# Do economic recessions cause inequality to rise?*

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## ABSTRACT

We use a local projection approach to analyze the effect of economic recessions on income inequality in a comprehensive sample of 43 countries from 1960 to 2016. Although we consider both business-cycle and growth-cycle recessions, we fail to find evidence of significant positive impacts of economic downturns on income distribution, once controls are added to the model. However, we do find important differences across countries, which mainly depend on the degree of economic development.

Key words: economic cycles, income inequality, local projections.

Classification JEL: C22, C53, E32, F44.

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## 1. Introduction

Inequality has perhaps been one of the most relevant topics in academia, mainstream and political circles during the last decades, especially after the Great Recession. One example of this interest in inequality is the survey conducted by the Pew Research Center (Pew Research Center, 2014), which found that the existing difference between the rich and the poor was the biggest concern for nearly 60 percent of total respondents.

One leading concern in the literature is determining the potential dependence of income inequality on economic cycles. As stated in the survey by Parker (1998), the interest started with Mendershausen (1946) and Kuznets (1953), who showed that top income shares increased in recessions and decreased in expansions during the US interwar period. Dimelis and Livada (1999) found a countercyclical pattern of inequality in US and UK, although inequality did not seem to exhibit a cyclical pattern for Italy, while in Greece it was procyclical. Maliar, Maliar and Mora (2005) found a countercyclical behavior of inequality in the US using a neoclassical growth model with heterogeneous agents.

The Great Recession raised a renewal interest on the potential business cycle behaviour of inequality. Among others, Atkinson and Morelli (2011) found that banking crises tend to end up with income inequality increases. In addition, several OECD reports (2011, 2015) evidenced increasing inequality in relation to economic recessions, but also in expansions. Finally, although Saez (2013) showed a fall in the US top income shares during the Great Recession, he documented that the Gini index fell during and after that period.

In spite of these findings, the question of whether economic downturns cause income inequality remains unresolved. Figure 1 shows that the Gini index exhibits a secular trend rather than a cyclical pattern in the US, regardless of whether we focus on business cycles or growth cycles. With the aim of adding some light in this literature, we evaluate the net effect of growth-cycle and business-cycle recessions on income inequality in a large set of 43 countries from the five continents between 1960 and 2016, after controlling for a broad set of relevant macroeconomic factors.

Our benchmark is the local projection approach introduced in Jorda (2005) and used in Jorda, Schularick and Taylor (2013). This approach is based on the premise that

impulse responses are properties of the data that can be calculated directly rather than indirectly through a reference model like a VAR. Within this framework, conditional on experiencing a recession of a particular type (taken here as a given), we examine what its effect on income inequality is, measured by the Gini index after controlling for a set of relevant controls.

In addition, our paper contributes to the literature in the following ways: (i) it encompasses a comprehensive world sample instead of focusing on certain regions or single economies; (ii) it uses an inequality database within a high degree of comparability between countries; (iii) the study at the country level is conducted by applying a homogeneous treatment for all countries; (iv) our research goes beyond a trends analysis, since the impact of the economic cycle is obtained after controlling for other relevant factors; (v) we isolate the effect of the general economic cycle instead of focusing on particular types of economic crises (financial, currency, etc); and (vi), with the aim of completeness, we use both growth and business cycle concepts in order to obtain more robust conclusions.

Overall, our empirical results suggest that, regardless of whether we consider a business cycle or a growth-cycle analysis, recessions do not raise a significantly positive effect on income inequality. In spite of this overall result, it is worth mentioning that we do find important differences across countries on the impact of recessions on inequality, which seem to be related with countries' degree of economic development.

The rest of the paper is structured as follows. Section 2 contains a brief description of how the local projection approach applies in this framework. Section 3 describes the data and analyzes the main results from our analysis. Section 4 concludes.

## 2. Local projection approach

We are interested in establishing empirical regularities of the net impact of economic recessions on inequality, once macroeconomic controls are added to the model. To do this, we rely on the local projection model advocated by Jorda (2005).

Some notation is required to define the statistical model. For a set of *N* countries, let $\Delta_h y_{i,t+h}$ be the change experienced by the Gini index, $y_{i,t+h}$, of country *i* at time *t*, *h* periods in the future,

$$\Delta_h y_{i,t+h} = y_{i,t+h} - y_{i,t}, \tag{1}$$

where *i*=1,...,**N**, *h*=1,...,*H*, and t=1,...,*T*-*H*. Let $C_{i,t}$ be a recessionary indicator that takes the value of 1 when either a business cycle or a growth cycle recession occurs and 0 otherwise. Let $X_{i,t}$ be the set of macroeconomic controls for country *i* at time *t*, which can include lagged values of the changes in the Gini index.

Following Koop, Pesaran and Potter (1996) the cumulated response can be defined as the difference between two forecasts:

$$IR_i\left(t,h,C\right) = E_{i,t}\left[\Delta y_{i,t+h} \mid X_{i,t}; C_{i,t}=1\right] - E_{i,t}\left[\Delta y_{i,t+h} \mid X_{i,t}; C_{i,t}=0\right],$$

(2) which refers to the response across recessions of the Gini index for country *i* at a horizon *h* periods in the future, in response to a change in the treatment variable from expansion to recession conditional on the set of macroeconomic controls. In linear frameworks, the cumulated response is simply the sum of the 1 to *h* standard impulse responses.

Jorda, Schularick, and Taylor (2013) show that impulse responses can be calculated by a sequence of projections of the endogenous variable shifted forward in time onto its lags and the set of macroeconomic controls. In particular, if $x_{i,t}^k$ is the set of exogenous macroeconomic controls, with *k*=1,…,*K*, we estimate the cumulated responses using the simple local projection regression

$$\Delta_h y_{i,t+h} = a_i^h + \rho_i^h \Delta y_{i,t-1} + \beta_i^h C_{i,t} + \sum_{k=1}^{K} \delta_{i,k}^h x_{i,t}^k + \varepsilon_{i,t+h},$$

(3) where $\varepsilon_{i,t+h}$ is an i.i.d error term with mean 0 and variance $\sigma^2$.

For the purposes of our contribution, the main parameters of interest are the set of $\beta_i^h$ coefficients, with *h*=1,…,10. These represent the conditional path for the cumulated response of the *i*-th country Gini index, after controlling for the past values of the Gini changes and the set of macroeconomic controls. As documented by Jorda (2005), the baseline model used to compute the local projections can be estimated by simple

regression techniques with standard regression packages. In addition, it is simple to test for the significance of these effects and to construct confidence bands, since standard statistics apply.[1]

## 3. Empirical application

### 3.1. Data description

The statistical dispersion of the income distribution of a nation's residents is measured with the Gini coefficient of disposable income (post-tax and post-transfers). A zero value of this coefficient expresses perfect equality because everyone has the same, whereas a Gini coefficient of 1 expresses maximal inequality among a country´s citizens. The time series of the national annual indices were extracted from the Standarized World Income Inequality Database or SWIID developed by Solt (2016). These indices are designed to provide a great coverage across countries and over time with the aim of maximizing the cross-country comparability of income inequality data.

Controls were downloaded from the World Development Indicators (WDI). The selection of the control variables follows two recent influential pieces of research on inequality determinants: Roine, Vlachos, and Waldenström (2009), and Dabla-Norris et al. (2015). However, we restrict the set of controls due to data availability.

In particular, we control for the development of domestic financial markets with credit to GDP. To control for external trade, we use the sum of imports and exports as a percentage of GDP. We control for the technological progress with the stock of patents. We include the female mortality rate to capture the link between the accesses to health services and income inequality. Finally, we include other controls such as population size and per capita GDP.[2]

The set of 43 countries included in the analysis, which represents an overwhelming share of world GDP, and the effective sample of each control are listed in Appendix I. We excluded from the analysis countries for which we were not able to obtain local

[1] Local projections are strictly related to direct forecasting methods. Under standard conditions, consistency and asymptotic normality are shown in Weiss (1991).
[2] We performed stationary transformations for those controls evidencing the presence of unit roots.

projections from samples of at least 30 degrees of freedom, countries with recession dummies of less than two recessions and countries with fewer than 4 controls.

Although Appendix II includes further details, dates of business cycle recessions are obtained by applying the annual dating algorithm developed by Berge and Jorda (2013) to seasonally adjusted national GDP time series. In addition, we date the growth cycle recessions as periods of GDP below a Hodrick-Prescott trend. Using these dates, we construct the recessionary dummy indicators, $C_{i,t}$, at time $t$ for each country $i$.

### 3.2. Business cycle analysis

The conditional responses of income inequality to a business cycle recession are estimated with local projection methods, which are displayed, along with their 90% confidence bands, in Appendix IV.[3] Each figure shows the estimated coefficients $\beta_i^h$ for changes in the Gini indices computed for up to $h$=10 years following a recession for each country $i$ of the sample.

Table 1 reports the percentage of countries for which a business cycle recession causes inequality to decrease (negative impact) or to increase (positive impact) in the short run (up to three-year impact) and in the medium run (four-to-six year impact). The table shows that a recession causes inequality to decrease in 54% of countries during the first three years after a recession, although the percentage rises to 57% in the medium run. However, the negative effect of a recession on inequality is significant for only 22% of countries in the short run and for 20% of countries in the medium run. This result agrees with those obtained by Roine, Vlachos and Waldesntröm (2009), who show that banking crises have a strong negative impact on the income shares of the rich.

Figure 2 provides a glimpse of how the effect of a business recession on inequality varies across geographic areas. Countries in red (orange) are countries experiencing significant (nonsignificant) increases in inequality as a consequence of a business cycle recession, while countries in dark blue (sky blue) are countries facing significant (non-significant) collapses in inequality due to these crises. According to Panel A, a recession cause inequality to decrease in the short run in Brazil, Costa Rica, Finland, Germany,

[3] We use a heteroskedasticity and autocorrelation consistent estimator of the model to compute the confidence bands

Greece (also found in Dimelis and Livada, 1999), India, Indonesia, Iran, Italy, Kenya, Korea, Norway, Panama, Peru, Philippines, Singapore, South Africa, Spain, Thailand, Tunisia, the United Kingdom and Zambia. In the medium run, a business cycle recession diminishes inequality in Australia, Brazil, China, Costa Rica, Denmark, Finland, France, Greece, Kenya, Korea, Malaysia, the Netherlands, Norway, Panama, Peru, Philippines, Singapore, South Africa, Spain, Thailand, Tunisia, the United Kingdom and Zambia.

Now we proceed with the geographical analysis by splitting the sample of countries into OECD and non-OECD nations. In line with the findings of OECD (2011 and 2015), Panel B of Table 1 shows that inequality falls during the first three years after a business cycle recession for 38% of OECD countries, while this percentage rises to 70% for non-OECD nations.[4] However, the effect is statistically significant for only 5% of OECD countries, but for 40% of non-OECD countries. Qualitatively, this result holds for a medium term analysis.

To complement the geographical analysis of the effects of a recession on inequality, we classify the countries according to the 2017 Countries Classification by Income conducted by the World Bank, whose list appears in Appendix III. For this purpose, we consider High Income Level countries as developed ones and the rest as emerging markets. In the short run, Panel C of Table 1 reports that a business cycle recession reduces inequality in 43% of high-income countries (5% of which face a significant reduction). When considering middle-income countries, this percentage rises to the 65% (significant reduction in 40%). In the middle run, the percentages are 52% (14% significant) for high-income countries and 60% (25% significant) for middle income countries.

In line with the analysis developed by, among others, Dabla-Norris et al. (2015), we consider that economic development is not the only source of inequality differential patterns. In contrast, geographical or cultural differences could also explain different responses of inequality to business cycle recessions. To analyze this potentially different response, in Appendix III we group the sample of countries into different

[4] In the case of US, this result agrees with the findings of Menderhausen (1946), Kuznets,1953, and Maliar, Maliar and Mora (2005).

regional clusters: Asia, Africa, Europe, Latin America and developed Anglo-Saxon regions.[5]

According to the percentages reported in Panel D of Table 1, inequality falls three years after a business cycle recession in the majority of countries for all regions. In particular, this effect holds in all the African and Anglo-Saxon countries, and in just over 50% of Asian, European and Latin American countries. Notably, the percentages of countries for which this effect is statistically significant fall considerably. In the medium run, the percentages of countries for which a recession causes inequality to fall are still over 50% in all regions except Anglo-Saxon countries. Again, the percentages that refer to significantly negative effects drop considerably.

### 3.3. Growth cycle analysis

The estimated coefficients $\beta_i^h$ for changes in the Gini indices as a consequence of a growth cycle recession and their 90% confidence intervals for each country i are plotted for $h$=1,…,10 in Appendix V. Following the lines of the business cycle analysis, Figure 3 plots a choropleth map in which countries are colored according to the reaction (and significance) of their Gini indices to a growth cycle recession.

To sum up, Panel A of Table 2, shows that a growth cycle recession causes inequality to drop by about the same percentage as a business cycle recession did, both in the short run and in the middle run. However, the percentages of countries for which the effect is statistically significant fall notably.

In addition, Panel B of Table 2 shows that the short-run negative reaction of inequality to a growth cycle recession is higher in OECD countries than in the case of business cycle recessions (72% versus 38%), but lower than in the case of non-OECD countries (50% versus 70%). This also holds for the medium term.

Regarding the countries' classification by income conducted by the World Bank, Panel C of Table 2 show that almost three quarters of high-income countries reduce inequality during the first three years after a growth cycle recession, while this

[5] Our results does not change significantly if UK appears in the set of European or in the set of Anglo-Saxon countries

proportion falls to one half for middle- income countries. As in the case of business cycle recessions, the effect is statistically significant in a lower percentage of countries. Moreover, the negative effect of recessions diminishes as the horizon increases in both groups of countries.

The percentages reported in Panel D of Table 2 shows that a growth recession causes inequality to drop in the short run in about the majority of countries in all areas but Asia. The negative effect is especially important in Latin America (89% of countries) and Europe (77% of countries). To a lesser extent, a growth cycle recession tend to reduce inequality in African and Anglo-Saxon countries (50% in both cases) while the percentage is only 31% in the case of Asian countries. However, the percentages of countries for which this effect is statistically significant diminish dramatically. These findings qualitatively hold in the medium term for all regions but Africa.

## 4. Conclusions

Does an economic downturn cause income inequality to rise? Within the framework of the local projection methods introduced by Jorda (2005), we track the effects of both growth-cycle and business-cycle recessions on the path of the Gini indices for up to ten years after a recession, once a broad set of macro-economic controls are in place.

Using annual data from a set of 43 countries from 1960 to 2016, we document several empirical facts. Overall, we fail to find significant evidence that an economic recession causes income inequality to rise, after controlling for a set of economic aggregates. Perhaps because the Gini indices are typically dominated by secular trends (also suggested in OECD, 2011 and 2015) rather than by cyclical movements, for most countries we find a negative effect of recessions on income inequality. However, the effect loses significance over time.

In spite of this overall conclusion, we find certain distinguishing patterns in the magnitude of the effects of recessions on inequality, which tend to depend on the degree of economic development. In short, business cycle recessions decrease inequality in more than fifty percent of counties, although this negative pattern seems to affect non-OECD and middle-income economies to a greater extent. In a geographical perspective,

the short-run response of the Gini indices to a business cycle recession is always negative in African and Anglo-Saxon countries and affect more than fifty percent of Asian, European and Latin American countries. The percentages tend to diminish when we focus on significant effects and when the analysis moves to the medium term.

Finally, our results suggest that a growth cycle recession causes inequality to drop by about the same percentage as business cycle recessions, both in the short and middle run. However, the percentages of countries for which the effect is statistically significant fall by more than half. In this case, the negative reaction of inequality to a growth cycle recession is higher in OECD countries and high-income economies. Overall, the geographical pattern of a growth cycle recession effect is similar, although to a lesser extent, to that of a business cycle recession.

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Table 1.Business cycle recessions

| Panel A. Total sample | | |
|---|---|---|
| | SR | MR |
| N-NS | 32% | 37% |
| N-S | 22% | 20% |
| P-NS | 29% | 37% |
| P-S | 17% | 7% |

| Panel B. OECD vs non-OECD. | | | | |
|---|---|---|---|---|
| | OECD | | Non-OECD | |
| | SR | MR | SR | MR |
| N-NS | 33% | 33% | 30% | 40% |
| N-S | 5% | 14% | 40% | 25% |
| P-NS | 43% | 43% | 15% | 30% |
| P-S | 19% | 10% | 15% | 5% |

| Panel C. World Bank high income vs middle income level | | | | |
|---|---|---|---|---|
| | High income | | Middle income | |
| | SR | MR | SR | MR |
| N-NS | 38% | 38% | 25% | 35% |
| N-S | 5% | 14% | 40% | 25% |
| P-NS | 38% | 38% | 20% | 35% |
| P-S | 19% | 10% | 15% | 5% |

| Panel D. Regional clustering | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Africa | | Asia | | Europe | | Latin America | | Anglosaxon (excluding UK) | |
| | SR | MR | SR | MR | SR | MR | SR | MR | SR | MR |
| N-NS | 25% | 25% | 42% | 33% | 46% | 38% | 13% | 50% | 75% | 25% |
| N-S | 75% | 75% | 17% | 17% | 8% | 23% | 38% | 0% | 25% | 0% |
| P-NS | 0% | 0% | 25% | 42% | 23% | 31% | 38% | 50% | 0% | 50% |
| P-S | 0% | 0% | 17% | 8% | 23% | 8% | 13% | 0% | 0% | 25% |

Note. Percentage of countries for which a business cycle recession cause inequality to decrease (negative impact) or to increase (positive impact). For each panel N-NS, N-S, P-NS and P-S refer to Negative-Nonsignificant, Negative-Significant, Positive-Nonsignificant and Positive-Significant effect. Panel A refers to the total sample, Panel B distinguishes between OECD and Non-OECD countries, Panel C distinguishes between high income and middle income level countries, according to the World Bank, while Panel D provides information according to regional differences. SR and MR refer to up to (short run) three-year and (medium run) four-to-six year effects.

Table 2. Growth cycle recessions

| Panel A. Total sample | | |
|---|---|---|
| | SR | MR |
| N-NS | 49% | 30% |
| N-S | 12% | 19% |
| P-NS | 33% | 33% |
| P-S | 7% | 19% |

| Panel B. OECD vs non-OECD. | | | | |
|---|---|---|---|---|
| | OECD | | Non-OECD | |
| | SR | MR | SR | MR |
| N-NS | 62% | 33% | 36% | 27% |
| N-S | 10% | 24% | 14% | 14% |
| P-NS | 24% | 29% | 41% | 36% |
| P-S | 5% | 14% | 9% | 23% |

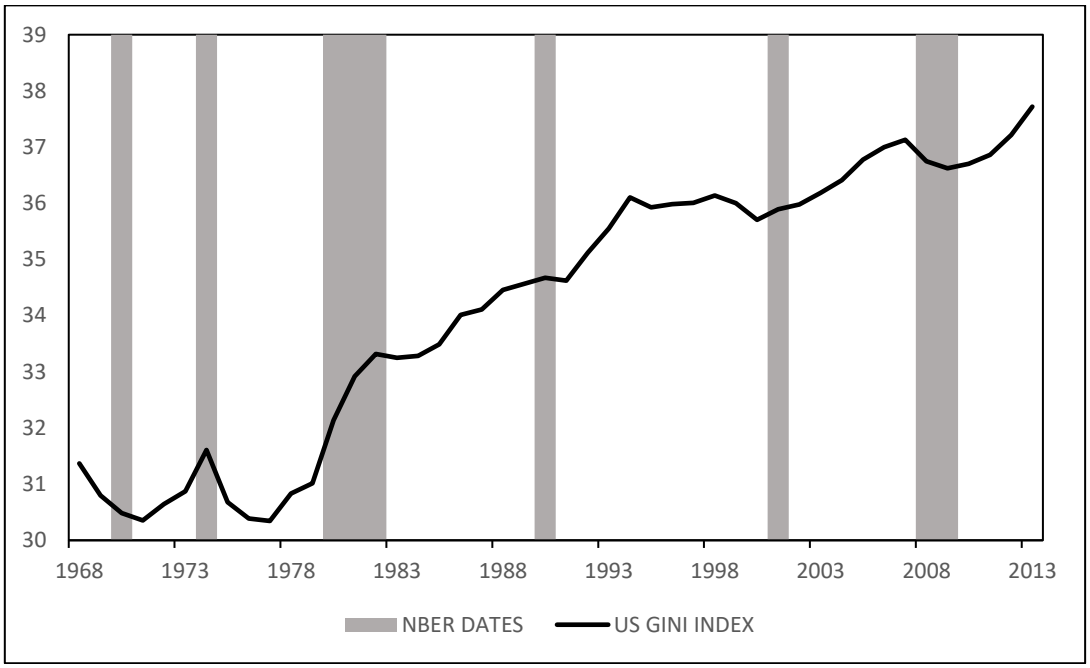
| Panel C. World Bank high income vs middle income level | | | | |
|---|---|---|---|---|
| | High income | | Middle income | |
| | SR | MR | SR | MR |
| N-NS | 57% | 38% | 41% | 23% |
| N-S | 14% | 24% | 9% | 14% |
| P-NS | 24% | 24% | 41% | 41% |
| P-S | 5% | 14% | 9% | 23% |

| Panel D. Regional clustering | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Africa | | Asia | | Europe | | Latin America | | Anglosaxon (excluding UK) | |
| | SR | MR | SR | MR | SR | MR | SR | MR | SR | MR |
| N-NS | 25% | 25% | 23% | 31% | 69% | 38% | 67% | 22% | 50% | 25% |
| N-S | 25% | 0% | 8% | 8% | 8% | 23% | 22% | 33% | 0% | 25% |
| P-NS | 50% | 50% | 62% | 31% | 23% | 31% | 0% | 33% | 25% | 25% |
| P-S | 0% | 25% | 8% | 31% | 0% | 8% | 11% | 11% | 25% | 25% |

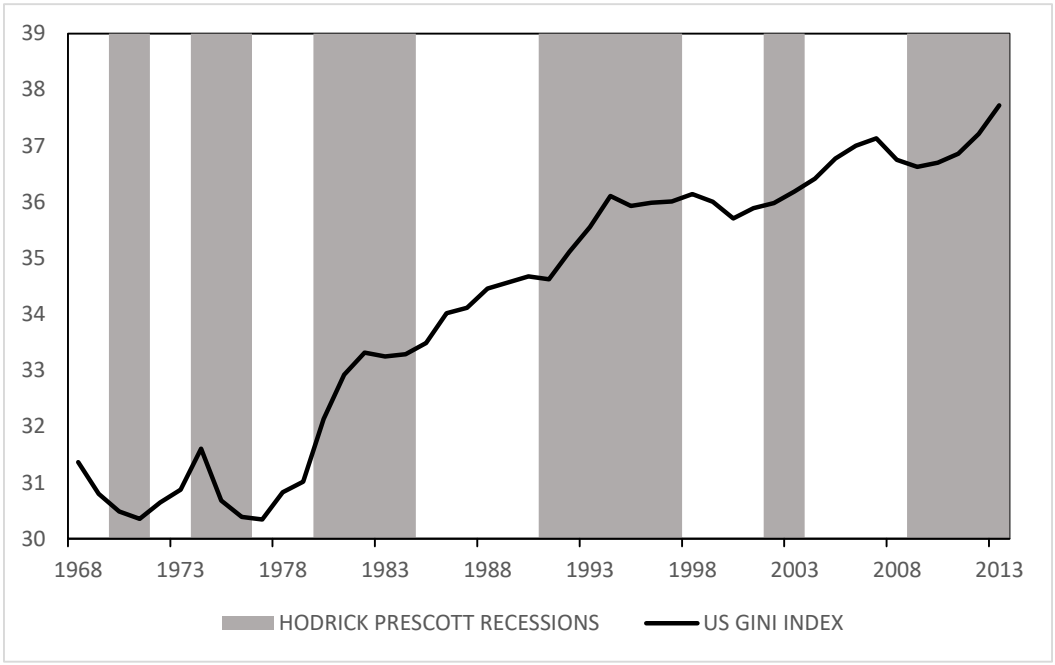
Note. Percentage of countries for which a growth cycle recession cause inequality to decrease (negative impact) or to increase (positive impact). For each panel N-NS, N-S, P-NS and P-S refer to Negative-Nonsignificant, Negative-Significant, Positive-Nonsignificant and Positive-Significant effect. Panel A refers to the total sample, Panel B distinguishes between OECD and Non-OECD countries, Panel C distinguishes between high income and middle income level countries, according to the World Bank, while Panel D provides information according to regional differences. SR and MR refer to up to (short run) three-year and (medium run) four-to-six year effects.

**Figure 1. US downturns and Gini index**

Panel A: Business cycle recessions



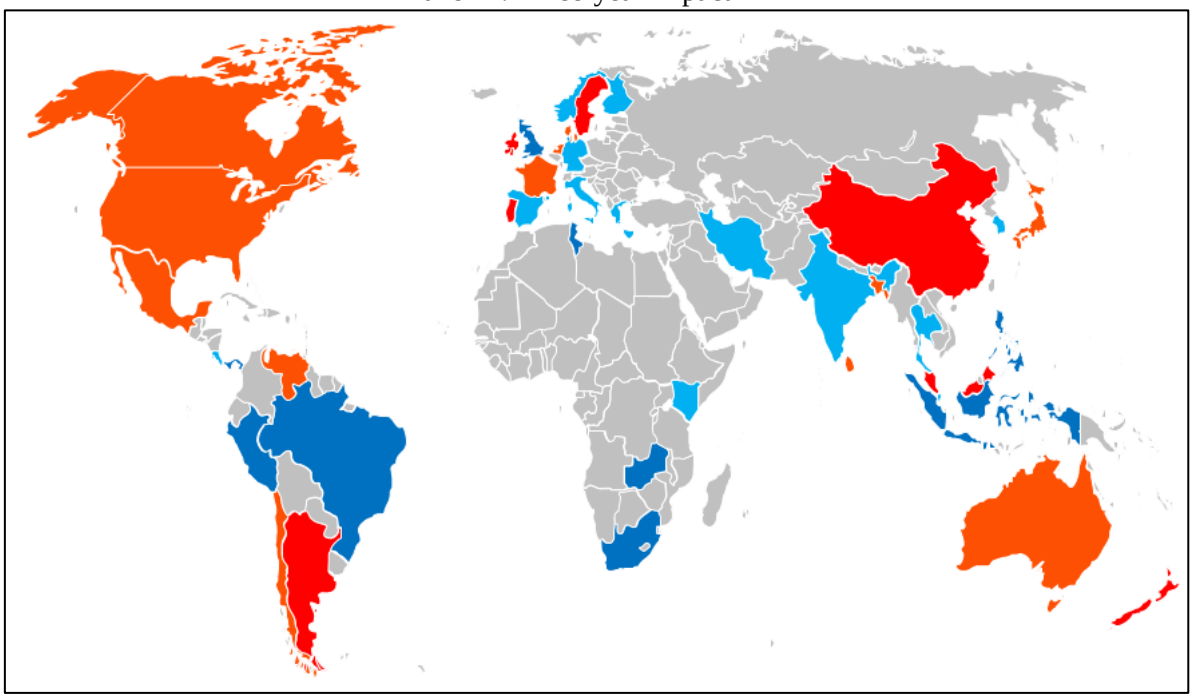

Panel B: Growth cycle recessions



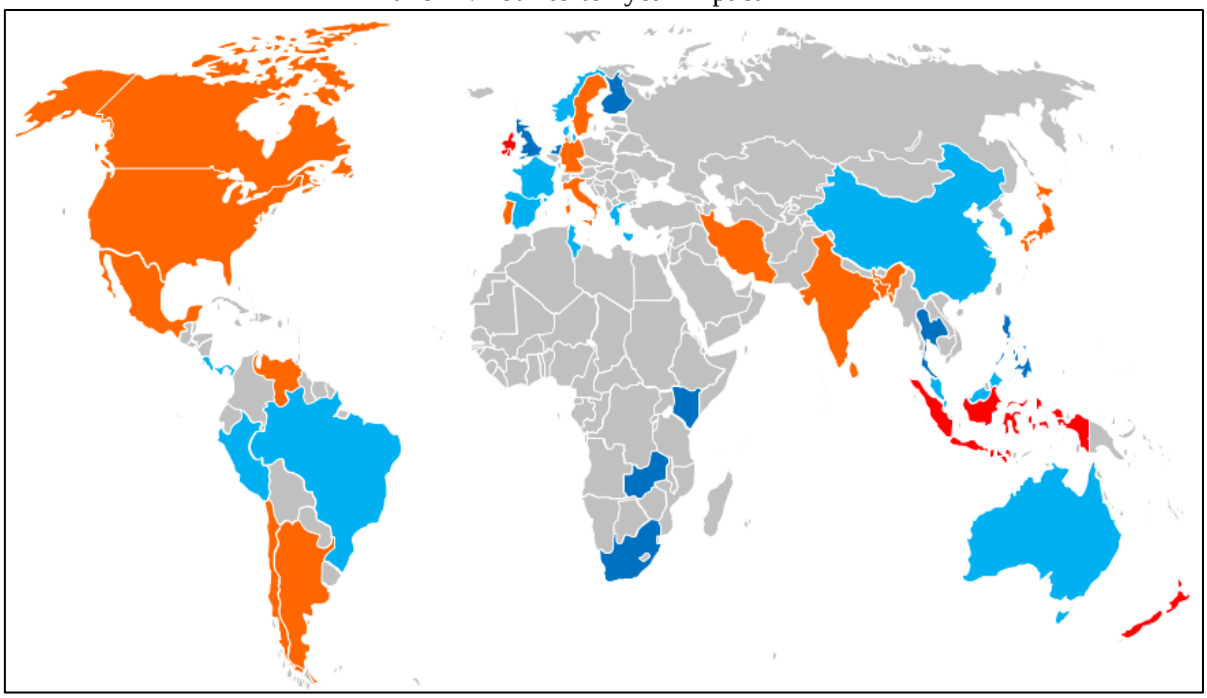

Notes. Business cycle recessions refer to NBER recessions while growth cycle recessions refer to negative deviations from a Hodrick-Prescott trend.

Figure 2. Impact of a business cycle recession

Panel A. Three-year impact



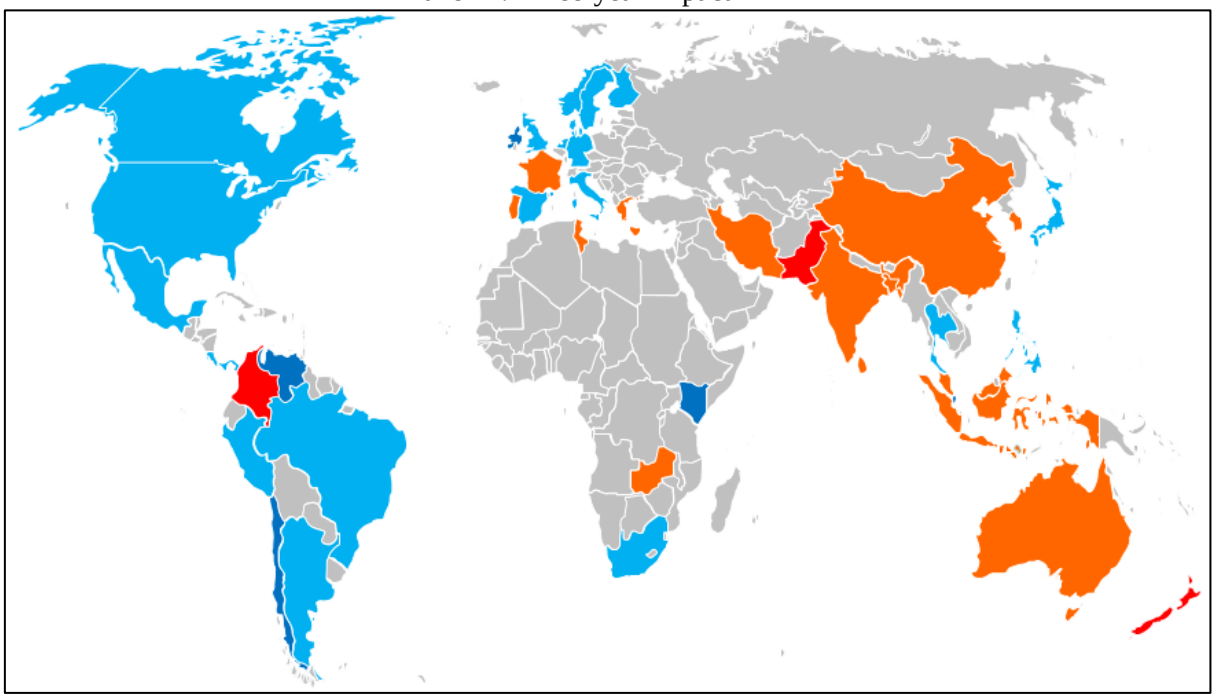
Panel B. Four-to-ten year impact



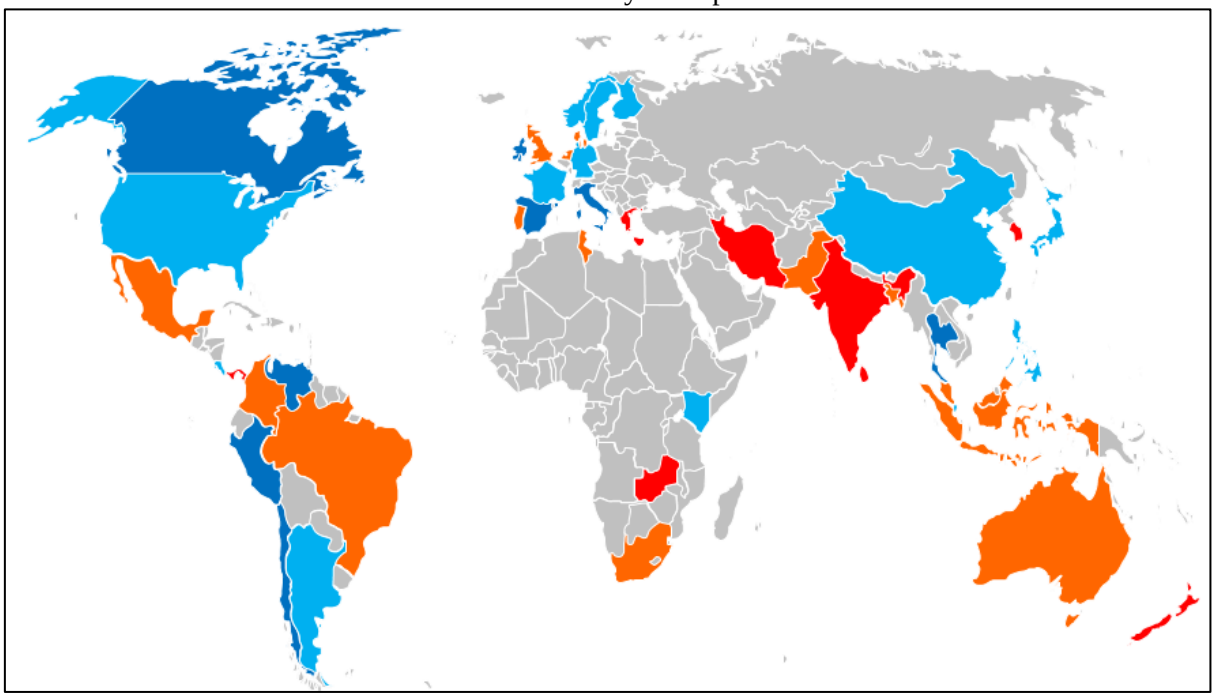
Notes: Countries in red (orange) experience significant (non significant) increases in inequality due to business cycle recessions. Countries in dark blue (sky blue) experience significant (non significant) decreases in inequality due to business cycle recessions.

Figure 3. Impact of a growth cycle recession

Panel A. Three-year impact



Panel B. Four-to-ten year impact



Notes: Countries in red (orange) experience significant (non significant) increases in inequality due to growth cycle recessions. Countries in dark blue (sky blue) experience significant (non significant) decreases in inequality due to growth cycle recessions.

Appendix I. Countries, variables and effective sample used in the analysis.

| COUNTRY | GINI INDEX | PRIVATE CREDIT TO GDP | TRADE OPENESS | GDPpc | POPULATION | PATENTS STOCK | FEMALE MORTALITY | GROWTH CYCLE CHRONO | BUSINESS CYCLE CHRONO | SAMPLE |
|---|---|---|---|---|---|---|---|---|---|---|
| ARGENTINA | 1961-2013 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1969-2014 | 1960-2014 | 1960-2015 | 1961-2014 | 1970-2013 |
| AUSTRALIA | 1972-2014 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1963-2014 | 1960-2011 | 1960-2015 | 1961-2014 | 1973-2011 |
| BANGLADESH | 1963-2010 | | 1960-2015 | 1960-2015 | 1960-2015 | | 1960-2014 | 1960-2014 | 1961-2014 | 1964-2010 |
| BRAZIL | 1970-2014 | | 1960-2015 | 1960-2015 | 1960-2015 | 1965-2014 | 1960-2014 | 1960-2015 | 1961-2014 | 1971-2014 |
| CANADA | 1965-2013 | 1960-2008 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2014 | 1960-2011 | 1960-2015 | 1961-2014 | 1966-2008 |
| CHILE | 1968-2013 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1963-2014 | 1960-2014 | 1960-2015 | 1961-2014 | 1969-2013 |
| CHINA | 1964-2013 | | 1960-2015 | 1960-2015 | 1960-2015 | | 1960-2014 | 1960-2015 | 1961-2014 | 1965-2013 |
| COLOMBIA | 1970-2014 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1963-2014 | 1960-2014 | 1960-2015 | - | 1971-2014 |
| COSTA RICA | 1969-2014 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1967-2014 | 1960-2015 | 1960-2015 | 1961-2014 | 1970-2014 |
| DENMARK | 1973-2014 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1963-2014 | 1960-2011 | 1960-2015 | 1961-2014 | 1974-2014 |
| FINLAND | 1971-2014 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1963-2014 | 1960-2012 | 1960-2015 | 1961-2014 | 1972-2012 |
| FRANCE | 1970-2013 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1963-2014 | 1960-2013 | 1960-2015 | 1961-2014 | 1971-2013 |
| GERMANY | 1960-2013 | 1970-2015 | 1970-2015 | 1970-2015 | 1960-2015 | 1963-2014 | | 1970-2015 | 1971-2014 | 1971-2013 |
| GREECE | 1974-2014 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2014 | 1960-2014 | 1960-2015 | 1961-2014 | 1975-2014 |
| INDIA | 1960-2011 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2014 | 1960-2014 | 1960-2015 | 1961-2014 | 1962-2011 |
| INDONESIA | 1964-2013 | | 1960-2015 | 1960-2015 | 1960-2015 | 1963-2014 | 1960-2014 | 1960-2015 | - | 1965-2013 |
| IRAN | 1969-2011 | 1960-2014 | 1960-2014 | 1960-2014 | 1960-2015 | 1963-2014 | 1960-2014 | 1960-2014 | 1961-2013 | 1970-2011 |
| IRELAND | 1973-2014 | 1960-2015 | 1960-2015 | 1970-2015 | 1960-2015 | 1963-2014 | | 1970-2015 | 1971-2014 | 1974-2014 |
| ITALY | 1967-2013 | 1963-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2014 | 1960-2010 | 1960-2015 | 1961-2014 | 1968-2010 |
| JAPAN | 1961-2011 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1963-2014 | 1960-2012 | 1960-2015 | 1961-2014 | 1964-2011 |
| KENYA | 1960-2006 | 1961-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1965-2014 | 1960-2014 | 1960-2015 | 1961-2014 | 1966-2006 |
| KOREA | 1966-2013 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2014 | 1960-2014 | 1960-2015 | 1961-2014 | 1967-2013 |
| MALAYSIA | 1968-2012 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1963-2014 | 1960-2014 | 1960-2015 | 1961-2014 | 1969-2012 |
| MEXICO | 1963-2014 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1963-2014 | 1960-2014 | 1960-2015 | 1961-2014 | 1964-2014 |

Appendix I (Continued). Countries, variables and effective sample used in the analysis.

| COUNTRY | GINI INDEX | PRIVATE CREDIT TO GDP | TRADE OPENESS | GDPpc | POPULATION | PATENTS STOCK | FEMALE MORTALITY | GROWTH CYCLE CHRONO | BUSINESS CYCLE CHRONO | SAMPLE |
|---|---|---|---|---|---|---|---|---|---|---|
| NEW ZEALAND | 1973-2014 | | 1971-2014 | 1977-2015 | 1960-2015 | 1963-2014 | | 1977-2015 | 1977-2014 | 1978-2014 |
| NORWAY | 1973-2013 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1963-2014 | 1960-2014 | 1960-2015 | 1961-2014 | 1974-2013 |
| PAKISTAN | 1969-2011 | 1960-2015 | 1967-2015 | 1960-2015 | 1960-2015 | 1964-2014 | 1960-2014 | 1960-2015 | - | 1970-2011 |
| PANAMA | 1969-2014 | 1960-2015 | 1960-2014 | 1960-2015 | 1960-2015 | | 1960-2014 | 1960-2015 | 1961-2014 | 1970-2014 |
| PERU | 1972-2014 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1972-2014 | 1960-2014 | 1960-2015 | 1961-2014 | 1973-2014 |
| PHILIPPINES | 1971-2012 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1963-2014 | 1960-2014 | 1960-2015 | 1961-2014 | 1972-2012 |
| PORTUGAL | 1973-2014 | | 1960-2015 | 1960-2015 | 1960-2015 | 1963-2014 | | 1960-2015 | 1961-2014 | 1974-2014 |
| SINGAPORE | 1972-2013 | 1963-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1966-2014 | 1960-2014 | 1960-2015 | 1961-2014 | 1973-2013 |
| SOUTH AFRICA | 1974-2012 | | 1960-2015 | 1960-2015 | 1960-2015 | 1963-2014 | | 1960-2015 | 1961-2014 | 1975-2012 |
| SPAIN | 1973-2014 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1965-2014 | | 1960-2015 | 1961-2014 | 1974-2014 |
| SRI LANKA | 1970-2013 | 1960-2015 | 1960-2015 | 1961-2015 | 1960-2015 | 1963-2013 | 1960-2014 | 1961-2015 | 1962-2014 | 1971-2013 |
| SWEDEN | 1960-2013 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1963-2014 | 1960-2014 | 1960-2015 | 1961-2014 | 1964-2013 |
| THAILAND | 1969-2011 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | | 1960-2014 | 1960-2015 | 1961-2014 | 1970-2011 |
| TUNISIA | 1965-2010 | 1965-2015 | 1965-2015 | 1965-2015 | 1960-2015 | 1963-2014 | 1960-2014 | 1965-2015 | 1966-2014 | 1966-2010 |
| UNITED KINGDOM | 1961-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1963-2014 | 1960-2013 | 1960-2015 | 1961-2014 | 1964-2013 |
| US | 1960-2014 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2015 | 1960-2014 | 1960-2013 | 1960-2015 | 1961-2014 | 1961-2013 |
| VENEZUELA | 1972-2013 | 1960-2013 | 1960-2014 | 1960-2014 | 1960-2015 | | 1960-2014 | 1960-2014 | 1961-2013 | 1973-2011 |
| ZAMBIA | 1972-2010 | 1965-2015 | - | 1960-2015 | 1960-2015 | 1966-2014 | 1960-2014 | 1960-2015 | 1961-2014 | 1973-2010 |

Appendix II. Cycle dating

*Business cycles*

Defining business cycle recessions reduces to event classification problem because most of the countries do not have agencies that determine turning points in economic activity. We overcome this problem by relying on the nonparametric dating algorithm early developed by Bry and Boschan (1971) to replicate the NBER decision procedure. In short, this algorithm isolates local maxima (peaks) and minima (troughs) in the seasonally adjusted national GDP time series subject to certain censoring rules. Then, expansions are defined as periods from troughs to peaks and recession as those from peaks to troughs.

Berge and Jorda (2013) extend this method, originally designated to monthly data to an annual context. In particular, if $z_t$ denote the logarithm of real GDP at year *t*, the algorithm identifies a peak in *t* when $\Delta z_t > 0$ and $\Delta z_{t+1} < 0$, while *t* corresponds to a through when $\Delta z_t < 0$ and $\Delta z_{t+1} > 0$.

*Growth cycles*

The growth cycle chronology is defined on the basis of the detrended GDP time series. For this purpose, we extract the cyclical component of the real GDP using the band-pass filter proposed by Hodrick and Prescott (1997). This method isolates the cyclical component through the minimization of product deviations from trend, subject to restrictions about trend smoothing. Then, sequences of positive values of the obtained cycle belong to growth cycle expansions while sequences of negative ones correspond to growth cycle recessions.

Appendix III. Countries classification

| COUNTRY | LABEL 1= OECD CLASSIFICATION | LABEL 2= WORLD BANK INCOME LEVEL CLASSIFICATION (2017) | LABEL 3= WORLD´S REGION |
|---|---|---|---|
| ARGENTINA | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | LATN AMERICA |
| AUSTRALIA | OECD | WORLD BANK HIGH INCOME LEVEL | ANGLO-SAXON |
| BANGLADESH | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | ASIA |
| BRAZIL | NON-OECD | WORLD BANK MIDDLE (UPPER) | LATIN AMERICA |
| CANADA | OECD | WORLD BANK HIGH INCOME LEVEL | ANGLO-SAXON |
| CHILE | OECD | WORLD BANK HIGH INCOME LEVEL | LATIN AMERICA |
| CHINA | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | ASIA |
| COLOMBIA | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | LATIN AMERICA |
| COSTA RICA | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | LATIN AMERICA |
| DENMARK | OECD | WORLD BANK HIGH INCOME LEVEL | EUROPE |
| FINLAND | OECD | WORLD BANK HIGH INCOME LEVEL | EUROPE |
| FRANCE | OECD | WORLD BANK HIGH INCOME LEVEL | EUROPE |
| GERMANY | OECD | WORLD BANK HIGH INCOME LEVEL | EUROPE |
| GREECE | OECD | WORLD BANK HIGH INCOME LEVEL | EUROPE |
| INDIA | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | ASIA |
| INDONESIA | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | ASIA |
| IRAN | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | ASIA |
| IRELAND | OECD | WORLD BANK HIGH INCOME LEVEL | EUROPE |
| ITALY | OECD | WORLD BANK HIGH INCOME LEVEL | EUROPE |
| JAPAN | OECD | WORLD BANK HIGH INCOME LEVEL | ASIA |
| KENYA | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | AFRICA |
| KOREA | OECD | WORLD BANK HIGH INCOME LEVEL | ASIA |
| MALAYSIA | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | ASIA |
| MEXICO | OECD | WORLD BANK MIDDLE INCOME LEVEL | LATIN AMERICA |
| NETHERLANDS | OECD | WORLD BANK HIGH INCOME LEVEL | EUROPE |
| NEW ZEALAND | OECD | WORLD BANK HIGH INCOME LEVEL | ANGLO-SAXON |
| NORWAY | OECD | WORLD BANK HIGH INCOME LEVEL | EUROPE |
| PAKISTAN | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | ASIA |
| PANAMA | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | LATIN AMERICA |
| PERU | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | LATIN AMERICA |
| PHILIPPINES | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | ASIA |

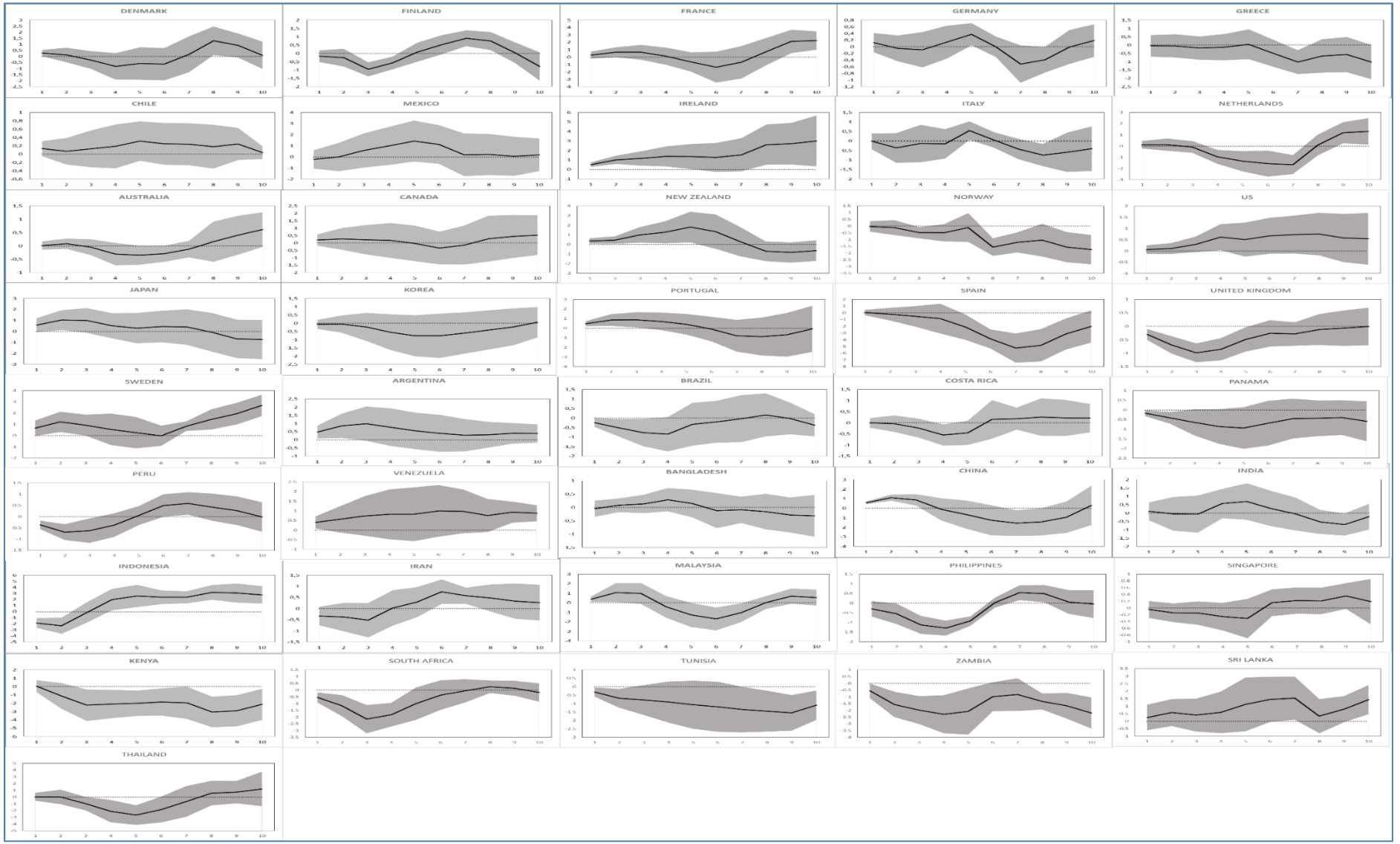
Note. Countries classified according to three different labels: (1) OECD vs non-OECD membership; (2) World Bank Income Level Classification from 2017; and (3) Region or political/cultural association.

Appendix III (Continued). Countries classification

| COUNTRY | LABEL 1= OECD CLASSIFICATION | LABEL 2= WORLD BANK INCOME LEVEL CLASSIFICATION (2017) | LABEL 3= WORLD´S REGION |
|---|---|---|---|
| PORTUGAL | OECD | WORLD BANK HIGH INCOME LEVEL | EUROPE |
| SINGAPORE | NON-OECD | WORLD BANK HIGH INCOME LEVEL | ASIA |
| SOUTH AFRICA | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | AFRICA/ANGLO-SAXON |
| SPAIN | OECD | WORLD BANK HIGH INCOME LEVEL | EUROPE |
| SRI LANKA | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | ASIA |
| SWEDEN | OECD | WORLD BANK HIGH INCOME LEVEL | EUROPE |
| THAILAND | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | ASIA |
| TUNISIA | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | AFRICA |
| UNITED KINGDOM | OECD | WORLD BANK HIGH INCOME LEVEL | EUROPE/ANGLO-SAXON |
| US | OECD | WORLD BANK HIGH INCOME LEVEL | ANGLO-SAXON |
| VENEZUELA | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | LATIN AMERICA |
| ZAMBIA | NON-OECD | WORLD BANK MIDDLE INCOME LEVEL | AFRICA |

Note. Countries classified according to three different labels: (1) OECD vs non-OECD membership; (2) World Bank Income Level Classification from 2017; and (3) Region or political/cultural association.

Appendix IV. Gini index responses to a business cycle recession



Appendix V. Gini index responses to a growth cycle recession.