30 standard deviations of the Gini coefficients for the short term and a rise as much as 0.32–0.62 standard deviations of the Gini coefficients for the 10 years after liberalization. Second, this increased income inequality involves the shrinking of the income share of the poor vs. the expansion of that of the rich. When comparing the 10 years before capital account liberalization with the

<sup>24</sup> Besides the index from the ICRG, two other datasets are widely used to measure corruption: the corruption perceptions index published by Transparency International and the control of corruption index of the World Governance Indicators. However, as these start from more recent years (1995), we use the ICRG's corruption index, which starts from 1984.

10 years thereafter, the liberalizing event is associated with a decrease in the income share of the poorest 50% by 2.66–3.79% points and an increase of the share of the richest 10% by 5.19–8.76% points. Third, we find that the direction and category of capital account liberalization are essentially important. Inward capital account liberalization is more associated with income equality than outward liberalization, and equity market liberalization is associated with a larger increase in the income share of the rich and a larger decrease in that of the poor; meanwhile, we do not find any significant association between the liberalization of FDI and income inequality.

While we acknowledge that the mechanism through which capital account liberalization affects income inequality is important, we do not discuss it in this study. To investigate this channel, we need more detailed micro-level data on household income such as the wages and compensation of workers with different levels of skill. Such data are insufficient at this stage, especially for developing economies. Therefore, we leave this task for future studies.

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## Supporting Information

Additional supporting information may be found in the online version of this article:

**Online Appendix:** Appendix

**Supplementary Data:** Data