INSTITUTE
OF ECONOMIC STUDIES
Faculty of Social Sciences
Charles University

DISTRIBUTIONAL EFFECTS OF EXCHANGE RATE DEPRECIATIONS: BEGGAR-THY-NEIGHBOUR OR BEGGAR-THYSELF?

Boris Fisera

IES Working Paper 8/2023

Institute of Economic Studies,
Faculty of Social Sciences,
Charles University in Prague

[UK FSV – IES]

Opletalova 26
CZ-110 00, Prague
E-mail : ies@fsv.cuni.cz
http://ies.fsv.cuni.cz

Institut ekonomických studií
Fakulta sociálních věd
Univerzita Karlova v Praze

Opletalova 26
110 00 Praha 1

E-mail : ies@fsv.cuni.cz
http://ies.fsv.cuni.cz

Bibliographic information:
Fisera B. (2023): "Distributional Effects of Exchange Rate Depreciations: Beggar-Thy-Neighbour or Beggar-Thyself?" IES Working Papers 8/2023. IES FSV. Charles University.

This paper can be downloaded at: http://ies.fsv.cuni.cz

Distributional Effects of Exchange Rate Depreciations: Beggar-Thy-Neighbour or Beggar-Thyself?

Boris Fisera[a]

[a]Faculty of Social Sciences, Charles University, Prague & Institute of Economic Research, Slovak Academy of Sciences, Bratislava
Email: boris.fisera@fsv.cuni.cz

April 2023

Abstract:
While it is often argued that exchange rate depreciation has a beggar-thy-neighbour effect, in this paper, we investigate, whether exchange rate depreciation has a beggarthyself effect. Specifically, we explore the distributional consequences of Exchange rate movements. Using a heterogeneous panel cointegration approach, we find that, on average, small depreciations of the domestic currency decrease income inequality over the long-term. However, large depreciations in excess of 25%, increase income inequality over the long term. Large appreciations of the domestic currency also increase income inequality. Next, we identify 119 episodes of managed depreciations to better capture the distributional consequences of exchange rate movements. Managed depreciations are defined as situations in which the central bank intervenes to depreciate its domestic currency. Using the local projections (LP) approach, we find that managed depreciation shocks decrease income inequality. We find no evidence supporting the idea that exchange rate depreciation has a 'beggar-thyself' effect with respect to income inequality, as it does not seem to increase inequality.

JEL: F10, F30, F31, F43
Keywords: exchange rate depreciation, income inequality, competitive devaluation, managed depreciation, distributional effects

Acknowledgements: We thank Roman Horvath, Jarko Fidrmuc and Maria Siranova for helpful comments. The author acknowledges that this paper has been supported by the Charles University Grant Agency under the project No. 341421 Exchange Rates and the Speed of Economic Recovery.

The author has no competing interests to declare that are relevant to the content of this article.

1 Introduction

There is a general consensus that depreciation of domestic currency can contribute to an increase in international competitiveness of the domestic economy, which then leads to higher exports and higher economic growth so long as the Marshall-Lerner condition holds (Marshall, 1890; Lerner, 1952).[1] While the standard theoretical literature (Alexander, 1952, 1959; Whitman, 1975) generally argues that weaker domestic currency *might* stimulate economic growth, the empirical literature (Aguirre and Calderon, 2005; Cuestas et al., 2020; Fisera and Horvath, 2022; Georgiadis et al., 2021; Habib et al., 2017; Leigh et al., 2017; Nouira and Sekkat, 2012; Rodrik, 2008) arrives at conflicting conclusions, finding both positive and negative, as well as insignificant effects of weaker domestic currency on economic growth.

Consequently, as the exchange rate of domestic currency might be influenced by policymakers, policymakers can use domestic currency depreciation to stimulate economic growth (and/or attain the inflation target). Such a policy has been alternatively referred to as competitive devaluation, managed depreciation and the use of exchange rate as an instrument of monetary policy. In this regard, several theoretical models incorporate such a policy as a means of escaping deflation and/or stagnation (Corsetti et al., 2018; Ghosh et al., 2016; McCallum, 2000; Svensson, 2000). Czech and Swiss National Banks depreciated their domestic currencies to attain their monetary policy goals in 2013 and 2011, respectively. However, such use of competitive devaluations is often referred to as a *beggar-thy-neighbour* policy since the competitive gains caused by the weaker domestic currency are achieved at the expense of foreign economies. As a result, competitive devaluations can trigger a currency war, which is a situation in which several countries compete to weaken their currencies. Even though the direct use of the exchange rate as an instrument of monetary policy remains relatively rare in advanced economies, most central banks continue to rely heavily on the exchange rate transmission mechanism when conducting monetary policy.[2]

While competitive devaluations are usually referred to as *beggar-thy-neighbour* policies, the theoretical model of Corsetti et al. (2018) indicates that they might actually be *beggar-thy-self* policies. Namely, while a weaker domestic currency might

[1] That is, if the increase in the volume of exports exceeds the increase in the value of imports that is caused by higher imports prices.

[2] This is evidenced by the recent appearance of the novel concept of *reverse currency wars*. The term reverse currency wars was coined by Frankel (2022), and it describes the response of central banks to the inflationary pressures that surfaced after the covid pandemic in the early 2020s. Reverse currency wars represent situations in which countries compete with each other to strengthen their domestic currencies (primarily by using indirect measures, such as increasing key interest rates) to tame inflationary pressures.

increase exports, employment and output, it also leads to a deterioration of the terms of trade, which lowers overall welfare. Moreover, the level of these welfare losses caused by weaker domestic currency might vary across diverse groups of economic agents and thus, competitive devaluations might have some distributional consequences.[3] This is the hypothesis that we aim to empirically investigate in this paper.

There are several channels through which exchange rate depreciation might influence income inequality. First, if the depreciation increases the domestic economic growth, it lowers income inequality via the *earnings heterogeneity channel*. Namely, higher economic growth increases domestic employment and thus puts an upward pressure on wages, which mainly benefits poorer households that are more dependent on labour income (Lenza and Slacalek, 2018; Samarina and Nguyen, 2023). Second, exchange rate depreciation can lead to higher inflation, and inflation itself has some redistributive consequences through which workers with indexed wages increase their income relative to that of other workers (Bulir, 2001). As there is no consensus on the overall distributional effects of higher inflation, depreciation might either increase or decrease inequality via this *inflation channel*. Third, Krugman and Taylor (1978) argue that the devaluation of domestic currency redistributes income from wages to profits and rents primarily by reducing the real value of wages (due to higher import prices) and by increasing the profits of exporters. Thus, weaker domestic currency might contribute to an increase in income inequality via the *income composition channel*. Fourth, depreciation might increase income inequality through the *foreign assets channel* because depreciation increases relative value of foreign assets and incomes, which mostly benefits richer households (Drienik et al., 2018). While domestic currency depreciation might influence income inequality through several channels, empirical evidence regarding the overall distributional consequences of exchange rates remains largely missing.

The heavy reliance of central banks, particularly in advanced economies, on non-standard monetary policy tools during the 2010s and the subsequent emergence of inflationary pressures in the early 2020s have led to discussions about potential revisions of monetary policy frameworks around the globe. The use of exchange rate as an instrument of monetary policy is one of the options discussed by both policymakers and academicians. This underlines the importance of studying the distributional consequences of exchange rate movements. Namely, higher income inequality can exert several negative consequences: High income inequality can hinder the transmission of monetary

[3] The model of Corsetti et al. (2018) indicates that since weaker domestic currency increases the real interest rate, it contributes to a reduction in domestic borrowing, which negatively affects particularly the young households.

policy (Guerello, 2018; Voinea et al., 2018), limit the provision of credit to low-income households (Coibion et al., 2020), and contribute to higher private sector debt and lower financial stability (Perugini et al., 2016). Furthermore, Berg et al. (2018) found that a low level of income inequality leads to faster and more sustainable economic growth.

In this paper, we extend the current empirical research by studying the distributional consequences of exchange rates across a large panel of 72 advanced and emerging economies. First, since income inequality is rather persistent over time, we use a heterogeneous panel cointegration approach to study, whether exchange rate movements influence income inequality on average over the long-term. We find that exchange rate movements have a small but statistically significant effect on income inequality. We also find significant non-linearities in the effect of exchange rates: small depreciations of the domestic currency seem to reduce income inequality, while large depreciations exceeding 25% seem to increase income inequality over the long term. Moreover, we also find that large appreciations of the domestic currency increase income inequality.

Next, to sharpen the identification of the effect of exchange rate, we quantitatively identify 119 episodes of managed depreciations, which are defined as situations in which policymakers intervene in the FX markets to depreciate the domestic currency. Namely, since exchange rate developments might be driven by various economic factors that might themselves influence inequality, we argue that focusing on the distributional consequences of managed depreciations can help us to improve the identification of the distributional consequences of exchange rates. Using the local projections (LP) approach, we find that managed depreciations decrease income inequality. While this effect is small in size, it is persistent even after five years following the managed depreciation. We find evidence that our results are driven by the earnings heterogeneity channel. That is, the depreciation of domestic currency enhances international competitiveness, increases domestic output, decreases unemployment, increases wages and thus reduces income inequality. Our results also indicate that it is only the managed depreciations that are conducted during the periods of economic recovery, which increase economic growth and cut inequality. Managed depreciations that are conducted during other stages of the business cycle, do not seem to influence inequality. Consequently, our empirical findings fail to provide evidence that a depreciation of the domestic currency is a 'beggar-thyself' with respect to income inequality.

Our contributions to the existing literature are fourfold. First, to the best of our knowledge, this is the first study to investigate the long-term effect of exchange rate movements on income inequality using a large panel of countries. Second, we also identify significant non-linearities (asymmetries) in the effects of different magnitudes of currency depreciations/appreciations. Third, we quantitatively identify 119 episodes of managed depreciation. Fourth, this is also the first study to investigate the distributional consequences of managed depreciations. Fifth, we provide some evidence on the channels through which exchange rate movements influence inequality.

The rest of the paper is organized as follows: Section 2 discusses the related literature. Section 3 presents the empirical methodology, while Section 4 outlines our data. We report the results on the long-term effect of exchange rates on income inequality in Section 5, while the findings on the distributional consequences of managed depreciations are reported in Section 6. Finally, Section 7 concludes the paper.

2 Related Literature

There exists a burgeoning empirical literature, which studied the determinants of income inequality (Agnello et al., 2012; Furceri and Ostry, 2019; Hasan et al., 2020; Tridico, 2012). Our research most closely follows the part of this literature that studied the distributional consequences of monetary policy. The empirical studies have thus far focused primarily on studying the distributional consequences of standard monetary policies. However, the empirical evidence remains inconclusive– with some studies arguing that restrictive (expansive) monetary policy leads to higher (lower) inequality (Coibion et al., 2017; Furceri et al., 2018; Guerello, 2018; Mumtaz and Theophilopoulou, 2017), while others arrive at an opposite conclusion (Davtyan, 2017; Herradia and Leroy, 2021). Next, there are also numerous studies, which explore the distributional consequences of unconventional monetary policies – primarily the quantitative easing. But even for this strand of literature, there is no agreement about the effect on inequality. Namely, studies such as Casiraghi et al. (2018) or Lenza and Slacalek (2018) find that unconventional monetary policies reduce inequality, while others, such as Saiki and Frost (2014) or Mumtaz and Theophilopoulou (2017), find that unconventional monetary policies have adverse distributional consequences. Nevertheless, even though the results are inconclusive, the empirical findings of these studies do indicate that various monetary policy instruments might have some (positive or negative) distributional consequences – via different channels. Consequently, the exchange rate, which might also be used as a tool of monetary policy, might, via numerous different channels, influence income inequality, too. Moreover, Bridges et al. (2021) finds that macroprudential policy tools limit the adverse distributional consequences of crises.

There are only very few studies, which investigated the distributional effects of exchange rate movements. One notable exception is Cravino and Levchenko (2017), who investigated the distributional consequences of 1994 Mexican devaluation. Their findings indicate that large devaluations might have significant distributional consequences. In particular, Cravino and Levchenko (2017) find that two years after the devaluation, the cost of living of poorest households increased much more than the cost of living of richest households – indicating an increase in income inequality due to a large devaluation. The two-country macroeconomic model of Carnevali et al. (2022) indicates that the exchange rates and the stock of foreign debt play an important role in influencing inequality (both across and within countries).

There are also a few studies that investigate the effect of inequality on exchange rate – that is, the opposite direction of causality to the one studied in this paper. These studies include for instance Backus and Smith (1993), or Kocherlakota and Pistaferri (2008). The findings of these papers are mixed – indicating either that there is no effect of inequality on real exchange rate, or that growth of inequality contributes to an appreciation of the real exchange rate.

3 Empirical Methodology

In the following section, we first outline the panel cointegration approach that we use to identify the long-term distributional consequences of exchange rates. Second, we describe the approach that we use to identify the episodes of managed depreciations. Third, we introduce the local projections (LP) approach that we use to identify the distributional consequences of managed depreciation shocks.

3.1 Long-term Effect of Exchange Rate on Income Inequality

Since income inequality is rather persistent over time, we first use a panel cointegration approach to study the long-term distributional consequences of exchange rate movements. Specifically, we use the pool mean group estimator (PMG) of Pesaran and Smith (1995) and Pesaran et al. (1999). We argue that this empirical approach is well-suited for our analysis because income inequality is rather persistent and does not change much over the short term, thus a long-term cointegration-based approach is well-positioned to identify the drivers of income inequality. An additional advantage of the PMG estimator is that while it studies the long-term relationship, it also controls for short-term deviations from the long-term relationship. The baseline regression specification takes the following form:

$$\Delta ineq_{i,t} = \sum_{j=1}^{p-1} \Phi_{i,j} \Delta ineq_{i,t-j} + \sum_{j=0}^{q-1} \Pi_{i,j} \Delta er_{i,t-j} + \sum_{j=0}^{r-1} \Theta_{i,j} \Delta X_{i,t-j} + \beta_{0,i}(ineq_{i,t-1} - \beta_1 er_{i,t} - \sum_{j=2}^{u} \beta_j X_{i,t} - \mu) + \epsilon_{i,t} \quad (1)$$

where $ineq_{i,t}$ stands for our measure of income inequality (Gini) in country i at a time t. er is our measure of exchange rate (NEER) and X is a vector of control variables. The detailed description of the control variables is provided in section 4. One of the advantages of the PMG estimator is that while it assumes that the long-term relationship is homogeneous across all the countries in the panel, the short-term deviations from the long-run relationship are country-specific. Therefore, the coefficients $\sum_{j=0}^{q-1} \Pi_{i,j}$ capture the heterogeneous (country-specific) effect of exchange rate changes on short-term deviations of income inequality from the long-term equilibrium relationship.[4] β_0 is the coefficient of the error correction term, which captures the speed of adjustment of short-term deviations back towards the long-term equilibrium. The coefficient β_1 is the primary coefficient of interest for our analysis because it captures the long-term effect of exchange rate on income inequality. Consequently, the PMG estimator enables us to study what is the effect of exchange rate movements on income inequality over the long-term – on average, for a large and global sample of countries.

While the equation 1 enables us to study the long-term effect of exchange rate on income inequality, several studies have already identified significant non-linearities in the effects of appreciations and depreciations (Nouira and Sekkat, 2012). Therefore, to address this concern, we follow the standard approach in the empirical literature and split our measure of exchange rate into two separate measures of appreciation and depreciation, and we introduce these two variables into our baseline regression:

[4] The inclusion of a sufficient number of lags of all the variables in the short-term equation helps to address the endogeneity concerns (Pesaran et al., 1999). However, the relatively small number of observations across time in our panel prevents us from including a large number of lags to the short-term equation. We include just one lag so that we do not lose too many observations.

$$\Delta ineq_{i,t} = \sum_{j=1}^{p-1} \Phi_{i,j} \Delta ineq_{i,t-j} + \sum_{j=0}^{q-1} \Pi_{i,j} \Delta appr_{i,t-j} + \sum_{j=0}^{z-1} \Psi_{i,j} \Delta depr_{i,t-j} + \sum_{j=0}^{r-1} \Theta_{i,j} \Delta X_{i,t-j} + \beta_{0,i}(ineq_{i,t-1} - \beta_1 appr_{i,t} - \beta_2 depr_{i,t} - \sum_{j=3}^{u} \beta_j X_{i,t} - \mu) + \epsilon_{i,t} \tag{2}$$

where *appr* and *depr* are the measures of appreciation and depreciation, respectively. To split *er* to separate measures for appreciations (*appr*) and depreciations (*depr*), we follow the approach of Shin et al. (2014), which was implemented in the context of exchange rates by for instance Bahmani-Oskooee and Mohammadian (2016) and Bahmani-Oskooee and Kanitpong (2017). This approach is based on first creating a variable, which captures the changes of the exchange rate (Δer). Then, this variable is split into two variables – one reflecting its positive changes (*appr*) and one reflecting its negative changes (*depr*):

$$\begin{aligned} appr_{i,t} &= \sum_{j=1}^{t} \Delta er^{+}_{i,j} = \sum_{j=1}^{t} max(\Delta er_{i,j}, 0) \\ depr_{i,t} &= \sum_{j=1}^{t} \Delta er^{-}_{i,j} = \sum_{j=1}^{t} min(\Delta er_{i,j}, 0) \end{aligned} \tag{3}$$

where $appr_{i,t}$ and $depr_{i,t}$ are simply the partial sum processes of positive and negative changes in the exchange rate.

Finally, we also address the issue of cross-sectional dependence – that is, the presence of correlation among the time series for the different cross-sectional units (i.e., countries). This could particularly be the case for both our variables of interest, the income inequality and the exchange rate because the developments of both of these variables could be influenced by global factors, which affect the values of these variables across several countries simultaneously. To control for the presence of cross-sectional dependence, we augment all our regressions with cross-sectional averages of all the variables. Consequently, the estimator that we use to estimate our regressions is the Common Correlated Effect PMG (CCEPMG) estimator, as introduced in Ditzen (2018), based on the work of Chudik and Pesaran (2015) and Chudik et al. (2016).

3.2 Identification of Managed Depreciation Episodes

While the empirical analysis outlined in the previous subsection enables us to identify whether, on average, exchange rate depreciations might influence income inequality (and thus, whether they are 'beggar-thyself'), exchange rate movements might be induced by various economic developments, which can themselves influence inequality. Consequently, to better identify the distributional consequences of exchange rate movements, we quantitatively identify episodes of managed depreciations, i.e., situations in which policymakers intervened in FX markets to depreciate domestic currency. Focusing on the distributional consequences of managed depreciations not only enables us to potentially better identify the specific effect of exchange rate, but since managed depreciations can also be described as competitive devaluations[5], focusing on these events is more appropriate with regard to our primary research question (i.e., whether when policymakers apply the policy of currency depreciation, the policy is actually 'beggar-thyself'). The drawback of focusing on managed depreciations is that our results are then driven by a smaller and less representative sample of such events.

The identification of managed depreciation episodes is not very straightforward as most central banks are reluctant to publicly acknowledge that they conduct such a policy. Therefore, we identify managed depreciation episodes based on the observed actual developments in each country in our sample. Since there is no universally agreed definition of managed depreciations, we define managed depreciations as situations in which the central bank takes a conscious action meant to weaken its own currency by intervening in the FX market.[6]

We identify the start of a managed depreciation episode on the basis of the following criteria:

- Net annual foreign exchange purchases by the central bank exceed 2% of the coun-

[5]We refer to these events as managed depreciations and not as competitive devaluations because we identify these events based on exchange rate developments and interventions in the FX markets. Therefore, our data does not enable us to infer, whether these events were induced by policymakers with a goal of enhancing international competitiveness or for some other goal, rather only that the depreciations in question were 'managed' by the policymakers.

[6]It could be argued that other monetary policy measures, such as the QE, might also lead (indirectly) to domestic currency depreciation. Nevertheless, in this research, we focus only on situations in which the central bank directly influences the exchange rate on the FX market, as this identification strategy enables us to explore the specific distributional consequences of exchange rate movements. Namely, the QE might influence the economy through several channels (i.e., via financial markets), causing the identification of its distributional consequences via the exchange rate to be more difficult.

try's previous year GDP (i.e., the central bank intervenes against its domestic currency).[7]

- The domestic currency depreciates by at least 2.5% against a trade-weighted average exchange rate of its main trading partners over the previous quarter.
- To exclude any one-off events, the domestic currency must remain weaker in the quarter following the start of the episode when compared to the quarter preceding the start of the episode.
- We exclude any episodes in which the depreciation was part of a long-term trend by excluding any episodes for which the domestic currency had depreciated during the two quarters preceding the start of the managed depreciation episode.
- Furthermore, we exclude any episodes that occurred within a year of a currency crisis (as identified by Laeven and Valencia (2018)) to ensure that the depreciation was not associated with a currency crisis.
- Finally, we exclude any episodes that occurred in oil-rich countries where the accumulation of FX reserves could have been associated with the investment of oil revenues in foreign currencies.

The identification strategy outlined above has an obvious drawback in that most central banks do not report whether they purchase foreign exchange with an explicit aim of depreciating their own domestic currency, so it is not clear whether the FX purchases actually did contribute to depreciation. In other words, our identification strategy does not allow us to identify causality between FX purchases and domestic currency depreciation. Nonetheless, we argue that since FX interventions against domestic currency weaken domestic currency and an annual intervention exceeding 2% of GDP represents an unusually large intervention, all the managed depreciation episodes identified with our strategy meet the conditions of an actual managed depreciation, as they feature both a large intervention against the domestic currency and an associated depreciation of the domestic currency. Moreover, in a robustness check, we sharpen our identification of managed depreciation episodes – in this robustness check, we trade a sharper identification strategy for a significantly reduced sample size. Our definition of managed depreciations is in line with the monetary policy instrument that Franta et al. (2014) refer to as the use of exchange rate as an instrument of monetary policy. We identify

[7]The threshold of 2% of GDP for the FX interventions against the domestic currency is in line with the U.S. Treasury's definition of currency manipulators.

the managed depreciation episodes based on quarterly data. Subsequently, we aggregate the identified managed depreciation episodes to an annual frequency.

3.3 Distributional Effects of Managed Depreciations

To study the distributional consequences of managed depreciations, we opt to use the local projections (LP) approach of Jorda (2005). The LP approach has been used to study the determinants of income inequality by, for instance, Furceri et al. (2018), Bridges et al. (2021) and da Souza Cardoso and da Carvalho (2022). This method is based on the generation of impulse responses through the estimation of a specific regression for each forecast horizon, with these regressions being conditional on a set of regressors in the initial time period.

To study the distributional consequences of managed depreciations, we estimate the following regression specification:

$$ineq_{i,t+h} - ineq_{i,t} = \alpha_i^h + \beta^h md_{i,t-1} + \gamma^h X_{i,t-1} + \nu_{i,t+h}, \;\; for \;\; h = 1, ..., 5 \tag{4}$$

where h is a forecast horizon for the impulse responses. $ineq_{i,t}$ stands for our measure of income inequality in country i and time t. md is a dummy variable, which takes the value of 1 if a managed depreciation episode started in the given year and 0 otherwise. However, in line with Melecky and Raddatz (2015), when constructing this dummy variable, we account for the fact that a managed depreciation episode might start at the end of the year and thus, a dummy with the value of 1 in the given year might not fully capture its consequences. As a result, to each managed depreciation episode, we assign the value of 1, which we proportionally split to the year when the episode began and to the following year.[8]. Finally, X is the vector of control variables and α_i are country fixed effects. The vector of control variables includes the same control variables that are included in the regressions estimated with the CCEPMG estimator. However, to ensure that the control variables are stationary, the control variables enter the regressions in first differences. Furthermore, the vector of control variables also include one lag of the main variable of interest (managed depreciation dummy) and two lags of the dependent variable (Gini coefficient).

The LP approach is based on the calculation of impulse responses by estimating

[8] For instance, if a managed depreciation episode started in one country in Q4 of 2018, we would allocate the value of 0.25 to the year 2018 and the value of 0.75 to the year 2019 – implicitly assuming that it takes one year for the effect of managed depreciation to start to materialize.

a regression for each forecast horizon h. These regressions are conditional on a set of control variables in the initial time period. In our case, we estimate the equation 4 for $h = 0, ..., 4$ – for 5 years after the managed depreciation. The impulse responses are calculated based on the results obtained from equation 4: point estimates are calculated based on the estimated β^h coefficients, while the confidence intervals are obtained from the standard errors of β^h coefficients. The standard errors are clustered at a country level to address the potential correlation of standard errors within the respective countries.

4 Data

Our primary dataset is a panel dataset of 72 emerging and advanced economies. The list of countries is reported in Table A1 in the Appendix. The dataset is unbalanced and covers the period between 1981 and 2018, with an annual frequency. While the dataset is unbalanced, we only include countries for which we have at least 21 years of data. This restriction enables us to have a sufficient number of observations across time for each country so that we can apply heterogeneous panel cointegration techniques and study the long-term relationship between exchange rate movements and income inequality.

As our primary measure of income inequality, we use the Gini coefficient. Data on the Gini coefficient are taken from the Standardized World Income Inequality Database (SWIID). We use the Gini coefficient that is based on market income inequality, following earlier empirical papers (Lenza and Slacalek, 2018; Bridges et al., 2021). Consequently, the Gini coefficient is calculated based on pre-tax and pre-transfer income. The main advantage of using the market-based Gini instead of the Gini coefficient that is based on disposable income is that we do not have to control for the redistributive effects of fiscal policy. The Gini coefficient takes values between 0 and 100, with a value of 0 indicating full equality and a value of 100 indicating full inequality.

The Gini coefficient is the most widely used measure of income inequality in the empirical literature (Furceri et al., 2018; Lenza and Slacalek, 2018; Bridges et al., 2021). The selection of this inequality measure also enables us to maximize the sample size, and the Gini coefficient captures the entire income distribution in one measure. However, we are aware of the critiques regarding the Gini coefficient. For instance, the Gini coefficient might be overly sensitive to developments in the middle of the income distribution (Cobham et al., 2016). And Palma (2011) has shown that changes in income inequality are driven by the tails of the income distribution (i.e., poorest and richest households). Therefore, in a robustness check, we use several alternative measures of income inequality, which are expressed as the share of total income earned by different segments of the income distribution. However, as the data coverage for these alternative measures of inequality is more limited than that of the Gini coefficient, we estimate these robustness checks on only a subsample of countries. Data on this alternative measure of inequality are taken from the World Inequality Database (WID).

As our primary measure of the exchange rate, we use the nominal effective exchange rate (NEER) from the International Monetary Fund's (IMF) International Financial Statistics (IFS) database. We select NEER, as it is a comprehensive measure of changes in the value of the domestic currency against the currencies of the main trading partners. Moreover, NEER changes even for countries with fixed exchange rate regimes, which enables us to maximize the sample size. We use the nominal exchange rate as our primary exchange rate measure, as this is the exchange rate that policymakers might seek to influence influence. NEER, along with all other exchange rate measures we used, is expressed in indirect quotation: an increase in its value represents an appreciation of the domestic currency.

However, one drawback of NEER is that this exchange rate measure might not be able to fully identify the long-term effect of the exchange rate on income inequality via the earnings heterogeneity channel (i.e., higher international competitiveness, better economic performance, higher employment, lower inequality).[9] Namely, a nominal depreciation of the domestic currency might be compensated by higher domestic inflation, leading to no international competitiveness gains and no effect of the exchange rate on income inequality. To address this drawback, we also use two alternative measures of exchange rate. First, we use the real effective exchange rate (REER) from the IMF's IFS database. REER is NEER adjusted for the relative price changes between domestic and foreign economies. Thus, REER might be better positioned to identify the changes in international competitiveness than NEER since it captures, whether the nominal depreciation was compensated for by an increase in domestic price level. Second, we use a measure of real currency misalignment (CM) (i.e., the over-/undervaluation of the domestic currency) from Couharde et al. (2017), which was taken from the CEPII database. This measure, which was estimated with a behavioural equilibrium exchange rate (BEER) model, captures whether the domestic currency is stronger or weaker than its medium-term equilibrium level. Consequently, the CM might also be well-positioned to identify the long-term effect of exchange rates on income inequality via the earnings heterogeneity channel.

Next, we introduce several control variables in our regressions to control for other

[9] Nonetheless, NEER is a good measure for identifying the effect of the exchange rate on income inequality via the inflation channel or via the foreign assets channel.

factors that might influence income inequality. However, since we use a cointegration-based empirical approach in our baseline regressions, we keep the number of control variables low, which is in line with the empirical literature that uses cointegration-based empirical approaches (Herzer and Vollmer, 2012; Herzer and Nunnenkamp, 2012; Thornton and Tomaso, 2020). Additionally, by limiting the number of control variables, we are also able to maximize the sample size; this is particularly true regarding the number of observations across time, as a sufficient number of observations across time is crucial for cointegration-based estimators.

First, we control for economic developments by including GDP per capita based on purchasing power parity (PPP). This variable not only enables us to control for economic developments across time but also for the different levels of economic development across countries in our sample. Second, we also include the short-term interest rate among our control variables to control for the role of monetary policy, as monetary policy has been found to influence income inequality (Coibion et al., 2018). The short-term interest rate is the 3-month interbank interest rate, or in the case it is not available, the 3-month Treasury Bills rate. Moreover, the short-term interest rate also helps us control for the domestic macroeconomic environment (Bridges et al., 2021). Finally, as Thornton and Tomaso (2020) and Hasan et al. (2020) have shown that financial development influences inequality, we also introduce financial development among the control variables. We use the comprehensive index of financial development of Svirydzenka (2016) as our primary measure of financial development. However, as financial development is highly endogenous to economic development, to avoid any issues of collinearity among the control variables, we follow the approach of Fisera (2022) and regress the comprehensive index of financial development on the level of economic development in a panel setting. Next, we use the residuals from this regression as our measure of financial development, which is not correlated with GDP (PPP) per capita. Consequently, this measure of financial development captures whether a country's level of financial development is higher (lower) than what the country's level of economic development would warrant for.

We report the summary statistics for the variables in Table A2 in the Appendix, while the detailed descriptions of the variables and their sources are reported in Table A3 in the Appendix.

5 Results: Long-term Effect of Exchange Rate on Income Inequality

In the following section, we report the results of our empirical analysis of the long-term effect of exchange rate on income inequality. Before proceeding to estimate the regressions themselves, we first test for the stationarity of the variables, as well as for the presence of cointegration among the variables. With regards to stationarity testing, we conduct four panel unit root tests: Im-Pesaran-Shin (IPS) test of Im et al. (2003), Fisher-type Dickey-Fuller and Phillips-Perron tests of Choi (2001), as well as the cross-sectionally augmented IPS (CIPS) test of Pesaran (2007), which allows for cross-sectional dependence among the cross-sectional units. We report the results of the panel unit root tests in Tables B1 and B2 in the Appendix. We find that the levels of all the variables exhibit a mix of stationary and non-stationary properties, while their first differences are stationary. Therefore, we conclude that the application of the CCEPMG estimator is appropriate in this setting, as this type of estimator can handle a combination of stationary and non-stationary variables, so long as these variables are either I(1) or I(0) (Pesaran et al., 1999).

Next, we conduct a panel cointegration test of Westerlund (2005) and we report the results in Table B3 in the Appendix. The results of the cointegration test do confirm the presence of cointegration among the variables included in the regressions. As a result, we can apply the cointegration-based CCEPMG estimator to estimate the regressions.

5.1 Baseline Results

We report the results of the baseline regressions in Table 1. In column (1), we report the results for the baseline measure of exchange rate, NEER (equation 1). Interestingly, we find that the coefficient of NEER in the long-run equation is negative and statistically significant, which would indicate that nominal appreciation of the domestic currency reduces income inequality, while depreciation increases inequality over the long-run, provided that the effects of both appreciation and depreciation are linear.

However, since appreciations and depreciations have already been found to have non-linear effects, in the next step of our analysis, we split our measure of the nominal exchange rate into two separate measures for appreciation and depreciation (equation 2). We report the results of this regression in column (2) of Table 1. Interestingly, we find that the results obtained for the single measure of NEER seem to be driven by depreciations. Namely, once we split the exchange rate into separate measures for appreciation

Table 1: Long-term Effect of Exchange Rate on Income Inequality

	(1)	(2) Gini	(3)
Long-run equation			
NEER (ln)	-0.187***		
	(0.020)		
NEER Depreciation		2.134***	-0.362***
		(0.024)	(0.049)
NEER Appreciation		2.653***	-5.753***
		(0.189)	(0.284)
NEER Depreciation Squared			1.456***
			(0.020)
NEER Appreciation Squared			36.941***
			(0.773)
GDP (PPP) per capita (ln)	-6.205***	-5.274***	-5.519***
	(0.188)	(0.123)	(0.127)
Interest rate (%)	-0.002***	-0.004***	-0.007***
	(0.000)	(0.000)	(0.000)
Fin. development	-4.606***	-3.350***	-3.297***
	(0.278)	(0.260)	(0.257)
Short-run equation			
Error correction	-0.133***	-0.088***	-0.089***
	(0.014)	(0.009)	(0.009)
D.NEER (ln)	-0.127		
	(0.117)		
D.NEER Depreciation		-0.102	-0.030
		(0.130)	(0.130)
D.NEER Appreciation		-0.100	0.070
		(0.147)	(0.149)
D.GDP (PPP) per capita	-0.653	-1.065*	-1.097*
	(0.535)	(0.613)	(0.610)
D.Interest rate (%)	0.004	0.003	0.003
	(0.003)	(0.003)	(0.003)
D.Fin. development	0.045	-0.146	-0.177
	(0.313)	(0.346)	(0.353)
Observations	2,108	2,108	2,108
R-squared	0.667	0.682	0.679
Countries	72	72	72

Notes: *D* stands for the first difference. *ln* stands for the natural logarithm. For ease of interpretation, the values of *NEER Depreciation* have been converted from negative to positive, i.e., an increase in the value of this variable corresponds to a greater nominal depreciation of domestic currency. All the regressions were estimated with the CCEPMG estimator. Standard errors are in parentheses. * indicates significance at 10 % level, ** at 5 % level and *** at 1 % level.

and depreciation, we find that both nominal appreciation and nominal depreciation have positive long-term effects on income inequality. For both of these variables, the coefficient in the long-run equation is positive and statistically significant.[10] While depreciations seem to increase inequality somewhat more than appreciations do, the long-term effect of the exchange rate on income inequality, while strongly statistically significant, is economically small. An increase in the magnitude of depreciation (appreciation) by one standard deviation increases the Gini coefficient by mere 0.4 p.p. (0.1 p.p.) over the long term. Thus, while we find that the nominal exchange rate might influence income inequality over the long term, this effect is rather small in size.

Moreover, our results robustly indicate that an increasing level of economic development is associated with lower income inequality over the long term. This finding is in line with the empirical findings of Barro (2000), who found that inequality first increases and then decreases with growing economic development.[11] Somewhat surprisingly, higher interest rates seem to reduce income inequality over the long term. Nonetheless, these findings are in line with the earlier results of Romer and Romer (1999), Davtyan (2017) or Herradia and Leroy (2021). Namely, higher interest rates might reflect a contractionary monetary policy that might reduce inequality over the long-term by reducing inflation and asset prices. We also find that a higher level of financial development reduces inequality over the long term, which aligns with the results of Thornton and Tomaso (2020). Interestingly, we also find that short-term deviations of income inequality from the long-run relationship are not influenced by exchange rate changes. It seems that only changes in the level of economic development influence short-term deviations of inequality from the long-run relationship – as evidenced by the coefficients obtained for the short-term equation. The coefficient of the error correction term is negative, between 0 and -1, and statistically significant. This finding provides evidence for the presence of error correction. Since Engle and Granger (1987) have shown that the presence of error correction implies the presence of cointegration, this finding confirms that there is a long-term cointegrating relationship among the variables in our sample.

Next, we explore further the effect of depreciations and appreciations on income inequality. Namely, the findings reported in column (2) of Table 1 indicate that the

[10]For ease of interpretation, we have converted the values of NEER depreciation from negative to positive, i.e., an increase in the value of this variable corresponds to a larger nominal depreciation of domestic currency.

[11]While our sample includes both advanced and emerging economies, it is more skewed towards middle-income and high-income economies – for which, we can expect the growing economic development to contribute to lower inequality.

larger the depreciation is, or the larger the appreciation is, the more income inequality increases over the long term. However, this result could be driven by very large depreciations/appreciations. To explore whether there are some non-linearities in the *magnitude* of depreciations/appreciations, i.e., whether larger depreciations/appreciations exert different effects on income inequality than smaller depreciations/appreciations, we introduce squared values of our measures of depreciation and appreciation into the baseline regression. We report the results in column (3) of Table 1.

Interestingly, once we include the squared values of depreciations/appreciations, the coefficients of the variables *NEER Depreciation* and *NEER Appreciation* become negative, while the coefficients of their squared values are positive. Consequently, we find that larger depreciations and larger appreciations contribute to higher inequality, while smaller depreciations and appreciations reduce income inequality over the long-term. To better illustrate these results, we present the effect of exchange rate on income inequality at different magnitudes of appreciation/depreciation in Figure B1 in the Appendix.

For depreciations, we find that small nominal depreciations with magnitudes of up to 5% reduce the Gini coefficient by approximately 0.3 - 0.4 p.p. This finding indicates that small exchange rate depreciations might contribute to higher international competitiveness, higher exports and higher domestic output, which in turn, is likely to reduce income inequality by reducing unemployment and increasing wages. It seems that for such small depreciations, this negative effect that operates through the earnings heterogeneity channel outweighs the positive effect of depreciation on income inequality that operates through higher inflation and through the higher value of foreign assets/incomes (in domestic currency terms). Namely, small depreciations are less likely to substantially increase inflation, and they also do not significantly increase the value of foreign assets and foreign incomes, which disproportionately accrue to richer households. Thus, we fail to find evidence that small depreciations are 'beggar-thyself', as they decrease rather than increase income inequality – even though the effect on inequality is small in size. While our findings robustly indicate that a small nominal depreciation of domestic currency might result in a slight reduction in income inequality over the long term, which could indicate that it is not 'beggar-thyself', the size of this effect is quite small. As a result, we further explore the effect of depreciation on inequality in another empirical exercise in the next section.

However, with increasing magnitude of depreciation, this negative effect of depreciation on income inequality begins to disappear, as larger depreciations are more likely to lead to higher inflation, which might increase income inequality, than to enhanced international competitiveness and higher domestic output. Furthermore, larger depreciations also lead to larger increases in the (relative) value of foreign assets and foreign incomes, which disproportionately benefits high-income households and thus contributes to higher income inequality. Nominal depreciations with a magnitude of more than 27% contribute to a long-term increase in income inequality.[12] However, the size of this distributional effect is, once again, very small. Our finding that large depreciations contribute to an increase in income inequality is in line with the findings of Cravino and Levchenko (2017), who also found that large devaluations contribute to an increase in income inequality.

For nominal appreciations, our findings also indicate that small appreciations might reduce income inequality, while a larger appreciation of the domestic currency increases income inequality. The negative effect of smaller nominal appreciations on inequality is, however, significantly smaller in size than the negative effect of small depreciations. We argue that smaller appreciation decreases inequality over the long term by being disinflationary and by decreasing the (relative) value of foreign assets/incomes, which benefits poorer households more than richer households. Moreover, while a nominal appreciation of domestic currency might negatively influence international competitiveness and, by extension, domestic output and thus contribute to higher inequality, a small appreciation of domestic currency is less likely to exert a long-term negative effect on international competitiveness. However, our results indicate that larger appreciations (exceeding 15%) have a positive long-term effect on income inequality. Very large annual appreciations (exceeding 25%) even exert a substantial effect on income inequality, increasing the Gini coefficient by more than 1 p.p. over the long-term. We hypothesize that this finding could be explained by the fact that larger appreciations might lead to a more pronounced erosion of international competitiveness and might have a more substantial (positive) effect on income inequality via the earnings heterogeneity channel. An effect, which, for larger appreciations, might outweigh the negative effect of appreciation on income inequality via the low inflation and lower relative value of foreign assets and incomes. Our findings for nominal appreciations thus also indicate that exchange rate movements primarily influence income inequality via the earnings heterogeneity channel.

5.2 Robustness Checks

Next, to verify the sensitivity of our baseline results, we use two alternative measures of exchange rate, namely REER and CM. We report the results of these regressions in Table B4 in the Appendix. REER, as a real exchange rate, could be better positioned

[12]Such a value of annual nominal depreciation of the domestic currency is quite large, but not completely unusual. Approximately 5% of all depreciations in our sample exceeded the magnitude of 27%.

to capture the effect of the exchange rate on income inequality via the earnings heterogeneity channel. Specifically, REER is a more comprehensive measure of international competitiveness than NEER, as it further controls for the relative price changes between domestic and foreign economies.[13] Our findings for REER are fully aligned with the baseline findings for NEER. We explain this result by the fact that while REER also reflects relative price changes between domestic and foreign economies, during the low-inflation periods, which dominate our sample, REER is highly correlated with NEER.[14]

In the next robustness check, we aim to find some support for our hypothesis that our baseline results are driven by the earnings heterogeneity channel. In columns (3-4) of Table B4 in the Appendix, we use the real currency misalignment (CM) as another alternative measure of the exchange rate. Currency misalignment, as the deviation between the actual real exchange rate and the medium-term equilibrium real exchange rate, might enable us to specifically identify the effect of the exchange rate on income inequality via the earnings heterogeneity channel. Specifically, the medium-term real over-/undervaluation is less likely to directly influence domestic inflation or the relative value of foreign assets/incomes (i.e., inflation and foreign assets channel), but it is a good measure of international competitiveness. As a result, we argue that any effect of over-/undervalued domestic currency on income inequality, would primarily operate via the earning heterogeneity channel. We find that an undervalued domestic currency decreases income inequality, while an overvalued domestic currency contributes to a long-term increase in income inequality. Consequently, we argue that this finding corroborates our hypothesis regarding the earnings heterogeneity channel of the exchange rate effect on income inequality, since undervalued (overvalued) domestic currency should be associated with higher (lower) international competitiveness, higher (lower) domestic output, lower (higher) unemployment, higher (lower) wages, and thus lower (higher) inequality.

6 Results: Distributional Effects of Managed Depreciations

While the results reported in the previous section robustly show that small nominal depreciations reduce income inequality over the long term, this effect is economically

[13]The competitiveness gains of nominal depreciation might be erased if the depreciation leads to a significant increase in domestic inflation. This would not be captured by NEER, but REER would capture such a compensation (if the relative increase in domestic prices fully compensates for the nominal depreciation, then REER, unlike NEER, would not indicate any change).

[14]In other words, changes in REER are driven by changes in the exchange rate, and not by changes in the relative price changes between the domestic and foreign economies.

small. As a result, in the following section, we use an alternative empirical approach, i.e., the local projections (LP) approach of Jorda (2005), to explore the short- to medium-term effects of exchange rates on income inequality and verify whether utilizing exchange rate depreciation is a 'beggar-thyself' policy.

The identification of the exchange rate shock is crucial for the implementation of the LP approach. Specifically, developments in the exchange rate might reflect various economic developments in both the domestic economy and abroad that might influence the level of income inequality. Therefore, to better identify the effect of the exchange rate on inequality, we focus on the effect of managed depreciations (please see subsection 3.2 for a detailed description of their identification), that is, situations in which policymakers induce exchange rate depreciation by intervening in the FX market. We argue that this approach enables us to better identify the specific effect of the exchange rate, since exchange rate depreciation is induced by policymakers and not by economic developments.[15]

6.1 Main Results

We report the response of the Gini coefficient to a managed depreciation shock in Table 2. In Figure 1, the cumulative impulse response function (IRF) of Gini coefficient to a managed depreciation shock is presented. We find that during the first two years following the managed depreciation shock, the level of income inequality decreases somewhat. While this effect is statistically significant, it is economically relatively small. During the first year following the managed depreciation shock, the Gini coefficient decreases by only approximately 0.05 p.p., while it decreases by slightly more than 0.1 p.p. during the second year following the shock. The cumulative decrease of income inequality thus equals almost 0.2 p.p. three years after the shock. This finding could provide some support for the 'trade channel', through which the exchange rate positively affects economic growth, which then, via the earnings heterogeneity channel, reduces income inequality. Namely, in line with the 'J-curve' concept, the positive effect of higher international competitiveness due to a depreciation is likely to fully materialize only following some time lag. Thus, the decrease in income inequality that is associated with higher domestic economic growth caused by the depreciation, is also likely to fully materialize only after some delay.

A managed depreciation ceases to have a statistically significant effect on income inequality three (and more) years after the shock. It seems that after three years,

[15] However, the policymakers might be influenced by the current economic environment when they opt to conduct a managed depreciation. We address this possibility in one of the robustness checks.

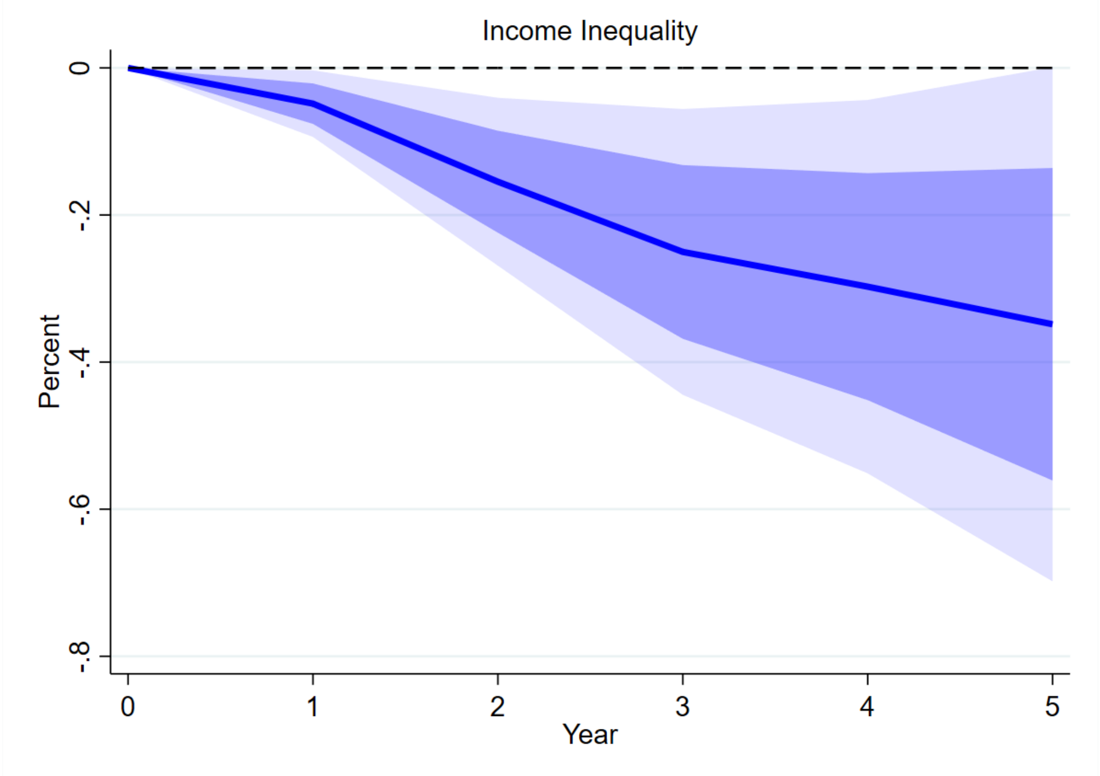
Table 2: Effect of Managed Depreciation Shocks on Income Inequality

	Year 1 K=0	Year 2 K=1	Year 3 K=2	Year 4 K=3	Year 5 K=4
			Gini growth		
L1.Gini growth	0.581***	0.388***	0.285***	0.091	0.074*
	(0.046)	(0.048)	(0.039)	(0.059)	(0.042)
L2.Gini growth	0.048	0.012	-0.071**	-0.013	-0.052
	(0.037)	(0.043)	(0.033)	(0.045)	(0.050)
L1.Managed depreciation	-0.048*	-0.103**	-0.073	-0.023	-0.028
	(0.027)	(0.044)	(0.053)	(0.045)	(0.059)
L2.Managed depreciation	-0.067**	-0.034	-0.001	-0.024	-0.058
	(0.028)	(0.042)	(0.039)	(0.052)	(0.056)
Observations	1,951	1,879	1,807	1,735	1,663
R-squared	0.402	0.185	0.078	0.018	0.017
Countries	72	72	72	72	72

Notes: *L1* stands for the one lag. *L2* stands for the two lags. The regressions also contained the following control variables: GDP (PPP) per capita, short-term interest rate, and financial development, as well as country fixed effects. Standard errors clustered at country-level are in parentheses. * indicates significance at 10 % level, ** at 5 % level and *** at 1 % level.

the competitiveness gains achieved by managed depreciation evaporate, and managed depreciation ceases to reduce income inequality further. However, the overall (cumulative) reduction in income inequality caused by managed depreciation during the first two years remains persistent up to five years after the managed depreciation shock. To conclude, we fail to find evidence that a depreciation of the domestic currency represents a 'beggar-thyself' policy. In fact, if a depreciation is brought about by the policymakers in a controlled manner, it seems to reduce the income inequality slightly. Presumably operating primarily via the 'trade channel' of the exchange rate, the exchange rate depreciation leads to an improvement in economic conditions, and to higher employment and wages, which reduce inequality (i.e., earning heterogeneity channel). Our results thus indicate that the distributional effect of weaker domestic currency via the earnings heterogeneity channel outweighs the distributional consequences of depreciation that operate through higher relative value of foreign assets and liabilities, or higher inflation (i.e., foreign assets and inflation channels). These results seem to be in line with our findings obtained by the CCEPMG estimator in the previous section, as they show that a small depreciation of the domestic currency (most managed depreciations in our sample are small with regards to the magnitude of the exchange rate change), reduce rather

Figure 1: Cumulative Response of Income Inequality to a Managed Depreciation Shock



Notes: Cumulative IRF of Gini coefficient to a managed depreciation shock. The solid line represents point estimate, shaded areas correspond to 68 and 90 percent confidence bands. The standard errors used to calculate these confidence bands were clustered at a country level. Y-axis: deviation in percentage points. X-axis: time in years. For ease of comprehension, 1 stands for the year of the impact of the shock (i.e., k=0).

than increase income inequality.

6.2 Robustness Checks

Next, we conduct several robustness checks to verify the robustness of our main results obtained by the LP estimator. In the first set of robustness checks, we explore the sensitivity of the baseline results to our modelling choices. The results of these robustness checks are reported in Figure C1 in the Appendix. First, we augment our baseline LP regression with time effects to also control for time-specific factors that might have influenced all the countries in our sample. Our results remain unaffected.

In the following two robustness checks, we sharpen the identification of managed depreciation episodes – albeit at a cost of fewer observations. Namely, for the baseline regressions, we identify the managed depreciations based on the observed developments of exchange rates and FX reserves. However, not all movements of FX reserves are driven by FX interventions. Moreover, some movements of exchange rates might be driven by macroeconomic developments and thus, can not be linked with interventions conducted by the policymakers. As a result, we use an alternative approach to identify managed depreciation episodes. In this alternative approach, we identify managed depreciations based on the volume of FX interventions against the domestic currency, relying on a unique dataset of FX interventions, which was compiled by Adler et al. (2021) based on public data on FX interventions and by constructing proxies for the FX interventions. Additionally, we also adjust the exchange rate (NEER) movements for the current macroeconomic environment.[16] Then, we identify the managed depreciation episodes based on the NEER adjusted for macroeconomic conditions and based on the data on actual FX interventions using the conditions outlined in sub-section 3.2. The drawback of this sharper identification is the significantly reduced sample size, as the number of observations is cut by two thirds. We reestimate our baseline regression with dummy variable for this alternative set of managed depreciations. Furthermore, we also reestimate the baseline regression with a variable capturing the magnitude (value) of managed depreciations – instead of a dummy variable. The results of these two robustness checks are reported in Figure C1 in the Appendix and are fully in line with our baseline finding.

Since income inequality has exhibited a global trend, in the fourth robustness check, we follow the approach of Bridges et al. (2021) and remove the global trend from our inequality measure (Gini). Then, we reestimate the baseline regression specification with the detrended Gini coefficient as the dependent variable. Moreover, in the fifth and sixth robustness checks, we exclude the lags of the main explanatory variable (managed depreciation dummy) and the lags of the dependent variable (Gini), respectively, from the vector of control variables. The latter robustness check should help us address the Nickell bias (Nickell, 1981). The results of all these robustness checks are reported in Figure C1 in the Appendix and they fully corroborate our baseline results.

In the next two robustness checks, we reestimate the confidence bands using the Driscoll-Kraay standard errors and we employ the bootstrap-corrected fixed-effects (BCFE) estimator of Everaert and Pozzi (2007) and Vos et al. (2015) to reestimate our

[16]More specifically, following the literature on exchange rate modelling, we regress exchange rate (NEER) on key macroeconomic variables, which could (at least theoretically) predict exchange rate movements. These variables included interest rate differential, inflation differential, economic growth, capital inflows, growth of money supply, and the volume of FX reserves. Subsequently, we use the residuals from this regressions, as our measure of exogenized exchange rate – i.e., exchange rate adjusted for macroeconomic developments.

baseline regression. The former robustness check enables us to address the potential issue of cross-sectional dependence, while the latter one enables us to address the Nickell bias caused by the inclusion of fixed effects in a dynamic panel model. The results reported in Figure C1 in the Appendix support the main conclusions of the baseline regressions.

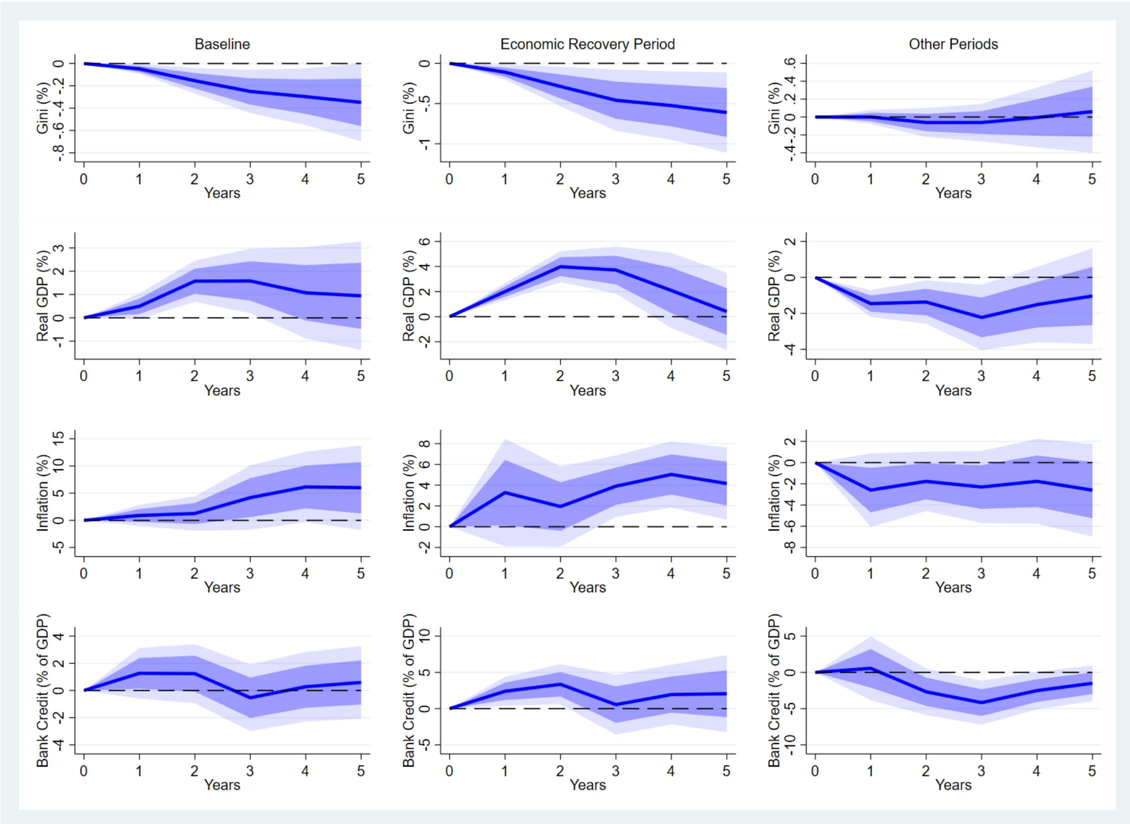
In the next set of robustness checks, we include additional control variables in the equation 4: trade openness, financial openness, and a dummy for recessions. While the number of available observations is reduced for these regressions, we once again find that managed depreciations reduce income inequality. The results are reported in Figure C2 in the Appendix.

Finally, in the last set of robustness checks, we explore the sensitivity of our baseline findings with regards to the choice of inequality measure. Namely, while the Gini coefficient is the most commonly used inequality measure, it has been criticized for overemphasising the developments in the middle of the income distribution. As a result, in the last set of robustness checks, we replace the Gini coefficient with a set of alternative inequality measures, which represent a share of overall income earned by certain segments of the income distribution. The results are reported in Figure C3 in the Appendix. We find that managed depreciations increase the share of income earned by the lowest earners and reduce the share of income earned by highest earners – which, once again, indicates a decrease in income inequality. In other words, managed depreciation shocks reduce the disparity between the top and the bottom of the income distribution. This finding can be viewed as an evidence in support of our conclusion that managed depreciations reduce income inequality primarily via the earnings heterogeneity channel: When weaker domestic currency contributes to higher economic growth and higher employment, these employment gains contribute to an increase in labour income. And since poorer households rely more on labour income, they are also more likely to benefit from weaker domestic currency and experience an increase in the share of overall income that they earn. These gains are likely to be highest for poorest households, which are also more likely to be unemployed and thus benefit the most from better employment opportunities. These conclusions are supported when we observe the responses of shares of overall income earned by the respective quintiles (see Figure C3 in the Appendix). We find that the income shares of the first three quintiles increase in response to a managed depreciation shock, while the response of the fourth quintile's income share is not statistically significant. Conversely, the income share of the fifth quintile drops in response to a managed depreciation.

6.3 Transmission Channels and Conditionality

The results reported above robustly indicate that managed depreciations are associated with a decrease in income inequality. In this sub-section, we extend our empirical analysis and explore the transmission channels through which managed depreciations might influence income inequality. We also investigate the conditionality of the distributional effects of managed depreciations.

Figure 2: Response of Selected Variables to a Managed Depreciation Shock – Conditional on Economic Recovery Period



Notes: Cumulative IRFs of selected variables to a managed depreciation shock. The solid line represents point estimate, shaded areas correspond to 68 and 90 percent confidence bands. The standard errors used to calculate these confidence bands were clustered at a country level. Y-axis: deviation in percentage points. X-axis: time in years. For ease of comprehension, 1 stands for the year of the impact of the shock (i.e., k=0). The left column shows the average responses. The middle column shows the responses if managed depreciation occurred during economic recovery period. The right column shows the responses if managed depreciation did not occur during the economic recovery period. From top to bottom, the panels show responses of Gini coefficient, real GDP, inflation, and bank credit.

First, in the left column of Figure 2, we report the responses of some key macroeconomic characteristics to managed depreciations. These characteristics include real

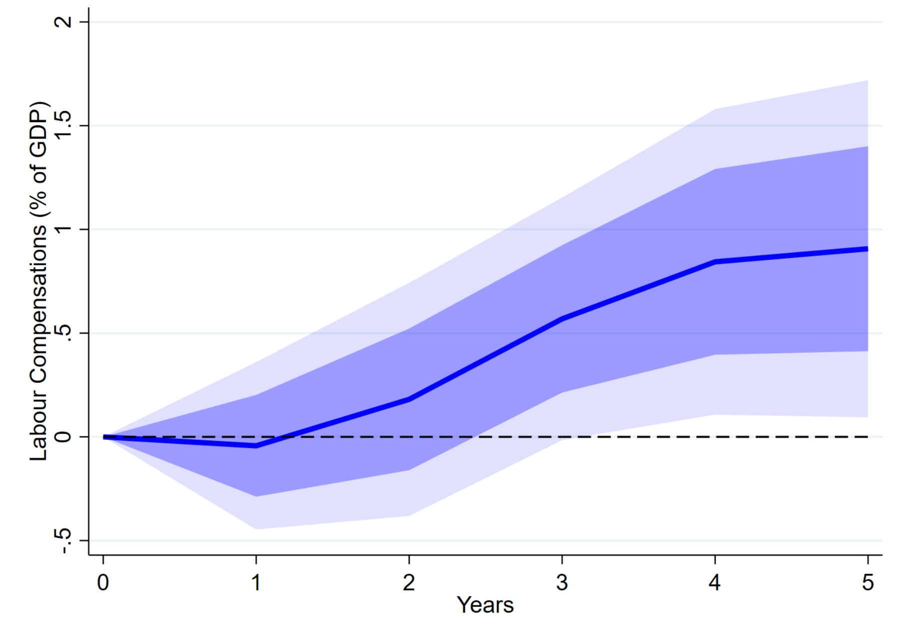
GDP, inflation and bank credit – since a managed depreciation shock might influence income inequality by influencing these variables. For comparison, we also include the response of the Gini coefficient in the top row of Figure 2. Consequently, the top left panel of Figure 2 corresponds to our baseline result reported in Figure 1. The results of this empirical exercise provide empirical support for our interpretation of the baseline results: a managed depreciation shock contributes to an increase in real GDP. An increase, which is most significant in the second year following the shock – indicating that it is the improvement in economic performance induced by the managed depreciation shock that decreases the income inequality. In other words, we interpret this result as supporting our argument that the distributional effects of exchange rates operate primarily via the earnings heterogeneity channel. Moreover, we also find that while both inflation and bank credit increase after a managed depreciation shock, their response is not statistically significant. Thus, it seems that a managed depreciation conducted by the policymakers, which is usually not large in magnitude, is not associated with significant inflationary pressures. Additionally, it does not seem to reduce the provision of bank credit by increasing the cost of external sources of funding and the relative value of external liabilities – once again, presumably owing to the smaller magnitude of the exchange rate change.

To provide some further empirical evidence for the hypothesis that our results are driven by the earnings heterogeneity channel, we report the response of labour compensations' share of GDP to a managed depreciation in Figure 3. We find that the labour compensations' share of GDP increases in the aftermath of a managed depreciation shock. This finding indicates that a managed depreciation does lead to an improvement in economic conditions and higher employment, which increases labour compensations' share of GDP, which benefits primarily poorer households and thus reduces income inequality.

Finally, we conduct a simple exploratory analysis to investigate, whether the distributional effect of managed depreciations depends on the stage of the economic cycle. Namely, if policymakers decide to conduct a managed depreciation, it is likely that they will do so to stimulate the economic recovery. Consequently, we follow the approach of Furceri et al. (2018) and Corsetti et al. (2021) and extend the equation 4 in order to identify, whether the distributional consequences of managed depreciations conducted during the period of economic recovery are different:[17]

[17] One of the advantages of the LP approach is that it allows a flexible estimation of non-linear responses.

Figure 3: Response of Labour Compensation to a Managed Depreciation Shock



Notes: Cumulative IRFs of labour compensations (% of GDP) to a managed depreciation shock. The solid line represents point estimate, shaded areas correspond to 68 and 90 percent confidence bands. The standard errors used to calculate these confidence bands were clustered at a country level. Y-axis: deviation in percentage points. X-axis: time in years. For ease of comprehension, 1 stands for the year of the impact of the shock (i.e., k=0).

$$\begin{aligned} ineq_{i,t+h} - ineq_{i,t} = \alpha_i^h + \beta_r^h \, \mathbb{I}_{i,t} \, md_{i,t-1} + \beta_n^h \, (1 - \mathbb{I}_{i,t}) \, md_{i,t-1} + \\ \gamma^h X_{i,t-1} + \nu_{i,t+h}, \;\; for \;\; h = 1, ..., 5 \end{aligned} \tag{5}$$

where $\mathbb{I}$ is an indicator variable for the period of economic recovery as identified by Fisera (2022). We then compare the estimated impulse responses $\{\beta_r^h\}_{h=0}^H$ and $\{\beta_n^h\}_{h=0}^H$ to gauge the difference in the distributional effect of a managed depreciation conducted during the period of economic recovery when compared to a managed depreciation conducted during any other stage of the business cycle. These estimates are reported in middle and right columns of Figure 2, respectively.

Interestingly, we find that managed depreciations only decrease income inequality, if they are conducted during the period of economic recovery. That is, only during the economic recovery periods do the managed depreciations positively influence economic growth and thus, cut inequality. On the other hand, managed depreciations that are conducted during any other stage of the economic cycle (i.e., expansion other than economic recovery, downturn), do not seem to influence positively the economic growth and thus, they do not have any statistically significant effect on income inequality.

7 Conclusions

While competitive devaluations are often argued to represent a 'beggar-thy-neighbour' policy, a depreciation of the domestic currency could also have a negative effect on the domestic economy and thus represent a 'beggar-thyself' policy. In this paper, we investigate whether domestic currency depreciation might represent a 'beggar-thyself' policy by studying whether it contributes to an increase in income inequality. First, using a heterogeneous panel cointegration approach and a panel of 72 advanced and emerging economies, we identify the long-term consequences of nominal exchange rate changes. We do find evidence that exchange rate movements influence income inequality over the long term. However, the economic significance of this effect is small. We find that a small nominal depreciation reduces income inequality, presumably by increasing international competitiveness, increasing domestic output and reducing unemployment (i.e., earnings heterogeneity channel). Only large nominal depreciations that exceed 25% seem to increase income inequality over the long term. Furthermore, we also find that large nominal appreciations also increase income inequality over the long term.

Next, to better identify the effect of the exchange rate on income inequality, we identify 119 episodes of managed depreciations, which we define as situations in which the central bank intervenes on the FX market to depreciate the domestic currency. We argue that this approach could be better positioned to specifically identify and isolate the effect of the exchange rate, since for managed depreciations, the exchange rate depreciation is not induced by economic developments (which could themselves influence inequality) but rather by policymakers. Next, using the local projections (LP) approach, we identify the short- to medium-term effect of a managed depreciation on inequality. We find that a managed depreciation reduces income inequality, with its effect being the strongest during the first two years following the managed depreciation. However, even five years after depreciation, the decrease in income inequality induced by the managed depreciation remains persistent. We also find empirical evidence that managed depreciations influence the income inequality via the earnings heterogeneity channel. Finally, our results also indicate that managed depreciations only reduce inequality when they are conducted during the period of economic recovery. During other stages of the business cycle, managed depreciations do not influence income inequality. Therefore, even for managed depreciations, we fail to find evidence that the depreciation of domestic currency represents a 'beggar-thyself' policy with respect to its effect on income inequality.

Considering the ongoing debate on the importance of exchange rate in the transmission of monetary policy, as well as on the possibility of using the exchange rate more directly in the conduct of monetary policy, our research contributes to this debate by exploring the possible side-effects of exchange rate movements. Namely, our findings indicate that exchange rate movements, except for very large appreciations/depreciations, do not have an adverse side effect in the form of increasing income inequality. Consequently, we argue that if policymakers decide to conduct a managed depreciation, or just rely on influencing the exchange rate to facilitate an efficient monetary transmission, they do not need to be concerned about potential adverse consequences of the exchange rate for income distribution, since in this respect, the exchange rate depreciation does not seem to be a 'beggar-thyself' policy.

References

Adler, G., K. S. Chang, R. C. Mano, and Y. Shao (2021). Foreign Exchange Intervention: A Dataset of Public Data and Proxies. IMF Working Paper WP/21/47, International Monetary Fund.

Agnello, L., S. K. Mallick, and R. M. Sousa (2012). Financial reforms and income inequality. *Economics Letters 116*(2012), 583–587.

Aguirre, A. and C. Calderon (2005). Real Exchange Rate Misalignments and Economic Performance. Working Papers No 315, Central Bank of Chile.

Alexander, S. S. (1952). Effects of Devaluation on a Trade Balance. *IMF Staff Papers 2*(2), 263–278.

Alexander, S. S. (1959). Effects of Devaluation: A Simplified Synthesis of Elasticities and Absorption Approach. *The American Economic Review 49*(1), 22–42.

Backus, D. and G. W. Smith (1993). Consumption and Real Exchange Rates in Dynamic Economies with Non-Traded Goods. *Journal of International Economics 35*, 297–316.

Bahmani-Oskooee, M. and T. Kanitpong (2017). Do Exchange Rate Changes Have Symmetric or Asymmetric Effects on the Trade Balances of Asian Countries? *Applied Economics 49*(46), 4668–4678.

Bahmani-Oskooee, M. and A. Mohammadian (2016). Asymmetry Effects of Exchange Rate Changes on Domestic Production: Evidence from Nonlinear ARDL Approach. *Australian Economic Papers 55*(3), 181–191.

Barro, R. J. (2000). Inequality and Growth in a Panel of Countries. *Journal of Economic Growth 5*(2000), 5–32.

Berg, A., C. G. Tsangarides, and Y. Yakhshilikov (2018). Redistribution, Inequality and Growth: New Evidence. *Journal of Economic Growth 23*, 259–305.

Bridges, J., G. Green, and M. Joy (2021). Credit, Crises and Inequality. Staff Working Paper No. 949, Bank of England.

Bulir, A. (2001). Income Inequality: Does Inflation Matter? *IMF Staff Papers 48*(1), 139–159.

Carnevali, E., F. Ruggeri, and M. V. Passarella (2022). Inequality and Exchange Rate Movements in an Open-Economy Macroeconomic Model. *Review of Political Economy*, forthcoming.

Casiraghi, M., E. Gaiotti, L. Rodano, and A. Secchi (2018). A "Reverse Robin Hood"? The Distributional Implications of Non-Standard Monetary Policy for Italian Households. *Journal of International Money and Finance 85*(July 2018), 215–235.

Chinn, M. D. and H. Ito (2006). What Matters for Financial Development? Capital Controls, Institutions and Interactions. *Journal of Development Economics 81*(1), 163–192.

Choi, I. (2001). Unit Root Tests for Panel Data. *Journal of International Money and Finance 20*(2001), 249–272.

Chudik, A., K. Mohaddes, M. H. Pesaran, and M. Raissi (2016). *Long-Run Effects in Large Heterogeneous Panel Data Models with Cross-Sectionally Correlated Errors.* Essays in Honor of Aman Ullah (Advances in Econometrics, Volume 36). Emerald Group Publishing Limited.

Chudik, A. and M. H. Pesaran (2015). Common Correlated Effects Estimation of Heterogeneous Dynamic Panel Data Models with Weakly Exogenous Regressors. *Journal of Econometrics 188*(2), 393–420.

Cobham, A., L. Schlogl, and A. Sumner (2016). Inequality and the Tails: The Palma Proposition and Ratio. *Global Policy 7*(1), 25–36.

Coibion, O., Y. Gorodnichenko, M. Kudlyak, and J. Mondragon (2020). Greater Inequality and Household Borrowing: New Evidence from Household Data. *Journal of European Economic Association 18*(6), 2922–2971.

Coibion, O., Y. Gorodnichenko, L. Kueng, and J. Silvia (2017). Innocent Bystanders? Monetary Policy and Inequality. *Journal of Monetary Economics 88*(June 2017), 70–89.

Coibion, O., Y. Gorodnichenko, and M. Ulate (2018). The Cyclical Sensitivity in Estimates of Potential Output. *Brookings Papers on Economic Activity 49*(2), 343–441.

Corsetti, G., K. Kuester, G. J. Muller, and S. Schmidt (2021). The Exchange Rate Insulation Puzzle. ECB Working Paper No 2630, European Central Bank.

Corsetti, G., E. Mavroeidi, G. Thwaites, and M. Wolf (2018). Step Away from the Zero Lower Bound: Small Open Economies in a World of Secular Stagnation. *Journal of International Economics 116*, 88–102.

Couharde, C., A.-L. Delatte, C. Grekou, V. Mignon, and F. Morvillier (2017). EQCHANGE: A World Database on Actual and Equilibrium Effective Exchange Rates. CEPII Working Paper No 2017-14, Centre d'Etudes Prospectives et d'informations Internationales.

Cravino, J. and A. A. Levchenko (2017). The Distributional Consequences of Large Devaluations. *American Economic Review 107*(11), 3477–3509.

Cuestas, J. C., E. Mourelle, and P. J. Regis (2020). Real Exchange Rate Misalignments in CEECs: Have they Hindered Growth? *Empirica 47*(2020), 733–756.

da Souza Cardoso, D. and L. B. da Carvalho (2022). Effects of Fiscal Consolidation on Income Inequality: Narrative Evidence from South America. *Empirical Economics*, fothcoming.

Davtyan, K. (2017). The Distributive Effect of Monetary Policy: The Top One Percent Makes the Difference. *Economic Modelling 65*, 106–118.

Ditzen, J. (2018). Estimating Dynamic Common-Correlated Effects in Stata. *The Stata Journal 18*(3), 585–617.

Drienik, A., G. Pereira, and D. J. Perez (2018). Wealth Redistribution after Exchange Rate Devaluations. *AEA Papers and Proceedings 108*(May 2018), 552–556.

Engle, R. F. and C. W. J. Granger (1987). Co-Integration and Error Correction: Representation, Estimation, and Testing. *Econometrica 55*(2), 251–27.

Everaert, G. and L. Pozzi (2007). Bootstrap-based Bias Correction for Dynamic Panels. *Journal of Economic Dynamics and Control 31*(4), 1160–1184.

Fisera, B. (2022). Exchange Rates and the Speed of Economic Recovery: The Role of Financial Development. IES Working Papers 18/2022, Institute of Economic Studies.

Fisera, B. and R. Horvath (2022). Are Exchange Rates Less Important for Trade in a More Globalized World? Evidence for the New EU Members. *Economic Systems 46*(1), 1–27.

Frankel, J. (2022). Get Ready for Reverse Currency Wars. Project Syndicate Analysis and Opinions, Belfer Center for Science and International Affairs.

Franta, M., T. Holub, P. Kral, I. Kubicova, K. Smidkova, and B. Vasicek (2014). The Exchange Rate as an Instrument at Zero Interest Rates: The Case of the Czech Republic. CNB Research and Policy Notes 3/2014, Czech National Bank.

Furceri, D., P. Loungani, and A. Zdzienicka (2018). The Effects of Monetary Policy Shocks on Inequality. *Journal of International Money and Finance 85*(July 2018), 168–186.

Furceri, D. and J. D. Ostry (2019). Robust determinants of income inequality. *Oxford Review of Economic Policy 35*(3), 490–517.

Georgiadis, G., G. J. Mueller, and B. Schumann (2021). Global Risk and the Dollar. CEPR Discussion Papers No DP16245, Centre for Economic Policy Research.

Ghosh, A. R., J. D. Ostry, and M. Chamon (2016). Two Targets, Two Instruments: Monetary and Exchange Rate Policies in Emerging Market Economies. *Journal of International Money and Finance 60*, 172–196.

Guerello, C. (2018). Conventional and Unconventional Monetary Policy vs. Households Income Distribution: An Empirical Analysis for the Euro Area. *Journal of International Money and Finance 85*(July 2018), 187–214.

Habib, M. M., E. Mileva, and L. Stracca (2017). The Real Exchange Rate and Economic Growth: Revisiting the Case Using External Instruments. *Journal of International Money and Finance 73*(B), 386–398.

Hasan, I., R. Horvath, and J. Mares (2020). Finance and Wealth Inequality. *Journal of International Money and Finance 108*, 102161.

Herradia, M. E. and A. Leroy (2021). Monetary Policy and the Top One Percent: Evidence from a Century of Modern Economic History. *International Journal of Central Banking 71*, 237–277.

Herzer, D. and P. Nunnenkamp (2012). The Effect of Foreign Aid on Income Inequality: Evidence from Panel Cointegration. *Structural Change and Economic Dynamics 23*(2012), 245–255.

Herzer, D. and S. Vollmer (2012). Inequality and Growth: Evidence from Panel Cointegration. *The Journal of Economic Inequality 10*(2012), 489–503.

Im, K. S., M. H. Pesaran, and Y. Shin (2003). Testing for Unit Roots in Heterogeneous Panels. *Journal of Econometrics 115*, 53–74.

Jorda, O. (2005). Estimation and Inference of Impulse Responses by Local Projections. *American Economic Review 95*(1), 161–182.

Kocherlakota, N. and L. Pistaferri (2008). Inequality and Real Exchaneg Rates. *Journal of the European Economic Association 6*(2/3), 597–608.

Krugman, P. and S. Taylor (1978). Contractionary Effects of Devaluation. *Journal of International Economics 8*(1978), 445–456.

Laeven, L. and F. Valencia (2018). Systemic Banking Crises Revisited. IMF Working Paper WP/18/206, International Monetary Fund.

Leigh, D., W. Lian, M. Poplawski-Ribero, R. Szymanski, V. Tsyrennikov, and H. Yang (2017). Exchange Rates and Trade : A Disconnect? IMF Working Paper No. 17/58, International Monetary Fund.

Lenza, M. and J. Slacalek (2018). How Does Monetary Policy Affect Income and Wealth Inequality? Evidence from Quantitative Easing in the Euro Area. Working Paper No 2190, European Central Bank.

Lerner, P. A. (1952). Factor Prices and International Trade. *Economica 19*(73), 1–15.

Marshall, A. (1890). *Principles of Economics*. 1st ed. Macmillan: London.

McCallum, B. T. (2000). Theoretical Analysis Regarding a Zero Lower Bound on Nominal Interest Rates. *Journal of Money, Credit and Banking 32*(4), 870–904.

Melecky, M. and C. Raddatz (2015). Fiscal Responses After Catastrophes and the Enabling Role of Financial Development. *The World Bank Economic Review 29*(1), 129–149.

Mumtaz, H. and A. Theophilopoulou (2017). The Impact of Monetary Policy on Inequality in the UK. An Empirical Analysis. *European Economic Review 98*, 410–423.

Nickell, S. (1981). Biases in Dynamic Models with Fixed Effects. *Econometrica 49*(6), 1417–1426.

Nouira, R. and K. Sekkat (2012). Desperately Seeking the Positive Impact of Undervaluation on Growth. *Journal of Macroeconomics 34*(2), 537–552.

Palma, J. G. (2011). Homogeneous Middles vs. Heterogeneous Tails, and the End of the Inverted U: It is all About the Share of the Rich. *Development and Change 42*(1), 87–153.

Perugini, C., J. Holscher, and S. Collie (2016). Inequality, Credit and Financial Crises. *Cambridge Journal of Economics 40*(1), 227–257.

Pesaran, M. H. (2007). A Simple Panel Unit Root Test in the Presence of Cross-section Dependence. *Journal of Applied Econometrics 22*(2), 265–312.

Pesaran, M. H., Y. Shin, and R. P. Smith (1999). Pooled Mean Group Estimation of Dynamic Heterogenous Panels. *Journal of American Statistical Association 94*(446), 621–634.

Pesaran, M. H. and R. Smith (1995). Estimating the Long-run Relationships from Dynamic Heterogeneous Panels. *Journal of Econometrics 68*(1), 79–113.

Rodrik, D. (2008). The Real Exchange Rate and Economic Growth. *Brookings Papers on Economic Activity 39*(2), 365–439.

Romer, C. D. and D. H. Romer (1999). Monetary Policy and the Well-Being of the Poor. *Economic Review 84*(1), 21–49.

Saiki, A. and J. Frost (2014). Does Unconventional Monetary Policy Affect Inequality? Evidence from Japan. *Applied Economics 46*(36), 4445–4454.

Samarina, A. and A. D. M. Nguyen (2023). Does Monetary Policy Affect Income Inequality in the Euro Area? *Journal of Money, Credit and Banking*, forthcoming.

Shin, Y., B. C. Yu, and M. Greenwood-Nimmo (2014). Modelling Asymmetric Cointegration and Dynamic Multipliers in a Nonlinear ARDL Framework. In R. Sickels and W. Horrace (Eds.), *Festschrift in Honor of Peter Schmidt: Econometric Methods and Applications*, pp. 281–314. New York City: Springer.

Svensson, L. E. O. (2000). The Zero Bound in an Open Economy: A Foolproof Way of Escaping from a Liquidity Trap. NBER Working Papers no. 7957, National Bureau of Economic Research.

Svirydzenka, K. (2016). Introducing a New Broad-based Index of Financial Development. IMF Working Paper WP/16/5, International Monetary Fund.

Thornton, J. and C. D. Tomaso (2020). The long-run Relationship between Finance and Income Inequality: Evidence from Panel Data. *Finance Research Letters 32* (2020), 101180.

Tridico, P. (2012). Financial crisis and global imbalances: Its labour market origins and aftermath. *Cambridge Journal of Economics 36* (1), 17–42.

Voinea, L., H. Lovin, and A. Cojocaru (2018). The Impact of Inequality on the Transmission of Monetary Policy. *Journal of International Money and Finance 85* (July 2018), 236–250.

Vos, I. D., G. Everaert, and I. Ruyssen (2015). Bootstrap-based Bias Correction and Inference for Dynamic Panels with Fixed Effects. *The Stata Journal 15* (4), 986–1018.

Westerlund, J. (2005). New Simple Tests for Panel Cointegration. *Econometric Reviews 24*, 297–316.

Whitman, M. V. N. (1975). Global Monetarism and the Monetary Approach to the Balance of Payments. *Brooking Papers on Economic Activity 6* (3), 491–556.

Appendices

Appendix A: Data Coverage and Sources

Table A1: List of Countries

Argentina	Hungary	Peru
Armenia	Iceland	Philippines
Australia	India	Poland
Austria	Indonesia	Portugal
Belgium	Ireland	Romania
Bolivia	Israel	Russia
Brazil	Italy	Sierra Leone
Bulgaria	Japan	Singapore
Canada	Korea	Slovenia
Chile	Latvia	South Africa
Colombia	Lesotho	Spain
Croatia	Lithuania	Sweden
Cyprus	Luxembourg	Switzerland
Czech Republic	Malawi	Thailand
Denmark	Malaysia	Trinidad and Tobago
Dominican Republic	Mexico	Tunisia
Fiji	Moldova	Turkey
Finland	Morocco	Uganda
France	Netherlands	Ukraine
Gambia	New Zealand	United Kingdom
Germany	Nigeria	United States
Ghana	Norway	Uruguay
Greece	Pakistan	Venezuela
Hong Kong	Paraguay	Zambia

Table A2: Summary Statistics

Variable	Unit	Obs.	Mean	St. Dev.	Min	Max
Baseline regressions						
Gini	Index	2,108	46.65	6.05	28.00	72.70
NEER	ln	2,108	4.86	1.41	2.68	27.80
NEER Depreciation	ln	2,108	0.07	0.20	0.00	3.07
NEER Appreciation	ln	2,108	0.02	0.04	0.00	0.58
GDP (PPP) per capita	USD	2,108	22880	16996	658	98537
Interest rate	%	2,108	8.65	10.41	-0.89	94.49
Fin. development	Index	2,108	0.08	0.15	-0.26	0.49
Model extensions						
REER	ln	2,093	4.60	0.23	3.61	6.95
CM	%	1,937	-1.25	14.75	-47.59	133.46
Managed depreciation	Dummy	2,094	0.06	0.19	0.00	1.00
Real GDP	USD	2,064	26096	19719	830	122174
Inflation	%	2,024	7.30	16.44	-10.33	260.78
Bank Credit	% of GDP	1,492	1.11	8.00	-60.79	97.89
Labour Compensations	% of GDP	1,881	54.82	8.36	30.57	90.30
Economic Recovery	Dummy	1,512	0.42	0.49	0.00	1.00
Trade Openness	% of GDP	1,886	85.36	66.23	11.08	442.62
Financial Openness	Index	1,980	0.66	0.36	0.00	1.00
Recession Dummy	Dummy	1,989	0.12	0.32	0.00	1.00

Table A3: Description and Sources of Variables

Variable	Description	Source
	Baseline regressions	
Gini	Gini coefficient of market income	SWIID
NEER	Nominal effective exchange rate, indirect quotation (an increase represents appreciation), indexed to 100 in Q1 2010	IMF, BIS
NEER Depreciation	Value of logarithmic change in *NEER* if *NEER* depreciated and 0 otherwise, values have been inverted from negative to positive	self-calculated
NEER Appreciation	Value of logarithmic change in *NEER* if *NEER* appreciated and 0 otherwise	self-calculated
GDP (PPP) per capita	Gross domestic product per capita, current prices, international dollars	IMF
Interest rate	Short-term interest rate: 3-month interbank interest rate, if not available 3-month treasury bills rate	IMF, TR
Fin. development	Deviation of actual composite index of financial development of Svirydzenka (2016) and the fitted value of a regression of financial development index on logarithm of *GDP (PPP) per capita*	self-calculated
	Model extensions	
REER	Real effective exchange rate, indirect quotation (an increase represents appreciation), indexed to 100 in Q1 2010	IMF, BIS
CM	Deviation of actual REER and equilibrium REER. Positive values represent overvaluation, while negative values represent undervaluation, % of equilibrium REER	CEPII
Managed depreciation	A dummy variable, which takes a value of 1, if a managed depreciation had taken place and 0 otherwise	self-calculated
Real GDP	GDP (PPP) per capita at constant international dollars	WB
Inflation	Annual % change in consumer price index	IMF
Bank Credit	Domestic credit to private sector, % of GDP	WB
Labour Compensations	Share of labour compensations in GDP at current national prices	PWT
Economic Recovery	A dummy variable, which takes the value of 1 when economy is in an economic recovery and 0 otherwise	Fisera (2022)
Trade Openness	Sum of exports of goods and services and imports of goods and services, % of GDP	IMF
Financial Openness	Chinn-Ito Index of de jure financial openness	Chinn and Ito (2006)
Recession Dummy	A dummy variable, which takes the value of 1 when the Real GDP decreased compared to previous year and 0 otherwise	self-calculated

Notes: IMF = International Monetary Fund; BIS = Bank for International Settlements; CEPII = Centre d'Etudes Prospectives et d'informations Internationales; WB = World Bank; TR = Thompson Reuters; PWT = Penn World Tables; SWIID = Standardized World Income Inequality Database.

Appendix B: Long-term Effect of Exchange Rate on Income Inequality

Table B1: Panel Unit Root Tests – Levels of Variables

		Gini	NEER	GDP (PPP) per capita	Interest rate	Fin. develop.
	Observations	2,108	2,108	2,108	2,108	2,108
	Number of panels	72	72	72	72	72
	Avg. number of periods	29	29	29	29	29
Im-Pesaran-Shin	P-value	0.84	0.00***	1.00	0.00***	0.00***
Dickey-Fuller	Inverse chi-squared, p-value	0.06*	0.06*	0.86	0.00***	0.99
	Inverse normal, p-value	0.96	0.65	0.99	0.13	1.00
	Inverse logit, p-value	0.98	0.65	0.99	0.00***	1.00
	Mod. inv. chi-squared, p-value	0.06*	0.05*	0.86	0.00***	0.98
Phillips-Perron	Inverse chi-squared, p-value	0.00***	0.00***	0.81	0.00***	0.00***
	Inverse normal, p-value	0.97	0.00***	1.00	0.00***	0.00***
	Inverse logit, p-value	0.38	0.00***	1.00	0.00***	0.00***
	Mod. inv. chi-squared, p-value	0.00***	0.00***	0.81	0.00***	0.00***
CIPS	P-value	>0.10	0.03**	>0.10	0.00***	>0.10

Notes: P-values are reported. For all panel unit root tests, the H0 is that all panels contain unit root. For Im-Pesaran-Shin and CIPS test, the Ha is that some panels are stationary, while for Dickey-Fuller and Phillips-Perron test, the Ha is that at least one panel is stationary.

Table B2: Panel Unit Root Tests – First Differences of Variables

		Gini	NEER	GDP (PPP) per capita	Interest rate	Fin. develop.
	Observations	2,108	2,108	2,108	2,108	2,108
	Number of panels	72	72	72	72	72
	Avg. number of periods	29	29	29	29	29
Im-Pesaran-Shin	P-value	0.00***	0.00***	0.00***	0.00***	0.00***
Dickey-Fuller	Inverse chi-squared, p-value	0.00***	0.00***	0.00***	0.00***	0.00***
	Inverse normal, p-value	0.00***	0.00***	0.00***	0.00***	0.00***
	Inverse logit, p-value	0.00***	0.00***	0.00***	0.00***	0.00***
	Mod. inv. chi-squared, p-value	0.00***	0.00***	0.00***	0.00***	0.00***
Phillips-Perron	Inverse chi-squared, p-value	0.00***	0.00***	0.00***	0.00***	0.00***
	Inverse normal, p-value	0.00***	0.00***	0.00***	0.00***	0.00***
	Inverse logit, p-value	0.00***	0.00***	0.00***	0.00***	0.00***
	Mod. inv. chi-squared, p-value	0.00***	0.00***	0.00***	0.00***	0.00***
CIPS	P-value	0.05**	0.02**	0.00***	0.00***	0.00***

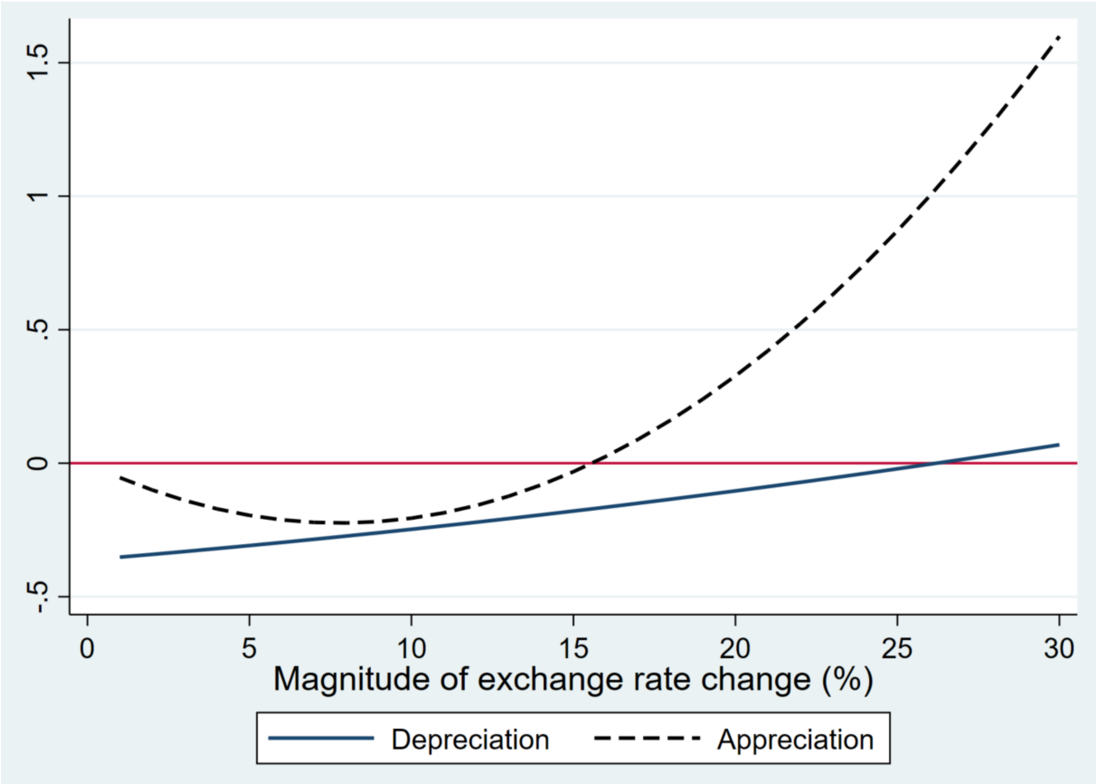
Notes: P-values are reported. For all panel unit root tests, the H0 is that all panels contain unit root. For Im-Pesaran-Shin and CIPS test, the Ha is that some panels are stationary, while for Dickey-Fuller and Phillips-Perron test, the Ha is that at least one panel is stationary.

Table B3: Westerlund Panel Cointegration Test

Statistic	(1)	(2)	(3)
VR_1	0.02**	0.00***	0.00***
VR_2	0.27	0.01***	0.00***

Notes: P-values are reported. VR stands for variance ratio. For VR_1, rejection of H_0 should be taken as evidence of cointegration of some cross-sectional units. For VR_2, rejection of H_0 should be taken as evidence of cointegration for the entire panel. The results reported in columns (1-3) correspond to specifications (1-3) in Table 1.

Figure B1: Long-term Effect of Exchange Rate on Income Inequality at Different Magnitudes of Exchange Rate Changes



Notes: Y-axis: long-term change in the value of the Gini coefficient in percentage points. X-axis: magnitude of exchange rate change in percentage points. These non-linear effects were obtained based on the coefficients from column (3) in Table 1.

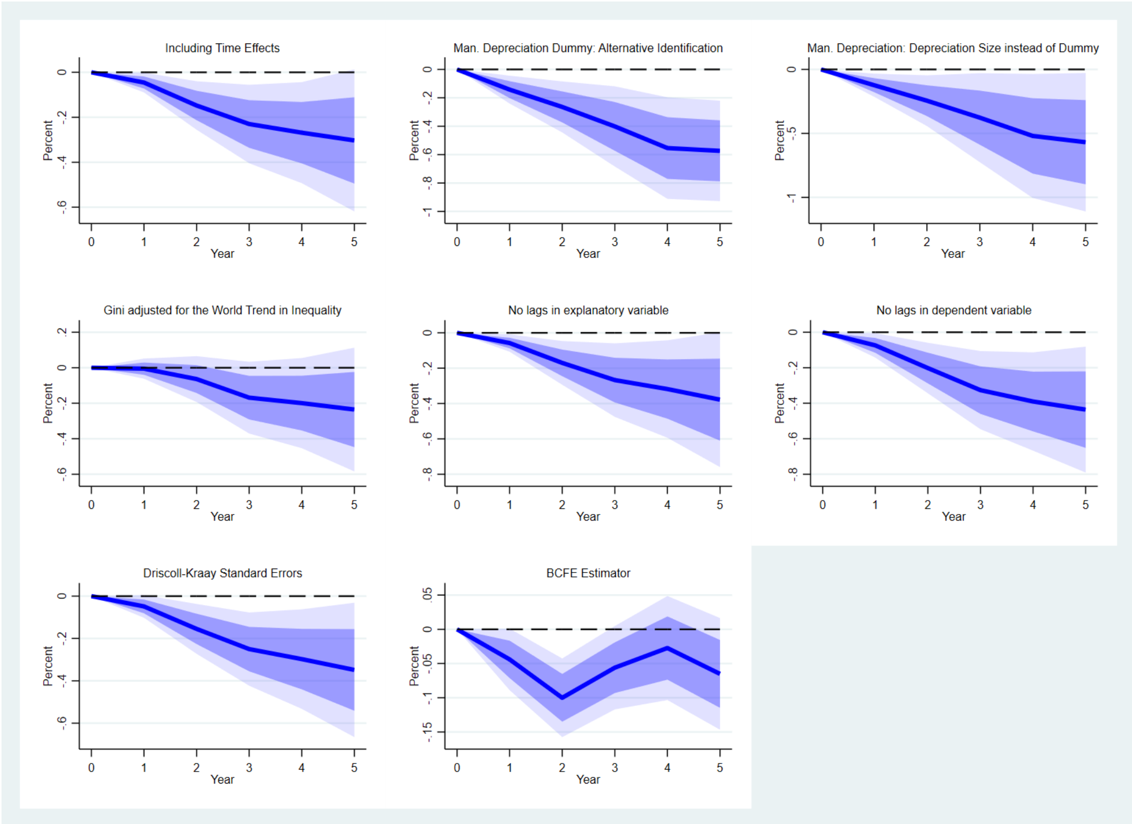
Table B4: Long-term Effect of Exchange Rate on Income Inequality – Alternative Exchange Rate Measures

	(1)	(2)	(3)	(4)
	Gini			
Long-run equation				
REER (ln)	-0.296***			
	(0.044)			
REER Depreciation		1.877***		
		(0.043)		
REER Appreciation		2.443***		
		(0.053)		
CM			0.003***	
			(0.001)	
CM Undervaluation				-0.002**
				(0.001)
CM Overvaluation				0.003**
				(0.001)
GDP (PPP) per capita (ln)	-4.317***	-6.607***	-4.179***	-4.249***
	(0.134)	(0.139)	(0.126)	(0.131)
Interest rate (%)	-0.000	0.001***	-0.020***	-0.024***
	(0.000)	(0.000)	(0.000)	(0.001)
Fin. development	-1.369***	-4.072***	0.160	-0.017
	(0.239)	(0.278)	(0.207)	(0.222)
Short-run equation				
Error correction	-0.120***	-0.085***	-0.130***	-0.128***
	(0.012)	(0.008)	(0.010)	(0.010)
D.REER (ln)	-0.117			
	(0.121)			
D.REER Depreciation		0.012		
		(0.150)		
D.REER Appreciation		-0.149		
		(0.159)		
D.CM			-0.001	
			(0.001)	
D.CM Undervaluation				0.000
				(0.002)
D.CM Overvaluation				-0.007**
				(0.003)
D.GDP (PPP) per capita (ln)	-0.497	-1.170*	-0.601	-0.414
	(0.546)	(0.674)	(0.591)	(0.542)
D.Interest rate (%)	0.002	0.003	0.005	0.006*
	(0.004)	(0.004)	(0.003)	(0.003)
D.Fin. development	-0.136	0.043	-0.183	-0.196
	(0.301)	(0.322)	(0.312)	(0.344)
Observations	2,090	2,086	1,889	1,889
R-squared	0.666	0.668	0.657	0.646
Countries	72	72	65	65

Notes: *D* stands for the first difference. *ln* stands for the natural logarithm. For ease of interpretation, the values of *REER Depreciation* have been converted from negative to positive, i.e., an increase in the value of this variable corresponds to a greater nominal depreciation of domestic currency. All the regressions were estimated with the CCEPMG estimator. Standard errors are in parentheses. * indicates significance at 10 % level, ** at 5 % level and *** at 1 % level.

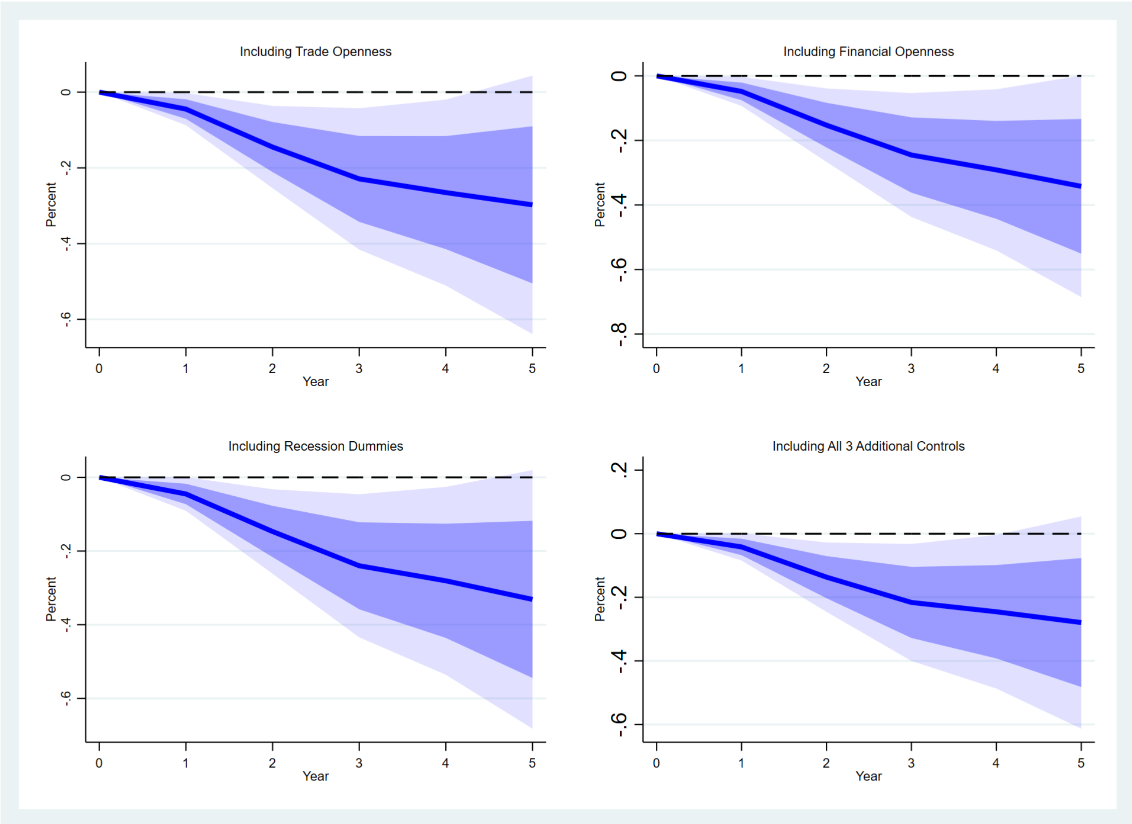
Appendix C: Distributional Effects of Managed Depreciations

Figure C1: Robustness Checks



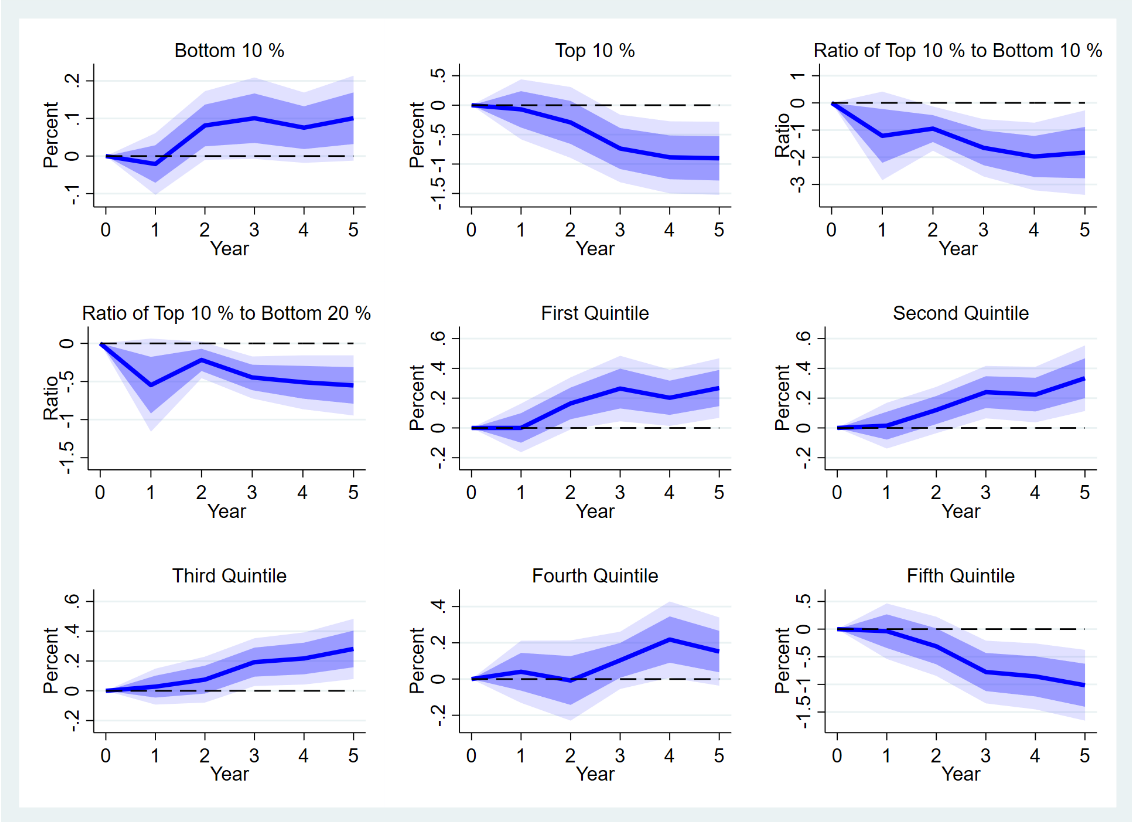
Notes: Cumulative IRFs of Gini coefficient to a managed depreciation shock. The solid line represents point estimate, shaded areas correspond to 68 and 90 percent confidence bands. The standard errors used to calculate these confidence bands were clustered at a country level. Y-axis: deviation in percentage points. X-axis: time in years. For ease of comprehension, 1 stands for the year of the impact of the shock (i.e., k=0). The top panel shows the following robustness checks (from left to right): i) including time effects; ii) using an alternative strategy to identify managed depreciation episodes; iii) using size (magnitude) of managed depreciation instead of a dummy variable. The middle panel shows the following robustness checks (from left to right): i) Gini coefficient adjusted for the world trend in income inequality; ii) not including the lags of the managed depreciation among the control variables; iii) not including the lags of the dependent variable among the control variables. The bottom panel shows the following robustness checks (from left to right): i) using Driscoll-Kraay standard errors to calculate the confidence bounds; ii) BCFE estimator used to estimate the regressions.

Figure C2: Robustness Checks – Additional Control Variables



Notes: Cumulative IRFs of Gini coefficient to a managed depreciation shock. The solid line represents point estimate, shaded areas correspond to 68 and 90 percent confidence bands. The standard errors used to calculate these confidence bands were clustered at a country level. Y-axis: deviation in percentage points. X-axis: time in years. For ease of comprehension, 1 stands for the year of the impact of the shock (i.e., k=0). The top panel shows the following robustness checks (from left to right): i) including trade openess expressed as a % of GDP among the vector of control variables; ii) including financial openess of Chinn and Ito (2006) among the vector of control variables. The bottom panel shows the following robustness checks (from left to right): i) including a dummy variable for recessions among the vector of control variables; ii) including trade openness, financial openness and recession dummy among the vector of control variables.

Figure C3: Robustness Checks – Alternative Income Inequality Measures



Notes: Cumulative IRFs of alternative income inequality measures to a managed depreciation shock. The solid line represents point estimate, shaded areas correspond to 68 and 90 percent confidence bands. The standard errors used to calculate these confidence bands were clustered at a country level. Y-axis: deviation in percentage points. X-axis: time in years. For ease of comprehension, 1 stands for the year of the impact of the shock (i.e., k=0). The top panel shows the following robustness checks (from left to right): i) response of the share of income earned by the bottom 10 % of the population; ii) response of the share of income earned by the top 10 % of the population; iii) response of the ratio of the share of income earned by the top 10 % of the population to the share of income earned by the bottom 10 % of the population. The middle panel shows the following robustness checks (from left to right): i) response of the ratio of the share of income earned by the top 10 % of the population to the share of income earned by the bottom 20 % of the population; ii) response of the share of income earned by the first quintile of the population; iii) response of the share of income earned by the second quintile of the population. The bottom panel shows the following robustness checks (from left to right): i) response of the share of income earned by the third quintile of the population; ii) response of the share of income earned by the fourth quintile of the population; iii) response of the share of income earned by the fifth quintile of the population.

IES Working Paper Series

2023

1. Josef Bajzik, Tomáš Havránek, Zuzana Iršová, Jiří Novák: *Are Estimates of the Impact of Shareholder Activism Published Selectively?*
2. Klára Kantová: *Ex-Prisoners and the Labour Market in the Czech Republic*
3. Theodor Petřík, Martin Plajner: *Concurrent Business and Distribution Strategy Planning Using Bayesian Networks*
4. Tijmen Tuinsma, Kristof De Witte, Petr Janský, Miroslav Palanský, Vitezslav Titld: *Effects of Corporate Transparency on Tax Avoidance: Evidence from Country-by-Country Reporting*
5. Zuzana Irsova, Pedro R. D. Bom, Tomas Havranek, Heiko Rachinger: *Spurious Precision in Meta-Analysis*
6. Vojtěch Mišák: *Does Heat Cause Homicides? A Meta-Analysis*
7. Fan Yang: *The Impact of Regulatory Change on Hedge Fund Performance*
8. Boris Fisera: *Distributional Effects of Exchange Rate Depreciations: Beggar-Thy-Neighbour or Beggar-Thyself?*

All papers can be downloaded at: http://ies.fsv.cuni.cz

Univerzita Karlova v Praze, Fakulta sociálních věd
Institut ekonomických studií [UK FSV – IES] Praha 1, Opletalova 26
E-mail : ies@fsv.cuni.cz http://ies.fsv.cuni.cz