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The dynamic effects of fiscal consolidations on income distribution: evidence for Spain over 1980-2020

Explaining the mechanisms driving income distribution dynamics

by

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Abstract Based on the Spain's annual and quarterly time series from 1980 to 2020, this paper presents the first case study on the dynamic effects of fiscal consolidation episodes on income distribution and the mechanisms driving the specific dynamics of the distribution. By estimating impulse response functions *via* Local Projections by Jordà (2005), I find supportive evidence of the increase in income inequality in the aftermath of consolidation episodes. I also find historical divergence between consolidation *intention* and *action* of the Spanish government represented by the heterogeneity in the effects on income inequality of the "conventional" and "narrative" (Devries et al., 2011) approaches of consolidation identification. Specifically related to the design of the consolidation program, expenditure-based plans appear to favour less the low part of the income distribution. The reactions of unemployment and wages appear to explain the distribution's low and medium part dynamics, whilst stock prices help explain the dynamics of the richest share. Also, these reactions highly depend on the prevailing business conditions. These results are robust to multiple specifications regarding alternative lag parameterizations, the effects of overlapping consolidation episodes, and the omission of controls.

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Introduction

The unexpected COVID-19 shock has meant a very noticeable relapse to the paths of government debt accumulation, given the dismal results of governments' budget balances in the EU. This event has entailed a mandatory shift in European government plans for fiscal consolidation following the 2008 financial crisis, a path of fiscal consolidation based on a steady reduction in the budget deficit. A country that has clearly experienced such a shift in fiscal consolidation strategy is Spain. This country experienced more than 10% budget deficit relative to GDP in 2009, which pursued a strong consolidation path until fulfilling the European Stability and Growth Pact budget deficit threshold of 3% with a 2.9% budget deficit in the 4^{th} quarter of 2019. Nevertheless, the extraordinary efforts made during the pandemic obligated the Spanish government to drop the budget deficit to 11% in the 4^{th} quarter of 2020 (Bank of Spain). Consolidation plans are highly expected in the wake of the pandemic, plans that will inevitably affect the Spanish economy and society.

While considerable literature have put research efforts on assessing the effects of fiscal consolidations on economic growth and unemployment specially after the 2008 financial crisis (e.g. Turrini (2013); Blanchard and Leigh (2014); Alesina, Barbiero, Favero, Giavazzi and Paradisi (2015); Alesina, Favero and Giavazzi (2015); Yang et al. (2015); Jordà and Taylor (2016); Heimberger (2017)), empirical research on the distributional effects of consolidation maneuvers has so far been comparatively underdeveloped (e.g. Agnello and Sousa (2012); Ball et al. (2013); Agnello and Sousa (2014); Furceri et al. (2016); Heimberger (2020)). Although the explicit and foremost objective of fiscal consolidations is to reduce the accumulation of debt by reducing the budget deficit below the threshold of 3% budget deficit relative to GDP established in the Stability and Growth Pact of the European Monetary Union, consolidation measures have indirect income distribution implications and, therefore, effects on national income inequality which can further aggravate the crisis effects on inequality. The literature on the topic has mainly narrowed the focus on OECD and EU aggregate studies of the direct effect of consolidation programs on income inequality measured by Gini indices, without addressing the effects at the whole distribution and without deeply empirically studying the mechanisms driving the effects.

Thus, the aim of this paper is to i) extract evidence from historical fiscal consolidations and its effects on income inequality in Spain, by assessing how positive or detrimental fiscal consolidations have been for the Spanish income distribution from 1980 to 2020, ii) investigate to what extent the effects differ when applying different ways of identifying fiscal consolidations ("conventional" vs "narrative" approach), iii) study if there is a differentiation in the effects of consolidation depending on the nature of the program (expenditure- or tax-based), and finally, iv) investigate what the mechanisms driving the specific dynamics of the income distribution are, as well as its dependence on the state of the economic cycle. Additionally, it will be concluded which type of consolidation plan is preferable in terms of inequality alleviation and turmoil minimization, thus suggesting the optimal design of consolidation programs in Spain.

The methodological approach applied in this paper is based on estimating the dynamics of income distribution after episodes of fiscal consolidation. This will be conducted by estimating Impulse Response Functions (IRFs) *via* Local Projections by Jordà (2005), thus complementing existing literature on the topic familiar with the methodology (Ball et al., 2013; Furceri et al., 2016; Heimberger, 2020). This method estimates how specific segments of the income distribution develop (cumulative percentage change) within h time units (years and quarters) after the start of a fiscal consolidation episode. Thus, conclusions regarding the persistence of the effects will be extracted since the short- and medium-term effects will be under investigation. This analysis will cover the Spanish economy from 1980 to 2020 in annual and quarterly data settings.

Overall, I find that by applying the "conventional" approach, pre-tax income inequality increases in the aftermath of fiscal consolidation episodes. At the same time, the effect smooths away in post-tax terms, which gives signs of the redistributive power of the Spanish social safety net. Concretely, in pre-tax terms, the low and medium parts of the distribution are detrimentally affected, with a positive effect on the upper tail (9^{th} & 10^{th} decile shares) and a detrimental effect on the top 1% of the distribution. Conversely, the application of the "narrative" approach by Devries et al. (2011) provides a persistent decrease in income inequality after consolidation plans which delivers information on the historical divergence between political *intention* and *action* of the Spanish government. Additionally, spending-based programs appear to favour less the low part of the income distribution than tax-based plans.

Regarding the second part of the analysis, I find that unemployment and wages explain the impact on the low part of the distribution: unemployment transitory increases after consolidation episodes and wages persistently decline five years after the shock. In addition, these effects highly depend on the prevailing business conditions: during periods of rapid economic growth (booms), the effect on unemployment is positive and negative on wages. Finally, I find a shift from a Neoclassical to a Keynesian behaviour of stock markets reacting to fiscal consolidations approximately two years after the shock. Such reaction explains the detrimental effect on the upper part of the income distribution, given the negative yet transitory reaction of stock prices, which is more robust during periods of rapid economic growth.

The rest of this paper is structured as follows. Chapter 2 provides a review of the concept of fiscal consolidation and the literature dealing with the effects of fiscal consolidations on income inequality. Chapter 3 presents the data utilized in this paper. Chapter 4 develops the identification of fiscal consolidation episodes in Spain and the econometric approach used in this paper. Chapter 5 presents the main empirical results, its discussion and multiple robustness checks. Chapter 6 provides policy implications derived from the analysis. And Chapter 7 concludes.

2

Literature Review

2.1 Fiscal consolidations: theory and measurement

Within the maneuvers used by governments in the fiscal matter, fiscal consolidations are placed as the most relevant, especially after periods of economic turmoil. Extraordinary expenditures and tax reductions aimed to smooth the impact of crises, as experienced recently during the COVID-19 pandemic, inevitably entail detrimental consequences for the public budget balance, described as revenues subtracted by expenditures. Fiscal consolidation actions describe government policy explicitly intended to reduce budget deficits and, therefore, debt accumulation, thus counteracting the detrimental consequences of turmoil episodes on the public budget. Success and persistence are ideal attributes of consolidation programs sought by policymakers. Holding constant the size of the deficit cut, long-lasting consolidations that minimize the disruption of the economy are preferred by policymakers since these also minimize political costs and maximize political acceptability (Perotti, 1998). The main obstacle to this utopian feature is the democratic political cycle system based on 4- to 6-years legislatures, as in Europe, which avoids implementing smooth long-term fiscal policy measures.

Also, budget deficits can be automatically reduced during periods of economic prosperity by increasing revenue collection (e.g. increase in consumption and population employed) and by decreasing public spending (e.g. reduction of unemployed population) —these effects receive the name of "cycle effects" (OECD, 2011). When focusing on fiscal consolidations, the goal is to isolate government policies explicitly intended to reduce budget deficits from that automatic response. The movement of government and revenues with the business cycle, automatic stabilizers, provokes a typical endogeneity problem when measuring fiscal consolidation indicators: the feedback relation between movements of expenditures and revenues and GDP. Researchers are interested in identifying fiscal maneuvers motivated by budget deficit reduction, which entails the necessity of accounting for the effect of automatic stabilizers on the calculation of the budget balance.

The macroeconometric literature distinguishes between two approaches to eliminate the endogeneity problem: the "conventional" and the "narrative" approach (Yang et al., 2015). The first is a standard statistical approach based on calculating changes in the cyclically-adjusted primary[1] balance (CAPB). Basically, the primary budget balance is corrected for the effects of the business cycle on expenditures and revenues. To understand the relevance of this measure, the European Commission periodically calculates cyclically-adjusted fiscal balances to control for the fiscal surveillance framework of the Economic and Monetary Union. Note that further on, a thorough discussion on the different methodologies applied to calculate cyclically-adjusted balances will be presented. However, the "conventional" approach presents some limitations regarding the cyclical adjustment procedure, the time-variant nature of the elasticities of each budgetary item to output, and the control for other adverse shocks taking place simultaneously to consolidation episodes Agnello and Sousa (2014).

To counteract these disadvantages, Devries et al. (2011) developed an annual database from 1978 to 2009 for OECD countries of fiscal consolidation episodes based on the "narrative" approach presented in the seminal work by Romer and Romer (2010). This method identifies government intentions to consolidate the budget balance by looking at policy documents. Overall, the "narrative" approach overcomes the "conventional" when it comes to reducing the bias generated by the latter. However, the treatment of this approach only allows studying from an annual frequency perspective.

To date, the only available option for identifying fiscal consolidation episodes in a quarterly data setting for advanced economies, which also applies to Spain, is the calculation of the quarterly CAPB by the "conventional" approach. There is lack of quarterly data on fiscal consolidation episodes that follows the "narrative" approach. Additionally, quarterly data analysis of fiscal policy shocks provides advantages for annual analysis. Against the frequent criticism of quarterly identification of fiscal shocks based on the year-by-year basis of fiscal decisions, it should be noted that decisions affecting fiscal policy during the year are always possible. Hence, these post-budget shocks must be identified as well. Therefore, quarterly fiscal shock identification provides a more accurate view of the inter-annual effects of fiscal policy shocks (De Castro and de Cos, 2008).

2.2 Fiscal consolidation effects on income inequality

Fiscal stimulus measures implemented in many OECD countries after the financial crisis of 2008 to counteract the crisis ignited the empirical question about the real effects of tax cuts and government spending increases on economic growth (Cottarelli et al., 2014). A series of papers provided evidence on the size of the fiscal multipliers and their dependence on the business cycle, monetary policy, the composition of the fiscal maneuver, and the initial level of indebtedness (e.g. Christiano et al. (2011); Ramey (2011); Eggertsson and Krugman (2012)). A similar question has recently emerged, given the shock of COVID-19. The global response of governments characterized by the deployment of aggressive fiscal policy measures, such as health expenditure boosts, extraordinary income transfers and increasing welfare payments, has started to be under investigation Auerbach et al. (2021); Makin and Layton

[1] The primary balance is defined as the budget balance excluding net interest payments on public debt, the measure of budget balance generally used in the literature.

(2021). Specifically, the isolation of fiscal policy effects on economic growth to the extraordinary curbing of production and consumption.

After the financial crisis, a shift towards fiscal consolidation, also expected after COVID-19, came with the emergence of a new strand of empirical literature concentrated on assessing the effects of fiscal austerity on economic growth and unemployment (Blanchard and Leigh, 2014; Alesina, Barbiero, Favero, Giavazzi and Paradisi, 2015; Alesina, Favero and Giavazzi, 2015; Jordà and Taylor, 2016). Opposing views on the effects of fiscal austerity on the economic stance ("expansionary vs contractionary austerity") have been subject of debate and controversy in the literature. Alesina and Ardagna (2010) led the support for the "expansionary austerity hypothesis" by arguing that reductions of the primary deficit relative to GDP due to cuts in current spending, government wage and non-wage components were associated with high GDP growth. Conversely, Blanchard and Leigh (2014) concluded in favour of the "contractionary austerity hypothesis" that the GDP losses created by fiscal austerity maneuvers were underestimated by the IMF and the European Commission, an underestimation of around 1% of the negative effects on GDP. With regards to unemployment, "contractionary austerity" effects have been observed represented by long-term unemployment increases (Ball et al., 2013) and by temporary unemployment increases after austerity *via* spending cuts, through increasing job destruction and a reducing job creation (Turrini, 2013).

The effects created by austerity fiscal policies do not end with their impact on growth and unemployment. However, there is a natural chain of effects that is transmitted to how a country's income is distributed. A clear example of this transmission is the indirect effect of fiscal consolidations on income distribution *via* changes in unemployment and wage gains or losses. Despite the intuitive and apparent indirect relationship between austerity policies and income distribution, only a tiny fraction of the literature, relative to the literature devoted to the effects on economic growth and unemployment, has enjoyed research efforts. These works can be classified depending on how fiscal consolidation episodes are identified: by the "conventional", the "narrative", or by using both identification criteria.

In the first group, Mulas-Granados et al. (2005) used the change in CAPB to identify fiscal consolidation episodes and found that expenditure-based consolidations increased income inequality more than revenue-based adjustments for a set of 15 EU countries during 1960-2000. Conversely, Agnello and Sousa (2012) reported reverse results focusing on 18 OECD countries during 1970-2010; net income inequality reacted negatively to fiscal consolidations when the fiscal maneuver succeeded in returning public debt to lower levels. Later on, Schneider et al. (2017) narrowed the focus on the pre- and post-financial crisis period (2006-2013) and, differently to all previous papers, estimated a parametric Lorenz curve model to compute Gini-like indices to evaluate distributional changes in the bottom and top of the income distribution, finding rising inequality at the top, thus indicating a welfare loss for society if there is no compensating growth.

Other works have exclusively made use of the narrative approach by Devries et al. (2011) (Ball et al., 2013; Agnello and Sousa, 2014; Schaltegger and Weder, 2014; Agnello et al., 2016). Based on a panel of 17 OECD countries during 1978-2009, Ball et al. (2013) revealed detrimental effects on net income inequality, significantly larger for spending-based consolidations. In agreement with the damaging effect of spending-driven programs, Agnello and Sousa (2014) additionally contributed by finding that during periods of low growth and when the larger the size[2] of the consolidation package was, the greater the effect on income inequality. However, the authors found that tax-driven austerity plans reduced income inequality. Specially focused on the dependence of the effects on the political party or government type Schaltegger and Weder (2014) detected that minority and single-party governments did significantly worse than coalition governments when it comes to income inequality reduction after austerity-driven programs. Also, successful consolidation plans significantly increased income inequality. Finally, from a between-regions disparities approach, Agnello et al. (2016) discovered how fiscal consolidations driven by spending cuts exacerbated regional dispersion[3] in Europe, more than tax hikes.

Ultimately, two works have taken advantage of both types of approaches and have estimated the dynamic effects of consolidation programs on income inequality. Furceri et al. (2016) found that both approaches provided the same detrimental effects of austerity-driven plans on net income equality, also explained by a decline of the share of wages after the consolidation shock. Finally, focuses on a panel of 17 OECD countries during 1978-2013, Heimberger (2020) discovered practically the same results as Furceri et al. (2016), with the novelty of extending the time dimension until 2013[4].

After presenting the evidence at the aggregate level, for OECD and European Union countries, the search for evidence for the reference country in this study, Spain, yields quite scarce results. De Castro and de Cos (2008) presented the main contribution of the effects of fiscal policy shocks on the main macroeconomic variables in a quarterly data setting from 1980 to 2004. By estimating a VAR specification, expansionary government spending shocks appeared to raise GDP in the short-term (peaking three quarters after the shock), although turning negative four years after the shock, mainly driven by public consumption shocks. Regarding tax increases, GDP reacted non-significantly in the first years after the shock, although it became significantly negative in the medium-term, predominantly driven by increases in direct taxes.

Specifically focused on the effects of fiscal shocks during periods of consolidation, De Castro and de Cos (2008) estimated a, on average, close to zero effect on GDP of fiscal adjustments during the end of the 90s in Spain, composed by a positive effect of expenditure-based austerity and a negative effect of tax-based plans, which coincide with posterior literature (Alesina and Ardagna, 2010). In line with this, De Castro et al. (2004) estimated a VAR model for Spain during 1964-2000 in an annual data setting and concluded that a credible fiscal consolidation strategy in Spain should be achieved through public expenditure cuts. Finally, Lago-Peñas et al. (2019) investigated potential regional divergence on the effects of fiscal consolidations and found that Galicia (the regional leader in compliance with fiscal consolidation targets) did not pay the price for fiscal adjustments in terms of short-run GDP growth reduction.

Although Ball et al. (2013), Furceri et al. (2016) and Heimberger (2020) have

[2] Agnello and Sousa (2014) transformed the information provided by Devries et al. (2011) in the form of dummies to the size of the package (in percentage of GDP), also as reported by Devries et al. (2011) relative to the mean of the program differentiating between spending- and tax-based plans.

[3] Agnello et al. (2016) measured regional dispersion by regional inequality Gini indices based on differences in GDP per capita between countries of Europe

[4] Note that the time period applied by Furceri et al. (2016) was 1978-2009, 4 years smaller than the one used by Heimberger (2020).

performed seminal work on the dynamic effects of fiscal consolidation episodes on income inequality, there is a major gap in the literature consisting on the study of the effects until the practically present day. Thus, I will fill that gap by including data for the decade after the financial crisis (1980-2020). Additionally, only Ball et al. (2013), Furceri et al. (2016) and Heimberger (2020) have slightly focused on providing empirical explanations of the effects of consolidation programs on income inequality. These works attributed to the share of wages and profits income in GDP and unemployment the power of explaining the effects on income inequality, although these have not received special attention.

There is a need to fill this gap in the literature, which is why I will in-depth study which mechanisms are capable of explaining the dynamics of the low and medium, and the upper parts of the distribution, as well as their dependence on the state of the economy. Also, when it comes to income inequality measurement, generally, the literature has focused on market and net Gini indexes. Only, Schneider et al. (2017) computed Gini coefficients for the bottom and top parts of the distribution. Thus, I will estimate the dynamic effects of fiscal consolidations on the whole income distribution by attending to the effects on every income share decile in pre- and post-tax terms.

Finally, there is a clear tendency to focus the analysis on the average effects of a set of countries in a given period, with an annual frequency, only De Castro and de Cos (2008) provided a detailed study of the macroeconomic effects of fiscal shocks in Spain in a quarterly data setting. In this way, any country-specific effects are overlooked, leaving aside the investigation of case studies focused on the country's economic conditions. For this reason, I will investigate the effects only in Spain, with a particular focus on the reaction of the mechanisms against fiscal consolidation shocks in a quarterly data setting, given the greater sample size. Thus, this work presents the first case study on the dynamic effects of fiscal consolidations in income inequality, even taking into account the obvious caveats concerning the sample size of the first part of the analysis[5].

[5]For this reason the second part of the analysis, the study of the mechanisms, places as the main part of the paper. The first part works as an intuition of the effects on the income distribution. For further research, the focus should be on the mechanisms driving the dynamic effects.

3

Data

3.1 Income distribution estimates

To assess the dynamic effects of fiscal consolidations on income distribution in Spain, I firstly use income distribution data from the World Inequality Database (WID). This worldwide project provides the most extensive available dataset on the historical evolution of the world distribution of wealth and income. In its early days, concretely in January 2011, the project started by gathering top income shares series for more than thirty countries until such time that it expanded in 2015 to aggregate wealth-income ratios and the changing structure of national income and wealth, thanks to the work of Piketty and Zucman (2014). More recently, the WID has aimed to produce annual estimates of the income and wealth distributions using concepts of income and wealth consistent with the national macroeconomic accounts, what is called the Distributional National Accounts (DINA) framework, developed by Alvaredo et al. (2016). This methodology combines tax and income micro-files[6], survey statistics and the imputation of missing incomes to scale up to the macroeconomic level the micro-level income information to finally obtain the national income distribution.

Specifically, I have extracted multiple annual estimates of pre-tax national income and post-tax national income per adult (equal-split individual terms[7]) for Spain from 1980 to 2020. Following the definitions of the WID, pre-tax national income is *"the sum of all pre-tax income flows corresponding to the individual owners of the production factors (labour and capital) before the operation of the tax and transfer system, but after the operation of the social insurance system"*[8]. Post-tax national income is equal to post-tax disposable income[9] of individuals adding the remaining government spending[10]. This data source provides the homogeniza-

[6]In this context, income micro-files refer to annual information on individual flows of both labour and capital incomes, according to the WID.

[7]These series distribute income to all adult individuals while splitting income equally within a couple or a household. For a more thorough explanation see Alvaredo et al. (2020) pp. 23.

[8]This income concept also includes pre-tax undistributed corporate sector profits.

[9]According to the WID, post-tax disposable income is defined as *"pre-tax national income, minus all taxes on production, income and wealth, plus social assistance benefits in cash"*. Note that this definition does not include the redistribution of all government spending.

[10]Specifically, to add up to national income, remaining government spending includes individual and collective consumption expenditure of the government, and the surplus or deficit of the government. Thus, the difference with the usually applied disposable income definition is the introduction

tion and unification of all available information on income shares, in this case, of Spain. Traditionally, income inequality estimations in Spain have been elaborated from Household Budget Surveys (HBS) from the National Statistical Institute (INE) of Spain, all in post-tax terms, which are only net of direct taxes. Alternatively, Torregrosa-Hetland (2016) provided an improvement [11] of HBS estimates by correcting for under-reporting of self-employed and by scaling-up micro-level data to the National level. Indeed, Torregrosa-Hetland (2016) found an under-estimation of income inequality in Spain when using HBS-based estimations. However, even correcting and controlling for potentially biasing factors, the series from WID have agglutinated a larger variety of data sources, which provide more informative data.

Concretely, I have extracted all income deciles in share terms, the top 1 per cent and the Gini coefficient for both definitions of national income. Note that the distributional time series of Spain are the result of the application of the DINA framework, series that underlie the work of Blanchet et al. (2019). The choice of these variables arises from the objective of obtaining a complete picture of the events that have occurred in the distribution of Spanish income after episodes of fiscal consolidation. A complete picture comes to say that if the study focuses only on the Gini coefficient, a non-changing Gini leads the researcher to conclude a stable level of income inequality. However, internal dynamics of the income distribution can be in place. For instance, the simultaneity of the improvement of the lower tail and the deterioration of the upper tail compensated by an improvement of the midsection of the distribution or a proportional improvement of both the lower and upper tails of the distribution of national income. The goal is to capture as much information as possible from the existing data on income distribution, differently from the general trend in the literature on the effects of fiscal policy on income inequality, (Furceri et al., 2016; Agnello et al., 2013; Agnello and Sousa, 2014; Ball et al., 2013; Balseven and Tugcu, 2017), which has focused on the usage of Gini coefficients and Theil indexes.

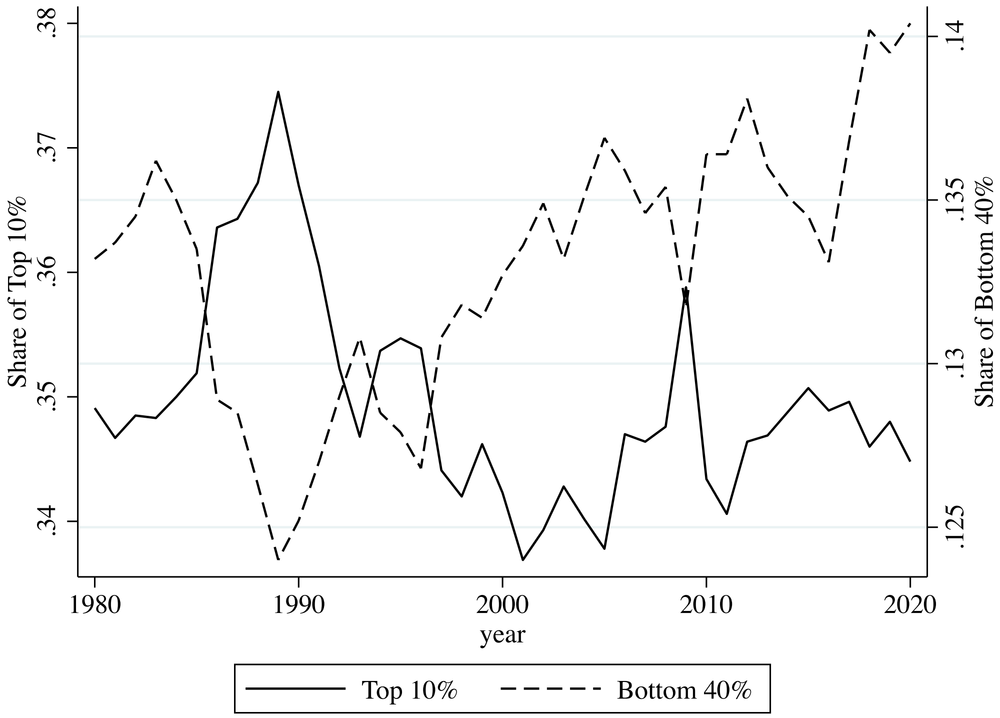
The following features can be highlighted when studying the Spanish income distribution and Gini collected series. The evolution of the lower tail, measured as the bottom 40% share[12] practically follows opposite trends as compared with the top 10 per cent share, as presented in Figure 3.1. In general, it is worth highlighting a general upward trend of the bottom 40% share, excluding the 80s, the 2008 financial crisis and a decline in the middle 2010s. Clear contrary paths were followed during the 80s when a continuous improvement of the upper tail share coexisted with a persistent deterioration of the lower 40% share. This observation matches with the fiscal changes conducted by the arrival of the social-democratic party PSOE (*Partido Socialista Obrero Español*) to the government, which lasted until 1996.

of the remaining government spending.

[11]Biases in income inequality estimations derived from the non-response and under-reporting of rich individuals, which implies an under-representation of the rich, drive the estimations downwards.

[12]Note that the low tail 40% is a result of summing the 1^{st}, 2^{nd}, 3^{rd} and 4^{th} decile shares. These shares are summed given that there is homogeneity in their overall trend, as presented in Figure A.1. Also, it needs to be mentioned that the sum of all decile shares is equal to 1 and that the Gini coefficient bounds from 0 to 1.

Figure 3.1: Evolution of pre-tax bottom 40% and top 10% shares of the Spanish income distribution from 1980 to 2020

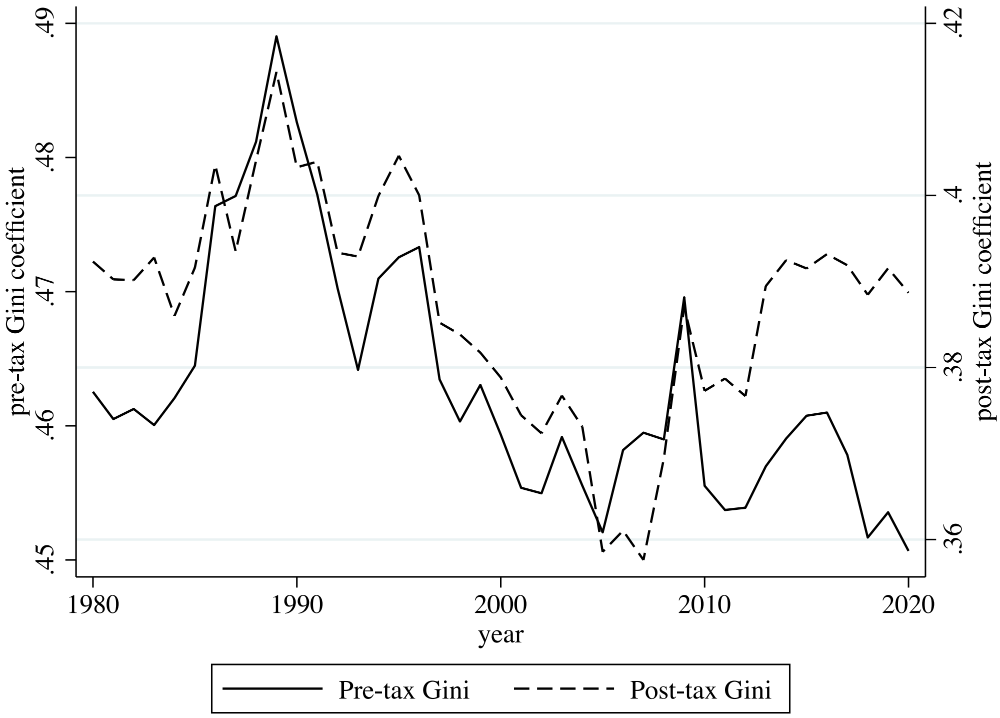


Source: WID. Author's elaboration.

The reduction of the number of brackets of the tax system and the cut down of top marginal tax rates meant a loss in the support for progressivity in Spain. Additionally, indirect taxation was reinforced, which directly detrimentally affected the lower tail of the income distribution. This fact is observed in Figure A.2, which traces out the evolution of post-tax low tail 40% share and top 10% share. These contrary trends are also reflected in the notorious increase of pre- and post-tax Gini coefficients during the 80s (Figure 3.2). During the 90s, these trends were overcome until years previous to the 2008 financial crisis. The share of the top 10% declined from .375 in 1989 to almost .34 in 2005, whilst the low 40% improved to more than .135 in the same year. This fact is also reflected in the declining trend of both Gini coefficients (Figure 3.2). This decline was partly caused by the alteration of the welfare state model in Spain since the end of the 1980s. New elements were introduced to protect citizens regardless of their participation in the labour market. For example, the incorporation of non-contributory benefits into the Social Security system from the 1990s onwards reinforced the social safety net (Torregrosa-Hetland, 2015; Martínez, 2021).

Subsequently, the real estate bubble created in Spain exploded in 2008, a bubble that let the top 10% peak as it had not done until the early 1990s, which coincided with a fall of the low tail 40%. The explosion of the crisis hardly hit the richest part of the distribution, which quickly rebounded to present an increasing trend, while the low 40% deteriorated until the mid-2010s. After that, an extraordinary shift in the declining trend of the low 40% after the mid-2010s took place, stopped by COVID-19. The contributors to the shift are mostly the first and second decile shares (Figure A.1).

Figure 3.2: Evolution of pre- and post-tax Gini coefficients of the Spanish income distribution from 1980 to 2020



Source: WID. Author's elaboration.

In post-tax terms, the gap between the poor and rich parts of the distribution has been closed when looking at the post-tax evolution of the low 40% and top 10%, a sign of redistribution (Figure A.2). In terms of redistributive power of the Spanish fiscal system, Figure 3.2 shows that the trends of both pre- and post-tax Gini coefficients have been similar up until 2010 when the gap between pre- and post-tax Gini coefficients has dilated. This event could be a sign of reduction of the fiscal redistribution (Torregrosa-Hetland, 2015). On average terms, the difference between pre- and post-tax Gini coefficients has been equal to 7.5% points during 1980-2020, which means an average income inequality reduction of 7.5% points during the last four decades in Spain. These series present the same trends as previous Spanish corrected income inequality estimations; income inequality increase in post-tax income during the 1980s (Torregrosa-Hetland, 2016), a continuous increase in pre-tax terms (Onrubia et al., 2007), also the increase in income inequality during mid-1990s followed by a decrease until the 2008 financial crisis (Onrubia et al., 2007). All these observations explain the characteristics of the historical evolution of the Spanish income distribution. This preliminary analysis aims to identify the most significant periods in the history of income distribution and thus be able to fit them into the history of fiscal consolidations, providing a coherent and meaningful historical context.

3.2 Macroeconomic variables

The process of identification of fiscal consolidation periods in Spain starts from the collection of quarterly data from the first quarter of 1980 to the fourth quarter of

2020 (1980:1-2020:4) of total government expenditures and revenues, and of each budgetary item of both expenditures and revenues from the data repository of the Bank of Spain, specifically from the updated Boscá et al. (2007) database. The classification of public sector variables contained in the dataset meets the *Intervención General de la Administración del Estado (IGAE, State's Accounts Department).* Budgetary data distinguish the following expenditures: intermediate consumption, gross capital formation, compensation of salaried employees, other taxes on production, subsidies, property income, payable current income tax[13], social benefits other than in-kind transfers, in-kind social transfers related to expenses, other current transfers, capital transfers, acquisitions less disposals of non-financial non-produced assets, and the following revenue items: market production, payments for other non-market production, taxes on production and imports, property income, current taxes on income, wealth, etc, social contributions, other current transfers and capital transfers. These series will serve to calculate the quarterly cyclically-adjusted primary balance (CAPB) of Spain, which will be applied to identify annual fiscal consolidation episodes using multiple criteria (Afonso, 2010; Alesina and Ardagna, 1998; Giavazzi and Pagano, 1990).

Alternatively to the usage of the CAPB-based methods of fiscal consolidation episodes identification, I will use the ones identified by Devries et al. (2011) from the IMF, which was extended up until 2014 by Alesina et al. (2020). This narrative approach focuses on identifying discretionary changes in taxes and expenditures primarily motivated to reduce the budget deficit, and therefore, to control government debt growth, and even pursuing debt reduction when budget surplus are achieved. This approach identifies these fiscal measures by examining policy documents, budget speeches, central bank reports and stability programs. The narrative database contains discrete variables that take value 1 when fiscal consolidation plans are detected in the document in year t, and also differentiates between tax- or expenditure-based fiscal consolidations. This differentiation depends on the fiscal instrument utilized to conduct the fiscal consolidation. Additionally, they include a more profound differentiation between direct tax-based, indirect tax-based, consumption and investment spending-based and transfer spending-based consolidations.

Since the analysis conducted in this paper dates up until 2020, I have extended the narrative approach for Spain from 2015 to 2020 by following the same method. In this case, I have analyzed the annual Stability Programs Updates of the Kingdom of Spain submitted to the European Commission and extracted information on the fiscal consolidation plans and measures after 2014. Overall, Spain has followed a continuous consolidation path since the 2008 financial crisis, although with various measures, from the tax reform until 2016 to relevant government expenditure reductions in 2018. Note that all the specific fragments of each Stability Program Update that explicitly refer following consolidations are presented in Appendix B.

In addition, quarterly data on real GDP in constant prices of 2015 and GDP deflator (2015=1) (1980:1-2020:4) from Bank of Spain has been collected for the calculation of the CAPB. The following macroeconomic variables used in the posterior analysis have also been extracted from the same source, all in quarterly frequency for the same period: total unemployment rate, population, exports and imports of goods and services, and money supply (M3). Finally, quarterly frequency CPI infla-

[13]This expenditure budgetary item refers to the current liability of the Spanish government that records the income taxes owed.

tion rate, long-term interest rate, and the share (stock) price index (1985:1-2020:4) have been extracted from OECD data.

4

Methodology

This chapter will i) present the procedure followed to quantitatively identify fiscal consolidation episodes in Spain from 1980 to 2020, ii) show the specification utilized to assess the dynamic effects of fiscal consolidations on income distribution, and iii) present the specifications modelled to explore the mechanisms driving the dynamics of different segments of the income distribution.

4.1 Identifying fiscal consolidation periods in Spain

The first phase of the fiscal consolidation identification process relies on calculating the CAPB. The usage of cyclically-adjusted government balance measures to analyze fiscal policy internal actions has recently become popular to identify fiscal episodes (either adjustments or expansions) (Afonso and Jalles, 2012). In the context of the Stability and Growth Pact (SGP) of the European Monetary Union, which was official in 1997, cyclically-adjusted measures have gained in importance, notably after the 2005 revision and reform of the SGP when it moved to the centre stage. It has become relevant to such an extent that the European Commission is responsible for calculating cyclically-adjusted balances (CAB) to examine whether or not each member country's fiscal situation can comply with the SGP requirements (maximum threshold of 3% budget deficit relative to GDP). Thus, all fiscal requirements of the pact are expressed net of cyclical conditions. The advantage of cyclically-adjusted measures compared to actual budget balances relies on the ability to isolate discretionary measures from the action of the automatic stabilizers that react to cyclical developments of the economy.

Multiple approaches have been proposed to calculate cyclically-adjusted government balances. One of the first attempts to extract the influence of the economic cycle from the budget balance was the full-employment approach by Brown (1956), which measured the budget deficit that would prevail in a full-employment economy. Brown (1956) showed the accuracy to the reality of the measure in the US 1930s as compared with the observed budget balance, although given the fact that modern economies stay far from full-employment, potential output (more specifically the output gap, the difference between potential output and real observed output) replaced full-employment as a reference of the economic cycle. Blanchard (1990) proposed an "indicator of discretionary change" based on the adjustment of the primary deficit by unemployment and relative to gross national product and the previous year's primary deficit. Initially, Blanchard (1990) warned of the need to adjust to interest rates and inflation, although it was fixed by applying the primary balance, which is net of interest payments. Other authors have applied more econometrically sophisticated methods to isolate the discretionary component of the changes in the budget balance, such as structural VARs (Dalsgaard and De Serres, 1999) and unobserved component models (Camba-Mendez and Lamo, 2002). Another way of gauging the CAB is the two-stage procedure[14] (Larch and Turrini, 2010) applied by the European Commission (EC) and OECD, which has come out on top in practice, although both institutions' measures differ. The EC's expression subtracts the product of the output gap in year t and the budgetary sensitivity to the nominal budget balance, taking into consideration four revenue categories and aggregating them in a weighted sum all revenue item elasticities while expenditure is adjusted by the unemployment rate. The OECD follows the same two-stage elasticity procedure differently, although revenues' elasticities are disaggregated into four cyclical components.

More recently, a new way of measuring the CAPB has appeared to improve the EC procedure. Carnazza et al. (2020) warned about the usage of the estimation of potential GDP *via* a production function based on the non-accelerating wage rate of unemployment (NAWRU) as the business cycle reference. According to Carnazza et al. (2020); FitzGerald (2014), the NAWRU is excessively dependent on recent observations of unemployment, which upwardly bias the NAWRU estimates in times of high unemployment. That being said, Carnazza et al. (2020) proposed a way to dispense with the estimation of potential GDP and, therefore, of the NAWRU, to compute the CAPB, and simultaneously focus only on the budgetary items, both revenues and expenditures, that automatically react to the business cycle. The idea is to choose the budgetary items whose cyclical component is significantly correlated with the cyclical component of GDP. Thus, these items will significantly react as automatic stabilizers and will clear the actual primary balance, finally isolating the discretionary fraction of the budget balance. Note that for simplicity reasons, following Blanchard (1990), the primary budget balance will be cyclically-adjusted, not the budget balance, since it automatically adjusts for inflation and interest rates.

Following Carnazza et al. (2020) 's methodology, firstly, the budgetary time series need to be seasonally adjusted. I have applied the most popular model-based seasonal adjustment method, Time series Regression with Autoregressive integrated moving average (ARIMA) errors and Missing Observations-Signal Extraction for ARIMA Time Series (TRAMO-SEATS), developed by the Bank of Spain (Gómez and Maravall Herrero, 1996). Additionally, I have converted the budgetary data in real terms by using the GDP deflator. Finally, all budgetary series and GDP have been decomposed into cycle and trend by using the Hodrick-Prescott (HP) filter (Hodrick and Prescott, 1997) with a smoothing parameter $\gamma = 1600$ given the quarterly frequency of the fiscal and GDP data. The next step is to calculate the elasticity of each budgetary item's cyclical component with respect to the cyclical

[14]The two-stage procedure used to calculate the CAB is based on the following expression:

$$CAB_t = BB_t - CC_t = BB_t - \epsilon \cdot OG_t, \tag{4.1}$$

where BB_t is the nominal budget balance in year t, CC_t is the cyclical component of the budget balance in year t, ϵ the budgetary sensitivity parameter (the difference between the revenue and expenditure elasticity) and OG_t the output gap in year t, which is preferably derived from the estimation of a production function method.

component of GDP. Thus, I will estimate the following expression by OLS after transforming the budgetary cycle series in logarithms, following Carnazza et al. (2020):

$$y^c_{i,t} = \gamma_i g^c_t + \epsilon_{i,t}, \tag{4.2}$$

where $y^c_{i,t}$ represents the log of the cyclical component of budgetary item i at time t, g^c_t the cyclical component of GDP at time t, γ_i the elasticity of the budgetary item i and $\epsilon_{i,t}$ the error term. At a 5% significance level, for revenues, taxes on production and imports, current taxes on income, wealth, etc, social contributions, and for expenditures, subsidies and social benefits other than in-kind transfers present a significant elasticity to the cyclical component of GDP[15].

Once the significant budgetary items have been selected, the CAPB can be calculated by clearing from the actual primary balance the significant cyclical components by storing each elasticity and each predicted values series ($\hat{\gamma}_i g^c_{i,t}$)):

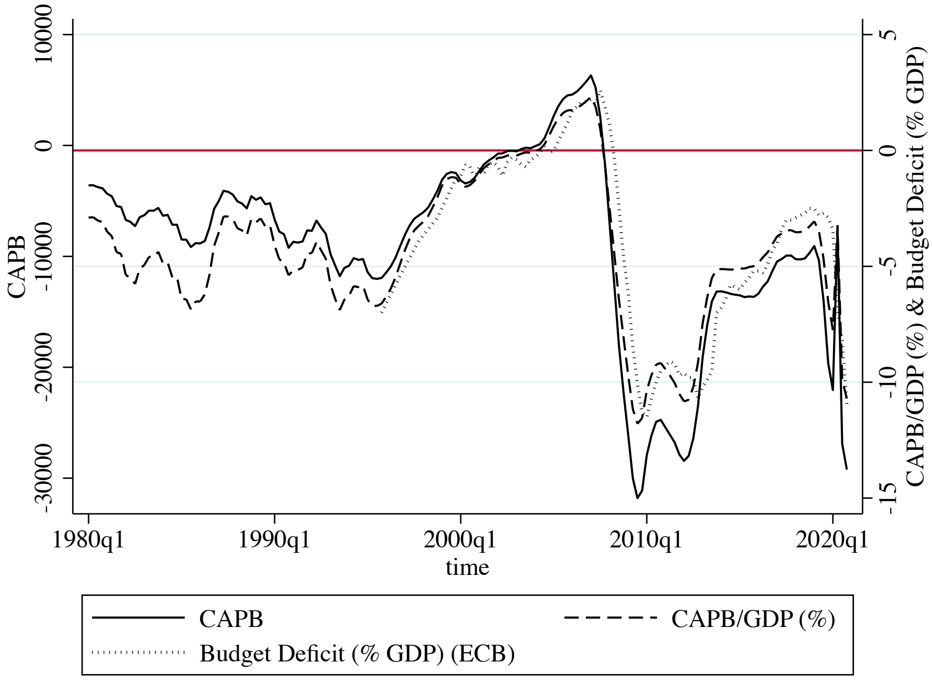
$$CAPB_t = (R_t - E_t) - \left\{ \sum_{i=1}^{n} R_{i,t}[1 - exp(-\hat{\gamma}_i g^c_{i,t})] - \sum_{i=1}^{n} E_{i,t}[1 - exp(-\hat{\gamma}_i g^c_{i,t})] \right\}, \tag{4.3}$$

where R_t represents total revenues at time t in Spain, E_t total expenditures (excluding interest rate payments), $R_{i,t}$ and $E_{i,t}$ are budgetary items revenues and expenditures, respectively, at time t, and each $\hat{\gamma}_i g^c_{i,t}$) represents the predicted value of the cyclical component of each significant budgetary item with respect to the cyclical component of GDP. The first bracketed element represents the actual primary balance of the Spanish government at time t, and the second element, the cyclical primary balance at time t. Therefore, the final result will be the discretionary part of the actual primary balance, the CAPB. Expression (3) can be easily interpreted: during a positive stage of the economic cycle ($g^c_{i,t} > 0$), budgetary items such as current taxes on income, wealth, etc, automatically rise ($\hat{\gamma}_i > 0$), therefore, the adjustment needs to be negative, thus, neutralizing the impact of the positive cycle. The contrary holds for expenditure items that increase during negative stages of the economic cycle ($g^c_{i,t} < 0$ and $\hat{\gamma}_i > 0$), such as social transfers and unemployment benefits, thus, the adjustment needs to be positive.

In addition to the calculation of the CAPB series, I have calculated CAPB normalized by GDP, the relative measure used by central banks and the EC to gauge the distance of each government's cyclically-adjusted budget deficit to the Stability and Growth Pact 3% negative threshold. Figure 4.1 presents both series for Spain from the first quarter of 1980 to the last quarter of 2020. Slight fiscal efforts (reductions of the CAPB) were made in Spain during the 1980s, with continuous relapses until mid-1990s related to the economic crisis of the beginning of the decade, when a path of fiscal consolidation was set by the Spanish government following the guidelines of the Maastricht Treaty of 1992. The government aimed to achieve a budget surplus, thus fulfilling the EC requirements. In the first quarter of 2007, the Spanish government reached a maximum historical CAPB surplus of 2.3%. However,

[15]Note that at a 10% significance level, for revenues, market production, taxes on production and imports, current taxes on income, wealth, etc, social contributions, other current transfers and capital transfers, and for expenditures, subsidies and social benefits other than in-kind transfers are significant. The final calculation of the CAPB is practically identical at both significance levels. Both levels will provide exact results, yet the more traditional level of significance, 5%, has been selected for the rest of the empirical analysis.

Figure 4.1: Evolution of the CAPB and budget deficit in Spain from 1980 to 2020



Source: CAPB and CAPB relative to GDP are author's elaboration (1980:1-2020:4) and Budget Deficit series (1995:4-2020:4) is from Bank of Spain quarterly data.

a real estate bubble finished bursting during the most healthy public finances, and the 2008 financial crisis hardly hit the Spanish state.

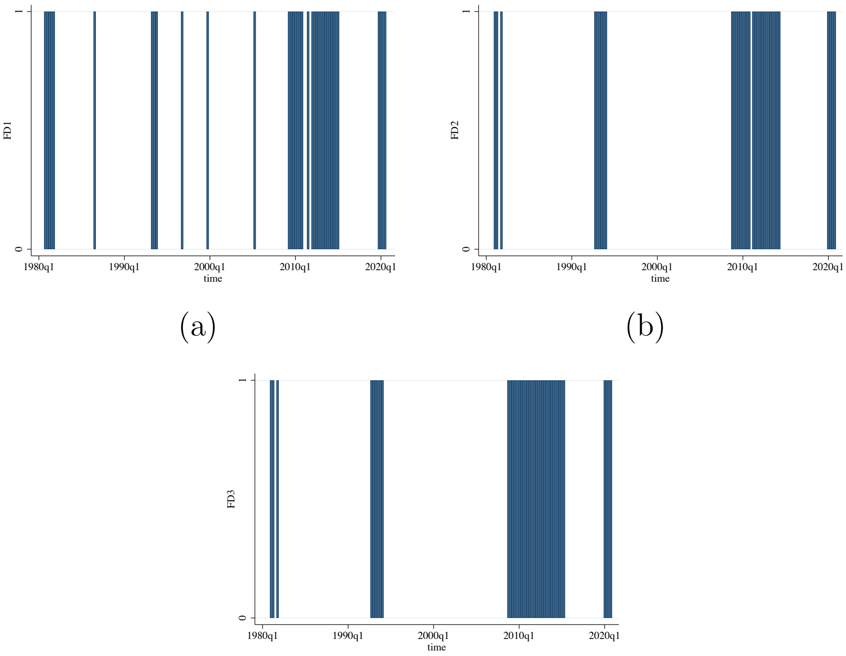
Consequently, expansionary fiscal measures were carried out, which worsened the public deficit until approximately 11.8% in the third quarter of 2009, given the exceptional effort on government expenditures and an enormously detrimental effect on revenues. After the financial crisis, a path of a required fiscal consolidation started, reaching up to a 3% deficit in the first quarter of 2019. However, COVID-19 forced the Spanish government to shift from the consolidation path and activate special fiscal stimulus packages to cushion the pandemic shock. Such effort has been reflected in a Spanish' public finances deterioration of a budget deficit equal to 10.7% during the last quarter of 2020, according to the normalized by GDP CAPB estimations. Overall, this estimated measure successfully captures the volatility of the budget deficit in Spain, although adjusted by the cycle. This fact is proven by comparing both series with Bank of Spain quarterly (from the last quarter of 1995) data on the Spanish budget balance relative to GDP (dotted line) (see Figure 4.1). Thanks to the calculation of the CAPB, I have extended the existing quarterly budget balance data for Spain until the first quarter of 1980 and simultaneously cyclically adjusted it. The adjustment is manifested in a more immediate caption of budget balance changes since the CAPB relative to GDP changes previously to the budget deficit. Additionally, the CAPB considers the economic cycle and presents a smoother fashion compared with the budget deficit.

The next step is to consistently identify episodes when the fiscal effort of the Spanish government to consolidate has been notable. The idea is to transform the CAPB relative to GDP, a continuous variable, into a discrete variable that consistently chooses a fiscal episode if the change of the CAPB during one year is more significant than a reference. To do so, I will apply various measures already existing in the literature that select different criteria to identify fiscal episodes and, therefore, different references.

The first was proposed by Afonso (2010) and determines that a fiscal consolidation episode occurs when either the change in the CAPB in one year is at least one and half times the standard deviation of the change in the CAPB series, or when the change in the CAPB is at least one standard deviation in average in the last 2 years. This identification criteria contains a multiplier of the standard deviation $\delta = 1.5$, following Afonso (2010). This dummy variable will be named $FD1_t$ in the posterior analysis.

In addition, I have computed the definition of fiscal consolidation episodes proposed by Alesina and Ardagna (1998), which takes as a reference changes in GDP and explains that the change in the CAPB is at least 2 pp of GDP in one year or at least 1.5 pp in 2 years on average. Note that this fiscal consolidation measure will be named $FD2_t$. Finally, I have computed Giavazzi and Pagano (1990) 's measure, which explains that the cumulative change in the CAPB is at least 5, 4, 3 pp of GDP in respectively 4, 3 or 2 years, or 3 pp in 1 year. Note that this fiscal consolidation measure will be named $FD3_t$.

Figure 4.2: Quarterly Fiscal Consolidation Episodes in Spain: Afonso (2010) (FD1), Alesina and Ardagna (1998) (FD2) and Giavazzi and Pagano (1990) (FD3).

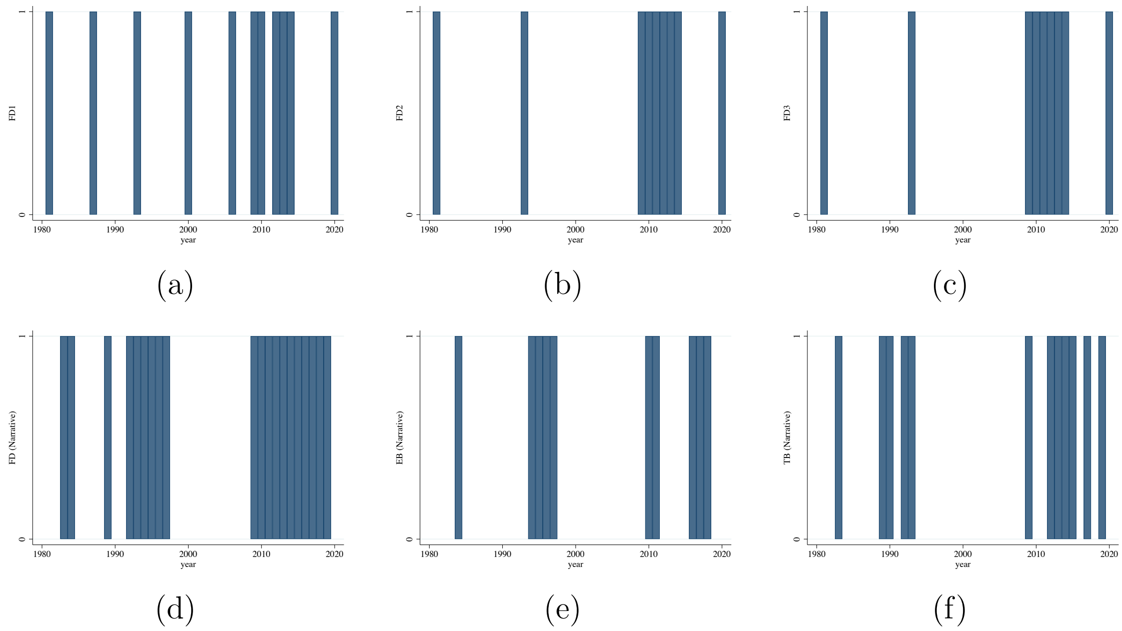


(a) (b) (c)

Note: Panel (a) corresponds to the application of Afonso (2010) (FD1), (b) to Alesina and Ardagna (1998) (FD2) and (c) to Giavazzi and Pagano (1990) (FD3) identification indicators. *Source:* Author's elaboration.

Hence, I have computed three different fiscal consolidation episodes indicators in quarterly terms, meaning that every quarter is compared with the quarter one year ahead. Additionally, and necessary for the first part of the estimation analysis, I have transformed both the CAPB and GDP in annual terms by computing the annual sum of the CAPB (in absolute terms) and GDP and then calculating the annual CAPB relative to GDP. Furthermore, I have applied the above fiscal consolidation definitions and computed annual fiscal consolidation episodes. Figures 4.2 and 4.3 represent the quarterly and annual frequency fiscal indicators, respectively. In both cases, $FD1$ captures more distributed through time fiscal episodes with a special focus during the 1980s and 1990s. Commonly with $FD2$ and $FD3$, fiscal episodes in 1981 and 1992 are identified.

Figure 4.3: Annual Fiscal Consolidation Episodes in Spain: Afonso (2010) (FD1), Alesina and Ardagna (1998) (FD2), Giavazzi and Pagano (1990) (FD3) and Devries et al. (2011)'s narrative approach extension.



Note: Panel (a) corresponds to the application of Afonso (2010) (FD1), (b) to Alesina and Ardagna (1998) (FD2), (c) to Giavazzi and Pagano (1990) (FD3) identification indicators, panel (d) to the narrative approach extension (Devries et al., 2011), panel (e) to expenditure-based episodes from the narrative approach, and panel (f) to tax-based episodes from the narrative approach. *Source:* Author's elaboration.

All indicators mainly capture fiscal efforts after the financial crisis and not long-lasting episodes during the beginning of both 1980s and 1990s. Note how these indicators capture fiscal consolidation episodes during the COVID-19 pandemic; since they are compared to changes in GDP, an aggressive decline of GDP leads to easier identification of a fiscal consolidation episode. Finally, conducting an exercise of comparison with the narrative approach (3 graphs at the bottom of Figure 4.3), there is a clear difference between *intention*, fiscal efforts meant to be realized in the subsequent periods by the Spanish governments that are captured by the narrative approach, and *action*, realized and observed fiscal consolidation episodes identified by the mentioned criterion. Multiple fiscal episodes are captured by the narrative approach during the 90s, 1983 and 1984 and a series of continuous fiscal efforts after the 2008 financial crisis. It is probably expected that the results underlying the application of the narrative approach in estimating the dynamics of the income distribution will differ from the application of the CAPB-based methods of fiscal consolidation episodes' identification. Note that the distribution between expenditure- and tax-based consolidations are similar. However, it is worth mentioning that the first and last consolidation measures conducted post-financial crisis are expenditure-based while tax-based during the consolidation path.

4.2 Empirical design: the dynamics of income distribution

In this section, I will investigate the short- and medium-term evolution of the income distribution in Spain by estimating the dynamic reaction to fiscal consolidations. *Via* Local Projections by Jordà (2005), I will compute Impulse Response Functions (IRFs) of each income share and Gini coefficient after a fiscal consolidation shock in pre- and post-tax terms and for every fiscal consolidation indicator. The objective is to analyze the dynamics of different segments of the Spanish income distribution, the potential divergence between the results when applying the conventional and the narrative approach, the divergence in the dynamics of the income distribution depending on the nature of the fiscal consolidation shock (expenditure- or tax-based), and the potential difference between pre- and post-tax estimations, which can provide information on the redistributive power of the Spanish fiscal system against the same fiscal consolidation shock.

This method has been selected over others capable of computing IRFs for many reasons. Alternatively, IRFs can be computed from the estimated coefficients of an autoregressive distributed lag (ARDL) equation estimation, as developed by Romer and Romer (1989) in the study of the effects of monetary policy shocks on the index of industrial production and unemployment, and Cerra and Saxena (2008) on the dynamic effects of political and financial crisis on economic growth. IRFs derived from ARDL estimation tend to be quite sensitive to the number of lags and the order of the autoregressive component, which makes the IRFs undesirably unstable. Additionally, highly persistent dependent variables, as it is the case in this paper[16], can be the reason for long-lasting effects with the application of ARDL models (Cai and Den Haan, 2009). Conversely, IRFs computed by LPs do not suffer from these problems because of the introduction of lags of the dependent variable as controls in the model, which are not taken into consideration for the computation of the IRF. Hence, the mentioned dependency of the dependent variable is not directly considered in the calculation of the IRF[17]. Also, another relevant advantage of the usage of LPs in the name of efficiency is the calculation of confidence bands by the computation of the standard deviations of the estimated coefficients; therefore, no bootstrapping techniques or Monte Carlo simulations are required.

As compared with the computation of IRFs *via* vector autoregressions (VARs), and as advocated by Stock and Watson (2007), LPs are a more flexible alternative given its non-imposition of dynamic restrictions and its robustness to misspecifications of the data generating process. In the case of the LPs, it is not necessary

[16]Such a statement means that the variability of income distribution and inequality series in the data sample used in this paper is low.

[17]The introduction of lags of the dependent variable as an explanatory variable has the aim of controlling for the own persistent dynamics of the variable, which is not directly considered in the estimation of the IRFs yet indirectly considered since it influences the estimated coefficient of the main explanatory variable.

to estimate a VAR model and derive the IRFs by transforming such a VAR into a moving average representation by appealing to Wold's decomposition theorem (Haug and Smith, 2012). Also, note the robustness of the method against small sample sizes[18].

Recent literature has used this method to investigate the effects of fiscal policy on the economy. Jordà and Taylor (2016) studied the dynamic impact of fiscal shocks represented by changes in the CAPB on GDP while considering the state of the business cycle (*booms vs slumps*). Focusing on spending-side effects and from a historical approach (1889-2015), Ramey and Zubairy (2018) estimated long-term LPs to investigate whether government spending multipliers in the US were higher during periods of economic slack and of near the zero lower bound interest rates or not. On the tax side, Cloyne et al. (2018) identified and created a new series of exogenous tax changes in the context of interwar Britain, employing the narrative approach and estimating its dynamic effects on GDP, unemployment rate, consumer price level and the Bank of England's policy interest rate. Similarly, Gupta and Jalles (2022) estimated the effects of tax reforms in developing countries, identified by Akitoby et al. (2020)[19], on income inequality, specifically on the Gini coefficient and income share of bottom 10%. Differently, Stolbov and Shchepeleva (2021) investigated macrofinancial linkages, for instance, the relation between economic policy uncertainty indices and industrial production, for a set of European countries from 1997 to 2019 although applying a quintile approach by introducing a transformation of the LP method by Barnichon and Brownlees (2019). Finally, Sarasa-Flores (2022) investigated the dynamic effects of discretionary changes in government spending in the EU on the income distribution.

Related with the dynamic effects of fiscal consolidations, Carriere-Swallow et al. (2018) focused on Latin America and the Caribbean countries and developed a new narrative dataset that identified changes in fiscal policy motivated by a desire to improve the budget deficit. By estimating IRFs *via* LPs, the authors investigated the dynamic effects on GDP, unemployment, private demand, current account, and real effective exchange rate, also differentiating by the state of the economic cycle. With a purely focused approach on the conditioning factors of the effects of fiscal consolidations on the main macroeconomic indicators, Banerjee and Zampolli (2019) modelled a difference-in-difference version of LP to estimate the effects of fiscal consolidations on GDP, employment, current account, government budget, inflation and monetary policy conditioned to the state of the business cycle, the monetary policy stance, the level of public debt, the strength of private credit growth and the occurrence of a financial crisis, for OECD countries from 1978 to 2007. Finally, and focused on 21 emerging markets from 2000 to 2018, David et al. (2019) estimated the dynamic effects of fiscal austerity announcements[20] on Emerging Markets Bond Index sovereign spreads, also conditioned to the state of the economic cycle.

More specifically, in hand with the idea addressed in this paper, the first work

[18]The reader is directly referred to Jordà (2005) for a further technical exposition of the characteristics of the computation of IRFs *via* LPs.

[19]The authors developed a novel narrative tax reform database for low-income countries and emerging markets.

[20]David et al. (2019) developed a daily narrative database based on the search of specific terms ("fiscal consolidation", "fiscal adjustment", "austerity", "tax reform", "tax adjustment", "spending cuts" and "budget cuts") on the central economics and financial newspaper outlets to capture the announcements on fiscal consolidations.

estimating the effects of fiscal consolidations on income inequality *via* LP was Ball et al. (2013). The authors worked on a panel data setting of 17 OECD countries over the period 1978-2009 and estimated the short- and medium-term effects of fiscal consolidations episodes by Devries et al. (2011) on the Gini coefficient for disposable income from the Standardized World Inequality Database (Solt, 2020) *via* a panel-corrected standard error (PCSE) estimator by OLS. Subsequently, Furceri et al. (2016) extended Ball et al. (2013) 's idea by providing robust results using the CAPB-based methods of fiscal consolidation identification applied in this paper and estimated the same PSCE estimator by OLS. Finally, the most recent published paper that has worked on this idea is Heimberger (2020). The novelty of this work was the extension of the period until 2013, counting on fiscal consolidations after the 2008 financial crisis, and the study of the effects on both gross and net Gini coefficients conditioned to the size of the fiscal adjustment, the state of the business cycle and the existence of financial crisis. Overall, from an aggregate perspective, these works have investigated average OECD short- and medium-term effects of fiscal consolidations on income inequality. The novelty of the present work relies on the investigation of a specific country, Spain. However, the most significant weight falls on the study of the mechanisms driving specific dynamics of the income distribution, primarily due to sample size reasons.

The basic idea of LP is to compare the conditional expectation (forecast) of the income percentile share given the information available at time t when a fiscal consolidation period starts, $FD_t = 1$, against the forecast absent the fiscal consolidation episode, $FD_t = 0$. This comparison can be characterised by the following expression:

$$\tau(h) = E(p_{t+h} - p_{t-1}|FD_t = 1; \Omega_t) - E(p_{t+h} - p_{t-1}|FD_t = 0; \Omega_t) \quad ; \quad h = 0, ..., H, \tag{4.4}$$

where $p_{t+h} - p_{t-1}$ refers to the change in the natural log of the income percentile share from the year the fiscal consolidation occurs to a future time h years later. FD_t is a dummy variable that takes value 1 if fiscal consolidation is occurring at year t, and 0 otherwise, and Ω_t refers to the information available at time t. The fiscal consolidation indicator will take the form of the CAPB-based identification methods (Giavazzi and Pagano, 1990; Alesina and Ardagna, 1998; Afonso, 2010) ($FD3$, $FD2$ & $FD1$, respectively) and the narrative approach (Devries et al., 2011). Both types of fiscal consolidation identification measures will be used in this part of the analysis, given the annual frequency nature of Devries et al. (2011) 's database.

Thus, the LP will consist of estimating τ_h, in this case, with a time horizon equal to 5 ($H = 5$) to capture the short- and medium-term dynamics of the income distribution. In particular, the following set of regressions will be estimated, and the coefficient of interest $\hat{\varphi}^h$ will be traced out to represent the response of each income percentile share up until five years[21] ahead of the fiscal consolidation episode:

$$p_{a,t+h} - p_{a,t-1} = \gamma_t^h + \sum_{j=1}^{l_1} \beta_j p_{a,t-1-l_1} + \varphi^h FD_t + \vartheta^h X_t + \varepsilon_t^h, \tag{4.5}$$

where $\hat{\tau}(h) = \hat{\varphi}^h$, and $p_{a,t}$ is the natural log of the income distribution percentile share. Note that subindex a refers to all income share deciles, the top 1 share

[21]The selection of a time horizon equal to 5 ($H = 5$) is due to that higher time horizons would mean a significant proportion of the time sample size. Thus, to study short- and medium-term effects, a maximum time horizon equal to 5 is suitable for the study and sample size.

of the income distribution and the Gini coefficient, all in both pre- and post-tax terms, thus, $a \in [0-10, 10-20, 20-30, 30-40, 40-50, 50-60, 60-70, 70-80, 80-90, 90-100, 99-100]$ and the Gini coefficient. Additionally; γ_t^k denotes time-variant characteristics, the model includes up to three lags of the dependent variable to control for the own dynamics ($l_1 = 3$), and ε_t^h is the projection residual. The coefficient of interest, φ^h, denotes the cumulative response of the variable of interest, p_a, in each h year after the fiscal consolidation. In interpretation terms, the dependent variable, $p_{a,t+h} - p_{a,t-1}$ refers to the log transformation change of variable p_a in an expanding window, which comes to mean that impulses can be interpreted as cumulative percent changes of the p_a after the shock.

Following Furceri et al. (2016), potential unobserved factors influencing the dynamics of income inequality and income distribution can also affect the probability of occurrence of a consolidation episode, which could be a source of endogeneity omitted variable bias. Thus, *via* automatic stabilizers, a relevant deterioration in economic activity may provoke an increase in the budget deficit and therefore increase the probability of fiscal consolidation. Accordingly, vector X_t will be composed of a discrete variable indicating crisis episodes (banking, debt and currency crises[22]) from the Systemic Banking Crises Database by Laeven and Valencia (2020), the change in economic activity (proxied by real GDP growth rate) and the change in total unemployment rate.

Regarding the selected estimator, LPs will be estimated *via* OLS with Newey-West standard errors[23], a type of Heteroskedastic and Autocorrelation Consistent (HAC) standard errors, given the autocorrelation of the LP residuals and the potential autocorrelation between the independent variables, consistent to the way practitioners estimate LPs (Ramey, 2016). The estimation of HAC standard errors is supported by Jordà (2005), who argued that since the true data generating process is unknown, Generalized Least Squares (GLS) is not possible, and HAC standard errors must be applied.

4.3 The mechanisms behind income distribution dynamics

The existing literature dealing with the dynamic effects of fiscal consolidations on income inequality has briefly addressed the channels through which these dynamics occur (Ball et al., 2013; Furceri et al., 2016; Heimberger, 2020). In this section of the paper, I rely on suggestions of mechanisms presented in the existing literature, and I will propose new mechanisms potentially driving income distribution dynamics.

Once the dynamics of the different segments of the income distribution have been identified, the next objective is to select and model the mechanisms driving the specific dynamics. Different variables will explain the dynamics occurring in the lower and medium tail of the distribution and others in the upper part. Additionally, it

[22]For the case of Spain, the database identified a currency crises in 1983, and the systemic banking crisis in 2008.

[23]The selection of the maximum lag considered in the autocorrelation structure follows the criteria of Newey and West (1986), who established that the maximum lag (l_m) should be equal to $T^{1/4}$, where T is the sample size. In this particular annual data setting, $l_m = 3$, which has been rounded upwards. Note as well that the selection $l_m = 2$ does not change the results.

will be under investigation to what extent these mechanisms' reactions to fiscal consolidation episodes depend on the state of the economy. In other words, investigate the role of business cycle conditions for the effects of fiscal consolidations on the mechanisms driving income distribution dynamics, following Furceri et al. (2016); Heimberger (2020). Thus, I will allow the impact of consolidation shocks to vary over the business cycle following Auerbach and Gorodnichenko (2013) 's approach, which will provide valuable information on the characteristics of the dynamic effects. Note that this section of the paper is based on the usage of higher frequency data, quarterly data for Spain from the first quarter of 1980 to the fourth quarter of 2020.

4.3.1 Mechanisms driving low and medium tail dynamics

The range of actions a government can take to pursue fiscal consolidation is very broad, from changes in multiple tax rates to reductions in public employee wages. In turn, the range of mechanisms by which the income level of individuals is affected is also extensive. Consolidation actions, as investigated earlier, affect the income of the low and medium parts of the distribution. Following the traditional view of income split into wages, profits and rents, only the richest have access to income in the form of profits and rents. Therefore, the vast of the income of the low and medium tail comes from wages, as expressed by Ball et al. (2013). Hence, these ideas give rise to theorizing that fiscal consolidations will probably affect wages given the effects on the low and medium parts with applying the CAPB-based method. The natural question following this reasoning is: What mechanism drives this alleged evolution of wages after fiscal consolidations? The best-positioned candidate is unemployment.

According to Ball et al. (2013) 's reasoning, unemployment could be the indirect channel driving wage income declines. The authors focused on short- and long-term unemployment[24] to explain the dynamics of income inequality and found increasing short- and long-term unemployment[25] after fiscal consolidations. Additionally, yet applying a different methodological approach, Turrini (2013) explored the effects of fiscal consolidations, measured by changes in the primary balance, on the cyclical component of unemployment[26] *via* a two-order autoregressive model (AR(2)), and found increasing unemployment after fiscal consolidations, amplified in the case of tax-based consolidations. Regarding the effects on wages, Ball et al. (2013); Furceri et al. (2016) studied the dynamic reaction of the share of wage income in GDP after fiscal consolidations, and found a reduction of the *slice of the pie* going to only wage earners.

Thus, I will estimate the short- and medium-term dynamics of unemployment and wages after fiscal consolidation shocks with a time horizon equal to 20 quarters ($H = 20$) which is equivalent to a time horizon of 5 years. Thus, the homogeneity in the time horizon units is reached to facilitate the comparison power of the analysis. The quarterly unemployment rate refers to total unemployment and wages to the total compensation of salaried employees. The following set of LPs will be estimated, and the estimated coefficient of interest $\hat{\psi}^h$ will be traced out to represent the IRFs

[24] Ball et al. (2013) based on an annual panel data setting, which highly facilitates the obtainment of data on short- and long-term unemployment (people who have been unemployed for 12 months or more). In the present paper, working with quarterly frequency data highly limits the usage and finding of short- and long-term unemployment data.

[25] As Ball et al. (2013) highlighted, the effects are significant for long-term unemployment.

[26] Turrini (2013) additionally presented similar results on the total unemployment rate.

of unemployment and wages:

$$u_{t+h} - u_{t-1} = \gamma_t^h + \sum_{j=1}^{l_1} \beta_j u_{t-1-l_1} + \psi^h FD_t + \vartheta^h M_t + \varepsilon_t^h, \qquad (4.6)$$

where u_t is the natural log of total unemployment rate, which will take the form of wages (w_t) as well. In this case, the model includes up to twelve lags of the dependent variable to control for the own dynamics of unemployment and wages ($l_1 = 12$). The rest of components of the model are the same as in model (4.5). In interpretation terms, ψ^h denotes the cumulative percentage change of unemployment and wages in each h quarter after a fiscal consolidation episode.

Given the quarterly frequency nature of this part of the analysis, FD_t will be, in this case, in the form of CAPB-based identification methods (Giavazzi and Pagano, 1990; Alesina and Ardagna, 1998; Afonso, 2010). The application of the narrative approach by Devries et al. (2011) is not possible in this quarterly data setting. Note as well that these LPs will be estimated *via* OLS with Newey-West standard errors as model (4.5).

Vector of controls M_t will be composed of determinants of aggregate unemployment. Following the study of the dynamic effects of credit contractions on unemployment *via* LPs Borsi (2018), M_t will include CPI inflation rate from OECD data, total population, the output gap measured as the cyclical component of GDP[27], GDP growth and trade openness which is measured as the sum of exports and imports of goods and services relative to GDP. Note that all variables are in quarterly terms from the first quarter of 1980 to the fourth of 2020. All control variables are also introduced in natural logs in the model to homogenize interpretation to percentage terms.

State-of-the-cycle dependence: low and medium parts

As presented before, model (4.6) includes as controls the output gap and GDP growth, which extract the influence of the state of the economy from the relevant estimated coefficient, $\hat{\psi}^h$. However, the inclusion of these variables does not provide *per se* information on how dependent the dynamic effects of fiscal consolidations on unemployment and wages are on the economic cycle. Probably, these effects could be accentuated in times of economic recession, as found by Heimberger (2020) on average for 17 OECD countries.

Concretely, I will apply the method developed by Auerbach and Gorodnichenko (2013) to introduce the business cycle dependence in the model through two simple interactions. This method has been recently applied in the study of the dynamic effects of tax reforms on income inequality (Gupta and Jalles, 2022). Thus, I will modify model (4.6) to include that the dynamic response is now allowed to vary with the state of the economy:

$$u_{t+h} - u_{t-1} = \gamma_t^h + \sum_{j=1}^{l_1} \beta_j u_{t-1-l_1} + \psi_r^h F(z_t) FD_t + \psi_b^h (1 - F(z_t)) FD_t + \vartheta^h M_t + \varepsilon_t^h, \quad (4.7)$$

[27]Note that the cyclical component of GDP has been computed by applying the HP filter as conducted in the calculation of the elasticities of each budgetary item in the computation of the CAPB.

with

$$F(z_t) = \frac{exp(-\gamma z_t)}{1 + exp(-\gamma z_t)}, \quad \gamma > 0, \tag{4.8}$$

where z_t is an indicator of the state of the economic cycle, real GDP growth, which has been normalized to zero mean and unit variance, following the specifications of Auerbach and Gorodnichenko (2013). The weighting function $F(.)$ assigns to each state a value varying between 0 and 1, which can be interpreted as the probability of being in a given state of the economy. Coefficient ψ_r^h will capture the dynamic effects of fiscal consolidations on unemployment and wages in case of extreme recessions ($F(z_t) \approx 1$) and ψ_b^h in case of booms ($(1 - F(z_t)) \approx 1$). According to Auerbach and Gorodnichenko (2013), I choose $\gamma = 1.5$, which will mean that the Spanish economy spends approximately 20 per cent of the time in a recessionary regime, which is realistic considering the impact of the devaluation crisis of 1993, long-lasting effects of the 2008 financial crisis and the short impact in the sample of the pandemic. Thus, the model will be estimated with non-linearities of the effect of fiscal consolidations.

4.3.2 Mechanisms driving upper tail dynamics

Once the mechanisms driving low and medium tail dynamics have been addressed, I will investigate which factors can explain the dynamics occurring in the upper part of the Spanish income distribution and its dependency on the prevailing business conditions. The literature on this specific topic is relatively scarce, the reason why I will propose one mechanism potentially driving the upper tail dynamics in the Spanish economy.

Previous works have focused on the evolution of the share of profits and rents on GDP to explain whether the *slice of the pie* going to profit and rent recipients, mainly upper tail individuals, increased or not after fiscal consolidation episodes (Ball et al., 2013; Furceri et al., 2016). The absence of share of profits data in quarterly frequency obligates the researcher to search for another factor. In this case, I propose the reaction of the closing price of the stock price index of Spain from the third quarter of 1993 to the fourth quarter of 2020, the IBEX35, from Bolsas y Mercados Españoles Market Data (Spanish Stock Exchanges and Markets). In addition, and to extend the estimation sample size, I have collected data on the share prices indices from the first quarter of 1985 to the fourth quarter of 2020 from OECD data for Spain. These series are calculated from the closing date prices of common shares of companies traded on national or foreign stock exchanges. Both series are practically identical, as presented in Figure A.10 in Appendix A. Hence, their estimation will provide practically similar results.

The relation between fiscal policy and the stock market has been theoretically addressed (Tobin, 1969; Blanchard, 1981; Shah, 1984; Charpe et al., 2011). Tobin (1969) presented a model that allowed for both monetary and fiscal policy to affect stock market outcomes and argued that fiscal policy affected stock markets *via* effects on interest rates and the confidence effects on long-run sustainability of budgetary position. In addition, fiscal policy can affect the level of economic activity, which in turn implies effects on the stock market. Following Blanchard (1981), the effect of changes in either current or anticipated fiscal policy provokes changes in the anticipated sequence of interest rates and profits, which in turn affects the stock market. The role of anticipation and expectations of stock market operators is quite relevant when assessing the link between fiscal policy and stock markets. Depending on the view adopted by stockholders (Keynesian, Ricardian or Neoclassical[28]), the expected effects of stock markets are disparate. In a Keynesian context, public deficit expansions will positively affect stock prices. From a Ricardian vision, fiscal maneuvers should not affect stock indexes. Following Neoclassical theory, rising budget deficits will raise total life consumption, and interest rates will go up to bring capital markets to balance, which harms stock prices. Hence, the effect of fiscal policy on stock prices will depend on the view adopted by stock operators.

Evidence is mixed regarding the limited empirical literature on the link between stock markets and fiscal policy. Van Aarle et al. (2003) found by estimating a structural VAR (SVAR) that after an increase in public deficit in the EMU, Japan and U.S. stock prices rise. Focusing on the U.S., U.K., Germany and Italy, Afonso and Sousa (2011) also estimated a SVAR model and found an adverse and transitory reaction of stock prices to an increase in the public deficit. Using a panel of OECD countries from 1960 to 2002, Ardagna (2009) showed that stock market prices increase around times of fiscal consolidations and plunge in periods of loose fiscal policies. From an enticing perspective, Beetsma et al. (2015) studied the effects of fiscal consolidations on private sector confidence, using long-term sovereign debt interest rates and stock prices as measures of confidence, and found that fiscal consolidations that occurred when the output gap was positive, produced a significant fall in the stock index. Finally, Foresti and Napolitano (2016) estimated by dynamic ordinary least squares (DOLS) a model, with up until one lag, of stock price determination and found that fiscal maneuvers influenced stock markets by decreasing (increasing) stock markets indexes following an increase (decrease) in the public deficit.

Contextualizing the case of Spain, in 2020, 17.1% of total stocks were directly owned by families (Spanish Stock Exchanges and Markets). In 2017, 11.6% of total households in Spain owned listed shares, according to the Encuesta Financiera de las Familias 2017 (*Family Financial Survey*) (Bank of Spain), from which a significant fraction was owned by the top 10% of the income distribution. More concretely, according to Chancel et al. (2021) the wealthiest 10% of the Spanish population owned 58% of total household wealth. This concept includes all financial assets (e.g. stocks and bonds) and non-financial assets (e.g. housing) net of debts. Hence, a decrease in stock prices after a fiscal consolidation shock will negatively affect the power of income generation streaming from the stock assets of the richest, which in turn will be translated into a decrease in the income share. The estimation of the following LPs with a time horizon equal to 20 quarters ($H = 20$) aims to provide evidence of the dynamic reaction of stock prices after episodes of fiscal consolidations in Spain:

$$s_{t+h} - s_{t-1} = \gamma_t^h + \sum_{j=1}^{l_1} \beta_j s_{t-1-l_1} + \zeta^h FD_t + \vartheta^h Z_t + \varepsilon_t^h, \tag{4.9}$$

where ζ^h denotes the cumulative percentage change of stock prices in each h quarter after a fiscal consolidation episode, s_t is the natural log of the share price index of Spain, and the rest of elements are the same as in model 4.9, except for the composition of the vector of controls. Following Foresti and Napolitano (2016), the vector of controls Z_t includes the natural log money supply (M3 from Bank

[28]See Bernheim (1989) for a thorough explanation of these economic views on budget deficits.

of Spain), GDP growth and long-term interest rate (OECD data). In addition, following the seminal work by Cohn and Lessard (1981), the natural log of inflation will be included as a determinant of stock prices. Note that the set of LPs will estimated again *via* OLS with Newey-West standard errors.

State-of-the-cycle dependence: upper tail

Additionally, I will estimate the dependence of the effects on stock prices on the prevailing business conditions motivated by the great volatility of stock prices in times of economic recessions (Hamilton and Lin, 1996), in line with the idea of model (4.7):

$$s_{t+h} - s_{t-1} = \gamma_t^h + \sum_{j=1}^{l_1} \beta_j s_{t-1-l_1} + \zeta_r^h F(z_t) FD_t + \zeta_b^h (1 - F(z_t)) FD_t + \vartheta^h Z_t + \varepsilon_t^h, \quad (4.10)$$

with the log of share price index as the dependent variable, and vector Z_t of controls to estimate whether the effect of fiscal consolidations on stock prices depends on the prevailing business conditions *á la* Auerbach and Gorodnichenko (2013). Only few works have investigated this topic. Beetsma et al. (2015) found that during periods of rapid economic growth fiscal consolidations had negative effects on stock prices, and on the contrary, Foresti and Napolitano (2016) estimated that stock prices reacted negatively to fiscal consolidations during periods of crisis. The scarce literature addressing this idea and the disagreement present a perfect opportunity to investigate the state-of-the-cycle dependence of the dynamic effects on stock prices for Spain.

5

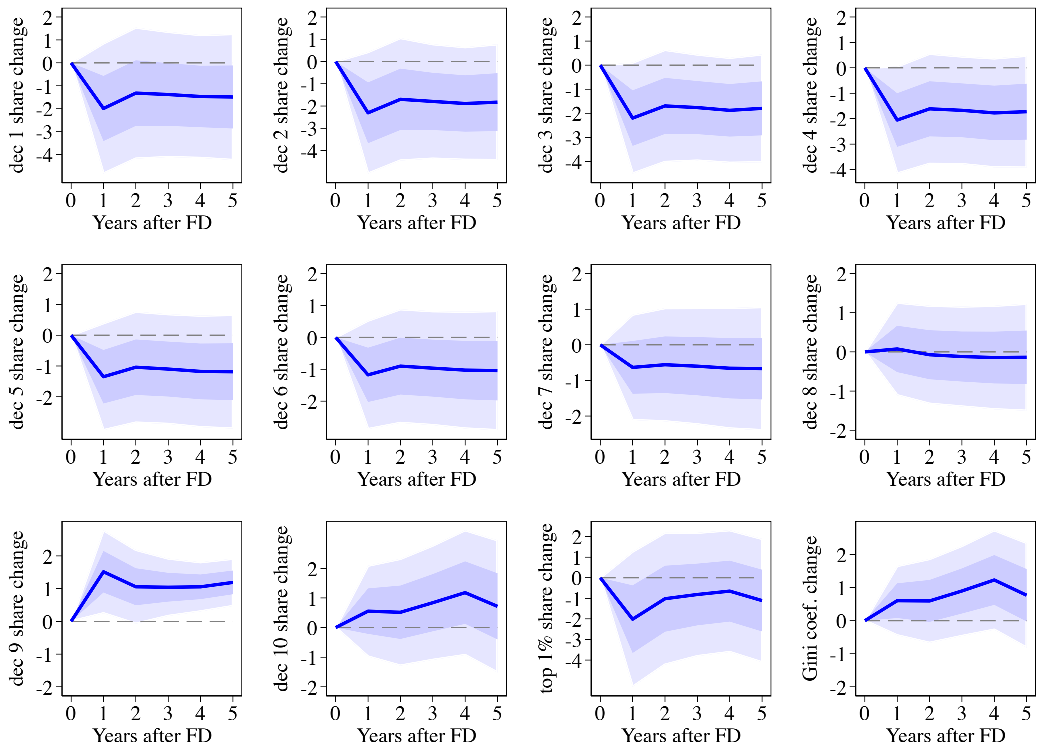
Results

5.1 Fiscal consolidation effects on the income distribution

Given the significant amount of results derived from estimating model (4.5), I decided to present in this section the results from the application of Afonso (2010)'s indicator ($FD1$). The results derived from the application of $FD2$ and $FD3$ are presented in Appendix A, which simultaneously works to show the robustness of the results by changing the definition of the shocking variable. The dynamic impacts of fiscal consolidation episodes in Spain, defined by Afonso (2010)'s criteria, on income distribution and the Gini coefficient are shown in Figure 5.1 (pre-tax terms) and Figure 5.2 (post-tax terms). For every figure containing IRFs from LPs the first row shows from the first income decile share to the fourth (1^{st}, 2^{nd}, 3^{rd}, 4^{th} deciles, in this ordering), the second row from the fifth to the eight, and the third row contains the ninth, tenth, the top 1 per cent and the Gini coefficient. Each figure shows the estimated IRF (blue line) and 1 and 2 standard error bands (blue shaded areas). The horizontal axis measures the years after the start of the fiscal consolidation episode, and the vertical axis shows the cumulative percentage change of each dependent variable.

In general, fiscal consolidation episodes are followed by heterogeneous dynamics occurring in the pre-tax income distribution (Figure 5.1), globally represented in the Gini coefficient dynamics. The lowest part tail of the income distribution, from the 1^{st} to the 4^{th} decile, is negatively and persistently affected —the effect is practically similar for every decile. In magnitude terms, it is remarkable how these deciles worsen up to 2% one year after the shock, maintaining in the medium term an asymptotic value close to 2%. Regarding the middle part of the distribution, from the 5^{th} to the 10^{th} decile, there is a slighter deterioration of income shares as compared with the low part. These deciles are progressively less affected, to such an extent that the 8^{th} is practically not impacted. Differently, the upper part of the distribution, deciles 9^{th} and 10^{th}, and the top 1%, is benefited from fiscal consolidations, especially the 9^{th} and 10^{th} deciles, however, the top 1% share is negatively and temporarily affected. The overall image of these dynamics is shown in the evolution of the pre-tax Gini coefficient. This positive yet transitory effect means an increase in income inequality up to 4 years after the shock when the cumulative effect is equal to 1 pp.

Figure 5.1: Impulse response functions estimated from model (4.8): pre-tax income decile shares response after Afonso (2010) (FD1) shock



Note: the solid blue line corresponds to the cumulative IRF (φ^h estimated coefficients) and limits of the blue areas correspond to 1 and 2 standard errors confidence bands. The x-axis denotes time in: $t = 0$ is the year of the fiscal consolidation episode. And time horizon is $H = 5$.

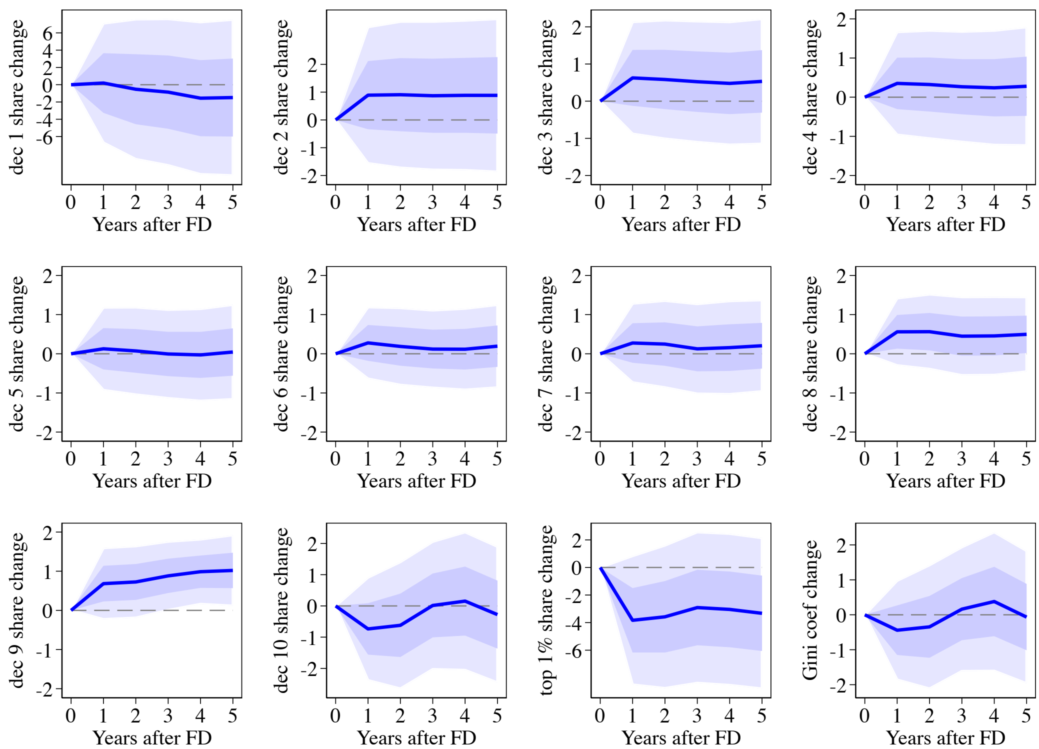
Once income has been redistributed through the system of income transfers, benefits and taxation, the dynamic effects on income distribution naturally change. The impact on the post-tax income distribution substantially changes as compared with pre-tax results, as presented in Figure 4.8. Hence, there are signs of redistribution of the Spanish fiscal system. The low part of the distribution cushions the detrimental effect experienced in pre-tax terms thanks to the transfers system. Note that even positive effects are perceived on the 2^{nd} and 3^{rd} decile shares.

Additionally, the middle segment appears intact after the shock, again due to the redistributive system. Finally, the effects on the upper part are expected: the improvement in the situation of the lower part of the distribution is offset by the temporary deterioration of the top 10% and the persistent deterioration of the top 1%. In magnitude terms, the drop of up to 4 percentage points of the top 1% is remarkable. However, note the maintained improvement of the 9^{th} decile share. These effects are reflected in the fluctuating-around-zero dynamic reaction of the post-tax Gini coefficient.

Similar conclusions are drawn from analysing the results using the criteria by Alesina and Ardagna (1998) ($FD2$) and Giavazzi and Pagano (1990) ($FD3$). $FD2$ results are presented in Appendix A in Figures A.3 and A.4 (pre- and post-tax, respectively) and $FD3$ results in Figures A.5 and A.6 (pre- and post-tax, respectively). Overall, both indicators present common dynamics with the application of FD1 criteria. Since the three indicators identify similar episodes of fiscal consolidations in Spain, the results from the regression analysis are similar. Only note that

i) in pre-tax terms, income inequality continues to increase, ii) in post-tax terms, the top 1% continues to suffer from the effects of consolidation coupled with the effect of income extraction *via* taxation, thus showing the action of the redistributive system, and iii) in both pre- and post-tax terms the 1^{st} decile is extraordinarily negatively affected. A feature that could be explained by the historical increases in the value-added tax (VAT) in Spain since 1992, the year of the creation of the law by the head of state (Law 37/1992). This tax, which is regressive by nature, underwent a general rate increase between 1992 and 1995 from 12% to 18%, which directly affected the level of income in post-tax terms of the most vulnerable part of the distribution, the 1^{st} decile. Note that CAPB-based methods identify fiscal consolidation episodes between 1992 and 1995.

Figure 5.2: Impulse response functions estimated from model (4.8): post-tax income decile shares response after Afonso (2010) (FD1) shock



Note: same as in Figure 5.1.

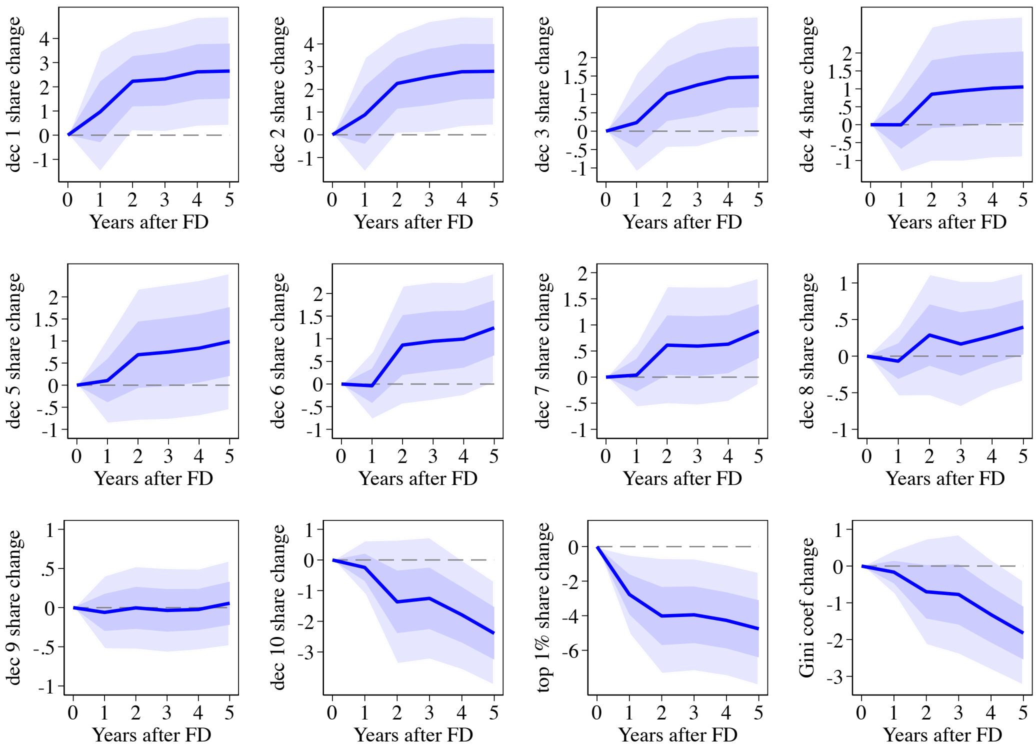
The enticing feature of this analysis is the assessment of the dynamics inside the income distribution, which in global terms explain the dynamics of income inequality (Gini coefficient). These results coincide with the general view in the literature that fiscal consolidation episodes are associated with increases in income inequality (Ball et al., 2013; Agnello and Sousa, 2014; Furceri et al., 2016; Heimberger, 2020). However, there is a point regarding past evidence and its comparability with the present paper. In this part of the analysis, CAPB-based methods have been applied to study the link between fiscal consolidations and income inequality, which is the case as well in Furceri et al. (2016); Heimberger (2020). These works conducted a comparison of the results between the usage of the narrative approach (Devries et al., 2011) and CAPB-based methods. In particular, both works applied the definition by Afonso (2010). The results were similar to the findings of this first part of the analysis.

The natural question that follows these facts is whether the Spanish income distribution reacts similarly after shocks of fiscal consolidation identified by CAPB-based methods ("conventional") and shocks identified by the narrative approach or not. If these results do not coincide, there is a clear divergence between the effects of policy intentions and observable actions. Also, note that the average results obtained from previous literature may hide the fact that specific countries in the chosen sample have behaved contrary to the average, which is why this study of the Spanish case may lead to different conclusions from previous studies[29].

5.1.1 Conventional vs Narrative Approach

So far, I have based the results on the conventional method of identifying fiscal consolidation episodes, the set of CAPB-based methods. In this section, I present the results from estimating model (4.5) by applying the Devries et al. (2011) narrative approach (concretely the extension of Devries et al. (2011) and later Alesina et al. (2020) dataset for the case of Spain). The IRFs of the set of dependent variables of interest with a time horizon equal to 5 have been traced out in Figures 5.3 and 5.4, in pre- and post-tax terms, respectively.

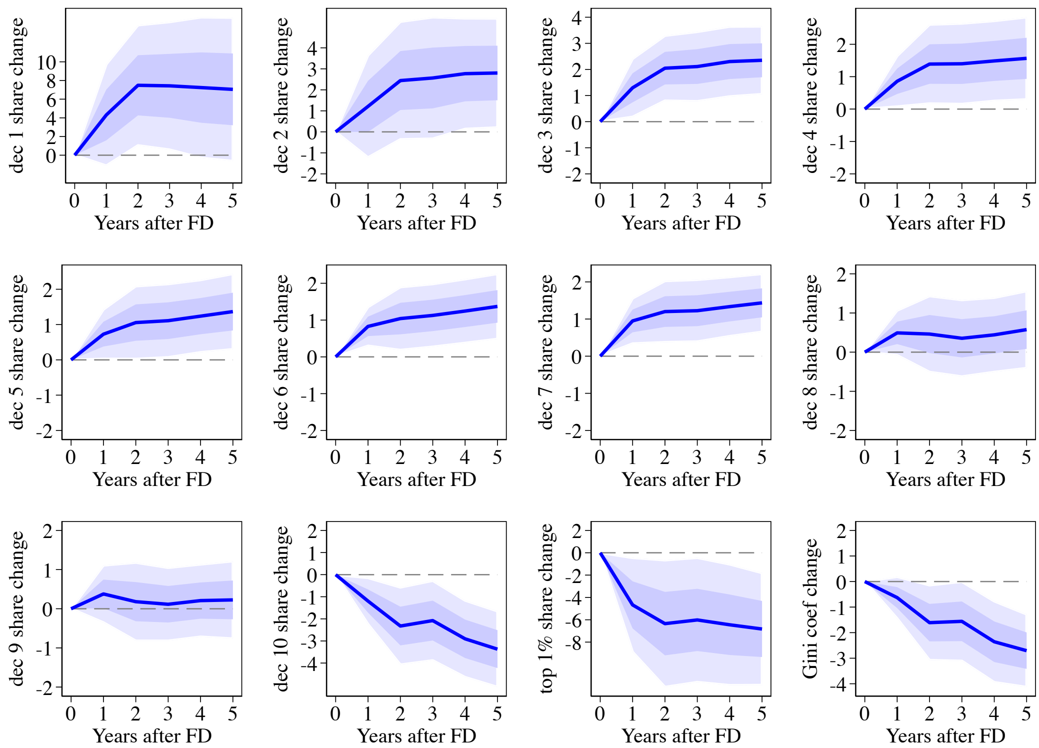
Figure 5.3: Impulse response functions estimated from model (4.8): pre-tax income decile shares response after narrative approach (Devries et al., 2011) shock



Note: same as in Figure 5.1.

[29]Note also that the results and conclusions from this part of the analysis, the study of the dynamics of the income distribution, should not be taken as strong evidence given the limited sample size. However, the second part of the analysis, the study of the mechanisms, counts with a more robust power of explanation of reality given the usage of quarterly frequency data. Hence, this part of the analysis should be interpreted as an intuition of the direct dynamic effects on the income distribution.

Figure 5.4: Impulse response functions estimated from model (4.8): post-tax income decile shares response after narrative approach (Devries et al., 2011) shock



Note: same as in Figure 5.1.

Overall, the heterogeneity in the income distribution dynamics is of higher notability. The lower tail of the distribution is favoured to a higher degree (greater magnitude) than with CAPB-based methods, and the positive effect persists through time until reaching the maximum time horizon. The impact on the medium part of the distribution appears to be greater with the narrative approach, although lower than the lower tail effects. With regards to the upper tail (10^{th} decile and top 1%), the results present highly detrimental effects, persistent through time, and more significant in magnitude in post-tax terms. These observed dynamics are represented in the evolution of the Gini coefficient, a persistent and positive effect on income inequality alleviation, more excellent in magnitude in post-tax terms (in absolute values).

There is a great difference between "conventional" and "narrative" approach results. This in-magnitude-divergence reflects the existing and mentioned difference between *intention* and *action* from the Spanish government. The fiscal consolidation timing highly influences the effects on income distribution, as seen with this comparison.

A couple of notes on the differences between capturing episodes of both approaches need to be made. There is a continuous intention of consolidation during the 2010s identified by the narrative approach, which coexists over time with the decline of the pre-tax Gini coefficient after 2015, which means an increase in income equality (Figure 3.2 from the data chapter) and the notable improvement of the bottom 40% of the pre-tax distribution right after 2015 (Figure 3.1). However, CAPB-based methods capture a detour from the consolidation path in 2015, and hence, these are not considered to have an alleviation effect on income inequality after 2015 potentially.

Regarding consolidation episodes during the 1980s, the narrative approach captures adjustments in 1983, 1984 and 1989. As presented in detail by Devries et al. (2011), in 1982, the Spanish government aimed to reduce the budget deficit in 1983 by an upward adjustment in rates of indirect taxes and withholdings for personal income tax. However, as presented in Figure 4.1, the CAPB relative to GDP augmented during 1983. A similar event happened in 1984; by spending cuts equivalent to 0.75% of GDP and tax hikes of 0.37% of GDP, the Spanish government intended to restrain the budget deficit with a package of measures meant to be implemented in 1984. This intention is not reflected in an improvement of the CAPB relative to GDP during 1984; indeed, the contrary occurred. The last intention during the 1980s to consolidate the budget balance was in 1989; the 1989 Spanish general budget called for a strengthening in the finances by increasing direct taxes (income and property). However, the CAPB relative to GDP officially experienced a continuous deterioration during 1989. The great decline in income inequality observed after 1989 (Figure 3.2) coincides with the attempt to consolidate.

During the 1990s, continuous intentions of consolidation were stated by the Spanish government, especially during 1992-1997[30]. CAPB-based methods only identify adjustments in 1993, a period of a slight improvement in the budget balance. However, years after 1993 show a fluctuating CAPB relative to GDP, consistently improving until 2000. The second part of 1990 again coexists in tome with a notable decline in income inequality.

Overall, there is a clear divergence between intention and observed results from a purely descriptive perspective, supporting the predictions and estimations from the estimation. The effects of the narrative approach could be more related to decreases in income inequality in Spain, as opposed to the harmful effects of CAPB-based episodes using descriptive intuition, which is yielded from the results.

These results coincide with another strand of literature that shows that episodes of fiscal consolidation are associated with a decreasing income inequality (Agnello and Sousa, 2012; Rawdanowicz et al., 2013; Agnello and Sousa, 2014). More specifically, Agnello and Sousa (2012) found that fiscal adjustments were negatively linked with income inequality, leading to a reduction of the income gap. Rawdanowicz et al. (2013) expressed that fiscal consolidations *via* increasing household direct taxes would reduce income inequality. Similarly, Agnello and Sousa (2014) found that while fiscal consolidations driven by spending cuts have detrimental effects on the income distribution, tax hikes have an equalizing effect.

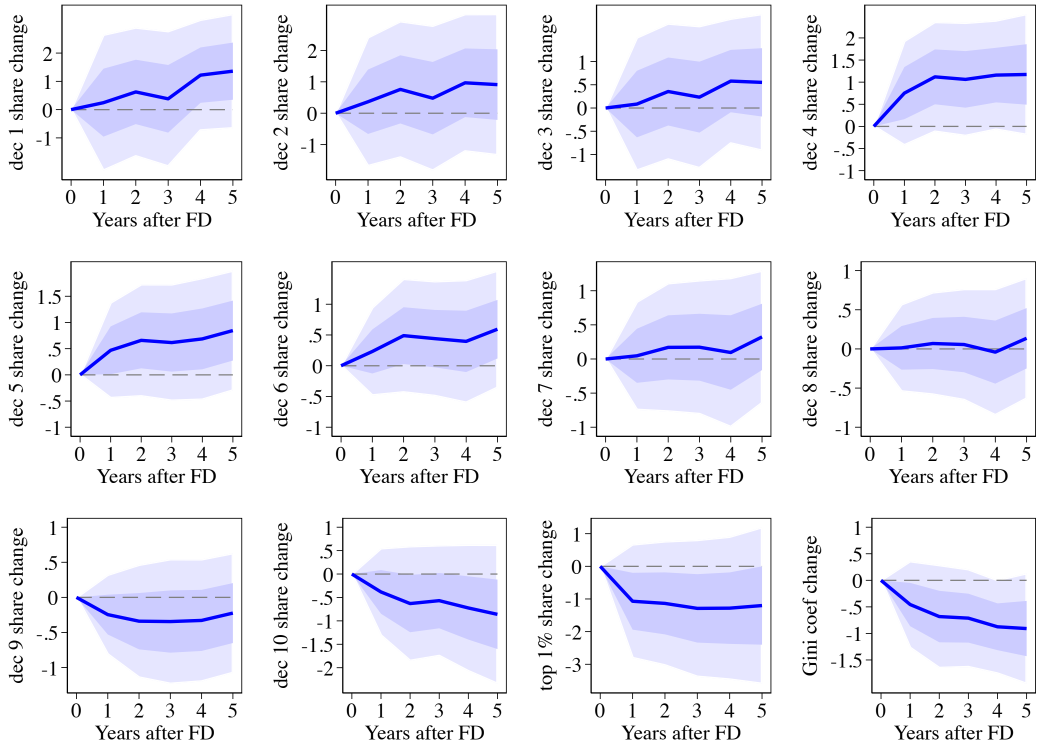
5.1.2 Expenditure-based vs Tax-based fiscal consolidations

In this section, I will investigate if the composition of fiscal consolidation matters for the evolution of income distribution. To test this hypothesis, model (4.5) has been separately estimated for expenditure- and tax-based fiscal consolidation adjustments by applying the differentiation made in Devries et al. (2011) dataset and its extension for Spain. Figures 5.5 and 5.6 present the estimated IRFs, both in pre-tax terms and since conclusions made from post-tax results are similar (post-tax expenditure-based and tax-based results are presented in Figures A.7 and A.8, respectively, in Appendix A). The dynamics observed in the previous narrative approach results

[30]See Devries et al. (2011) for a thorough exposition of the extracts of each year.

persist, although there are differentiating aspects of both expenditure- and tax-based results. Fiscal consolidations *via* tax adjustments have more rapid and positive effects on the lower tail than expenditure-based effects, effects that persist through time. The middle part appears to be more favoured with tax-based adjustments. And the upper tail is detrimentally affected in both cases, although to a higher degree after tax-based consolidation episodes. In income inequality terms, both adjustments present similar effects on the Gini coefficient, a persistent and negative effect (increasing income equality).

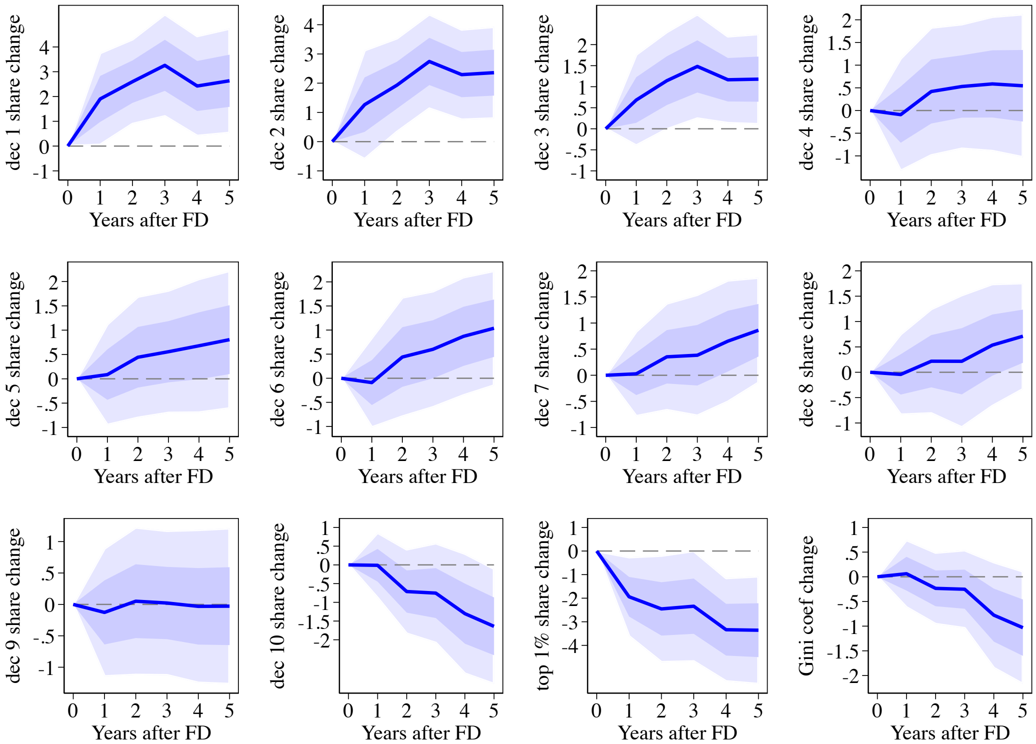
Figure 5.5: Impulse response functions estimated from model (4.8): pre-tax income decile shares response after expenditure-based narrative approach (Devries et al., 2011)



Note: same as in Figure 5.1.

These results support the previously mentioned view of the positive effects of tax hikes on the low tail of the income distribution (Rawdanowicz et al., 2013; Agnello and Sousa, 2014). In addition, these results coincide with the findings of Furceri et al. (2016); spending-based fiscal consolidations provoke worse effects on the income distribution as compared with tax-based consolidations. As collected in Devries et al. (2011), planned personal income tax rate increases for all but the lowest income categories in 1992 could explain the comparative improvement for the lowest deciles (see Figures A.7 and A.8) in tax-based plans as compared with spending cuts.

Figure 5.6: Impulse response functions estimated from model (4.8): pre-tax income decile shares response after tax-based narrative approach (Devries et al., 2011) shock



Note: same as in Figure 5.1.

5.2 Mechanisms driving income distribution dynamics

5.2.1 Low and medium tail dynamics results

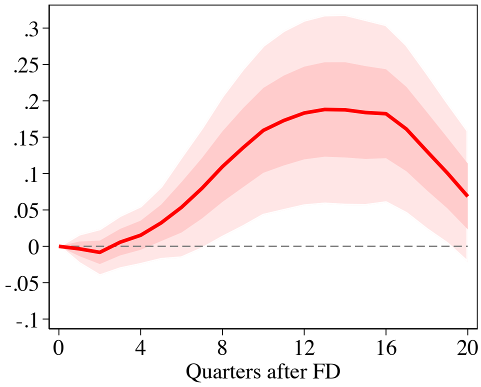
So far, the analysis has focused on the direct nexus between fiscal consolidations and income distribution, which works as an intuition of the dynamic effects. Hence, it is necessary to investigate what sort of economic forces drive these dynamics *via* a more substantial analysis given the usage of higher frequency data (quarterly). Note that this section will consist of the application of CAPB-based methods given the non-availability of the narrative approach (Devries et al., 2011) in quarterly frequency for Spain. Therefore, the results obtained in this part will be directly compared with those obtained by applying the range of CAPB-based methods in the previous analysis on the effects on the pre-tax income distribution before the action of the redistributive system.

The evidence presented so far indicates that the low and medium tail of the income distribution in Spain has been detrimentally affected by fiscal consolidations following CAPB-based results. A natural candidate with the power of explaining these dynamics is the unemployment rate. The dynamic response of unemployment is presented in Figure 5.7 with the application of the three CAPB-based identification criteria (panel a for Afonso (2010) ($FD1$), panel b for Alesina and Ardagna (1998) ($FD2$) and panel c for Giavazzi and Pagano (1990) ($FD3$))[31]. The red line

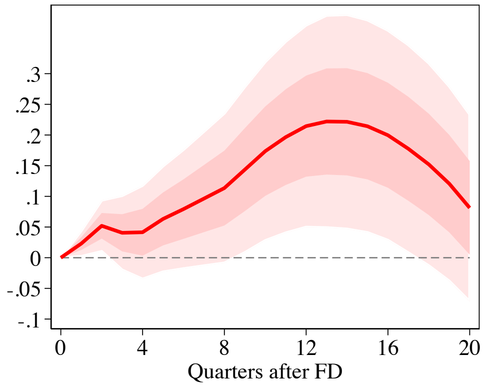
[31] In this case, I present estimations of the three CAPB-based methods. None of them is placed

represents the tracing out of the estimated coefficient $\hat{\psi}^h$ from model (4.6) up to 20 quarters after the shock. Overall, unemployment temporarily increases similarly for all identification criteria. Additionally, it is worth noting that the peak of the dynamic effect is reached approximately 12 quarters after the shock and is equivalent to a .2 pp cumulative increase. Note that for $FD3$ the maximum peak is slightly superior, equal to a .25 pp cumulative increase.

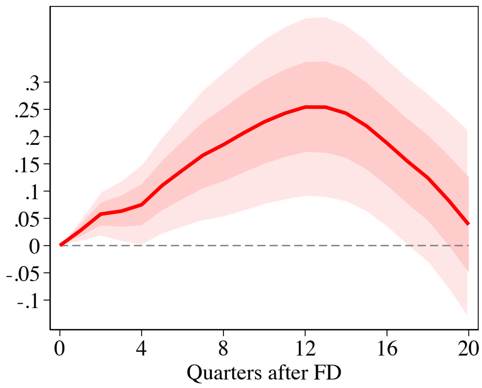
Figure 5.7: Impulse response functions estimated from model (4.6): The dynamic responses of unemployment in Spain.



(a)



(b)



(c)

Note: the solid red line corresponds to the IRF (ψ^h estimated coefficients) and limits of the red areas correspond to 1 and 2 standard errors confidence bands. The x-axis denotes time in quarterly terms: $t = 0$ is the quarter of the fiscal consolidation episode. And time horizon is $H = 20$. Panel (a) corresponds to the application of Afonso (2010), (b) to Alesina and Ardagna (1998) and (c) to Giavazzi and Pagano (1990) identification indicators.

With regards to the significance of the IRFs, Table 5.1 presents a recapitulation of the estimated effects for 4, 8, 12, 16, and 20 quarters after the shock using the identification criteria by Afonso (2010) and Alesina and Ardagna (1998). Note that the estimated effects using Giavazzi and Pagano (1990)'s criteria are presented in Table A.1 in Appendix A, given the similarity with Alesina and Ardagna (1998)'s results. The effects on unemployment are significant, especially between 8 and 16

in Appendix A because their filled space is not transcendental. Thus, these presented results will work as well as robustness given the variety of consolidation episode measures.

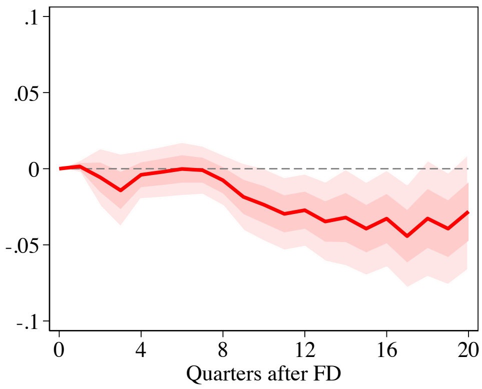
quarters after the shock. Note that the decrease in observations goes parallel with the increasing time horizon.

Table 5.1: The effects of fiscal consolidations on unemployment and wages in Spain (1980-2020): estimation of ψ^h from model 4.9 for selected time horizons after fiscal consolidation shocks of á la *Afonso (2010) and Alesina and Ardagna (1998)*

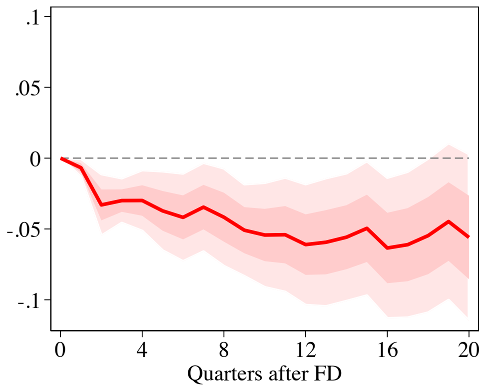
	Horizon									
	Panel A: FD1					Panel B: FD2				
	h=4	h=8	h=12	h=16	h=20	h=4	h=8	h=12	h=16	h=20
unem	.015	.109**	.183***	.182***	.068	.041	.113*	.214***	.199**	.081
	(.020)	(.048)	(.063)	(.061)	(.045)	(.038)	(.061)	(.082)	(.085)	(.076)
wages	-.003	-.007	-.027**	-.032**	-.028	-.029***	-.042**	-.061***	-.063**	-.056*
	(.008)	(.008)	(.012)	(.016)	(.019)	(.011)	(.017)	(.021)	(.025)	(.029)
Obs.	149	145	141	137	133	149	145	141	137	133

Note: standard errors in parenthesis. ***,**,* denote significance at 1 percent, 5 percent and 10 percent, respectively. Horizons are in quarterly terms. The first column indicates the following: *unem* and *wages* denote that the dependent variable is unemployment and wages respectively. FD1 denotes the application of Afonso (2010)'s criteria and FD2 of Alesina and Ardagna (1998) as consolidation shocks.

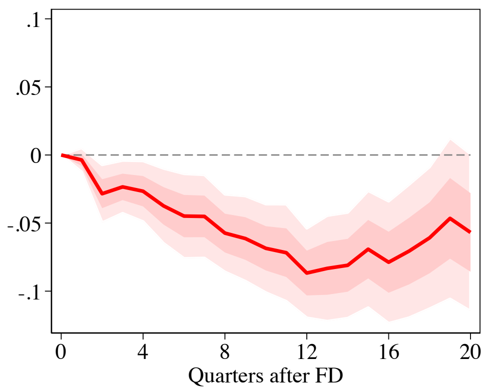
Figure 5.8: Impulse response functions estimated from model (4.6): The dynamic responses of wages in Spain.



(a)



(b)



(c)

Note: same as in Figure 5.7.

These results on unemployment are complemented by the estimated dynamic effects on wages in Spain. The IRFs of wages after fiscal consolidation shocks have been traced out in Figure 5.8, and reflect the detrimental effect on wages of consolidations. The negative peak is reached 12 to 16 quarters after the shock, and the effects appear to be more persistent than for unemployment. Attending again at Tables 5.1 and A.1, the effects on wages are highly and negatively significant in practically all time horizons for $FD2$ and $FD3$, $FD1$ presents significant results 12 and 16 quarters after the shock.

Theoretically, this increasing unemployment can be explained by a variety of factors. The effects of the economic cycle can be argued to influence the evolution of unemployment. However, model (4.6) already controls for the cycle component of GDP; thus, the effect of fiscal consolidations on unemployment is already isolated from changes in the economic cycle. Note that the measurement of CAPB is already isolated from the cycle. Unemployment might also be directly affected by the state's role as an employer. Consolidation maneuvers based on public employment reductions aimed to cut public spending and increase unemployment directly —also the distortionary effects of raising taxes on labour income. The tax burden generated can discourage employers from hiring and reduce the incentives for the employed to job searching. Following the fiscal theory, taxation can bring forth unemployment by increasing taxes, levies and fees that directly increase the cost of labour (employment compensation taxes and social security payroll taxes), and by increasing taxes, levies and fees that decrease the productivity of labour *via* capital formation prevention (personal income taxes and capital stock taxes, among others).

The Spanish income tax has experienced reforms based on tax rate increases[32] to boost tax revenues during periods of consolidation, especially from 2010 onwards (Stability Programs Updates, 2013-2016). From an empirical point of view, Nickell (1997) found that higher labour taxes increased unemployment in Europe, which was partially driven by the rigidness and strict regulation of the labour market, a feature that the Spanish labour market shares (Garcia-Cabo and Madera, 2019). In line with this, an increase in labour market flexibility reduces youth unemployment and, in particular long-term unemployment (Agnello et al., 2014).

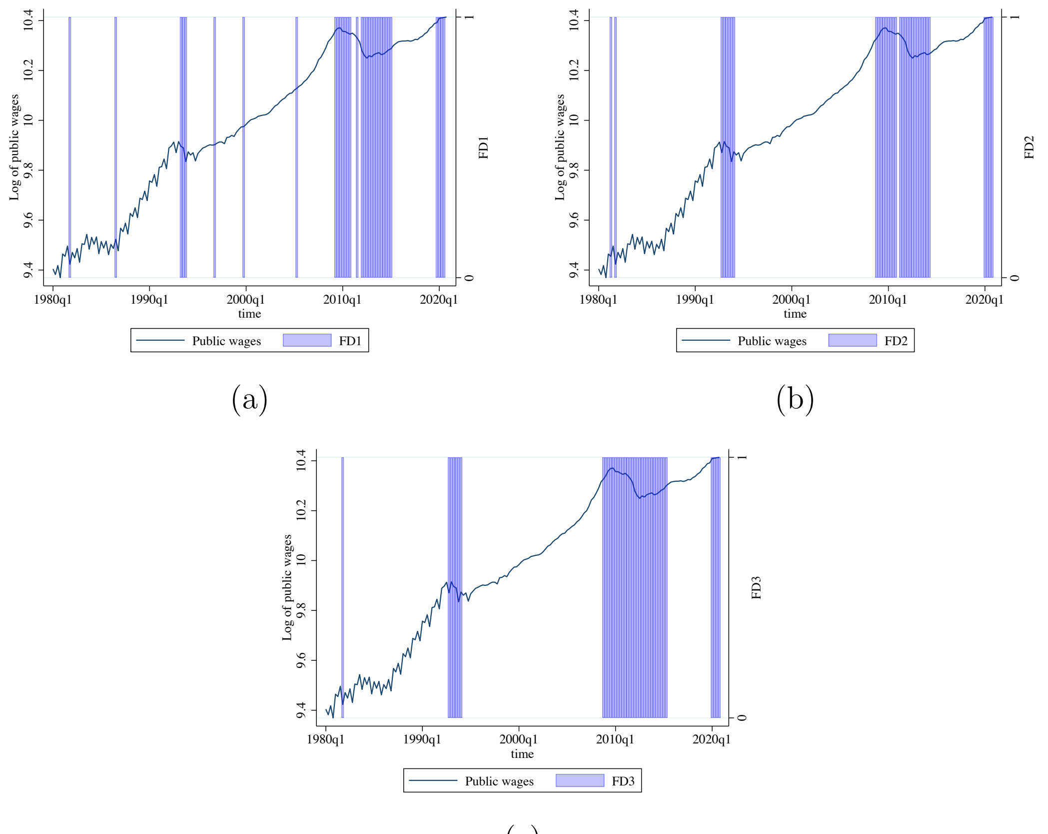
The role of long-term unemployment in explaining the detrimental effects on unemployment is relevant. Ball et al. (2013) found that fiscal consolidations lead to a significant and long-lasting increase in long-term unemployment. In the absence of quarterly data, annual data on long-term unemployment in Spain from the OECD from 1986 to 2020, which is presented in Figure A.9 in Appendix A, shows the increase in long-term unemployment during the mid-90s (an 11% pp increase from 1992 to 1995), right after three episodes of consolidation. Additionally, note the notorious increase from 18% of long-term unemployment in 2008 to 52.8% in 2014; the aftermath of the financial crisis, when simultaneously forces driven by ongoing fiscal consolidations could have boosted long-term unemployment. Also, Broadbent and Daly (2010) found increases in unemployment after fiscal adjustments in Ireland. Overall, the negative effects on unemployment coincide with previous findings in the literature (Broadbent and Daly, 2010; Ball et al., 2011; Turrini, 2013; Agnello et al., 2014).

Regarding the effects on wages, apart from its complementarity to the effects on unemployment, these results coincide with the findings of the literature on the

[32]Especially, the royal decree-law 20/2012 of 13th of July (*Real Decreto Ley 20/2012*) of measures to guarantee budgetary stability and promote competitiveness, which contains various measures to reduce and rationalize government spending and increase revenues.

evolution of the share of wages after fiscal consolidation shocks (Ball et al., 2011, 2013; Furceri et al., 2016). The explanation could be an austerity plan *via* a fall in public sector wages or the increase in unemployment itself. Concerning the first potential explanation, Figure 5.9 provides facts of simultaneity between Spanish public sector wages cuts and CAPB-based identified consolidation episodes. Note that data on public sector wages is extracted from the Bank of Spain. Identified fiscal consolidation episodes in 1982, 1993 and right after the financial crisis coexist in time with evident declines in public sector wages, which could explain the effects on unemployment.

Figure 5.9: The evolution of public wages and fiscal consolidation episodes in Spain (1980-2020)

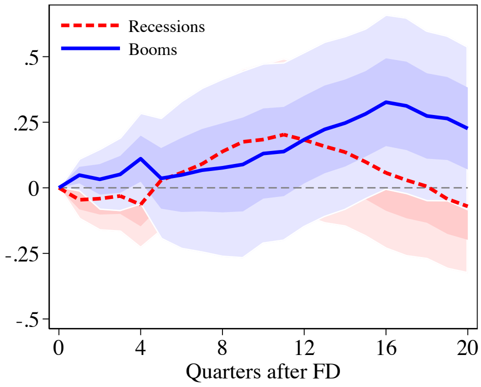


Note: the blue line corresponds to the quarterly natural log of public sector wages and the blue vertical lines indicates fiscal consolidation episodes identified by $FD1$ (panel a), $FD2$ (panel b) and $FD3$ (panel c).

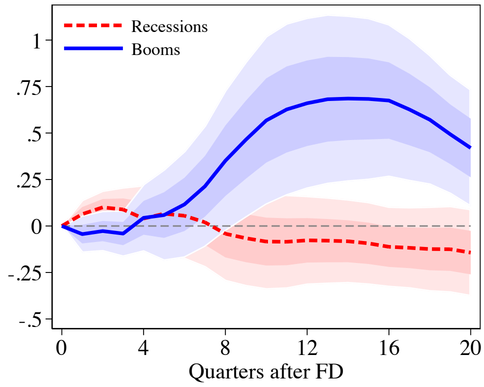
5.2.2 Recessions vs Booms: unemployment and wages

As presented before, unemployment transitorily increased, and wages persistently decreased after Spain's fiscal consolidation episodes. The average response through time has been estimated, controlling by the state of the economy. However, the response can vary depending on the prevailing business conditions. Figure 5.10 presents the tracing out of the dynamic responses of unemployment after fiscal consolidation shocks when the economy is in recessions (dashed red line) and in booms (solid blue line), up to 20 quarters after the shock ($H = 20$). These responses are the estimated coefficients $\hat{\psi}_r^h$ (recessions) and $\hat{\psi}_b^h$ (booms) from model (4.7) *á la* Auerbach and Gorodnichenko (2013).

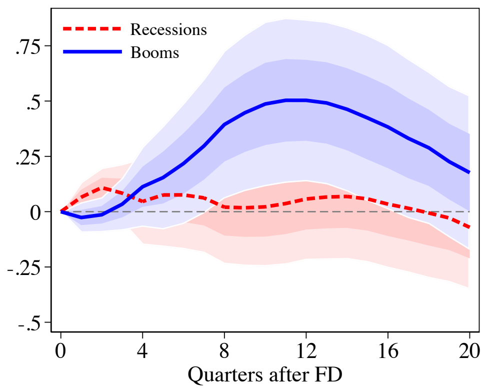
Figure 5.10: Impulse response functions estimated from model (4.7): The dynamic responses of unemployment in Spain over the business cycle.



(a)



(b)



(c)

Note: the dashed red line corresponds to the IRF during recessions (ψ_r^h estimated coefficients) and limits of the red areas correspond to 1 and 2 standard errors confidence bands, the same is in blue for booms (ψ_b^h estimated coefficients). The x-axis denotes time in quarterly terms: $t = 0$ is the quarter of the fiscal consolidation episode. And time horizon is $H = 20$. Panel (a) corresponds to the application of Afonso (2010), (b) to Alesina and Ardagna (1998) and (c) to Giavazzi and Pagano (1990) identification indicators.

Results suggest that, indeed, the response of unemployment in Spain to fiscal consolidations significantly varies with the prevailing business conditions. When the economy experiences booms, the effect on unemployment is transitorily[33] positive and practically non-existent when experiences recessions, except for a slight increase in unemployment during economic downturns following $FD1$ results. In times of economic booms, the peak is reached between 12 and 16 quarters after the consolidation shock. The magnitude and significance of the results are compiled in Table 5.2 for $FD1$ and $FD2$, and in panel B from Table A.1 in Appendix A for $FD3$[34]

[33] By the expected trajectories of the dynamic responses, their transitory nature can be predicted.
[34] Due to space considerations, and the similarity between the results, $FD3$ results are collected in Appendix A.

($unem^r, unem^b$). The effects during booms are significant from 8 to 20 quarters after the shock. Note the greater magnitude of the effects during booms of $FD2$ and $FD3$ compared with $FD1$. Both tables also formal tests with F-statistics ($F-stat^u$) the difference in the effect between recessions and booms. At a 5% significance, the effect is significantly different 12, 16 and 20 quarters after the shock, especially following $FD2$ and $FD3$. Given the slight increase during recessions for $FD1$, the difference is not significant, which would mean the existence of non-linearities of the specification regarding the state of the economy for $FD1$. Contrary, $FD2$ and $FD3$ applications present the existence of non-linearities in the specification.

Table 5.2: The effects of fiscal consolidations on unemployment and wages in Spain over the business cycle (1980-2020): estimation of ψ_r^h and ψ_b^h from model 4.10 for selected time horizons after fiscal consolidation shocks of á la *Afonso (2010) and Alesina and Ardagna (1998)*

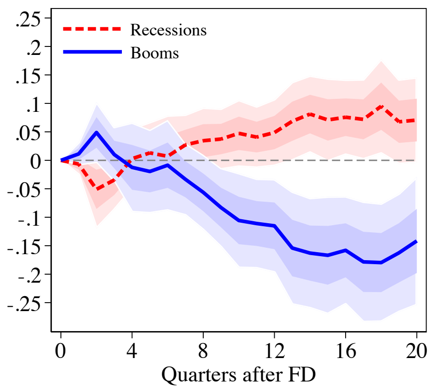
	Horizon									
	Panel A: FD1					Panel B: FD2				
	h=4	h=8	h=12	h=16	h=20	h=4	h=8	h=12	h=16	h=20
$unem^r$	-.063	.138	.182	.057	-.070	.040	-.042	-.077	-.112	-.143
	(.082)	(.131)	(.145)	(.144)	(.127)	(.089)	(.127)	(.119)	(.108)	(.117)
$unem^b$	.111	.076	.183	.326**	.226	.043	.351*	.660***	.675***	.419***
	(.087)	(.169)	(0.00)	(.167)	(.156)	(.091)	(.189)	(.229)	(.205)	(.158)
$F-stat^u$	1.10	0.05	1.72	0.88	1.22	0.00	1.83	5.95	9.37	5.99
$wages^r$	.002	.034	.048*	.075**	.070*	-.026	-.007	.020	.017	.051
	(.026)	(.029)	(.029)	(.032)	(.037)	(.026)	(.032)	(.038)	(.048)	(.047)
$wages^b$	-.012	-.056*	-.115***	-.158***	-.141***	-.036	-.094**	-.184***	-.185***	-.217***
	(.039)	(.033)	(.040)	(.047)	(.056)	(.046)	(.039)	(.036)	(.054)	(.054)
$F-stat^w$	0.06	2.32	6.13	9.79	6.12	0.02	1.93	10.03	4.85	10.39
Obs.	149	145	141	137	133	149	145	141	137	133

Note: standard errors in parenthesis. ***,**,* denote significance at 1 percent, 5 percent and 10 percent, respectively. Horizons are in quarterly terms. The first column indicates the following: $unem^r$ indicates that the dependent variable of the model is unemployment but the estimated coefficient collected is the one related with recessions (ψ_r^h), and similar for $unem^b$ with booms (ψ_b^h). The same is applied for $wages^r$ and $wages^b$. $F-stat^u$ is the statistic resulting from the hypothesis contrast $H_0 : \psi_r^h = \psi_b^h$ when the dependent variable is unemployment, the same is applied for wages ($F-stat^w$). FD1 denotes the application of Afonso (2010)'s criteria and FD2 of Alesina and Ardagna (1998) as consolidation shocks.

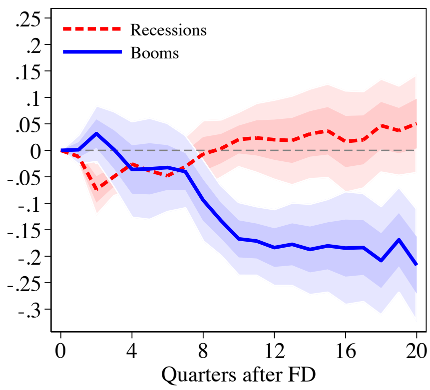
These results suggest that it is more effective in terms of unemployment deterioration to implement fiscal consolidations when the Spanish economy grows relatively slowly. Conversely, periods of rapid growth drive a great part of the increase in unemployment after fiscal consolidations. This piece of evidence is in agreement with the famous Churchill's claim to *"never let a good crisis go to waste"*. The existing evidence on the dependency of the dynamic effects of fiscal consolidations on unemployment is scarce. Although focusing on income inequality, Agnello and Sousa (2014) found that during periods of low economic growth (GDP growth rate lower than 2%), consolidation programs were more detrimental for income inequality than periods of rapid growth (>2%).

This evidence needs to be carefully considered when compared with the present paper's results. The key is the method applied in Agnello and Sousa (2014), a static panel OLS regression. The dynamic information is ignored when estimating the relation between fiscal consolidations and income inequality contemporaneously (for every t). As presented in Figure 5.10, an increase in unemployment during recessions and a slight decrease during booms are observed during the first year. To make the results comparable with the findings by Agnello and Sousa (2014), I have estimated simple OLS models where the dependent variable is the log of unemployment. The regressors are the fiscal consolidation indicator interacting with the weighting function $F(.)$ (for each CAPB-based method indicator) and the same controls as in model (4.7). The results show a generally significant positive effect on unemployment during recessions and the contrary during booms. Thus, these results coincide with Agnello and Sousa (2014) although they ignore the dynamic evolution, which is one of the novelties of this paper.

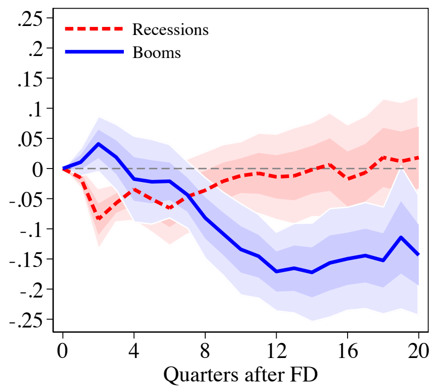
Figure 5.11: Impulse response functions estimated from model (4.7): The dynamic responses of wages in Spain over the business cycle.



(a)



(b)



(c)

Note: same as in Figure 5.9.

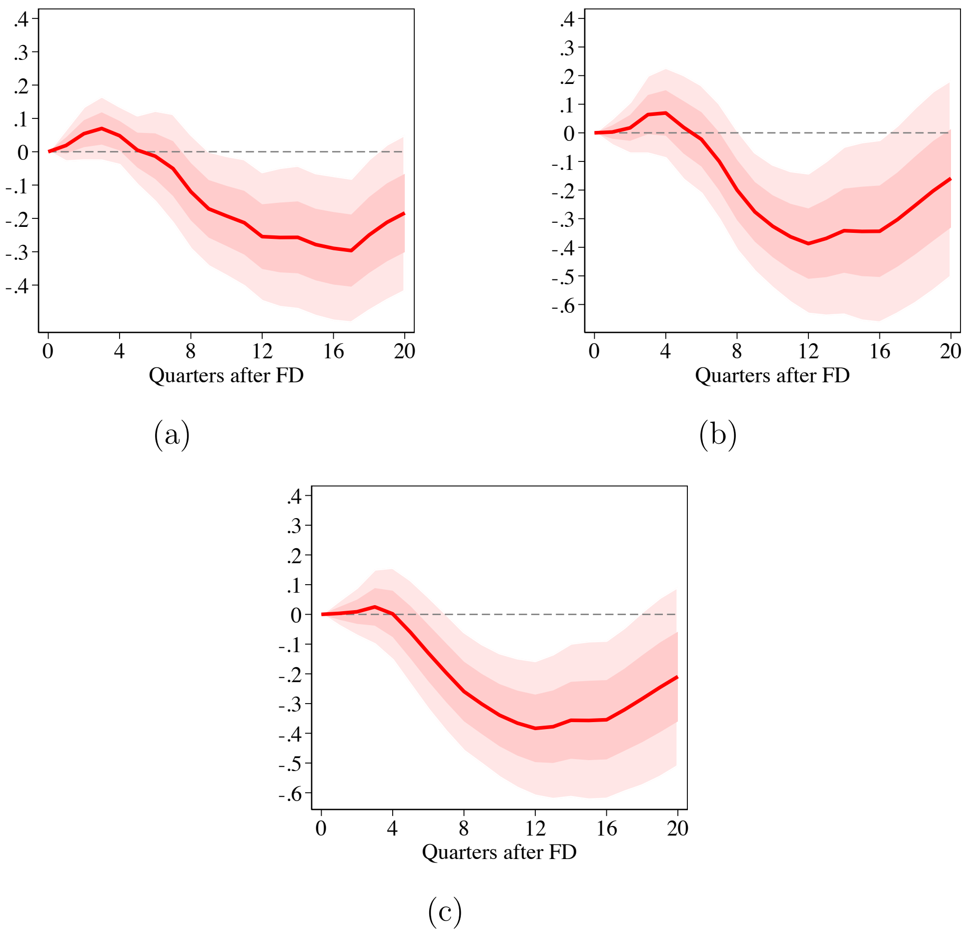
Regarding the effects on wages, Figure 5.11 presents the tracing out of the responses of wages depending on the state of the economy. Results suggest that wages persistently deteriorate in the medium-term during booms, more than during recessions. Indeed, during periods of low growth, the effects practically fluctuate around zero. These results fit with those on unemployment, which can be seen as a consequence of the dynamically increasing unemployment. It is worth noting that fiscal consolidations during recessions detrimentally affect wages in the short-run, although it goes quickly to zero. Also, Table 5.2 and Table A.1 from Appendix A show highly significant detrimental effects on wages during booms 8, 12, 16 and 20 quarters after the shock ($wages^b$). Attending to the F-statistics ($F - stat^w$), the effect during recessions and booms is significantly different 12, 16 and 20 quarters after the shock. Note also that to compare these results with Agnello and Sousa

(2014)'s, I have estimated OLS models again with the log of wages as the dependent variable and found that wages decrease more during recessions than during booms, in agreement with the view of Agnello and Sousa (2014). Hence, once again, the dynamic perspective provides valuable and complementary information.

5.2.3 Upper tail dynamics results

Again, this section will consist of applying CAPB-based methods, which results will be compared with the application of those methods in the analysis of pre-tax income distribution dynamics, isolating the effect from redistributive actions (post-tax terms). Specifically, the evidence presented so far regarding the dynamics of the upper tail of the distribution shows a negative effect on pre-tax top 10% and top 1% of the income distribution. This intuition of the dynamics of the richest segment of the Spanish income distribution will be explained by the reaction of share prices[35] after fiscal consolidation shocks.

Figure 5.12: Impulse response functions estimated from model (4.9): The dynamic responses of stock prices in Spain.



Note: same as in Figure 5.7.

The dynamic response of share prices is presented in Figure 5.12 by applying the three CAPB-based identification criteria (panel a for $FD1$, b for $FD2$ and c

[35] As presented in the methodology chapter, share prices series explain the same evolution as stock prices.

for $FD3$). The estimated coefficient $\hat{\zeta^h}$ from model (4.9) has been traced out up to 40 quarters after the shock (red line). Overall, stock prices transitory increase and then experience a notable decline. The following features are of relevance: i) the initial increase is slight, reaching up to almost .1 pp cumulative increase, ii) the negative effect is moderately persistent, practically transitory, and iii) the negative peak is reached 12 to 16 quarters after the shock, close to -.4% following $FD2$ and $FD3$, and close to -.3% following $FD1$.

Regarding the significance of the dynamic effects, Table 5.3 presents the estimated effects for 4, 8, 12, 16 and 20 quarters after the shock for $FD1$ and $FD2$. Table A.2 in Appendix A presents $FD3$ results, given the similarity with the rest of the results. The adverse effects on stock prices are highly significant 12 and 16 quarters after the shock. Note that the initial increase in stock prices four quarters after the shock is not significant. These results explain a part of the reaction of the richest part of the pre-tax income distribution in Spain. A decrease in stock prices lessens the power of income generation streaming from stock assets, which is empirically translated into a deterioration of the richest's pre-tax income shares.

Table 5.3: The effects of fiscal consolidations on stock prices in Spain (1980-2020): estimation of ζ^h from model 4.12, ζ_r^h and ζ_b^h from model 4.13 for selected time horizons after fiscal consolidation shocks of á la *Afonso (2010) and Alesina and Ardagna (1998)*

	Horizon									
	Panel A: FD1					Panel B: FD2				
	h=4	h=8	h=12	h=16	h=20	h=4	h=8	h=12	h=16	h=20
stock	.048	-.119	-.254***	-.289***	-.183	.069	-.199*	-.387***	-.344**	-.159
	(.044)	(.086)	(.097)	(.108)	(.117)	(.079)	(.105)	(.123)	(.159)	(.172)
$stock^r$	-.164	-.096	-.112	-.380	-.712**	.214	.236	.162	-.116	-.272
	(.147)	(.241)	(.321)	(.375)	(.341)	(.209)	(.161)	(.269)	(.259)	(.315)
$stock^b$	.085	-.534	-.701**	-.417	.145	-.411*	-1.124***	-1.273***	-.752*	-.255
	(.198)	(.357)	(.347)	(.414)	(.370)	(.248)	(.291)	(.426)	(.397)	(.551)
$F-stat^s$	0.56	0.57	0.85	0.00	1.66	2.00	10.23	4.83	1.16	0.00
Obs.	129	125	121	117	113	129	125	121	117	113

Note: standard errors in parenthesis. ***,**,* denote significance at 1 percent, 5 percent and 10 percent, respectively. Horizons are in quarterly terms. The first column indicates the following: *stock* denotes that the dependent variable is stock prices, $stock^r$ indicates that the dependent variable of the model is stock prices but the estimated coefficient collected is the one related with recessions (ψ_r^h), and similar for $stock^b$ with booms (ψ_b^h). $F-stat^s$ is the statistic resulting from the hypothesis contrast $H_0 : \psi_r^h = \psi_b^h$ when the dependent variable is stock prices. FD1 denotes the application of Afonso (2010)'s criteria and FD2 of Alesina and Ardagna (1998) as consolidation shocks.

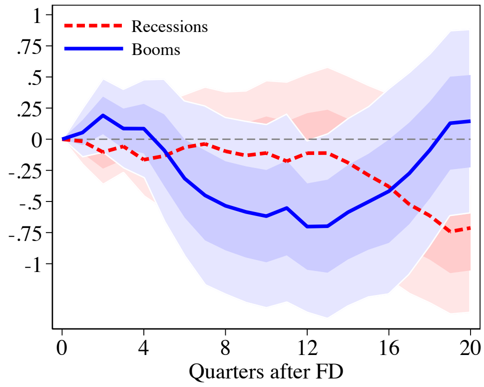
These results relate to previous literature in two different manners. These coincide with Van Aarle et al. (2003) and Beetsma et al. (2015) in the negative dynamic effect eight quarters after the shock, potentially driven by a fall in confidence which in the eyes of stockholders may mean that public finances are indeed weaker than perceived thus far. Differently, the results presented on the initial increase of stock prices are in line with the findings of Afonso and Sousa (2011), Ardagna (2009) and Foresti and Napolitano (2016), although only in the very short-term. Through a decline in interest rates provoked by fiscal adjustments, stock prices can probably increase, explaining the positive evolution in the short-term.

A shift in the stock market/holders' behaviour can be deduced from these results. In the very short-term, Neoclassical behaviours characterize the reaction of stock prices. At the same time, there is a shift to an apparent Keynesian behaviour of stockholders, accentuated eight quarters after the shock. Additionally, stock markets do not take a pure Ricardian perspective following episodes of fiscal consolidations. Thus, the application of the dynamic approach to this study provides valuable information on the potential modifications of stock market behaviour.

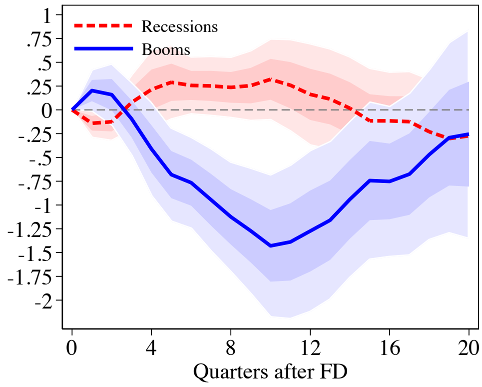
5.2.4 Recessions vs Booms: stock prices

Finally, this section presents the results on the dependence on prevailing business conditions of the dynamic effects of fiscal consolidations on stock prices. Figure 5.13 shows the tracing out of the estimated coefficients ζ_r^h (recessions) and ζ_b^h (booms) from model (4.10), up to 20 quarters after the shock.

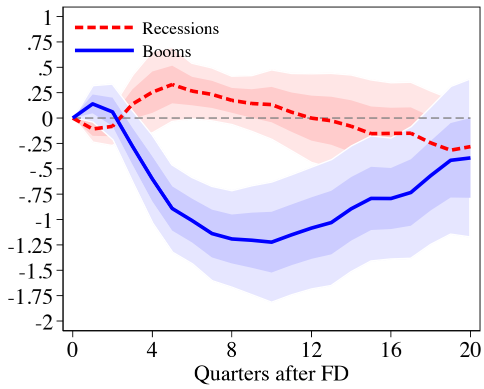
Figure 5.13: Impulse response functions estimated from model (4.10): The dynamic responses of stock prices in Spain over the business cycle.



(a)



(b)



(c)

Note: the dashed red line corresponds to the IRF during recessions (ζ_r^h estimated coefficients) and limits of the red areas correspond to 1 and 2 standard errors confidence bands, the same is in blue for booms (ζ_b^h estimated coefficients). The x-axis denotes time in quarterly terms: $t = 0$ is the quarter of the fiscal consolidation episode. And time horizon is $H = 20$. Panel (a) corresponds to the application of Afonso (2010), (b) to Alesina and Ardagna (1998) and (c) to Giavazzi and Pagano (1990) identification indicators.

Results suggest, as in the case of unemployment and wages, that the dynamic response of stock prices in Spain to fiscal consolidation episodes significantly varies with the state of the economic cycle. In times of rapid economic growth, stock prices rapidly decline 3 to 4 quarters after the shock and return to zero 20 quarters after the shock showing its transitory nature. Conversely, when the economy is involved in recessions, the effect is not remarkable, although positive only in the very short-term, comparatively more long-lasting for $FD1$. Additionally, as presented in Table 5.3, the effect during recessions is highly significant up until eight quarters after the shock following the first criteria, which contrasts with the high and adverse effect during booms 8 and 12 quarters after following the second criteria, and 4, 8, 12 and 16 quarters after following the third criteria, as it is presented in Table A.2 in Appendix A.

These results are in line with Beetsma et al. (2015) findings on the conditional on the business cycle effect of fiscal consolidations on stock prices. Fiscal consolidations can diminish confidence in the long-run sustainability of the budgetary position (Tobin, 1969), and in case such adjustment programs are performed during periods of economic upswing, confidence could be further eroded. This fact could be since periods of economic booms may be sufficient to improve the budgetary position in the eyes of investors and stockholders. Thus, the fall in confidence translated into changes in interest rates will cause stock market prices to fall further in periods of economic growth, basically due to a strong shock on the expectations of stock market holders. However, this exercise finds contradicting evidence as compared to the findings of Foresti and Napolitano (2016) on the negative reaction of stock prices against fiscal consolidations during periods of crisis. Under financial stress, stock market operators require support from fiscal authorities through boosting economic growth policies. Thus austerity maneuvers would not support stockholders and would react negatively in times of economic recession. Thus, this part of the analysis provides novel evidence on the case of the Spanish stock market reaction to fiscal consolidation episodes.

5.3 Robustness checks

5.3.1 Local projections' lag parameterizations

In a critical paper, Kilian and Kim (2011) doubted the reliability of the estimation of IRFs *via* LPs (Jordà, 2005) and warned about the sensitivity of the method in comparison with the VAR when it comes to changing the lag length of the dependent variable with small sample sizes. To check the robustness of the results against this critique, I have estimated models 4.5 (income distribution dynamics), 4.6 (unemployment and wages dynamics), 4.7 (state-of-the-cycle dependence of unemployment and wages dynamics), 4.9 (stock prices dynamics) and 4.10 (state-of-the-cycle dependence of stock prices dynamics) with different lag lengths of the dependent variable. For model 4.5, I have estimated the specification with one and five lags of the dependent variable ($l_1 = 1$ & $l_1 = 5$), for all measures of fiscal consolidation ("conventional" and "narrative") and all income shares and Gini coefficients, in pre- and post-tax terms. In general, the results do not vary with the lag length selection. Given the incredible amount of results derived from that robustness test, the results are available under request.

Regarding the second part of the analysis, I have estimated models 4.6, 4.7, 4.9 and 4.10 with four and twenty lags of the dependent variable ($l_1 = 4$ & $l_1 = 20$). Note that these models are estimated in a quarterly data setting. Figure A.11 in Appendix A presents the results of estimating unemployment dynamics (model 4.6) with both lag lengths. Figure A.12 presents the results of the state-of-the-cycle dependency of unemployment effects (model 4.7) with both lag lengths. Figure A.13 shows the results of estimating the dynamics of wages (model 4.6) with both lag lengths. Figure A.14 presents the results of the state-of-the-cycle dependency of wage effects (model 4.7) with both lag lengths. Figure A.15 presents the results of estimating the dynamics of stock prices (model 4.9) with both lag lengths. And finally, Figure A.16 presents the results of the state-of-the-cycle dependency of stock price effects (model 4.10) with both lag lengths. Overall, the results do not vary with the lag length selection. Hence, the set of specifications is robust to lag length selection.

5.3.2 Periods of consecutive fiscal consolidations

Especially in the second part of the analysis, the amount of periods of continuous fiscal consolidation episodes is more significant than in the annual analysis due to its quarterly frequency nature. As explained in Jordà et al. (2022) in the study of the long-run effects of pandemics on macroeconomics, the existence of overlapping episodes in the estimation window, in this case of fiscal consolidations, can bias the estimation. Thus, I will introduce an element in the models that captures periods of consecutive fiscal consolidations. Thus, I will sterilize the effects of overlapping consolidation episodes by introducing lags of the consolidation shock. In a general fashion, models from the study of the mechanisms will take the following form:

$$y_{t+h} - y_{t-1} = \gamma_t^h + \sum_{j=1}^{l_1} \beta_j y_{t-1-l_1} + \sum_{j=1}^{l_2} \delta_j FD_{t-l_2} + \omega^h FD_t + \vartheta^h X_t + \varepsilon_t^h, \tag{5.1}$$

where y_t will take the form of unemployment, wages and stock prices, basically the dependent variables from models (4.6) and (4.9) with their respective controls (vector X_t). To control for consecutive consolidation episodes, l_2 will be equal to 20[36]. Figure A.17 in Appendix A presents the results. Overall, the conclusions do not vary with the inclusion of 20 lags of the shock. Although, it is worth noting the generation of sawtooths in the effect on wages, losing part of its smoothness. Also, the initial upswing of stock prices seems exacerbated.

5.3.3 Omission of controls in LPs

Another potential caveat regarding the robustness of the results is the sensitivity of the LP specification to the omission of controls. Excepting GDP growth, which is crucial for the avoidance of endogeneity and biases generation, I have omitted the rest of controls in models (4.6) and (4.9) to check the sensitivity of the response of the main mechanisms; unemployment, wages and stock prices[37]. Figure A.18 in Appendix A presents the results. In general, the results are not sensitive to the omission of controls. Only note the attenuation of the effects on stock prices when controls are omitted.

[36] The period of maximum number of consecutive consolidation episodes identified by CAPB-based methods is equal to 20 quarters, which happened after the financial crisis of 2008.

[37] Note that the specification of income distribution dynamics, given the small sample size, is quite sensitive to the omission of controls, another argument to support the recommended intuition character of that part of the analysis.

6

Policy implications

High public debt and rising income inequality can be considered two of the most pressing policy issues in Spain, especially in post-COVID-19 times (Briceño and Perote, 2020; Lariau and Liu, 2022). However, the impact of bringing public debt back on the path to sustainability on income inequality is inevitable, concretely *via* fiscal consolidation programs aimed to decelerate debt accumulation. A sufficient reason to let well-informed policy-makers rely on robust estimates about the development of income inequality after fiscal consolidation programs.

The debate on the optimality of fiscal consolidation plans has recently received attention in the literature. The elaboration of austerity programs considers the projection of economic circumstances during the temporal consolidation window. However, consolidation plans should explain how these policies respond to different scenarios and shocks. In periods of growth slower than envisaged in the plan, for instance, it should be specified that unemployment benefits would be protected from cuts during periods of slow growth (Ball et al., 2011). Therefore, the flexibility of the plan will be required while credibly preserving the medium-term goals (Lagarde, 2011). Also, if permitted by the EU authorities, the optimal duration of the plan should be long-lasting (Blanchard and Leigh, 2013), with gradual budget deficit reductions, which imply, in the context of this paper, minimized detrimental effects on income inequality. It is desirable as well the combination of consolidation plans and growth-impulsing structural reforms (Ball et al., 2013; Hernández De Cos and Moral-Benito, 2013). The non-simultaneity of approval of consolidation measures and their implementation appears to be particularly helpful. An example is linking statutory retirement ages to life expectancy and thus, reducing spending from the pension system. As a consequence of successful consolidation plans, the lighter burden of interest debt payments could be a motive to cut distortionary taxes (Ball et al., 2013). An alternative tool to consolidate the fiscal stance would be to deliver public services more efficiently and thus, comply with the promised spending cuts without explicitly reducing the delivery of public goods and services (Gupta et al., 2017).

When considering the evidence presented in this paper, the optimal design of consolidation plans in Spain should be directed to tax hikes more than spending cuts if the Spanish government considers the plans' adverse effects on income equality. The design should also consider the estimated increase in unemployment by simultaneously to the program implementing reforms of employment protection and creation to smooth the adverse effects. Thus, the negative effects on wages would smooth away as well. Additionally, according to the estimations and to minimize the negative effects on employment, consolidation plans should be implemented when the Spanish economy is growing relatively slowly. Regarding the effects on stock prices, Spanish policy-makers should consider the consequences of their fiscal maneuvers in terms of stock market reaction, given its significant negative reaction, more exacerbated during economic booms. Furthermore, based on the non-neutrality of fiscal consolidations on stock prices, changes in public spending and revenues could be helpful tools for monetary policy to smooth excessive financial market oscillations. Overall, these results imply that consolidation programs in Spain should not be conducted during economic booms.

Related to the nature of the consolidation program, it is debatable which should be the program's target. Evidence of the more detrimental effect of spending-based plans on income inequality gives rise to argue that a larger share of the adjustment burden could be borne by the rich through tax hikes. Although, the distortionary effects of tax increases could convey undesirable implications on capital and labour accumulation and creation. An alternative view would be that consolidation plans are a temporary effort of society to improve public finances, which implies inevitable equity detrimental effects. Equity considerations will be taken into account only once public finances are healthy.

7

Conclusion

This paper has analyzed the dynamic effects of fiscal consolidations episodes on the income distribution in the short- and medium-term in Spain from 1980 to 2020, with a particular focus on the mechanisms driving specific income distribution dynamics by deriving impulse response functions *via* Local Projections by Jordà (2005). With this work, I have contributed to the relevant empirical literature by providing the first case study on the dynamic effects of consolidation episodes on income inequality from a "conventional" and "narrative" approach with the most prolonged period to date. Additionally, the novelty of this paper relies on the estimation of the CAPB in quarterly terms from 1980 to 2020 for Spain, as well as the extension of the Devries et al. (2011) narrative approach until 2020. Ultimately, this paper has offered an in-detail explanation of income distribution dynamics by estimating the reaction of potential mechanisms driving those dynamics in the aftermath of fiscal consolidation episodes.

According to the results from the first part of the analysis, fiscal consolidations typically lead to an increase in income inequality represented by i) negative and persistent effects on the low and medium parts of the distribution, ii) positive and transitory effects on the upper tail, iii) negative effect on the top 1%, and iv) an increase of the Gini coefficient in pre-tax terms. These results are largely consistent with earlier literature on the topic (Ball et al., 2013; Agnello and Sousa, 2014; Furceri et al., 2016; Heimberger, 2020). Also, the social safety net appears to deliver some redistribution capable of compensating part of the negative consolidation shock. Contrary results yielded from the application of the narrative approach indicate a clear decrease in income inequality after consolidation episodes which coincides with another strand of findings (Agnello and Sousa, 2012; Rawdanowicz et al., 2013; Agnello and Sousa, 2014), thus, denoting notable divergence between *intention* and *action* of the Spanish government. Additionally, expenditure-based consolidation programs appear to be more detrimental to income inequality, which is in agreement with previous literature (Furceri et al., 2016).

Regarding the second part of the analysis, increasing unemployment and decreasing wages in the aftermath of consolidation episodes explain the detrimental effect on the low and medium segments of the distribution, which coincide with earlier literature (Broadbent and Daly, 2010; Ball et al., 2011; Turrini, 2013; Agnello et al., 2014), effects that are exacerbated during periods of rapid growth. Concerning explaining the dynamics of the upper part of the distribution, the negative reaction of stock markets in the medium-term after consolidation episodes explains these dynamics. Neoclassical behaviors characterize the reaction of stock markets in the short-term, which concurs with previous literature (Afonso and Sousa, 2011; Ardagna, 2009; Foresti and Napolitano, 2016), while there is a shift to Keynesian reactions in the medium-term (Van Aarle et al., 2003; Beetsma et al., 2015). These effects are especially stronger during periods of rapid economic growth.

Considerations on the optimality of Spanish consolidation plans can be extracted from this analysis. Programs conducted during economic recessions will favour the evolution of unemployment, wages and stock prices. Furthermore, Spanish policy-makers should consider the detrimental effects on unemployment by complementing consolidation plans with job creation and protection reforms, especially the protection of long-term employment. Also, lessons from the impact on stock prices should be not taken for granted, given its power to stabilize stock markets and its potential complementarity with monetary policy.

Future research could be oriented to construct quarterly frequency consolidation episodes for Spain based on the narrative approach *á la* Devries et al. (2011). This potential advancement would allow for a case study on the mechanisms driving income distribution dynamics with full comparability power with the first part of the analysis. Additionally, further research could focus on estimating quarterly series of the Spanish income distribution to provide more robust estimates on the dynamics of income inequality after consolidation shocks. Regarding the mechanisms that explain the dynamics of the income distribution, a more thorough investigation of other macroeconomic factors could be conducted to explain the causes of the income distribution dynamics more in detail. Thus, suggestions on the optimal design of consolidation plans could be provided more extensively. The next step in the analysis of the impact of consolidation programs on income inequality would be to analyze the effects of austerity from a lifetime income distribution approach (Rawdanowicz et al., 2013). Also, the interaction with other policies needs to be investigated, for instance, the combination with labour market reforms, as stated earlier. The consolidation of public finances must be patched up with protective labour market treatments.

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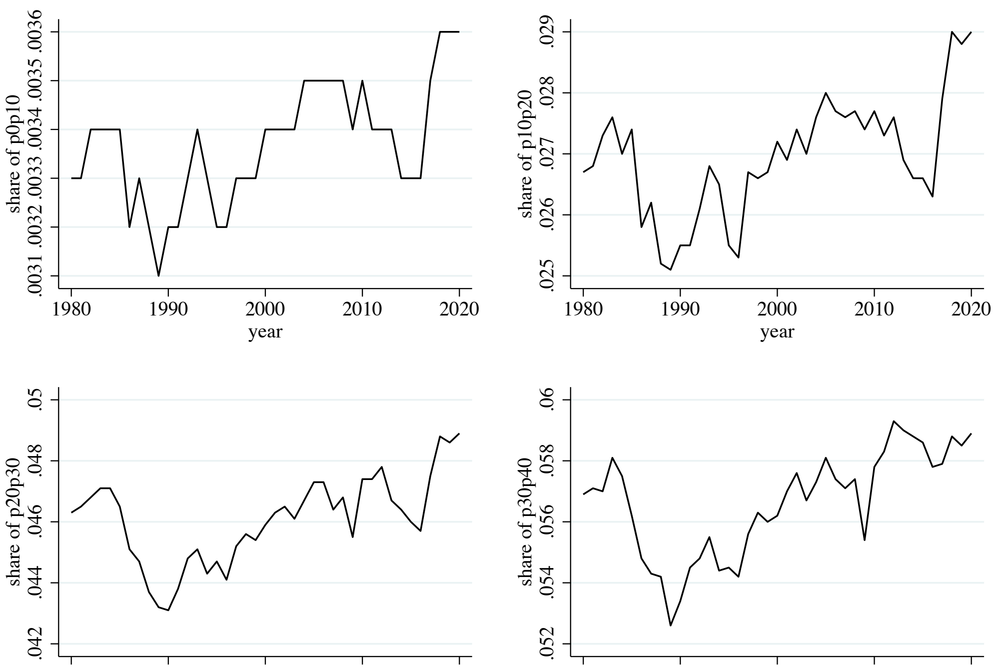
Appendix A

Figures and Tables

Figure A.1: Evolution of pre-tax 1st, 2nd, 3rd and 4th decile shares of the Spanish income distribution from 1980 to 2020

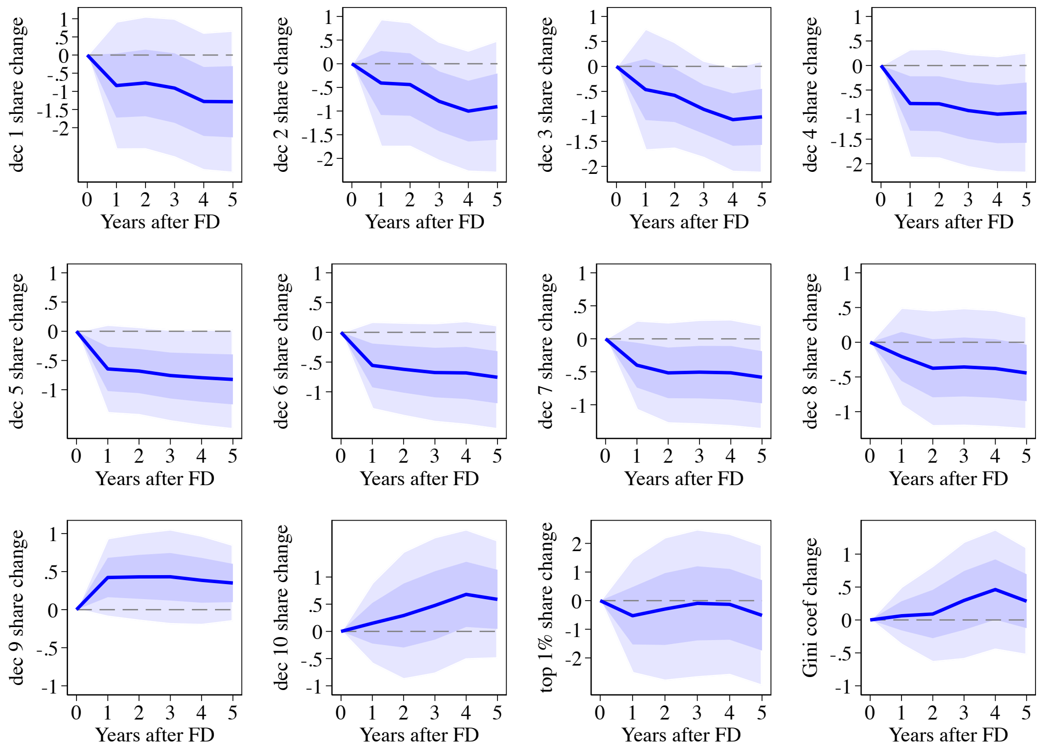


Source: WID. Author's elaboration.

Figure A.2: Evolution of post-tax low tail 40 percent and top 10 decile shares of the Spanish income distribution from 1980 to 2020

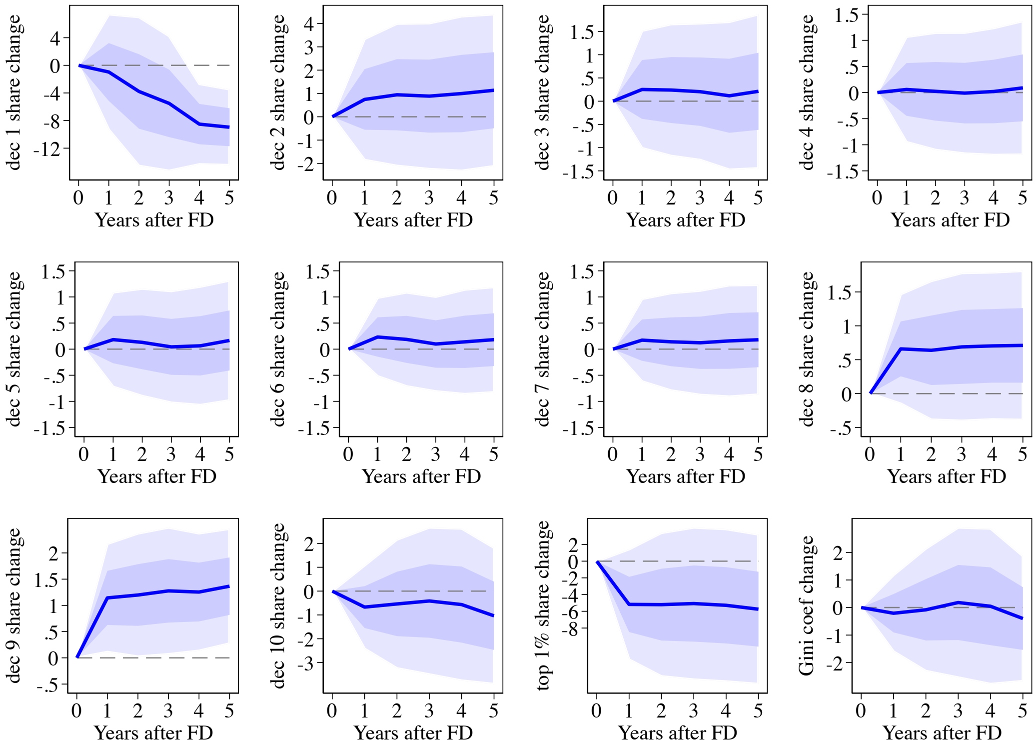
Source: WID. Author's elaboration.

Figure A.3: Impulse response functions estimated from model (4.8): pre-tax income percentile shares response after Alesina and Ardagna (1998) (FD2) shock



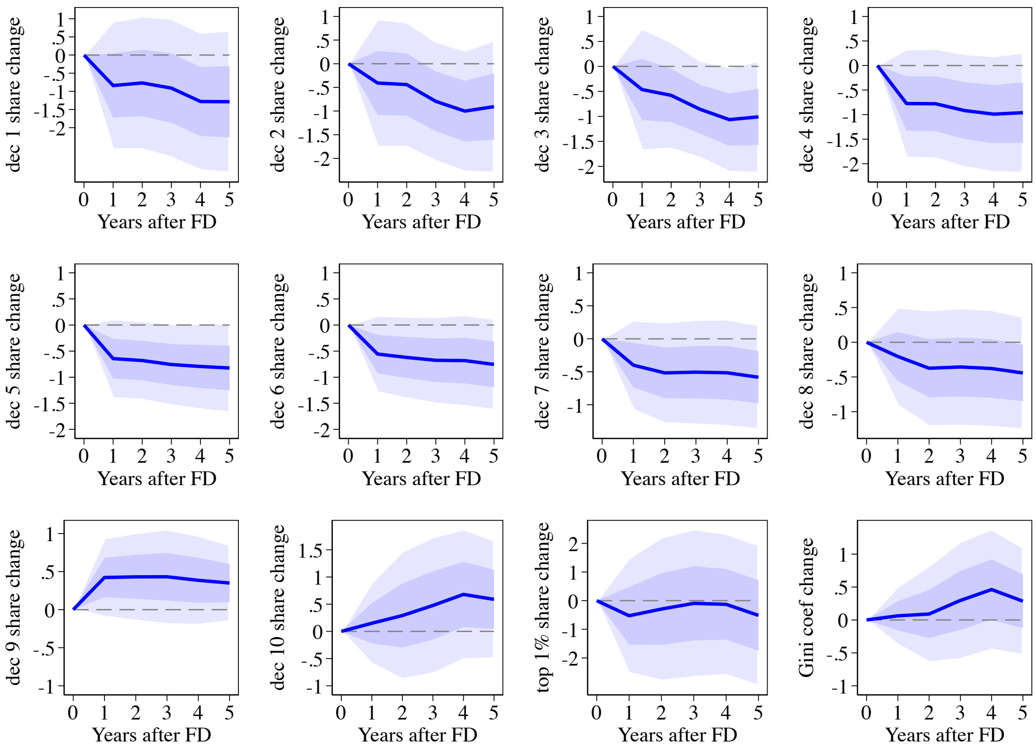
Note: same as in Figure 5.1.

Figure A.4: Impulse response functions estimated from model (4.8): post-tax income percentile shares response after Alesina and Ardagna (1998) (FD2) shock



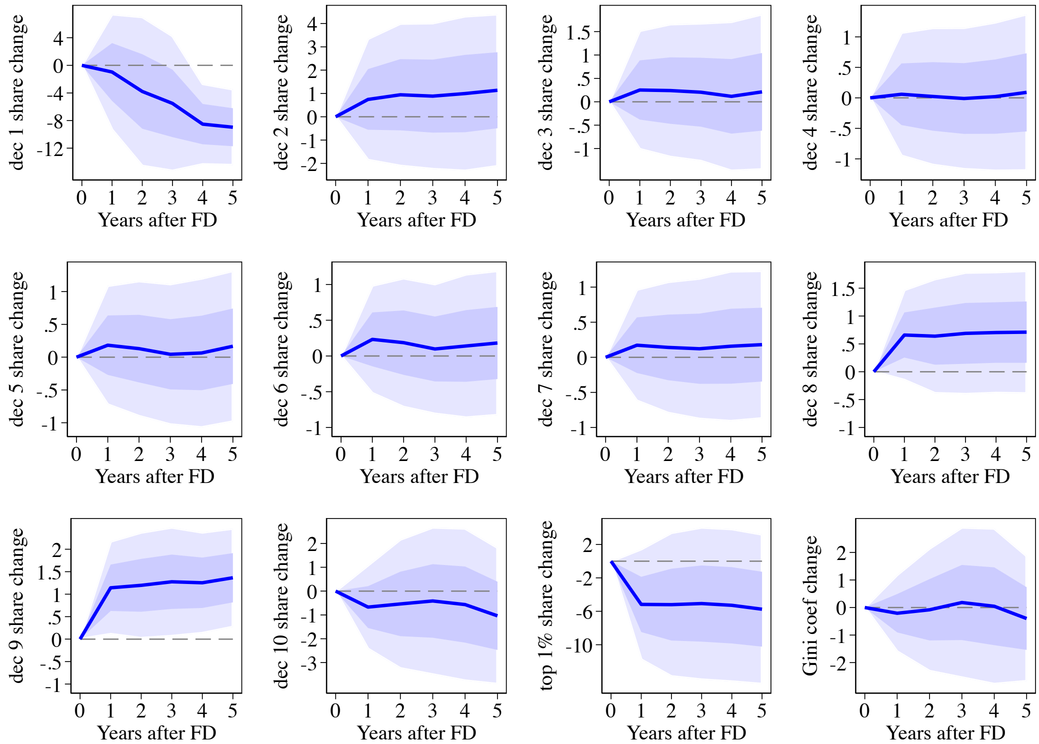
Note: same as in Figure 5.1.

Figure A.5: Impulse response functions estimated from model (4.8): pre-tax income percentile shares response after Giavazzi and Pagano (1990) (FD3) shock



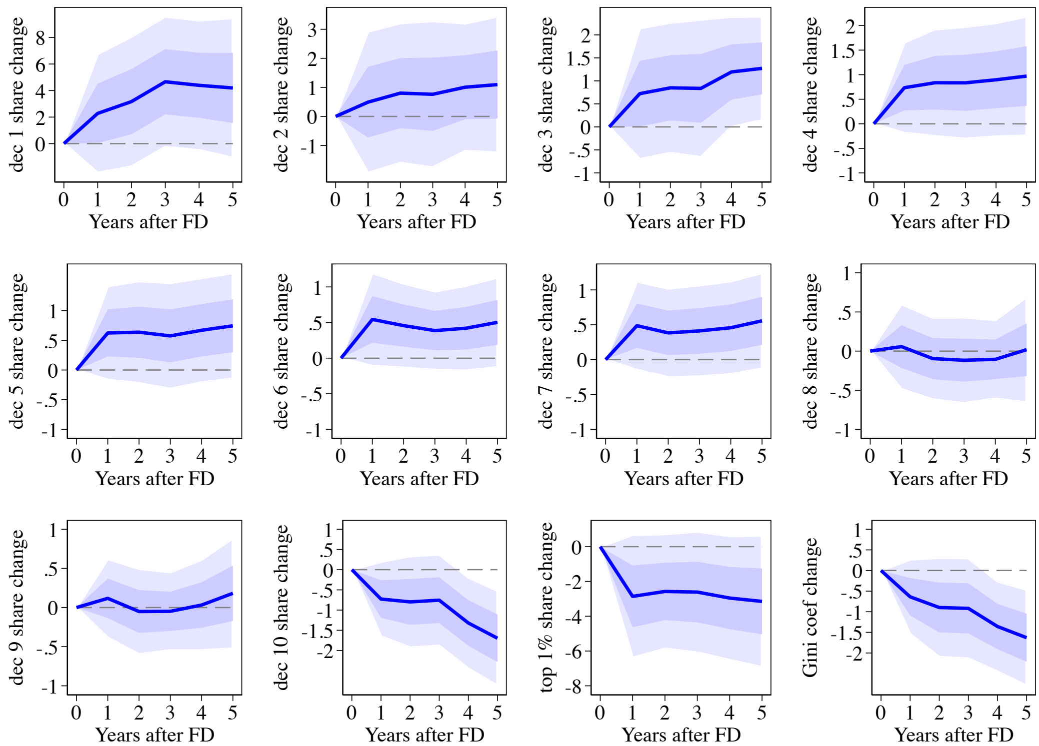
Note: same as in Figure 5.1.

Figure A.6: Impulse response functions estimated from model (4.8): post-tax income percentile shares response after Giavazzi and Pagano (1990) (FD3) shock



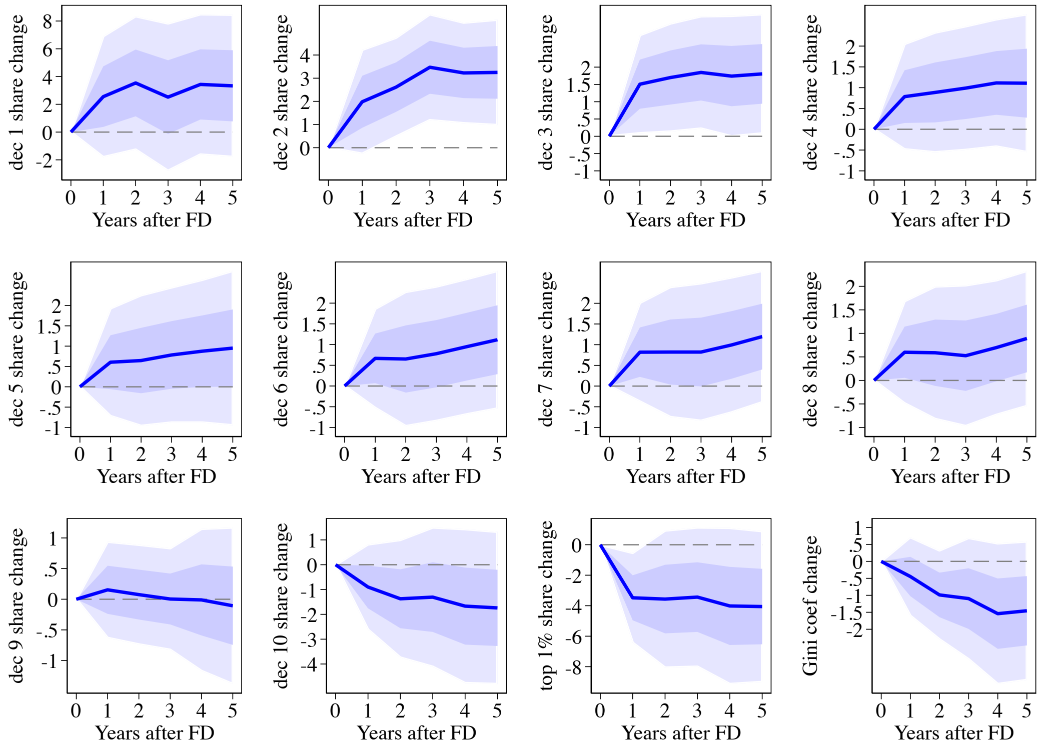
Note: same as in Figure 5.1.

Figure A.7: Impulse response functions estimated from model (4.8): post-tax income percentile shares response after expenditure-based narrative approach (Devries et al., 2011)



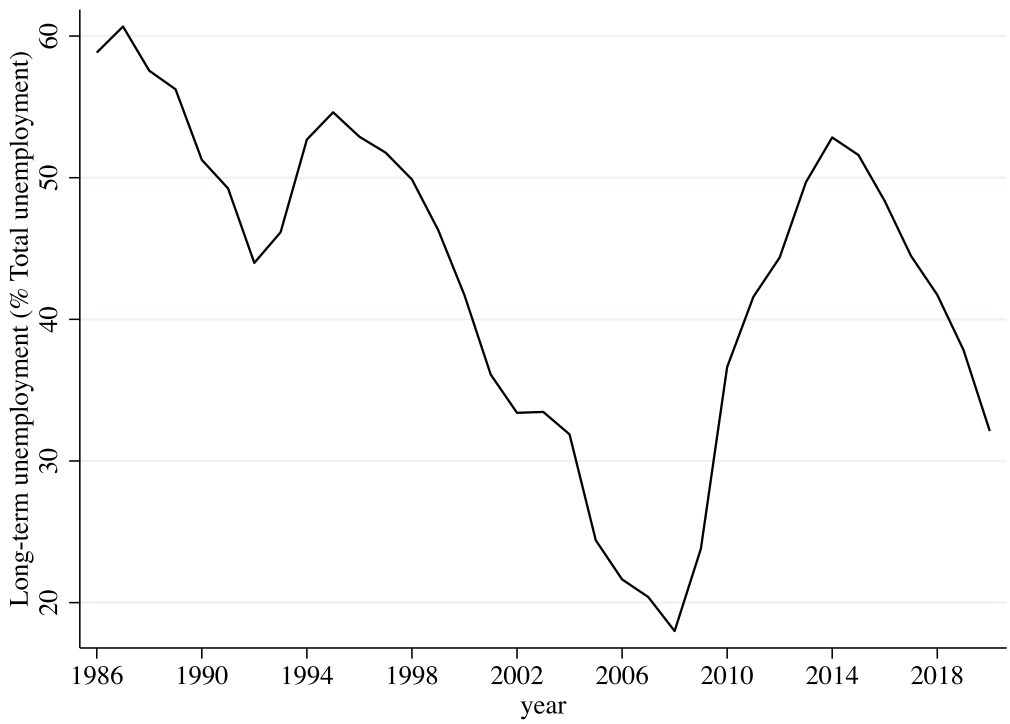
Note: same as in Figure 5.1.

Figure A.8: Impulse response functions estimated from model (4.8): post-tax income percentile shares response after tax-based narrative approach (Devries et al., 2011)



Note: same as in Figure 5.1.

Figure A.9: Evolution of long-term unemployment in Spain from 1986 to 2020



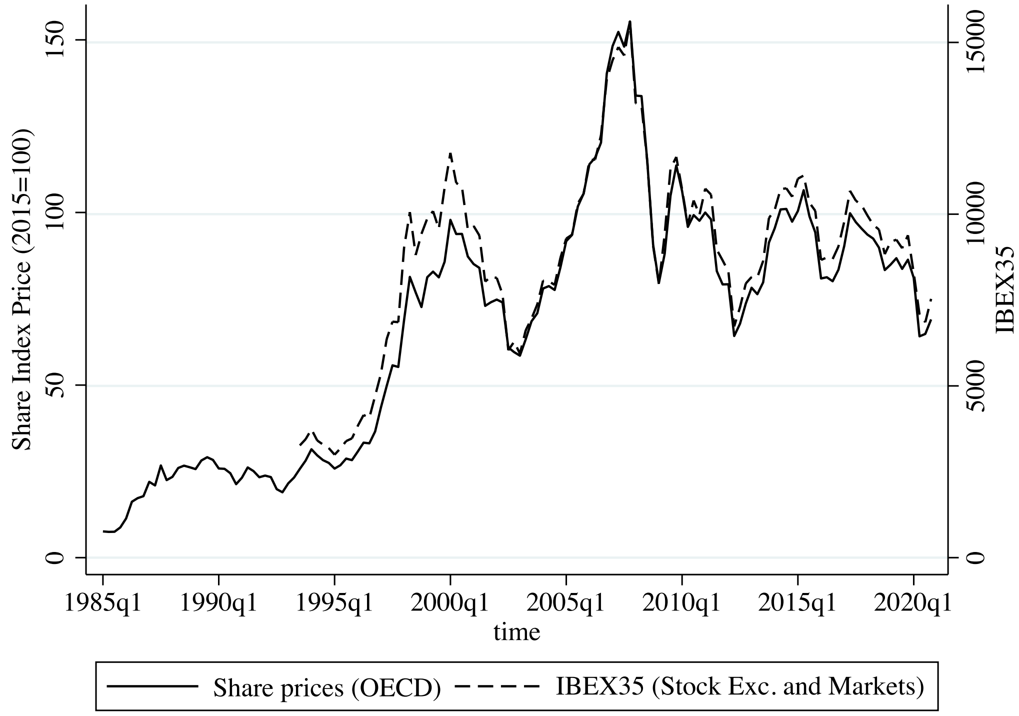
Source: OECD data. Author's elaboration.

Table A.1: The effects of fiscal consolidations on unemployment and wages in Spain (1980-2020): estimation of ψ^h from model 4.9, ψ_r^h and ψ_b^h from model 4.10 for selected time horizons after fiscal consolidation shocks of á la *Giavazzi and Pagano (1990)*

	Horizon				
	h=4	h=8	h=12	h=16	h=20
Panel A					
unem	.075**	.185***	.254***	.188**	.038
	(.038)	(.067)	(.082)	(.078)	(.087)
wages	-.027**	-.057***	-.087***	-.079***	-.057**
	(.011)	(.014)	(.016)	(.022)	(.029)
Panel B					
$unem^r$	.046	.020	.057	.034	-.071
	(.098)	(.129)	(.138)	(.144)	(.140)
$unem^b$	.113	.394**	.503	.383**	.176
	(.091)	(.167)	(.183)	(.186)	(.175)
$F-stat^u$	0.14	2.02	2.75	1.46	0.90
$wages^r$	-.034	-.036	-.014	-.017	.018
	(.026)	(.032)	(.036)	(.046)	(.051)
$wages^b$	-.017	-.082**	-.171***	-.149***	-.144***
	(.036)	(.034)	(.033)	(.043)	(.050)
$F-stat^w$	0.08	0.58	6.52	2.91	3.77
Obs.	149	145	141	137	133

Note: standard errors in parenthesis. ***,**,* denote significance at 1 percent, 5 percent and 10 percent, respectively. Horizons are in quarterly terms. The first column indicates the following: *unem* and *wages* denote that the dependent variable is unemployment and wages respectively, $unem^r$ indicates that the dependent variable of the model is unemployment but the estimated coefficient collected is the one related with recessions (ψ_r^h), and similar for $unem^b$ with booms (ψ_b^h). The same is applied for $wages^r$ and $wages^b$. $F-stat^u$ is the statistic resulting from the hypothesis contrast $H_0 : \psi_r^h = \psi_b^h$ when the dependent variable is unemployment, the same is applied for wages.

Figure A.10: Evolution of stock price indexes (share price index and IBEX-35) in Spain from 1985 to 2020



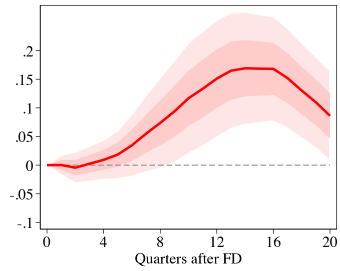
Source: share price index from OECD data (1985:Q1-2020:Q4) and IBEX-35 closing date price from Spanish Stock Exchanges and Markets (1993:Q3-2020:Q4). Author's elaboration.

Table A.2: The effects of fiscal consolidations on stock prices in Spain (1985-2020): estimation of ζ^h from model 4.12, ζ_r^h and ζ_b^h from model 4.13 for selected time horizons after fiscal consolidation shocks of á la *Giavazzi and Pagano (1990)*

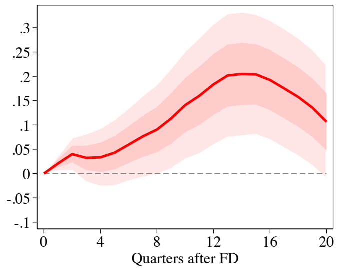
	Horizon				
	h=4	h=8	h=12	h=16	h=20
Panel A					
stock	.002	-.259***	-.383***	-.354***	-.209
	(.078)	(.100)	(.113)	(.133)	(.151)
Panel B					
$stock^r$	.255	.174	-.001	-.151	-.282
	(.204)	(.122)	(.222)	(.253)	(.262)
$stock^b$	-.599***	-1.191***	-1.084***	-.793***	-.393
	(.220)	(.241)	(.303)	(.301)	(.393)
$F-stat^u$	4.39	16.06	5.12	1.75	0.04
Obs.	129	125	121	117	113

Note: standard errors in parenthesis. ***,**,* denote significance at 1 percent, 5 percent and 10 percent, respectively. Horizons are in quarterly terms. The first column indicates the following: *stock* denotes that the dependent variable is stock prices, $stock^r$ indicates that the dependent variable of the model is stock prices but the estimated coefficient collected is the one related with recessions (ψ_r^h), and similar for $stock^b$ with booms (ψ_b^h). $F-stat^s$ is the statistic resulting from the hypothesis contrast $H_0 : \psi_r^h = \psi_b^h$ when the dependent variable is stock prices.

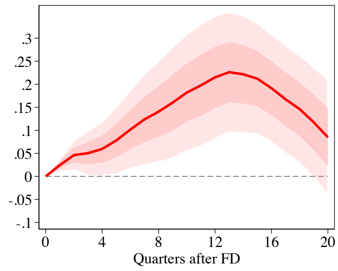
Figure A.11: Impulse response functions estimated from model (4.6): The dynamic responses of unemployment in Spain with different lag criteria ($l_1 = 4$ & $l_1 = 20$)



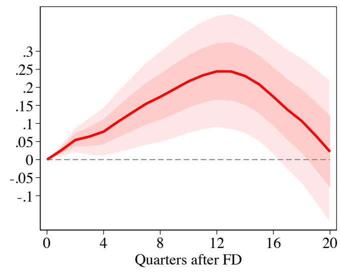
(a)



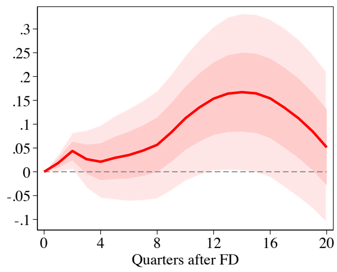
(b)



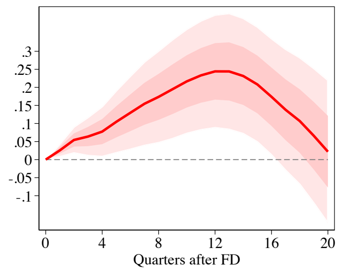
(c)



(d)



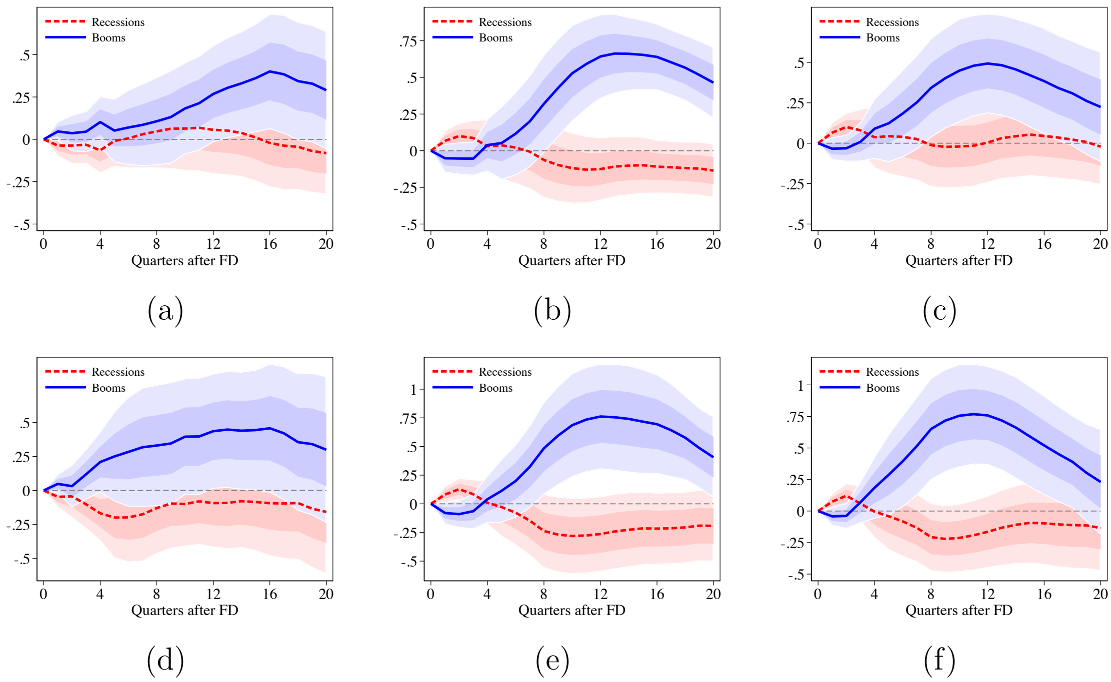
(e)



(f)

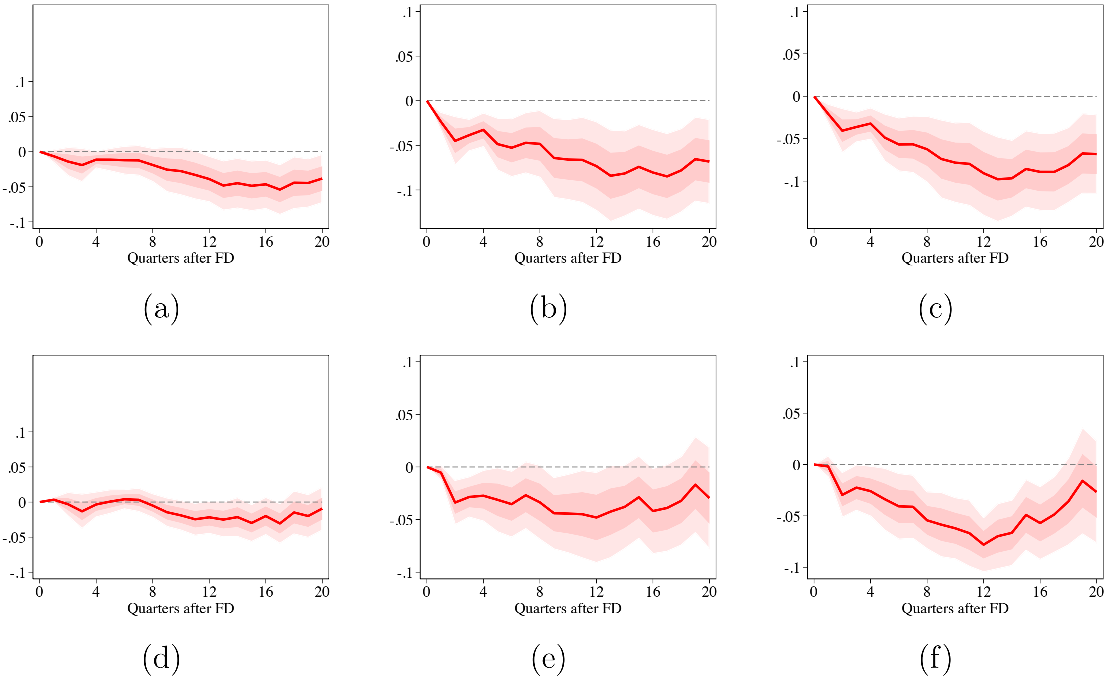
Note: the solid red line corresponds to the IRF (ψ^h estimated coefficients) and limits of the red areas correspond to 1 and 2 standard errors confidence bands. The x-axis denotes time in quarterly terms: $t = 0$ is the quarter of the fiscal consolidation episode. And time horizon is $H = 20$. Panel (a) to (c) refers to $l_1 = 4$ lag length and from (d) to (f) to $l_1 = 20$. Specifically, panels (a) and (d) refer to Afonso (2010) criteria, (b) and (e) to Alesina and Ardagna (1998), and (c) and (f) to Giavazzi and Pagano (1990).

Figure A.12: Impulse response functions estimated from model (4.7): The dynamic responses of unemployment in Spain over the business cycle with different lag criteria ($l_1 = 4$ & $l_1 = 20$)



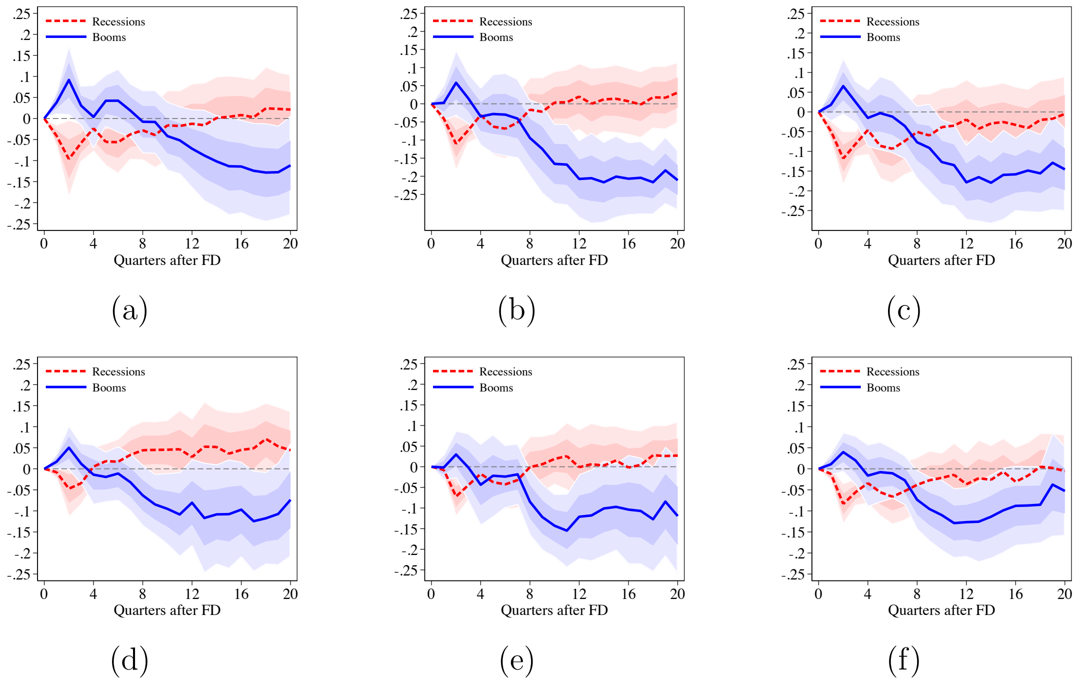
Note: the dashed red line corresponds to the IRF during recessions (ψ_r^h estimated coefficients) and limits of the red areas correspond to 1 and 2 standard errors confidence bands, the same is in blue for booms (ψ_b^h estimated coefficients). The x-axis denotes time in quarterly terms: $t = 0$ is the quarter of the fiscal consolidation episode. And time horizon is $H = 20$. Panel (a) to (c) refers to $l_1 = 4$ lag length and from (d) to (f) to $l_1 = 20$. Specifically, panels (a) and (d) refer to Afonso (2010) criteria, (b) and (e) to Alesina and Ardagna (1998), and (c) and (f) to Giavazzi and Pagano (1990).

Figure A.13: Impulse response functions estimated from model (4.6): The dynamic responses of wages in Spain with different lag criteria ($l_1 = 4$ & $l_1 = 20$)



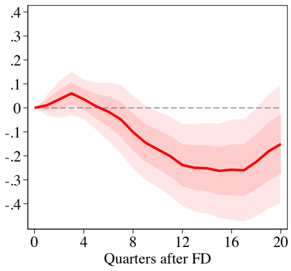
Note: same as in Figure A.11.

Figure A.14: Impulse response functions estimated from model (4.7): The dynamic responses of wages in Spain over the business cycle with different lag criteria ($l_1 = 4$ & $l_1 = 20$)

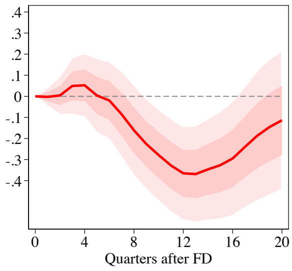


Note: same as in Figure A.12.

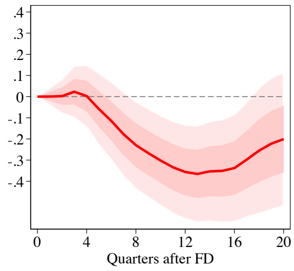
Figure A.15: Impulse response functions estimated from model (4.9): The dynamic responses of stock prices in Spain with different lag criteria ($l_1 = 4$ & $l_1 = 20$)



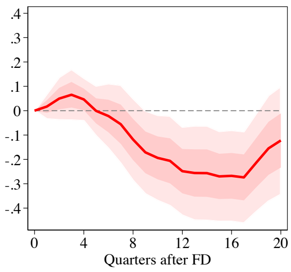
(a)



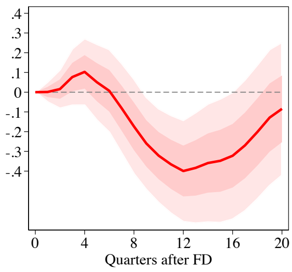
(b)



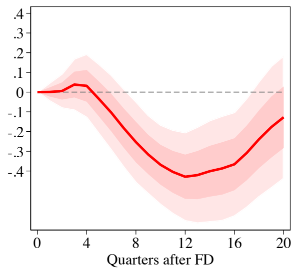
(c)



(d)



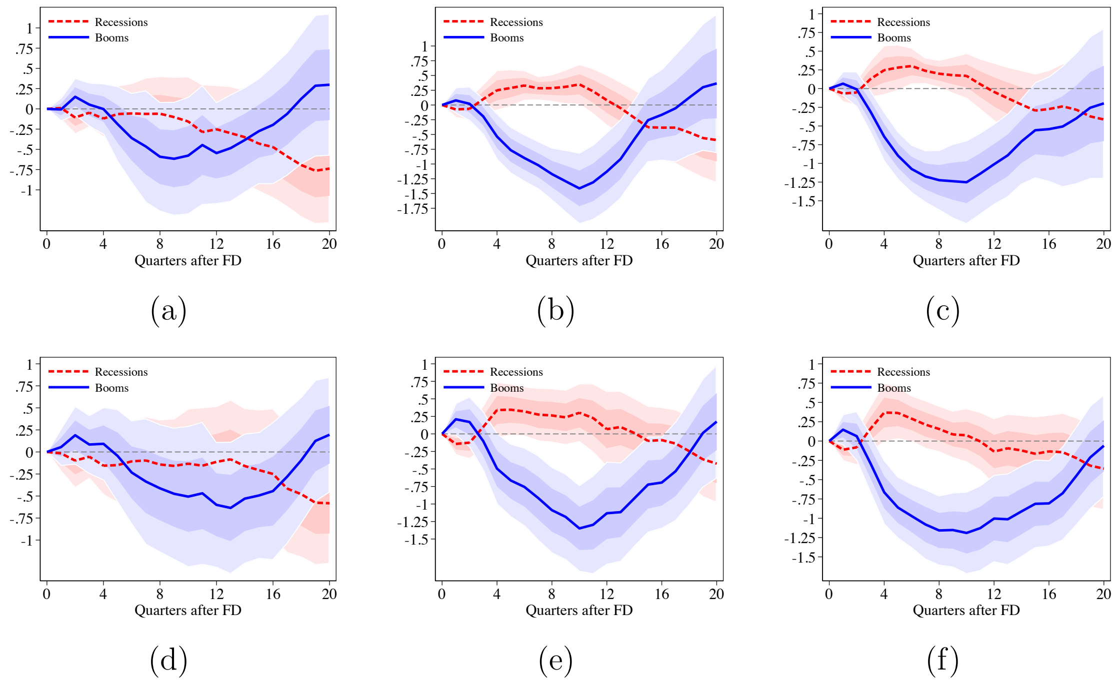
(e)



(f)

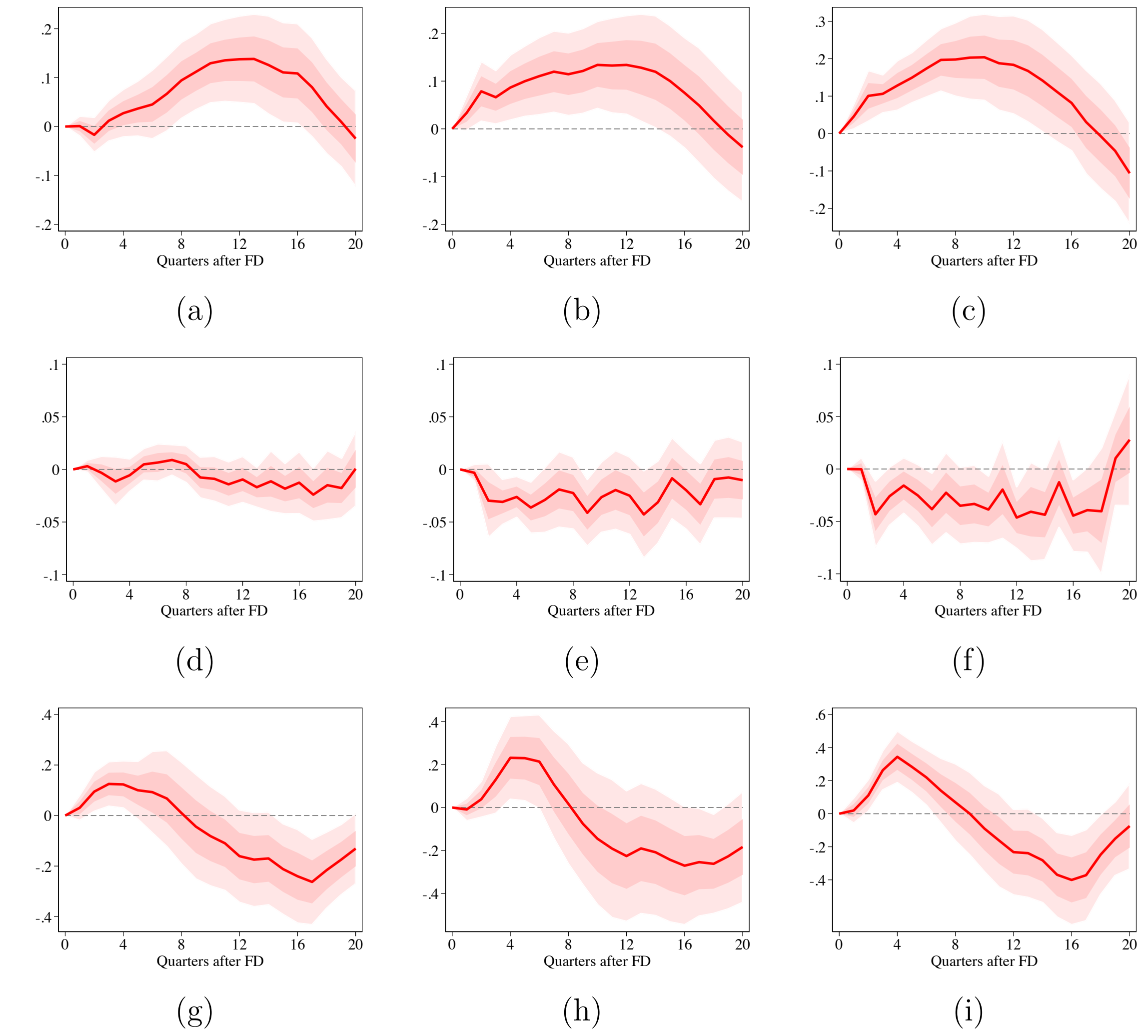
Note: the solid red line corresponds to the IRF (ζ^h estimated coefficients) and limits of the red areas correspond to 1 and 2 standard errors confidence bands. The x-axis denotes time in quarterly terms: $t = 0$ is the quarter of the fiscal consolidation episode. And time horizon is $H = 20$. Panel (a) to (c) refers to $l_1 = 4$ lag length and from (d) to (f) to $l_1 = 20$. Specifically, panels (a) and (d) refer to Afonso (2010) criteria, (b) and (e) to Alesina and Ardagna (1998), and (c) and (f) to Giavazzi and Pagano (1990).

Figure A.16: Impulse response functions estimated from model (4.10): The dynamic responses of stock prices in Spain over the business cycle with different lag criteria ($l_1 = 4$ & $l_1 = 20$)



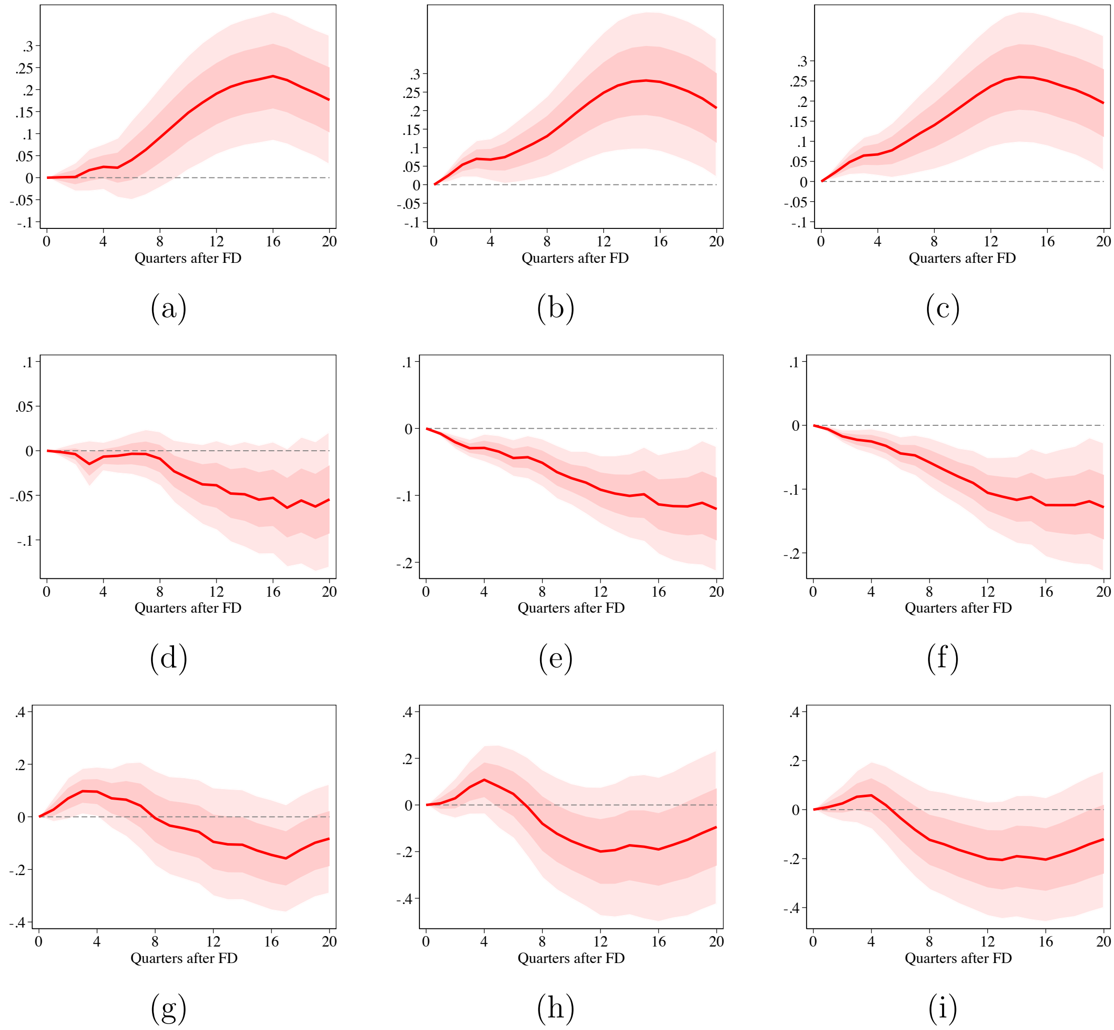
Note: the dashed red line corresponds to the IRF during recessions (ζ_r^h estimated coefficients) and limits of the red areas correspond to 1 and 2 standard errors confidence bands, the same is in blue for booms (ζ_b^h estimated coefficients). The x-axis denotes time in quarterly terms: $t = 0$ is the quarter of the fiscal consolidation episode. And time horizon is $H = 20$. Panel (a) to (c) refers to $l_1 = 4$ lag length and from (d) to (f) to $l_1 = 20$. Specifically, panels (a) and (d) refer to Afonso (2010) criteria, (b) and (e) to Alesina and Ardagna (1998), and (c) and (f) to Giavazzi and Pagano (1990).

Figure A.17: Impulse response functions estimated from model (5.1): The dynamic responses of unemployment, wages and stock prices in Spain controlling for consecutive consolidation episodes ($l_2 = 20$)



Note: the solid red line corresponds to the IRF (ψ^h & ζ^h estimated coefficients) and limits of the red areas correspond to 1 and 2 standard errors confidence bands. The x-axis denotes time in quarterly terms: $t = 0$ is the quarter of the fiscal consolidation episode. And time horizon is $H = 20$. Panels (a) to (c) refers to the effects on unemployment, from (d) to (f) to wages, and from (g) to (i) to stock prices. Specifically, panels (a), (d) and (g) refer to $FD1$, (b), (e) and (h) to $FD2$, and (c), (f) and (i) to $FD3$.

Figure A.18: Impulse response functions estimated from models (4.6) & (4.9): The dynamic responses of unemployment, wages and stock prices in Spain with omission of controls



Note: the solid red line corresponds to the IRF (ψ^h & ζ^h estimated coefficients) and limits of the red areas correspond to 1 and 2 standard errors confidence bands. The x-axis denotes time in quarterly terms: $t = 0$ is the quarter of the fiscal consolidation episode. And time horizon is $H = 20$. Panels (a) to (c) refers to the effects on unemployment, from (d) to (f) to wages, and from (g) to (i) to stock prices. Specifically, panels (a), (d) and (g) refer to $FD1$, (b), (e) and (h) to $FD2$, and (c), (f) and (i) to $FD3$.

Appendix B

Extra documentation

2015: Stability Program update 2015-2018 of the Kingdom of Spain.

As stated in the program, *" the macroeconomic scenario envisages the continuation of the fiscal consolidation path started in 2012, fulfilling the 4.2% of GDP deficit commitments in 2015 and 2.8% in 2016 set out in the Council of the European Union Recommendation of 21st June 2013"*. Thus, the Spanish Stability Program aimed to fulfilled the provisions of the Code of Conduct of the Stability and Growth Pact of the EU. Concretely, this planned fiscal consolidation was aimed to be conducted by increases in both direct and indirect taxes: *"In 2015, it is expected that total State taxes (including the participation of Regional Governments and Local Corporations in Personal Income Tax, VAT and Excise Taxes) will grow by 6.3% compared to 2014 outturn, driven by expected increases in direct and indirect taxes of 5.8% and 7%, respectively"*.

2016: Stability Program update 2016-2019 of the Kingdom of Spain.

As explicitly stated, *" The fiscal strategy projected for the 2016-2019 period continues with the intense consolidation process carried out by the Public Administrations since 2011, which has allowed reducing the public deficit by more than 4 points of GDP since then."* Also, the deficit goal was corrected; *" With the Stability Programme Update a new stability goal has been set for the Central Government subsector, from a deficit target of 2.2% of GDP initially forecasted for 2016 to a deficit target of 1.8% of GDP."* Mainly, the consolidation was aimed to be conducted *via* expenditures; *" As for the expenditure, it will drop by 3%, mainly as a result of the decrease in current and capital transfers and in interests"*.

2017: Stability Program update 2017-2020 of the Kingdom of Spain.

The consolidation path was aimed to continue; *" With regards to the public sector, this Stability Programme Update maintains the commitment to reduce the public deficit, in line with the path recommended in the EU Council Decision adopted on 8th August 2016, regarding the need to take the necessary measures to correct the excessive deficit. Thus, the deficit target for the General Government is set at 3.1% of GDP in 2017 and at 2.2% in 2018"*, *via* an increase in direct taxes, *" the modifications introduced in the Corporate Income Tax by Royal Decrees-Law 2 and 3/2016 "*, and expenditures; *" on the expenditure side, the Agreement of Non-Availability (known as AND in Spanish) of credits amounting to € 5.5 billion and the adoption of measures to control the expenditure implementation during 2017, as well as the* *various agreements signed with Farmaindustria and the Regional Governments, in order to limit the growth of the pharmaceutical expenditure while guaranteeing the population's access to the latest health treatments can be highlighted"*.

2018: Stability Program update 2018-2021 of the Kingdom of Spain.

The fiscal path continued to be consolidation-based; *" In line with the commitments assumed within the framework of the European Union, Spain will continue with the process of consolidating public finances. A gradual reduction of the public deficit is expected, from 3.1% recorded in 2017 to 2.2% in 2018, thus abandoning the Excessive Deficit Procedure and approaching the budget balance in the following fiscal years."* A continuous consolidation *via* expenditures; *" it is planned a reduction in the weight of practically all expenditure items as a percentage of GDP, especially in the components of public consumption: compensation of employees, intermediate consumption and social transfers in kind, an essential element for public administrations to comply with the expenditure rule"*.

2019: Stability Program update 2019-2022 of the Kingdom of Spain.

The fiscal path was aimed to continue; *"fiscal consolidation efforts shall continue until 2022 through a variety of fiscal measures, which are already in an advanced stage of their administrative and approval process, with a projected deficit reduction from 2.5% in 2018 to 2% in 2019, 1.1% in 2020 and 0.4% in 2021, reaching a balance in 2022"*, *via "tax measures introduced in the 2019 General State Budget, anti-fraud measures and new taxes (Tax on Financial Transactions and Tax on Certain Digital Services)"*.

2020: Stability Program update 2020-2021 of the Kingdom of Spain.

The fiscal plan was an extraordinary effort given the irruption of the COVID-19 pandemic which implied a shift from consolidation aims; *"the unprecedented fiscal effort underlying this scenario translates into an estimated deficit for the general government as a whole of 10.3% of GDP by 2020"*.