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Spanish recessions 1850–2023: A business cycle accounting analysis☆

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ABSTRACT

This paper quantitatively analyzes six major recessions in the Spanish economy between 1850 and 2023 using an accounting framework that decomposes deviations from trend into structural components. The results identify two types of recessions: those driven by labour-aumenting efficiency—such as the *fin de siècle Depression* and the *Great Depression*—and those primarily shaped by the household labour wedge—namely, the *Great Stagflation*, *European Recession*, *Great Recession*, and the COVID-19 crisis. Tax dynamics played a key role in the *Great Stagflation*, but not in the more recent crises. Openness and employment composition are informative about labour-aumenting efficiency trend, while institutional labour market features — such as temporary contracts and unemployment benefits — are closely linked to the household labour wedge. The analysis confirms the growing relevance of the household labour wedge in explaining macroeconomic fluctuations in Spain, even when accounting for a stochastic downward trend in hours worked.

1. Introduction

The period from 1850–2023 is striking from a macroeconomic perspective because of a number of short-run events and also because of it its importance in the long-run evolution of the Spanish economy. This period includes the *fin de siècle Depression*[1] to which the agrarian great depression of 1873 and the international financial crisis of 1884 dragged the Spanish economy. It also includes the *Great Depresion-Civil War* of the 1930s, in which government consumption rose enormously, taking away resources from the private sector. There were also the *Spanish economic miracle* or *Golden Age*, a period of exceptionally rapid growth and development across all major areas of economic activity in Spain between 1950s to 1974. The *stagflation* of the 1970s and 1980s with the mixture of external and internal components; on the one hand the oil crisis and the international monetary system, and on the other hand the instability and uncertainty generated by the decline of Franco's dictatorship. More recently, the *Great Recession* that began at the end of 2007, and the 2020 COVID-19 recession caused by the policies implemented by most of the world's governments to fight the spread of the virus.

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[1] In economic history, generally referred to the period between 1873 and 1879 (in the U.S.) or 1873 and 1896 (in the U.K. and much of Europe) as Long Depression. The Long Depression was sparked off by a global financial panic in 1873. What followed was a thirty-year period of gradually declining prices and GDP in most parts of the world. I use here the term most commonly used in Spanish historiography: *fin de siècle Depression* (*Depresión Finisecular)*.

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The present paper is the first approach to these early recessions using quantitative dynamic stochastic general equilibrium theory and performing an accounting exercise that provides directions for future research. Such exercises help to identify the fundamental processes affecting economic performance and can be used to determine the most promising theories regarding the main features of the economy. The exercise I perform is inspired by Business Cycle Accounting (BCA), first used in Cole and Ohanian (2002), and Chari et al. (2002), and then developed further in Chari et al. (2007), and Brinca et al. (2016), and applied to low-frequency phenomena as in Hansen et al. (2021) or Jiang and Weder (2021).

The methodology relies on the collection of so-called wedges. The wedges represent the overall distortions to the relevant equilibrium conditions of a model of stochastic growth, and they include efficiency, investment, resource constraint and two labour wedges. The efficiency wedge reflects frictions that cause factor inputs to be used inefficiently. The investment wedge reflects the gap between the intertemporal marginal substitution rate and the return on capital in expect value, while the resource wedge reflects the gap between output and its allocation to consumption and investment. I compute two labour wedges: the household labour wedge that it is the gap between the real wage and the marginal rate of substitution between leisure and consumption, and the firm labour wedge that it is the gap between the marginal productivity of the firm and the real wage. To identify both wedges I will use data on the factor income distribution.

With these wedges, which equal the number of endogenous variables, the model fits the data of the per capita hours worked, output, investment, and labour share perfectly, and therefore the model is used as an accounting device. To do this, the measured wedge values are individually, or in a group, fed back into the decision rules to assess the amount of the observed movements in macroeconomic variables that can be attributed to each wedge. Simulating the solution of the model for each wedge, I calculate the wedge-alone component of each variable caused by each wedge, reflecting each wedge's contribution to the movements of the variable around its trend from 1850 to 2023 and in the recessions.

The model considers a utility function allowing hours worked per capita to show a long-term decreasing trend. In particular, I use a utility function discussed by Boppart and Krusell (2020) (the MaCurdy, 1981 utility function) instead of the usual utility function proposed by King et al. (1988) (KPR), which implies that hours worked per capita are constant along a balanced growth path (BGP). Fig. 1 panel (a) shows the evolution of my measure of hours worked per capita for the Spanish economy over the period considered, showing the decreasing trend in hours worked. This is not peculiar to the Spanish economy, Boppart and Krusell (2020) show a decline for several developed countries. BCA exercises typically use KPR preferences, and therefore send the discrepancy between the existing decreasing trend of hours and their constant BGP value to the wedges, especially to the labour market wedges. On the other hand, several authors have pointed out the importance of the household labour wedge in explaining aggregate fluctuations in economies, e.g. Galí et al. (2007) and Karabarbounis (2014). The joint consideration of a decreasing trend accounting model of hours worked and the two labour wedges allows for a better appreciation of the importance of the household labour wedge.

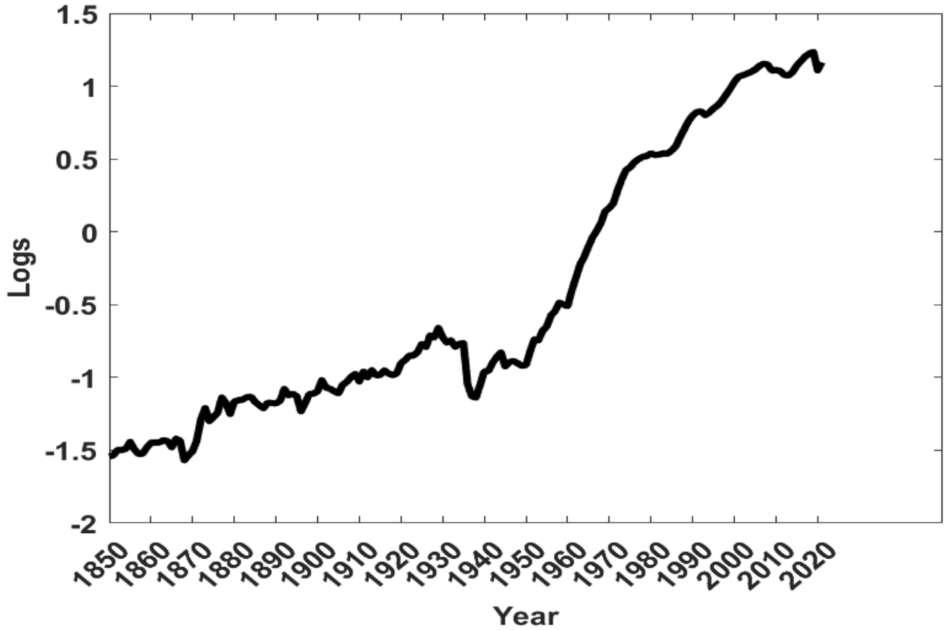
Another ingredient of the model is motivated by the evidence that my estimate of the labour-augmenting factor scale has a stochastic trend. Thus, I consider that shocks to the growth rate have permanent effects on the level of the labour-augmenting factor scale process. Aguiar and Gopinath (2007) found that shocks to trend growth are the primary source of fluctuations in emerging economies, which are characterized by frequent regime switches in fiscal, monetary, and trade policies. This is a very appropriate feature for the Spanish economy during the period under review.

The six recessions studied can be classified into two classes: those whose causes are related to the efficiency wedge (*fin de siècle Depression* and *Great Depression*) and those whose causes have been transmitted through the household labour wedge (*Great Stagflation*, *European Crisis*, *Great Recession* and COVID-19). In seeking explanations for the behaviour of the wedges, I have found that during the Great Stagflation an important part of both the evolution and the contribution to aggregate variables of the household labour wedge and the investment wedge was explained by the evolution of taxes. In any case, the importance of the household labour wedge in the macroeconomic fluctuations of the Spanish economy is not diminished by the consideration of preferences compatible with a stochastic downward trend in hours worked. I have also found that the labour-aumenting factor scale is stably and positively related to the degree of openness of the economy and changes in the composition of the labour factor that capture increases in its human capital, as the growth literature has been pointing out.

The most important conclusion is that theories are needed in which the transmission mechanism of shocks is through the household labour wedge, as many authors have pointed out, starting with Galí et al. (2007) and Karabarbounis (2014). For example, a large literature has studied the interaction of financial frictions with macroeconomic fluctuations, a comprehensive summary can be found in Quadrini (2011) and Brunnermeier et al. (2013). Much of this literature establishes a link between financial frictions and the firm labour wedge (in addition to TFP), see for example Arellano et al. (2019). My exercise suggests that a good understanding of the transmission of shocks requires studying the link between financial frictions and the household labour wedge. For example, Jones et al. (2022) study a model where there is an investment wedge and a household labour wedge created by household unionization, but more research is needed.

Some authors have analysed the period 1850–2019 for Spain using quantitative general equilibrium tools. del Río and Lores (2023) use the neoclassical growth model in its perfect foresight version to study the characteristics of Spain's economic growth. These authors use the factor income distribution to calculate two efficiency wedges to study the growth of the Spanish economy between 1850–2019, here the focus is on fluctuations so it is more interesting to consider two labour wedges. Giménez and Montero (2015) find that most of the Spanish economic downturn during the *Great Depression* of the 1930s was driven by the fall of TFP. Rodríguez-López and Solís García (2016), applying the BCA methodology to the analysis of the Spanish economy after 1976, find that the recession of the 1970s and the *Great Recession* were mainly driven by the labour wedge. These authors calculate a single labour wedge.

(a) Hours worked per capita.



(b) GDP per capita.

Fig. 1. GDP and Hours Worked per Capita.
Note: The data used are described in Appendix A.

There are some authors that apply BCA to a group of countries in which Spain is a part, all of them are all driving a single labour wedge.[2] Kolasa (2013) uses the BCA framework to investigate the differences between economic fluctuations in central and

[2] Brinca et al. (2024) provides a comprehensive survey of the BCA literature.

eastern european countries (the Czech Republic, Hungary, Poland, Slovakia and Slovenia) and the euro area in the period 1995-Q1 to 2011-Q4. This author finds that the major differences between the euro area and the region concern the importance of the labour and investment wedges, which account for a relatively larger share of movements in the central and eastern european region. Chakraborty and Otsu (2013) also find this importance of the investment wedge in the rapid development of the BRIC countries. Gerth and Otsu (2017) study the *Great Recession* in 30 European countries, including Spain. They find that although the efficiency gap drove the fall in output in most European countries, there were exceptions among southern European countries. Spain was one of the exceptions; in Spain it was the investment wedge that was the main cause of the fall in output. More recently, Fernandes (2022) studies the economic shock caused by the COVID-19 pandemic, both in the euro area and in the USA. He finds that in the euro area it was the efficiency wedge that drove the fall in output while in the USA it was the labour wedge. Likewise, the investment wedge had a positive effect on output in both regions. In this literature my exercise places Spain as one of the European exceptions where the importance is in the labour wedge (of households).

The structure of the remainder of this study is organized as follows. Section 2 presents a detailed description of the model employed in the analysis. Section 3 provides a concise discussion on the interpretation of wedges and their linkages to various facets of economic reality. In Section 4, I examine the detrended variables and wedges across the entire period under consideration. Section 5 explores the diverse modelling approaches adopted in the literature to enhance the understanding of the findings. Section 6 focuses on identifying and dating the recessions to be analysed. In Section 7, I investigate the six most significant economic crises in the Spanish economy from 1850 to 2023. Section 8 is dedicated to analysing the wedges to uncover explanations for their behaviour. Finally, Section 9 offers concluding remarks.

2. The model

The model is a one-sector neoclassical dynamic growth model with five stochastic variables, henceforth called ‘wedges’. These wedges are ‘distortions’ and represent policies and institutions which affect productivity, hours worked, capital accumulation, and resource constraint: the *efficiency wedge* γ_t, the *firm labour wedge* $\pi^f_{l,t}$, the *household labour wedge* $\pi^h_{l,t}$, the *investment wedge* $\pi_{x,t}$, the *resource wedge* $\pi_{g,t}$.

The representative household maximize expected utility over per capita consumption $\tilde{c}_t$ and per capita labour $\tilde{h}_t$, the representative household at time t is composed of L_t members and $L_{t+1} = \eta L_t$ where η is the population gross growth rate. Each member of the representative household is endowed with one unit of time that can be shared between labour, $0 < \tilde{h}_t < 1$, in return for a wage, W_t, and leisure, $1-\tilde{h}_t$. Therefore, $H_t = L_t\tilde{h}_t$ is time offered in the labour market by the representative household. The intertemporal utility function is

$$U = E\left\{\sum_{t=0}^{\infty} L_t\beta^t\left(\frac{\tilde{c}_t^{1-\sigma}-1}{1-\sigma} - \frac{\tilde{h}_t^{1+\frac{1}{\theta}}}{1+\frac{1}{\theta}}\right)\right\} \tag{1}$$

The intertemporal utility function of the representative household is of the family characterized in Boppart and Krusell (2020) whose main feature is that it is compatible with a decreasing hours worked path in the balanced-growth path of the economy. I use the MaCurdy (1981) utility function which is a particular case of this family and which imposes a relationship between the elasticities of substitution and Frisch. $0 < \beta < 1$ is the discount factor, $1/\sigma$ is the intertemporal elasticity of substitution and θ the Frisch elasticity of labour supply. With this utility function the values of the intertemporal elasticity of substitution and the Frisch elasticity have to be consistent with the change rate in the labour-intensive margin along a balanced growth path ($-\nu$).

$$\nu = \frac{\sigma-1}{\sigma+\frac{1}{\theta}}$$

Parameter ν can be interpreted as the fraction of a 1 percentage point productivity gain that the representative household chooses to convert into more leisure, as opposed to more consumption, along a balanced-growth path. With $\nu > 0$, hours fall when productivity rises as the income effect dominates the substitution effect on a balanced-growth path. Similarly, if $\nu < 0$, hours rise when productivity rises.

The household maximize expected utility subject to the budget constraint,

$$L_t\tilde{c}_t + \pi_{x,t}X_t = W_t\tilde{h}_tL_t/\pi^h_{l,t} + r_tK_t + B_t$$

where $\pi^h_{l,t}$ is the *household labour wedge* and $\pi^{-1}_{x,t}$ is the *investment wedge* and B_t are lump-sum transfers, $B_t = (1 - 1/\pi^h_{l,t})W_t\tilde{h}_tL_t - (1 - \pi_{x,t})X_t - (1 - \pi_{g,t})Y_t$. This transfer system guarantees the consistency of the household budget constraint and the resource constraint.

Capital, K_t, evolves according to the following move law, which includes investment adjustment costs,

$$K_{t+1} = X_t + (1-\delta) K_t - \Psi\left(X_t/K_t\right) K_t$$

where $\Psi' > 0$, $\Psi'' > 0$ and $\Psi(\delta K_t) = 0$ and $0 < \delta < 1$ is the economic depreciation rate of capital at time t.

A representative firm produces output, Y_t, according to a neoclassical production function and using capital and labour as production factors,

$$Y_t = F\left(K_t, \Gamma_t H_t\right) \tag{2}$$

where $\Gamma_t \geq 0$ denotes the cumulative stochastic growth rate of the labour-aumenting factor scale. The law of motion for Γ_t is as follows:

$$\Gamma_t = \gamma_t \Gamma_{t-1}$$

where γ_t denotes the gross growth rate of the labour-aumenting factor scale and it is a stationary production processes. On the contrary, Γ_t represents the cumulative product of 'growth' shocks.

$$\Gamma_t = \prod_{s=0}^{t} \gamma_s$$

I will refer to the realizations of γ_t as the *efficiency wedge* since they constitute the stochastic trend of the labour-augmenting factor scale. Given that a realization of γ permanently influences Γ, output is non-stationary with a stochastic trend.

Firms maximize profits given by

$$F\left(K_t, \Gamma_t H_t\right) - r_t K_t - W_t \pi^f_{l,t} H_t$$

where $\pi^f_{l,t}$ is the *firm labour wedge*, W_t wage rate and r_t the rental price of capital.

The equilibrium of this economy in terms of the detrended variables per capita is summarized by the resource constraint,[3]

$$c_t + x_t = y_t \pi_{g,t}, \tag{3}$$

where $\pi_{g,t}$ is called the *resource wedge*. The resource wedge represents the discrepancy between production and the allocation of resources to consumption and investment. The resource wedge, π_g equals one minus the ratio of output no allocated to consumption or investment to the output. Therefore, it decreases when the output diverted from consumption and investment uses increases. $c_t = C_t/\Gamma_{y,t-1} L_t$ is detrended consumption per capita and $x_t = X_t/\Gamma_{y,t-1} L_t$ is detrended investment per capita, together with detrended output per capita, $y_t = Y_t/\Gamma_{y,t-1} L_t$, is given by the production function

$$y_t = f\left(k_t, \gamma_t h_t\right) \tag{4}$$

where $k_t = K_t/\Gamma_{y,t-1} L_t$ is detrended capital per capita and $h_t = H_t/\Gamma_{h,t-1} L_t$ are detrended hours worked per capita, and $\Gamma_{h,t} = \Gamma_t^{-\nu} = \Gamma_{y,t}/\Gamma_t$. I normalize by trend productivity through period $t-1$. This ensures that if a variable is in the agent's information set as of time $t-1$, so is the detrended variable. The solution to the model is invariant to the choice of normalization.

The evolution law of capital where $\gamma_{yt} = \gamma_t^{1-\nu}$,

$$\eta \gamma_{y,t} k_{t+1} = x_t + (1-\delta) k_t - \Psi\left(\frac{x_t}{k_t}\right) k_t \tag{5}$$

The representative firm hires capital to equalize its marginal productivity to their rental price (r_t). It also hires labour to equal its marginal productivity to $\pi^f_{l,t} W_t$

$$\varepsilon_t = r_t \frac{k_t}{y_t} \tag{6}$$

and

$$1 - \varepsilon_t = \pi^f_{l,t} w_t \frac{h_t}{y_t} \tag{7}$$

where $w_t = W_t/\Gamma_{t-1}$ is detrended wage per worked hour and

$$\varepsilon_t = \frac{k_t f_1\left(k_t, \gamma_t h_t\right)}{f\left(k_t, \gamma_t h_t\right)} \tag{8}$$

is output elasticity for capital and $1-\varepsilon_t$ is output elasticity for labour. According to the first order condition (7), the labour share (s_{lt}) equals the output elasticity for labour divided by the firm labour wedge, $s_{l,t} = (1-\varepsilon_t)/\pi^f_{l,t}$.

[3] The resource constraint is $Y_t = C_t + X_t + G_t$ where Y_t is aggregate output which is allocated to consumption, C_t, investment, X_t, and other ends, G_t. I rewrite the resource constraint as $\pi_{g,t} Y_t = C_t + X_t$ where $\pi_{g,t} = 1 - \frac{G_t}{Y_t}$ for technical convenience as the observations of G_t take negative values in some years, which makes it difficult to use logarithms in computing the solution of the model.

The first-order conditions characterizing a maximum of the household problem are as follows

$$u_c(c_t, h_t) = \beta\, \gamma_{y,t}^{-\sigma}\, E_t\left[u_c(c_{t+1}, h_{t+1})(1 + i_{t+1})\right] \tag{9}$$

$$\begin{aligned} r_{t+1} \;=\; & \frac{\pi_{x,t}\left(1 + i_{t+1}\right)}{1 - \Psi\left(\frac{x_t}{k_t}\right)} + \frac{\pi_{x,t+1}}{1 - \Psi\left(\frac{x_{t+1}}{k_{t+1}}\right)} \cdot \\ & \cdot \left[\Psi\left(\frac{x_{t+1}}{k_{t+1}}\right) - \Psi'\left(\frac{x_{t+1}}{k_{t+1}}\right)\frac{x_{t+1}}{k_{t+1}} - (1-\delta)\right] \end{aligned} \tag{10}$$

$$-\frac{u_h(c_t, h_t)}{u_c(c_t, h_t)} = \pi_{l,t}^{h} w_t \tag{11}$$

Here i_{t+1} is the interest rate at time $t+1$,

$$i_{t+1} = \frac{p_t}{p_{t+1}} - 1, \tag{12}$$

where p is the Arrow–Debreu price of the composite commodity. $u_c(\cdot)$ and $u_h(\cdot)$ are the marginal utility of consumption and hours.

The stochastic process for the exogenous states $s_t = (\log\gamma_t, \log\pi_{l,t}^{f}, \log\pi_{l,t}^{h}, \log\pi_{x,t}, \log\pi_{g,t})$ is governed by a first-order VAR:

$$s_{t+1} = P_0 + P s_t + Q v_{t+1} \tag{13}$$

in which P_0 and P are matrices of autoregressive coefficients to be estimated, v_t is a vector of innovations, and QQ' is the variance–covariance matrix of the innovations. To estimate the stochastic process for the s_t, I use a standard maximum likelihood procedure with a non-linear filter is used to back out the wedges because I use a second-order approximation to the decision rules of the model's control variables.

Equation (9) is the Euler equation, according to which expected (discounted) marginal utilities are equal over time. It is interesting to note that the discount factor is affected by γ_t ($\gamma_{yt} = \gamma_t^{1-\nu}$) and therefore the calculation of $\pi_{x,t}$ is affected by the growth rate of the labour-aumenting factor scale. Equation (10) establishes that the rental price of capital equals its user cost which, in addition to the interest rate and the economic depreciation rate, also includes the investment wedge and the investment adjustment costs. Equation (11) states that the marginal rate of substitution between consumption and leisure equals the wage adjusted by the household labour wedge. Appendix B performs a robustness test on the estimate.

The system of equations (3)–(13) characterizes the equilibrium of the economy.

3. Economic mechanisms behind the wedges

This section provides an economic interpretation of the wedges embedded in the model: the efficiency wedge, the labour wedge (comprising firm and household components), the investment wedge, and the resource wedge. These wedges capture deviations from the frictionless neoclassical benchmark and reflect distortions stemming from a variety of frictions, policy interventions, and institutional imperfections. Understanding the underlying mechanisms behind each wedge is essential for linking the model's empirical decomposition to observable economic structures and policy-relevant frictions. Table 1 provides a summary of the interpretation of wedge changes and Fig. 2 depicts them.

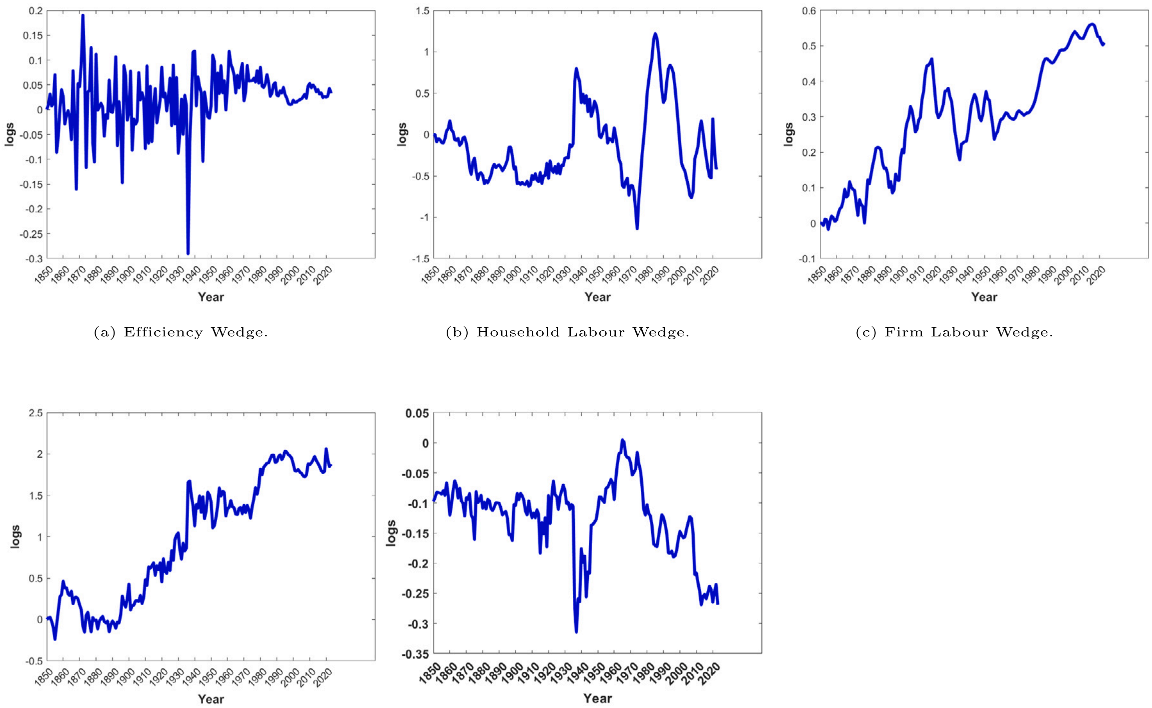
Efficiency wedge. The efficiency wedge (γ_t) accounts for differences in total factor productivity (TFP) that arise from intertemporal variations in technology and efficiency.[4] These differences may stem from barriers to technology adoption, weak institutional environments, deficiencies in human capital, inadequate infrastructure, lack of trade openness, or underdeveloped financial systems. The theoretical and empirical literature emphasizes the critical role of institutions (Acemoglu et al., 2005) and human capital (Hall & Jones, 1999) in driving long-run productivity growth. Moreover, the diffusion of innovation is shaped by the absorptive capacity of an economy—particularly its education system and R&D capabilities (Nelson & Phelps, 1966). Financial development (King & Levine, 1993) and international integration (Coe & Helpman, 1995) can also foster higher TFP by enhancing resource allocation and intensifying competition.

In the model, the *efficiency wedge* is interpreted as an exogenous residual that captures changes in productive efficiency. A decline in this wedge signals a deterioration in the economy's capacity to convert inputs into output, whether due to adverse shocks, institutional regressions, or other unobserved inefficiencies.

Labour wedges. The labour wedge reflects a deviation between the marginal product of labour (MPL) and the marginal rate of substitution (MRS) between consumption and leisure. It can be decomposed into two economically distinct sources: the *firm labour wedge* and the *household labour wedge*.

The **firm labour wedge** (π_{lt}^{f}) captures distortions on the production side. It represents the gap between the MPL and the real wage. These distortions can originate from monopolistic competition in product markets — typically modelled via price markups (e.g., Galí et al., 2007) — or from wage rigidities, hiring costs, and capital–labour complementarities that hinder labour demand responsiveness (e.g., Christiano et al., 2005).

[4] The other part of the changes in TFP is the output elasticity of labour, as will become clear later.



(a) Efficiency Wedge. (b) Household Labour Wedge. (c) Firm Labour Wedge.

(d) Investment Wedge. (e) Resource Constraint Wedge.

Fig. 2. Dynamic Paths of the Model Wedges.
Note: The series are interpreted as implicit distortions: an increase in the investment wedge is observationally equivalent to a decline in the tax on capital accumulation; a rise in the household labour wedge reflects a reduction in labour supply frictions, while a rise in the firm labour wedge reflects an increase in labour demand distortions. An upward movement in the efficiency wedge signals an improvement in total factor productivity. Finally, a decrease in the *resource wedge* implies that a larger portion of output is being absorbed by uses not allocated to consumption or investment.

Table 1
Economic interpretation of wedge movements.

Wedge	Interpretation of an Increase
Efficiency wedge	Higher tfp; improved efficiency in converting inputs into output.
Firm labour wedge	Stronger labour demand distortions; greater gap between marginal product of labour and real wage.
Household labour wedge	Lower labour supply distortions; reduced taxes, benefits, or other disincentives to work.
Investment wedge	Lower distortions to capital accumulation; lower effective tax or cost of investment.
Resource wedge	Smaller share of output absorbed by government, trade imbalances, or unmodelled uses.

The **household labour wedge** (π^h_{lt}), by contrast, reflects distortions on the supply side. It captures the gap between the real wage and the MRS, driven by labour income taxation (Prescott, 2004), unemployment benefits, or preference shocks that reduce the incentive to work. Bargaining frictions and search-and-matching inefficiencies, as in Mortensen and Pissarides (1994), may also depress labour supply by raising the opportunity cost of participation.

Taken together, these wedges form the *total labour wedge*, which summarizes the combined impact of supply- and demand-side frictions on employment. This decomposition is useful for isolating the relative contribution of institutional or behavioural sources of inefficiency. Empirical studies have shown that labour wedges are a key driver of employment fluctuations over the business cycle (e.g., Galí et al., 2007; Shimer, 2010).

In the model, an increase in the *firm labour wedge* reflects a rise in labour demand distortions—e.g., stronger market power or more binding frictions. Conversely, a rise in the *household labour wedge* signals a reduction in supply-side distortions — such as lower taxes or increased willingness to work — thus enhancing labour force participation incentives.

Investment wedge. The investment wedge (π^{-1}_{xt}) captures the discrepancy between the intertemporal marginal rate of substitution and the marginal product of capital, and is typically interpreted as reflecting capital market distortions. These may include financial frictions such as credit constraints or monitoring costs (Bernanke & Gertler, 1989; Kiyotaki & Moore, 1997), distortionary tax policies, or institutional barriers that impede efficient capital allocation. Such frictions increase the effective cost of capital and discourage investment.

Empirically, fluctuations in the investment wedge often coincide with episodes of financial stress or changes in the macro-financial environment, as documented in business cycle accounting exercises (e.g., Chari et al., 2007). In the model of my exercise, the *investment wedge* is interpreted as a tax on investment goods: an increase in the wedge implies a *decline* in the effective distortion, indicating improved conditions for capital formation.

Resource wedge. Finally, the *resource wedge* (π_{gt}) measures the portion of output not allocated to either private consumption or investment. This residual may be attributed to government consumption, net exports, or other unmodelled uses such as measurement errors or unobserved inefficiencies. A fall in the resource wedge implies that a larger share of output is being diverted from productive uses, thus reducing the resources available for capital accumulation and consumption. Although less frequently emphasized, this wedge captures potentially important channels — such as fiscal shocks or trade imbalances — that affect the economy's resource constraint.

4. The Spanish economy, 1850–2023

This section presents the long-run evolution of the Spanish economy through the lens of model-based wedges and detrended macroeconomic variables. I first analyse the dynamics of the five wedges obtained via the accounting methodology. I then describe the behaviour of key aggregates — output, hours worked, investment, the labour share and resource wedge — highlighting major historical episodes.[5]

The model-based wedges (see Fig. 2), panel (a) displays the efficiency wedge. This component has remained relatively stable since the mid-1950s but has exhibited a persistent decline since the mid-1980s. The literature has widely noted this stagnation of TFP as a distinctive feature of the Spanish economy (see Boldrin et al., 2010; Conesa & Kehoe, 2017; Prados de la Escosura & Rosés, 2021; del Río & Lores, 2023; Rodríguez-López & Solís García, 2016).

Panel (b) shows the household labour wedge. During the 19th century, this wedge declined until around 1880 and turned negative by the end of the century, indicating that real wages were growing faster than the marginal rate of substitution between consumption and leisure. The wedge increased moderately until the 1930s and then spiked during the Civil War. From that peak, it fell steadily until the mid-1970s, followed by a sharp rise during the economic turmoil of the 1980s. In the decades preceding the Great Recession, the wedge once again declined.

Panel (c) depicts the firm labour wedge. The gap between the marginal product of labour and the real wage widened significantly in two long episodes: from the mid-19th century to the end of World War I, and again from the mid-1970s to the present. In contrast, the wedge declined in the 1930s and remained relatively stable between the post-Civil War recovery and the mid-1970s. Notably, the *golden age* of the Spanish economy[6] is characterized by the stability of the firm labour and investment wedges, alongside a declining household labour wedge.

A large body of literature interprets the firm labour wedge derived from the accounting method as an aggregate measure of the economy's average markup. This measure is comparable to estimates from the recent 'production approach' literature, which recovers markups from firm-level data. For instance, De Loecker et al. (2020) find that average markups in the U.S. rose by 33% between 1980 and 2016. In the Spanish case, the firm labour wedge increased by about 20% since 1980, while the increase was even more pronounced during 1850–1920, reaching nearly 50%.

Panel (d) plots the investment wedge. This wedge reflects intertemporal distortions to capital accumulation. After a decline in the 1860s, the wedge remained relatively flat until the early 20th century, followed by an increase until the end of the civil war. Afterwards, it remained stable until the 1980s, when an increase began that would continue until the end of the 1990s. From an interpretive perspective, a rising wedge corresponds to a gradual reduction in the implicit tax on investment goods.

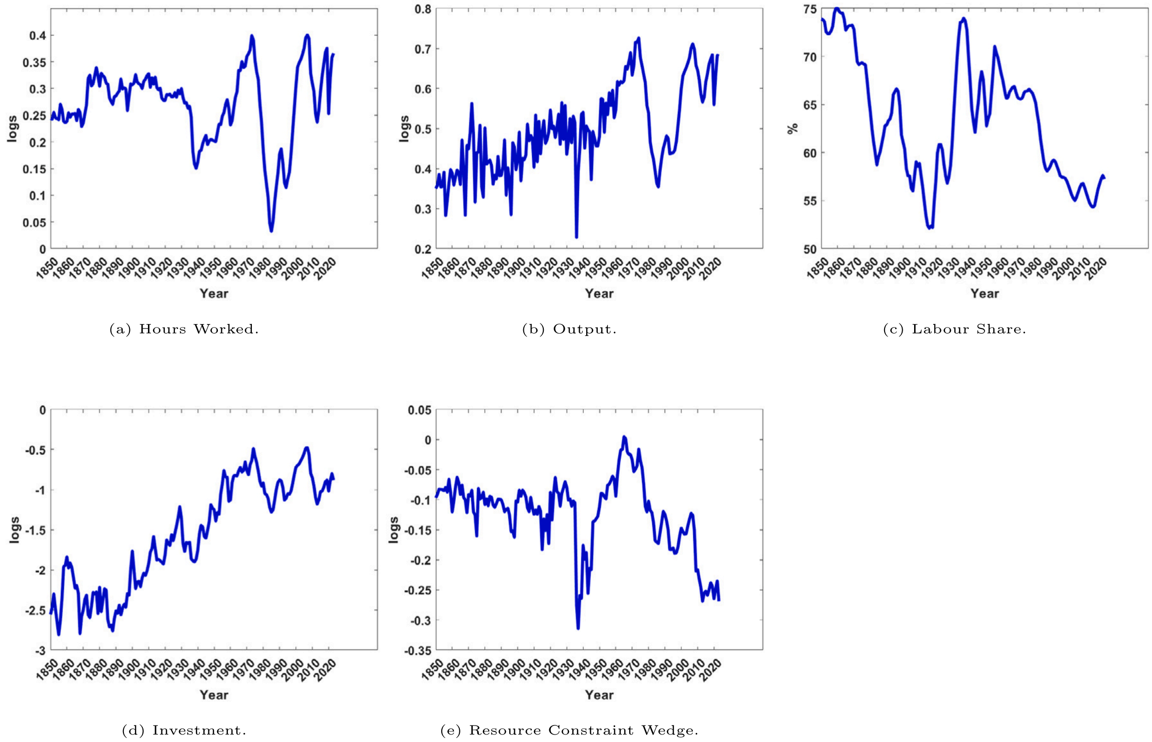
Panel (e) shows the resource wedge. Its most striking feature is the dramatic drop during the Civil War, indicating that a substantial portion of output was diverted away from private consumption and investment. From the late 1960s onwards, the wedge exhibits a steady decline, suggesting that unproductive or unmodelled uses of output (e.g., government spending or trade deficits) became progressively more important.

Turning to the detrended macroeconomic variables, Fig. 3 displays the detrended macroeconomic series. Several salient patterns emerge. Panel (a) shows the evolution of hours worked per capita. This variable remained relatively stable around its trend until the sharp collapse during the Spanish Civil War (1936–1939). Following a post-war rebound, hours increased persistently above trend until the mid-1970s, coinciding with the so-called *golden age* of the Spanish economy. Thereafter, a prolonged decline occurred, bottoming out in the mid-1980s, followed by a moderate recovery that lasted until the Great Recession.

Panel (b) plots detrended output per capita. The series remained close to trend until the late 19th century, after which a modest upward drift continued until the 1930s. A post-war rebound and the end of autarky in the 1950s were followed by an above-trend surge in output during the 1960s and early 1970s. The oil shocks of the 1970s marked the beginning of the Great Stagflation, which lasted until the mid-1980s. Output subsequently returned to an above-trend path, again disrupted by the Great Recession.

[5] Section 5 outlines the detrending procedure applied in the analysis. The data construction process is detailed in Appendix A, while Section III of the online appendix provides a comprehensive explanation of the accounting methodology.

[6] Spanish economic miracle or *golden age* refers to the period of exceptionally rapid growth and development across all major areas of economic activity in Spain from the mid-1950s to the mid-1970s, during the latter part of the Francoist regime. The economic boom was brought to an end by the 1970s international oil and stagflation crises.



(a) Hours Worked. (b) Output. (c) Labour Share.

(d) Investment. (e) Resource Constraint Wedge.

Fig. 3. Detrended Macro Aggregates.

Panel (c) shows the labour share, using historical estimates from Prados de la Escosura and Rosés (2021). Two major episodes of decline stand out: the first from the end of the 19th century to the 1920s, and the second from the 1980s to the present. The recent fall in the labour share is part of a broader international trend that has been widely studied (see, e.g., Karabarbounis & Neiman, 2014; Koh et al., 2020; del Río & Lores, 2019; del Río & Lores, 2023).

The detrended investment series (Panel d) displays several distinctive phases. It remains relatively stable up to around 1890, followed by a prolonged period of sustained growth lasting until approximately 1970, with the notable exception of the disruptions caused by the Spanish Civil War and the immediate postwar period (1936–1950). This prolonged expansion in investment is consistent with historical accounts of increasing industrialization and infrastructure development during Spain's transition from a largely agrarian economy to a more diversified productive structure (Carreras & Tafunell, 2010; Prados de la Escosura, 2022).

After 1970, detrended investment exhibits the cyclical behaviour seen in other macroeconomic aggregates such as output and hours worked, reflecting the broader patterns of economic liberalization, European integration, and macroeconomic volatility that have characterized the post-Franco and democratic periods. These investment dynamics offer insight into the underlying forces that shaped Spanish capital accumulation over the long run.

5. Comparative modelling assumptions and their implications

Several studies, including Giménez and Montero (2015), Rodríguez-López and Solís García (2016), Conesa and Kehoe (2017), and del Río and Lores (2023), have examined the Spanish economy using a similar framework to that employed in the present study—namely, a fully specified neoclassical growth model to analyse the dynamic behaviour of the economy. Prados de la Escosura and Rosés (2021) conduct a non-parametric traditional growth accounting exercise for the Spanish economy from 1850 to 2019. However, important differences in modelling assumptions exist across these contributions. As I will show, these differences have direct implications for the nature of the wedges derived from each model.

This section outlines the key differences in the specification of technological trends, wedge structures, and behavioural equations. Particular attention is given to how each formulation affects the interpretation of TFP, investment behaviour, and labour market distortions. Understanding these differences is crucial for explaining the divergence in results across studies and for assessing the validity of alternative methodologies.

The trend of the economy. The way in which the long-run trend is specified in the model determines how components of the dynamic behaviour of per capita variables are attributed either to trend growth or to short-run fluctuations. Moreover, the accounting method employed involves the estimation of a stochastic process using (13) via maximum likelihood, which requires that the variables used

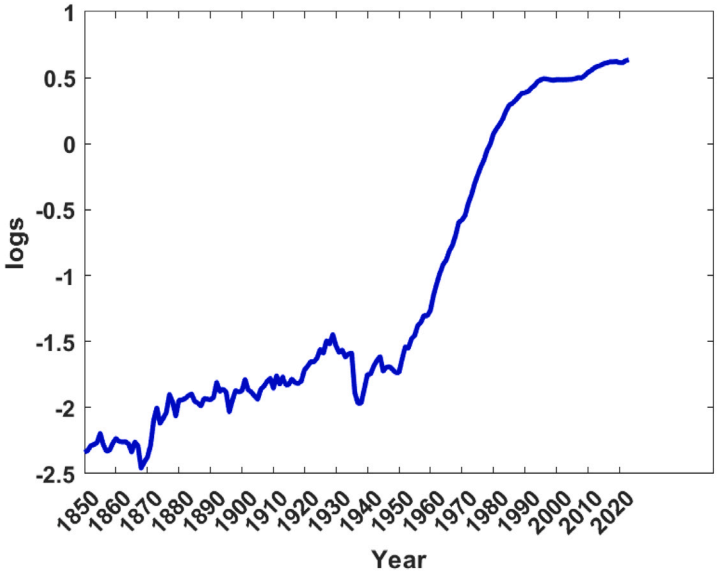


Fig. 4. The Labour-Augmenting Efficiency Factor Γ_t.
Note: Calculated with the values of the parameters $\rho = -1.2730$, $\alpha = 0.3659$, $\Phi = 0.0605$ and $\phi = 4.1307$. Section III of the online appendix provides a comprehensive explanation of the parameter values.

be stationary to ensure desirable statistical properties. The starting point is the trend specification applied to the variables in the model. Since the growth accounting procedure is applied to detrended series, alternative formulations for the trend lead to different quantitative results.

Consider a neoclassical production function with constant returns to scale and three forms of technical progress: Hicks-neutral (A_{yt}), Solow-neutral (A_{kt}), and Harrod-neutral (A_{ht}):

$$Y_t = A_{yt} F(A_{kt} K_t, A_{ht} H_t)$$

As shown by Diamond and McFadden (1965), it is not possible to separately identify all three technological components. The standard BCA method circumvents this identification problem by assuming a constant relative efficiency of capital to labour: $A_{ht} = \gamma^t z_t$, $A_{kt}/z_t = 1$, and $A_t = A_{yt} z_t$. The resulting specification for the production function is:

$$Y_t = A_t\, F\left(K_t, \gamma^t H_t\right) \tag{14}$$

In this formulation, A_t is interpreted as the efficiency wedge, modelled as a stationary stochastic process (together with the other wedges), as in (13). This specification is adopted by Rodríguez-López and Solís García (2016), Giménez and Montero (2015), and Conesa and Kehoe (2017).

By contrast, del Río and Lores (2023) follow a wedge-based growth accounting (WGA) approach, assuming that $A_{yt} A_{kt} = q_t$ and $A_{yt} A_{ht} = \Gamma_t$, which leads to the production function:

$$Y_t = F\left(q_t K_t, \Gamma_t H_t\right) \tag{15}$$

In the present paper, I adopt a simplified version of this formulation, setting $A_{yt} A_{kt} = 1$ and $A_{yt} A_{ht} = \Gamma_t$, which yields:

$$Y_t = F\left(K_t, \Gamma_t H_t\right) \tag{16}$$

Different assumptions about the structure of Γ_t yield different interpretations. One approach is to define its growth rate as a stationary stochastic process: $\Gamma_t = \gamma_t \Gamma_{t-1}$, where γ_t is stationary and interpreted as the efficiency wedge. This implies $\Gamma_t = \prod_{s=0}^{t} \gamma_s$, a purely stochastic process capturing cumulative changes in labour-augmenting productivity. This is the approach followed in the present paper.

Alternatively, a more structured specification assumes $\gamma_t = \gamma \epsilon_t$ with $\gamma > 1$ and ϵ_t stationary, implying $\Gamma_t = \gamma^t z_t$ with $z_t = \prod_{s=0}^{t} \epsilon_s$. The log of Γ_t then has a deterministic trend component and a stationary component: $\log(\Gamma_t) = \log(\gamma)\, t + \log(z_t)$. This approach is common in the growth literature and is also used in some BCA exercises. In WGA applications such as del Río and Lores (2023), the stochastic component z_t is treated as a known sequence (perfect foresight), which permits full stationarity of the model by removing the deterministic trend from the variables. In their setup, the trend components $\gamma^{1-\nu}$ (for real variables) and $\gamma^{-\nu}$ (for hours) are estimated independently from the production function.

In contrast, when γ_t is modelled as a stochastic process, Γ_{t-1} (or a transformation of it) must be eliminated from the variables to achieve stationarity. The structure of the equilibrium system therefore depends on the assumptions about Γ_t. For instance, under the deterministic trend assumption, the growth rate of the efficiency wedge, $\gamma_{yt} = \gamma^{1-\nu}$ for all t, enters both the capital accumulation law (5) and the Euler equation (9), which is the case in WGA methodology.

The choice between a stochastic or deterministic structure for Γ_t should be guided by the statistical properties of the series implied by the model. Section II of the online appendix reports the results of a unit root test that fails to reject the null hypothesis of a unit root in Γ_t, providing support for a purely stochastic specification. To derive the time series of Γ_t (see Fig. 4), I construct a per capita capital series using the per capita version of (5), starting from an initial condition $\tilde{k}_0 = K_0/L_0$, based on Prados de la Escosura (2022) with $K_0/Y_0 = 1.26$. Iterating forward with the series of per capita investment $\tilde{x}_t^d$, the following dynamic equation is used:

$$\eta\tilde{k}_{t+1} = \tilde{x}_t^d + (1-\delta)\,\tilde{k}_t - \frac{\phi}{2}\left(\frac{\tilde{x}_t^d}{\tilde{k}_t} - \Phi\right)^2 \tilde{k}_t$$

Given $\tilde{y}_t^d$ and $\tilde{h}_t^d$, the value of Γ_t is then obtained from the production function:

$$\tilde{y}_t^d = \left[\alpha(\tilde{k}_t)^\rho + (1-\alpha)\left(\Gamma_t\tilde{h}_t^d\right)^\rho\right]^{\frac{1}{\rho}}$$

Comparing statistical and model-based trends. I examine how the trend in Spanish output per capita, derived from a structural model grounded in economic theory, differs from those obtained using three standard statistical methods: the Hodrick–Prescott (HP) filter, the Baxter–King (BK) band-pass filter, and the Hamilton filter. These tools are commonly used in macroeconomic analysis to decompose time series into trend and cyclical components. The HP filter achieves this by penalizing fluctuations in the growth rate of the trend Hodrick and Prescott (1997); the BK filter isolates business-cycle frequencies through a symmetric moving average Baxter and King (1999); and the Hamilton filter estimates the trend as a fixed-horizon forecast from an autoregressive model, thereby avoiding endpoint bias and over-smoothing Hamilton (2018). Although all three methods rely solely on statistical criteria, the model-based trend is rooted in economic theory: it emerges endogenously from fundamentals and reflects the internal consistency of a structural macroeconomic framework (see Fig. 5).

The three statistical filters produce highly similar trend estimates over the long run. Their close alignment during major structural episodes — such as post-war reconstruction or the rapid growth phase from 1960 to 1975 — suggests that their smoothing properties impose a shared view of long-term growth that filters out much of the cyclical volatility.

In contrast, the model-implied trend (solid black line) diverges markedly in several key historical periods. It exhibits slower growth in the early 20th century, captures a deeper contraction during the Civil War and its aftermath, and shows a more tempered rise in the post-1990 period. These differences stem from the structural restrictions of the model, in particular the identification of the labour-augmenting efficiency trend. Because the theoretical model ties trend evolution to economic fundamentals, its trend reflects persistent shifts in productivity and distortions, rather than merely smoothing out statistical noise.

Total factor productivity. The way TFP is measured and interpreted varies significantly depending on the model's assumptions regarding technology and detrending. In general, TFP growth can be defined as the residual from a production function once the contributions of capital and labour inputs have been accounted for. Formally, it is expressed as:

$$g_{\text{TFP}_t} = g_{y_t} - \varepsilon_t g_{k_t} - (1-\varepsilon_t) g_{h_t},$$

where g denotes the growth rate of each variable in per capita terms, and ε_t is the output elasticity of capital.

Under the standard BCA method, A_t is computed from the detrended production function (14) using data for Y_t/γ^t, K_t/γ^t, and H_t, assuming $\varepsilon_t = \alpha$. The resulting single efficiency wedge, A_t, directly reflects TFP, implying that $g_{A_t} = g_{\text{TFP}_t}$.

In the WGA framework used by del Río and Lores (2023), the production function (15) leads to a decomposition of TFP growth as:

$$\varepsilon_t g_{q_t} + (1-\varepsilon_t) g_{z_t} = g_{\text{TFP}_t},$$

where q_t and z_t represent the capital and labour efficiency wedges, respectively, and the data are detrended using $Y_t/\gamma^{(1-\nu)t}$, $K_t/\gamma^{(1-\nu)t}$, and $H_t/\gamma^{-\nu t}$.

In the present paper, using the production function (16), TFP growth is captured by:

$$(1-\varepsilon_t)\gamma_t = g_{\text{TFP}_t},$$

where γ_t represents the growth rate of Γ_t. This is computed using data detrended with respect to $\Gamma_{t-1}^{1-\nu}$ for output and capital, and $\Gamma_{t-1}^{-\nu}$ for hours worked.

To provide a benchmark, I also compute the Solow residual (SR) growth rate as the residual from a conventional growth accounting decomposition:

$$\Delta\log(\text{SR}_t) = \Delta\log(\tilde{y}_t) - (1-\bar{s}_{ht})\Delta\log(\tilde{k}_t) - \bar{s}_{ht}\Delta\log(\tilde{h}_t),$$

where $\bar{s}_{ht} = (s_{ht} + s_{ht-1})/2$ is the average labour share. This measure assumes that factors are paid their marginal products and thus approximates TFP under competitive conditions.

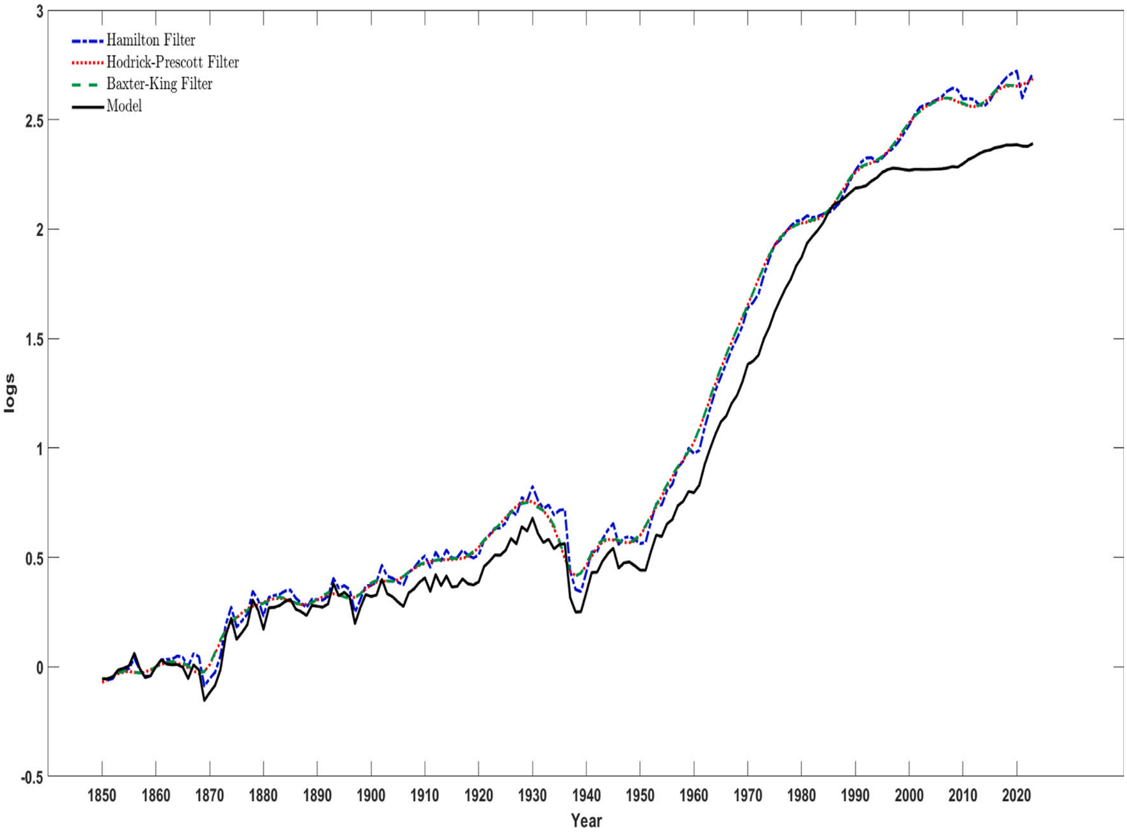


Fig. 5. Comparing Statistical and Model-Based Trends.
Note: The figure compares the trend component of Spanish output per capita obtained from the structural model (solid black line) with those estimated using three standard statistical filters. The Hamilton filter is applied with a lead length of 1 and lag length of 1, following Ravn and Uhlig (2002) the Hodrick–Prescott filter uses a smoothing parameter of 6.25, and the Baxter–King band-pass filter isolates cycles with periodicities between 2 and 8 years.

However, in the present model, this assumption does not hold due to the existence of wedges: $\pi^f_{l,t}$ reflects the gap between marginal productivity and wage, and $\pi^h_{l,t}$ reflects the wedge between the household's marginal rate of substitution and the wage.

Fig. 6 displays TFP estimates under different technological assumptions, along with the Solow residual. The divergence between TFP and SR, already evident since the 1960s, becomes more pronounced from the 1980s onward. This widening gap points to the growing relevance of market frictions and/or to changes in the evolution of capital-augmenting technical progress, which is assumed here to satisfy $A_{yt}A_{kt} = 1$ and is therefore only captured indirectly–masked within the Solow residual. Consequently, the apparent stagnation in productivity observed in the SR series can be attributed, at least in part, to these differences. In this regard, del Río and Lores (2019), del Río and Lores (2023) document a decline in capital-augmenting technical progress (q_t in Eq. (15)), computed under the assumption of perfect competition, for both Spain and the United States.

Labour wedge. The labour wedge captures the deviation between the marginal rate of substitution (MRS) on the household side and the marginal product of labour (MPL) on the firm side. Following Galí et al. (2007) and Karabarbounis (2014), this gap can be decomposed into two components: the wage markup, reflecting household-side frictions, and the price markup, reflecting firm-side frictions.

The wage markup is defined as:

$$\text{wage markup} = \frac{w_t}{-\frac{u_h(c_t,h_t)}{u_c(c_t,h_t)}},$$

which measures the discrepancy between the real wage and the marginal rate of substitution between consumption and leisure. Note that the household labour wedge ($pi^h_{l,t}$) is defined in the model as the inverse of the wage markup.

The price markup (firm labour wedge) is defined as:

$$\pi^f_{l,t} = \frac{(1-\varepsilon_t)y_t/h_t}{w_t},$$

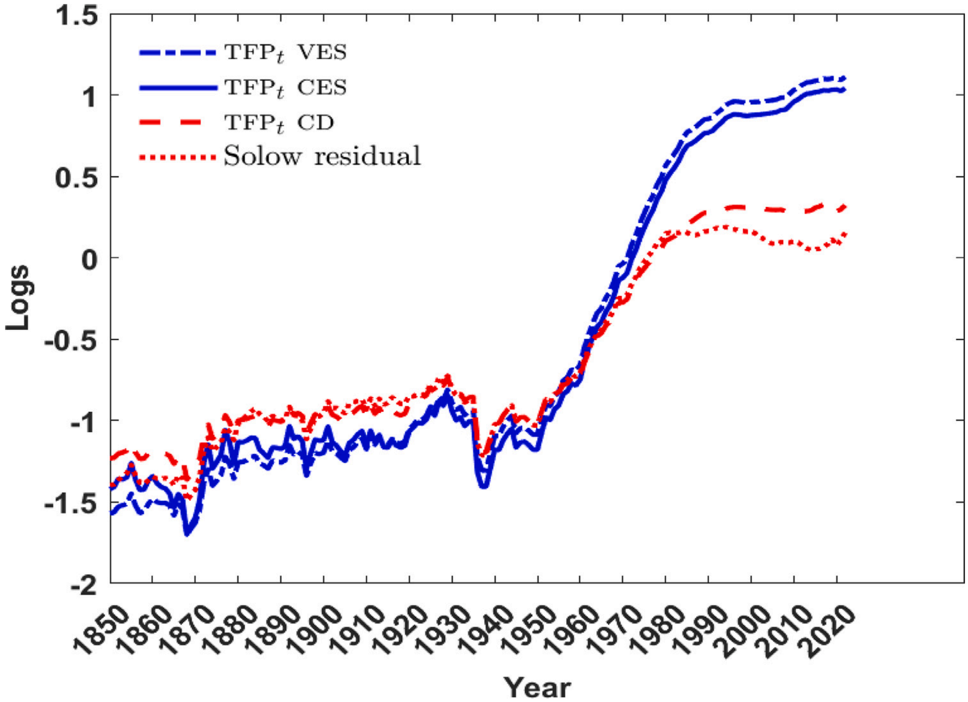


Fig. 6. TFP Estimates under Different Technological Assumptions and the Solow Residual.

which captures the deviation between the marginal product of labour and the real wage. The total labour wedge is then:

$$\pi_{l,t} \equiv \frac{\pi^f_{l,t}}{\pi^h_{l,t}} = \frac{(1-\varepsilon_t)y_t/h_t}{-\frac{u_h(c_t,h_t)}{u_c(c_t,h_t)}}.$$

Previous studies, including Giménez and Montero (2015), Rodríguez-López and Solís García (2016), Conesa and Kehoe (2017), and del Río and Lores (2023), compute the total labour wedge, although with important methodological differences. The first three studies adopt a Cobb–Douglas production function and KPR preferences, taking $\varepsilon_t = \alpha$ and using undetrended labour input. In contrast, del Río and Lores (2023) use a variable elasticity of substitution (VES) production function and determine output elasticities endogenously as a function of observable factor shares. Specifically, they assume:

$$\varepsilon_t = \varepsilon\left(\frac{q_t}{\Gamma_t}\frac{K_t}{H_t}\right) \equiv s_{kt}, \tag{17}$$

where s_{kt} is the observed capital share. This formulation ensures that rental prices and marginal products co-move, attributing all variation in factor shares to shifts in output elasticities, thus isolating labour supply distortions in the labour wedge. Moreover, del Río and Lores (2023) apply BK preferences and use data detrended with $\gamma^{(1-\nu)t}$ and $\gamma^{-\nu t}$ for output, consumption and hours, respectively. In this setting, the labour wedge is computed from data for $Y_t/\gamma^{(1-\nu)t}$, $C_t/\gamma^{(1-\nu)t}$, and $H_t/\gamma^{-\nu t}$.

In the present study, I adopt a similar approach to the decomposition of the total labour wedge. Based on the equilibrium condition (7), the following identity holds:

$$1-\varepsilon_t = \pi^f_{l,t}\cdot w_t \cdot \frac{h_t}{y_t},$$

where $\varepsilon_t = \varepsilon\left(K_t/\Gamma_t H_t\right) = \alpha\left[\alpha + (1-\alpha)(\Gamma_t H_t/K_t)^\rho\right]^{-1}$, and $w_t h_t/y_t \equiv s_{l,t}$. Thus, the firm-side wedge in my model captures the discrepancy between the observed labour share and the model-implied output elasticity of labour.

Investment wedge. The investment wedge reflects distortions affecting intertemporal choices, typically captured through deviations from the standard Euler equation. Its interpretation depends crucially on whether agents are assumed to have perfect foresight or face uncertainty about the evolution of economic fundamentals.

del Río and Lores (2023) adopt a perfect foresight version of the neoclassical growth model. In their setup, agents observe the entire future path of wedges, which simplifies the dynamic programming problem and leads to an Euler equation consistent with deterministic transitions. This is a conventional and tractable modelling choice in the growth literature, especially when the goal is to quantify long-run distortions.

By contrast, Rodríguez-López and Solís García (2016) and the present study are more concerned with short-run macroeconomic fluctuations. Therefore, both use a stochastic version of the neoclassical growth model, where agents make decisions under uncertainty and cannot perfectly anticipate future wedge paths. This distinction alters the interpretation and estimation of the investment wedge since it now reflects both the contemporaneous incentive to invest and the expectation of future returns under stochastic shocks.

Giménez and Montero (2015) and Conesa and Kehoe (2017) do not compute an investment wedge in their exercises. As a result, their frameworks are not directly comparable in this dimension.

In summary, the investment wedge in this study reflects intertemporal distortions faced by agents operating in a stochastic environment. This contrasts with the deterministic setup of del Río and Lores (2023), in which wedges are fully anticipated. The modelling choice — stochastic vs. deterministic — has significant implications for interpreting investment dynamics and the overall responsiveness of the economy to shocks.

6. Dating recessions 1850-2023

In order to identify the recessions in the Spanish economy that are the subject of this paper, I employ the Bry and Boschan (1971) method (adapted to the cyclical component of Spain's GDP derived from annual data), in conjunction with the chronology provided by the Spanish Business Cycle Dating Committee. The Bry-Boschan algorithm, a robust and objective tool for detecting business cycle turning points, is customized to address the high volatility and non-zero mean of the detrended GDP and hours series, particularly before 1973, through selective smoothing and a dynamic recession threshold. By cross-validating the algorithm's results with the Committee's established chronology, I ensure the reliability and historical consistency of the identified recession periods, providing a rigorous quantitative foundation for determining their number and dates.

The Spanish Business Cycle Dating Committee (SBCDC), established by the Spanish Economic Association, employs a methodology inspired by the NBER to date recessions in Spain, combining quantitative and qualitative approaches. Quantitatively, it analyzes multiple economic indicators (e.g., real GDP, employment, industrial production) using econometric tools like the Bry-Boschan algorithm and multiple change-point models, alongside the Coincident Economic Activity Index[7] to capture cyclical activity. Qualitatively, expert judgment validates these findings, considering economic context and historical events to ensure robustness. The committee identifies recessions based on depth, diffusion, and duration, prioritizing accuracy with retrospective analysis. Between 1970 and 2020, the SBCDC dated seven recessions: 1974Q1–1975Q2 (Oil Crisis I), triggered by the 1973 oil embargo; 1979Q4–1981Q2 (Oil Crisis II), due to the 1979 oil shock; 1992Q1–1993Q2 (European Crisis), linked to the European Monetary System turmoil; 2008Q1–2009Q2 (Great Recession), caused by the global financial crisis; 2011Q2–2013Q2 (Sovereign Debt Crisis), a double-dip from Eurozone debt issues; 2019Q4–2020Q2 (COVID-19 Recession), driven by pandemic lockdowns.

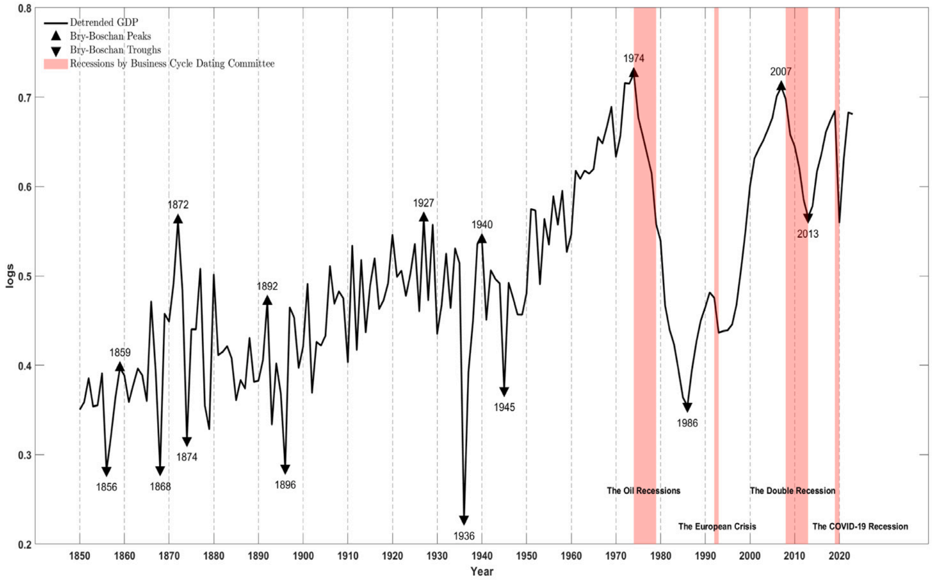
I have applied a Bry-Boschan-based algorithm to the detrended series of hours worked and gdp per worker (1850–2023) to identify major economic turning points and recessions. It detects peaks and troughs by checking if a point is the highest or lowest within a ±5-year window (10 years total), ensuring only significant, big fluctuations are captured. A minimum cycle duration of 2 years filters out short fluctuations, and recessions are dated as peak-to-trough periods where the series falls below a threshold (mean - std/2).

The Fig. 7 for the detrended GDP per capita (a) and hours worked per capita (b), reveal a comprehensive series of economic turning points aligned with significant recessions in Spain across various historical periods. For GDP per capita, peaks are identified at 1859, 1872, 1892, 1927, 1940, 1974, and 2007, with corresponding troughs at 1856, 1868, 1874, 1896, 1936, 1945, 1986 and 2013, reflecting pre-oil crisis recessions (e.g., a cycle around 1868–1874), the *fin de siècle Depression* (1892–1896), the period of the 1930s with the civil war and the post-war period (1927–1936 and 1940–1945), the oil Crisis (1974–1986), Great Recession (2007–2013), respectively. For hours worked per capita, peaks occur at 1878, 1956, 1973, 1991, 2007, with troughs at 1869, 1888, 1897, 1906, 1920, 1939, 1960, 1985, 1994, and 2013. The algorithm coincides in both series in pointing to the period of the end of the 19th century (1892/3-1896/7) and the turbulent 1930s and post-civil war years. The European Crisis is detected in hours worked but not in GDP, because the fall in GDP was smaller than in hours.

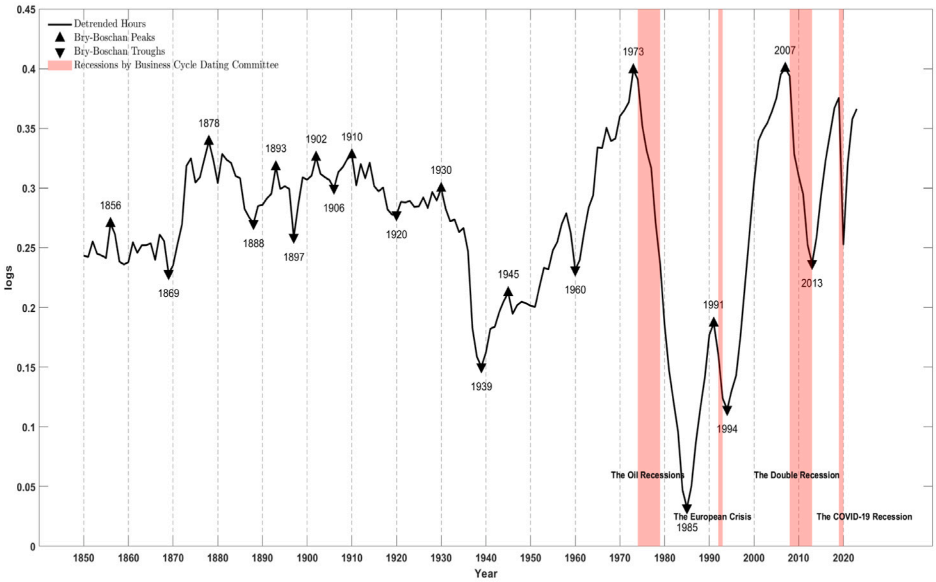
Both hours worked per capita and GDP per capita suggest a recession at the end of the 19th century, known in Spanish historical literature as the "depresión finisecular" or *fin de siècle Depression*, closely linked to the economic fallout from the Spanish-American War and the "Desastre del 98" (see for example Prados de la Escosura, 2017, or Ringrose, 1996). Tortella (2000) identifies the onset of this downturn around 1895–1896, driven by the decline in colonial revenues, industrial stagnation, and social unrest, with the crisis peaking in 1898 following the loss of Cuba, Puerto Rico, and the Philippines. The recession likely extended into the early 1900s, with recovery beginning around 1902–1903 as political stability under María Cristina's regency and initial industrial reforms emerged, as noted by Prados de la Escosura (2017). Similarly, English-language scholarship, such as Ringrose (1996), supports this timeline, emphasizing the economic dislocation and cultural regeneration efforts of the Generation of 98.

The literature on Spanish economic history regarding the Great Depression of the 1930s and the post-war period highlights a complex economic trajectory shaped by internal and external factors. According to Prados de la Escosura (2017), the Great Depression had a relatively muted impact on Spain compared to other European nations, with GDP growth slowing from 1929

[7] The Coincident Economic Activity Index is a composite indicator used by the SBCDC to measure the underlying level of economic activity in Spain in real time. It combines multiple coincident economic indicators, such as real GDP, employment, industrial production, and retail sales, into a single index to capture the cyclical fluctuations of the economy.



(a) Detrended GDP per capita.



(b) Detrended Hours worked per capita.

Fig. 7. Dating Recessions in Spain. 1850–2023.
Note: Detrended GDP per capita and hours worked per capita (solid lines) are $y_t = Y_t/\Gamma_{t-1}^{1-\nu}L_t$, $h_t = H_t/\Gamma_{t-1}^{-\nu}L_t$. Where Γ_t was obtained assuming the CES production function with $\rho = -1.2730$ and $\alpha = 0.3659$. Section 5 explains in detail how Γ_t was obtained and Section III in the online appendix the parameterization of the model. Triangles upwards indicate peaks and triangles downwards indicate troughs identified by the Bry-Boschan method. Shaded areas overlay the figures to highlight recession periods as dated by the Spanish Business Cycle Dating Committee.

but avoiding the severe contractions seen elsewhere, partly due to its limited integration into global markets; however, the crisis intensified social tensions leading to the Spanish Civil War (1936–1939). Post-war, Tortella (2000) describes a prolonged autarkic period under Franco's regime (1939–1959), marked by economic isolation, hyperinflation, and a GDP decline of about 10% until 1951, with recovery delayed until the 1959 Stabilization Plan initiated market liberalization.

Table 2
ϕ-statistics. *fin de siècle* recession.

Variable	$\phi^{\mathbf{y}}_{\pi_i^h}$	$\phi^{\mathbf{y}}_{\gamma}$	$\phi^{\mathbf{y}}_{\pi_i^f}$	$\phi^{\mathbf{y}}_{\pi_x}$	$\phi^{\mathbf{y}}_{\pi_g}$
			1892–1898		
h	0.027	0.609	0.121	0.049	0.193
y	0.011	0.969	0.007	0.006	0.007
x	0.139	0.110	0.173	0.386	0.193
$1-\varepsilon$	0.190	0.073	0.192	0.059	0.486

Based on the application of the Bry-Boschan method to the detrended GDP per capita and hours worked per capita, alongside insights from Spanish economic history literature, the recesions to be studied are determined as follows: the *fin de siècle Depression* (1892–1898); the *Great Depression* (1929–1940); the *Great Stagflation* (1973–1986) the oil shock-transition to democracy crisis of 1973; the *European Recession* (1991–1994); the *Great Recession* (2007–2013) and the COVID-19 Recession (2019–2020). These periods, spanning from the late 19$^{\text{th}}$ century to the present, encapsulate the major economic downturns in Spain relevant to this study.

7. Accounting for Spanish recessions: 1850–2023

This section uses the accounting methodology to study the six episodes of recession and compares them to findings within the historical literature and economic theory. The wedge alone components together with the corresponding observed variables (output, labour, investment, and labour share) are displayed in each panel of Figs. 8 to 12. As we shall see, the importance of each wedge in the recessions studied was different, indicating the different origin of each of them.

Tables 2 to 7 provide complementary information on goodness of fit by presenting the 'ϕ-statistics' for detrended hours worked per capita, output per capita, investment per capita, and labour share. The ϕ-statistic was proposed by Brinca et al. (2016) and is defined for each wedge-alone component i of an observable variable $\mathbf{y}$ as

$$\phi_i^{\mathbf{y}} = \frac{1/\sum_t \left(\mathbf{y}_{i,t} - \mathbf{y}_t\right)^2}{\sum_j \left(1/\sum_t \left(\mathbf{y}_{i,t} - \mathbf{y}_t\right)^2\right)},$$

where $\mathbf{y}_{i,t} \in \{h_{i,t}, y_{i,t}, x_{i,t}, s_{i,lt}\}$ is the wedge-alone component of a variable due to wedge i and $\mathbf{y}_t \in \{h_t, y_t, x_t, s_{lt}\}$ is the corresponding observed same variable. The ϕ-statistic has the desirable feature that it lies in $[0,1]$, sums to one across the five wedges, and when a particular output component tracks a variable perfectly, then its value is 1.

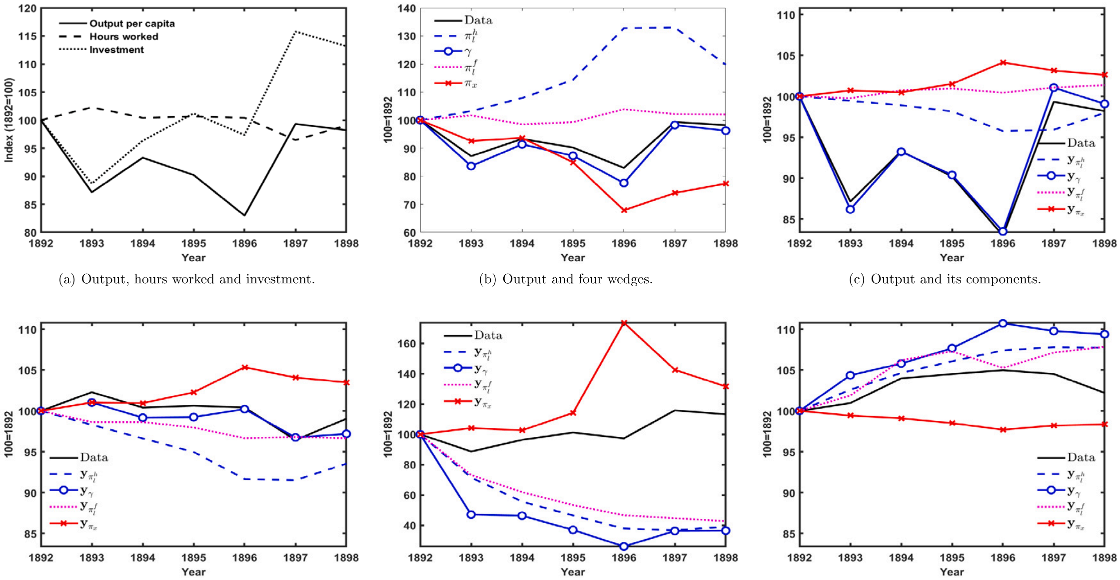
7.1. The Fin de Siècle Depression

The period commonly referred to as the *fin de siècle Depression* in Spain began around 1892 and lasted until approximately 1898. It was marked by a prolonged phase of low economic growth and persistent deflation. This downturn unfolded in the context of a broader international financial and agricultural crisis that affected much of Europe and the United States. One major source of financial instability during this period was the excessive and risky investment in infrastructure, particularly in railways, which had been aggressively expanded in the preceding decades. These investments became increasingly unsustainable and triggered banking stress and market corrections (Bertrán et al., 2012; Klitgaard & Narron, 2016). Concurrently, the dramatic fall in international transport costs facilitated a flood of cheap agricultural imports from the Americas and Eastern Europe into European markets, leading to a steep decline in agricultural prices and widespread agrarian distress (Carreras & Tafunell, 2021, Chap. 4).

Several features of this period make it a particularly suitable case for applying the business cycle accounting methodology grounded in dynamic general equilibrium theory. First, it occurred in the absence of a modern central bank as we understand it today. Although the Banco de España had existed under that name since 1856, it did not acquire effective monetary policy responsibilities until the enactment of the *Ley de Ordenación Bancaria* (also known as the *Ley Cambó*) in 1921. Prior to that, its role in stabilizing the economy was minimal, and financial regulation remained fragmented and largely ineffective in responding to macroeconomic shocks. Second, the labour market at the time was essentially unregulated, with minimal institutional interference in wage-setting or employment protection.

Together, these institutional absences make the *fin de siècle* depression a valuable historical episode for evaluating the performance of the economy under conditions of minimal policy intervention. The application of the BCA framework to this episode — for the first time in the literature — offers new insights into the sources of macroeconomic fluctuations in a less regulated economy, and provides a benchmark for understanding how institutional development may affect the propagation of shocks. It also opens up avenues for further research on pre-modern crises and their interpretation through the lens of modern macroeconomic theory. The decomposition of macroeconomic aggregates during the *Fin de Siècle* period, shown in panels (a)–(f) of Fig. 8, provides insights into the underlying forces behind the dynamics of output, hours worked, investment, and the labour share. Each component reflects the counterfactual path of the respective variable when only one wedge is active, isolating its contribution to the observed fluctuations.

Panel (c) shows the decomposition of output. The empirical path (black line) exhibits a clear downturn between 1892 and 1895, followed by a moderate recovery. Among the model-based components, the path driven by the efficiency wedge (blue circles) closely



(a) Output, hours worked and investment. (b) Output and four wedges. (c) Output and its components.

(d) Hours worked and its components. (e) Investment and its components. (f) Labour share and its components.

Fig. 8. The Fin de Siècle Depression.

tracks the actual downturn, suggesting that distortions to productive efficiency played a major role in the contraction phase. All other wedges appear relatively neutral.

Panel (d) focuses on hours worked. Here, again, the efficiency wedge dominates the dynamics, producing a soft decline over the period, consistent with the data. In contrast, The components of both labour wedges experienced a decline, especially the household labour wedge, indicating that distortions in labour supply and demand alone would have caused a sharp drop in hours worked. This reinforces the view that distortions to the labour market — whether through taxes, institutional frictions, or bargaining dynamics — were no central to the evolution of labour.

Panel (e) depicts investment and its components, revealing a notable collapse in the actual investment series during the early 1890s. This decline can be partially attributed to the labour and efficiency wedges. Remarkably, the investment wedge, which serves as a proxy for frictions in capital accumulation, exhibits a significant upward trend. This pattern aligns with recent perspectives on enhancements to the monetary system of that era. Nogues-Marco et al. (2019) show that the consolidation of a unified national money market in the final decades of the 19$^{\text{th}}$ century facilitated the integration of regional markets and reduced transaction costs across provinces.

Panel (f) examines the labour share. Unlike output or investment, the observed labour share remains relatively stable during the period, rising modestly through 1895 before stabilizing. The efficiency wedge (blue circles) reproduces this upward trend, suggesting that productivity improvements may have temporarily supported labour compensation relative to output. The labour wedge also contributes positively, but the investment wedge tends to lower the labour share.

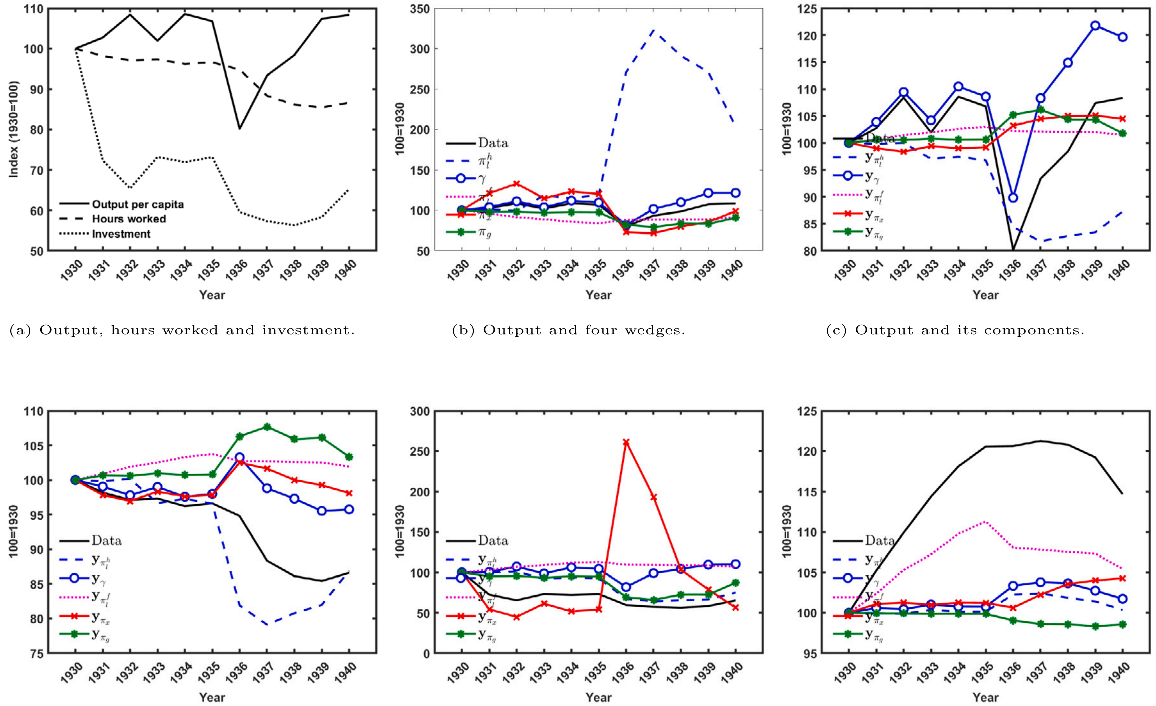
In summary, the accounting decomposition attributes the decline in output and employment during the 1890s primarily productive efficiency distortions.

7.2. The Great Depression

Historical scholarship has emphasized that the impact of the stock market crash of October 1929 on the Spanish economy was relatively mild compared to other European nations. Scholars remain divided on the primary drivers of Spain's *Great Depression*. One perspective, championed by authors such as Carreras and Tafunell (2021), Chap. 5, underscores the dominance of external factors, particularly through the channel of international trade. Conversely, other researchers, including Choudhri and Kochin (1980) and Bernanke and James (1991), argue that Spain's decision to abstain from the gold standard shielded the country from widespread deflationary pressures.

The data in Fig. 9, panel (a), support the notion of a mild *Great Depression* in Spain. Output remained close to its trend until the onset of the Civil War in 1936, while hours worked exhibited only a modest deviation. In contrast, investment experienced a pronounced decline from its trend starting in 1930.

Fig. 9, panel (c), illustrates the output components, revealing that the efficiency wedge primarily guided output's evolution until 1936. The subsequent drop in output during the Civil War resulted from a combination of declines in the efficiency wedge and the household labour wedge.



(a) Output, hours worked and investment. (b) Output and four wedges. (c) Output and its components.

(d) Hours worked and its components. (e) Investment and its components. (f) Labour share and its components.

Fig. 9. The *Great Depression*.

Table 3
ϕ-statistics. The great depression.

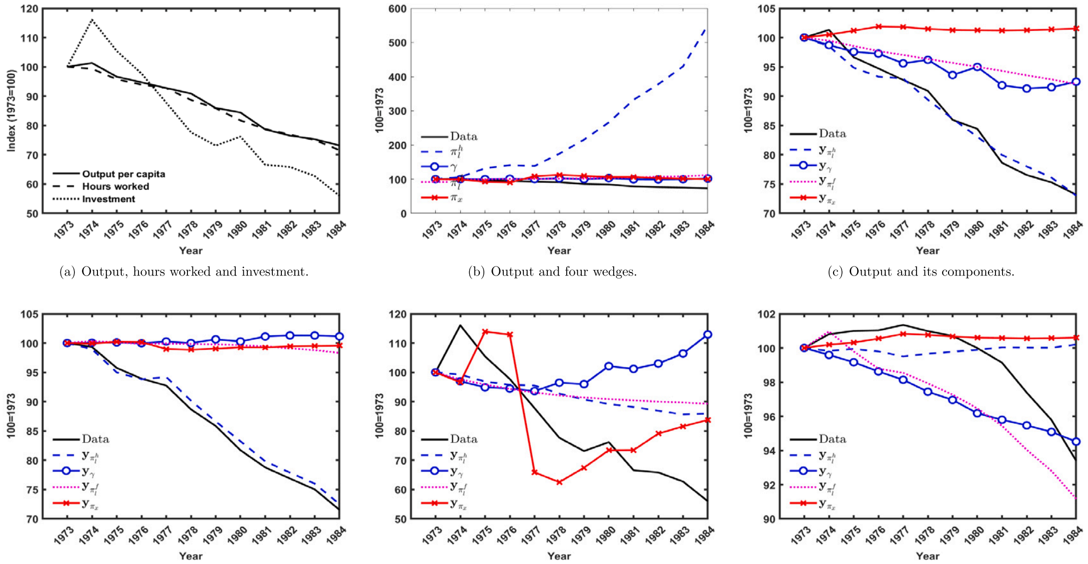
Variable	$\phi^{\mathbf{y}}_{\pi^h_l}$	$\phi^{\mathbf{y}}_{\gamma}$	$\phi^{\mathbf{y}}_{\pi^f_l}$	$\phi^{\mathbf{y}}_{\pi_x}$	$\phi^{\mathbf{y}}_{\pi_g}$
			1930–1940		
h	0.408	0.250	0.102	0.165	0.075
y	0.116	0.216	0.269	0.205	0.193
x	0.416	0.103	0.077	0.023	0.380
$1-\varepsilon$	0.147	0.168	0.398	0.167	0.119

Panel (d) of Fig. 9 depicts the components of hours worked, indicating that the decline at the Civil War's outset was driven by the household labour wedge. Meanwhile, the efficiency, investment, and particularly the resource wedges mitigated this fall. Military mobilization of the labour force offers a plausible explanation for the drop in the household labour wedge in 1936.

The investment decline in 1930, as shown in Fig. 9, panel (e), was propelled by the investment wedge. Jorge-Sotelo (2019) contends that private investment suffered a severe downturn during the Spanish *Great Depression* due to a sharp contraction in bank loans, constrained by the *Banco de España*'s limited emergency liquidity provisions. By 1936, following Spain's division into two zones, monetary chaos ensued, marked by bank withdrawal restrictions, the issuance of currency by various authorities, and the Republican government's use of Bank of Spain reserves to finance the war. Further research is needed to elucidate how this scenario aligns with the investment wedge's indicated boom in 1936.

Giménez and Montero (2015) employ a perfect foresight version of the neoclassical growth model to quantitatively assess Spain's *Great Depression*, finding that TFP predominantly shaped the economy's trajectory, with minimal influence from the foreign sector. They extend their model to incorporate labour market frictions, identifying a monopsonistic structure's impact on hours worked and wages. Applying the accounting method to this period complements Giménez and Montero (2015) by evaluating the neoclassical model's applicability. My findings align with their conclusions but offer a broader perspective, as the market distortion they propose (monopsonistic power) would manifest in the firm labour wedge, whereas the household labour wedge played a key role, suggesting supply-side market power rather than monopsony.

Finally, the labour share grew until 1935 and declined post-Civil War in 1939, primarily influenced by the firm labour wedge, as depicted in Fig. 9, panel (f).



(a) Output, hours worked and investment. (b) Output and four wedges. (c) Output and its components. (d) Hours worked and its components. (e) Investment and its components. (f) Labour share and its components.

Fig. 10. The *Great Stagflation*.

Table 4
ϕ-statistics. The great stagflation.

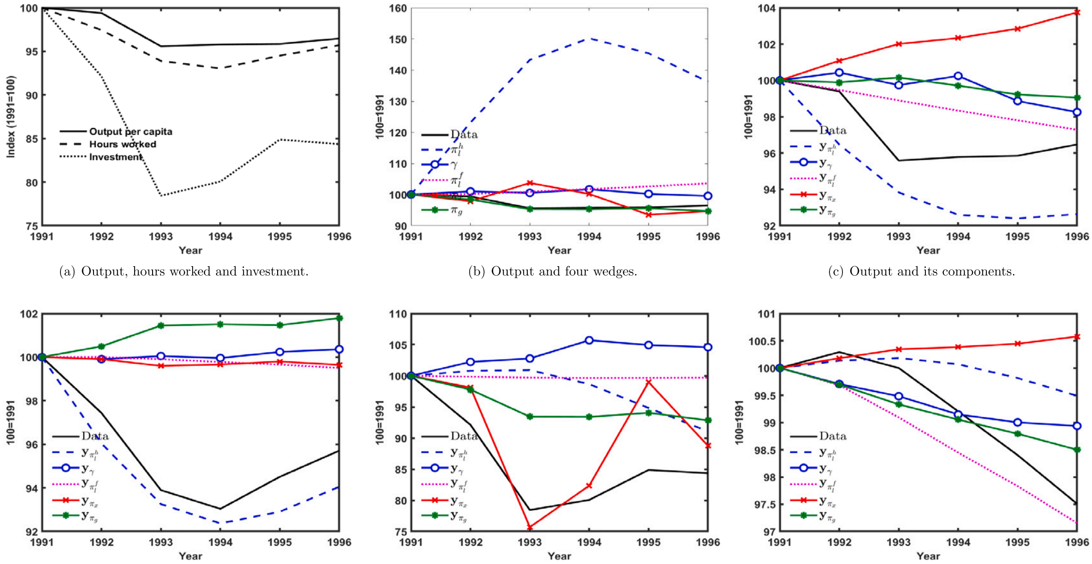
Variable	$\phi^{\mathbf{y}}_{\pi_l^h}$	$\phi^{\mathbf{y}}_{\gamma}$	$\phi^{\mathbf{y}}_{\pi_l^f}$	$\phi^{\mathbf{y}}_{\pi_x}$	$\phi^{\mathbf{y}}_{\pi_g}$
			1973–1984		
h	0.986	0.003	0.004	0.004	0.003
y	0.954	0.017	0.014	0.006	0.010
x	0.238	0.084	0.195	0.296	0.188
$1-\varepsilon$	0.172	0.178	0.161	0.158	0.331

7.3. The Great Stagflation

The years following the 1973 oil shock were marked by profound turbulence, driven by both an international economic crisis and a domestic political crisis in Spain. This period coincided with the waning of Franco's dictatorship, alongside an industrial and energy crisis characterized by rampant inflation. Additionally, a severe banking crisis emerged, leading to the collapse of numerous financial institutions. Over half of Spain's banking firms, representing 27% of the sector's resources, were impacted by various crisis processes, as detailed by Torreo Mañas (2009). During the four decades of dictatorship, extensive government intervention shaped the Spanish economy, with many firms operating under state ownership, primarily managed by the Instituto Nacional de Industria (INI). Post-1981, the INI and the broader public industrial sector underwent a gradual privatization process, culminating in the late 1990s and known as *la reconversión industrial*. A comprehensive overview of the policies enacted during this era is provided by Martín-Aceña (2010). Fig. 10, panel (a), underscores the severity of the economic downturn, with output and hours worked declining approximately 20% below their trends, while investment plummeted by over 40%. Rodríguez-López and Solís García (2016) apply the BCA methodology to this recession, concluding that the labour wedge is pivotal in explaining Spanish business cycles, including this period. While these authors calculate a single labour wedge, my accounting exercise reveals that the *Great Stagflation* was predominantly driven by the household labour wedge.

The fluctuations induced by the household labour wedge closely mirror the observed movements in output and hours worked. In contrast, the efficiency wedge plays a negligible role in accounting for these fluctuations. The investment and resource wedges contribute minimally to the observed variations in Spanish time series, as illustrated in Fig. 10, panels (c) and (d), and further detailed in Table 4. The investment wedge's fluctuations account solely for the observed changes in investment, as shown in Fig. 10, panel (e). Meanwhile, the decline in the labour share was influenced by the firm labour wedge and the efficiency wedge, as depicted in Fig. 10, panel (f).

La reconversión industrial involved extensive restructuring, featuring significant reforms in the management of key public industrial firms. This process saw thousands of workers transition to other sectors, predominantly services. Firms affected by this industrial overhaul were severely impacted by the 1970s oil price shocks, prompting the initiation of public firm privatizations during this time. In sectors such as oil refining, broadcasting, and telecommunications, liberalization preceded privatization. As noted by Rodríguez-López and Solís García (2016), the anticipated efficiency gains from *la reconversión industrial* either failed to materialize during this period or were absent altogether.



(a) Output, hours worked and investment. (b) Output and four wedges. (c) Output and its components.

(d) Hours worked and its components. (e) Investment and its components. (f) Labour share and its components.

Fig. 11. The *European Recession.*

Table 5

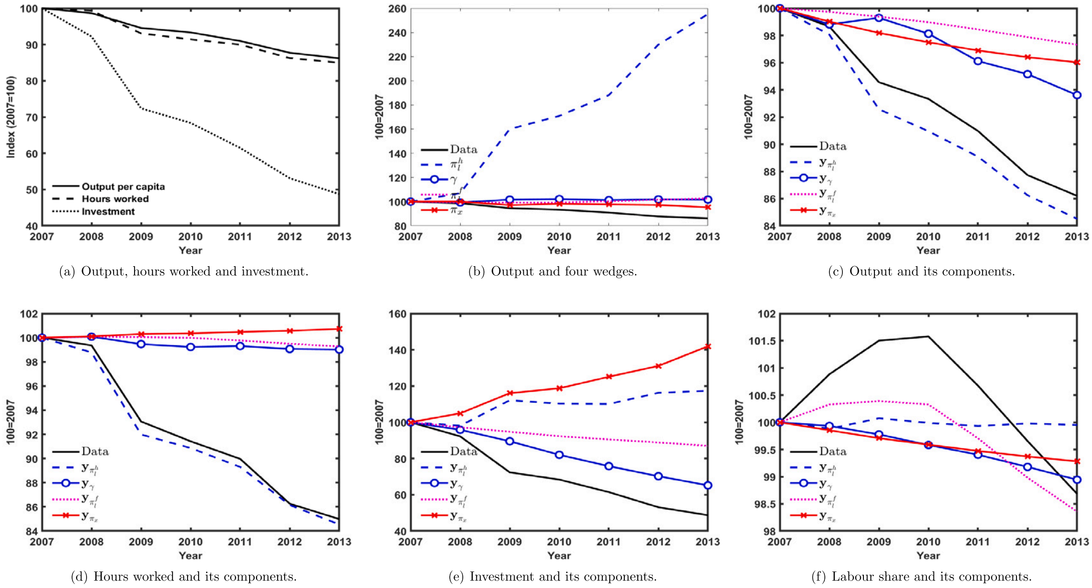
ϕ-statistics. The European Recession.

Variable	$\phi^{\mathbf{y}}_{\pi_l^h}$	$\phi^{\mathbf{y}}_{\gamma}$	$\phi^{\mathbf{y}}_{\pi_l^f}$	$\phi^{\mathbf{y}}_{\pi_x}$	$\phi^{\mathbf{y}}_{\pi_g}$
			1991–1994		
h	0.820	0.045	0.052	0.053	0.030
y	0.189	0.180	0.415	0.048	0.167
x	0.123	0.061	0.098	0.495	0.223
$1-\varepsilon$	0.098	0.220	0.300	0.044	0.338

7.4. The European Recession

The Spanish recession of 1991–1994, part of the broader "European crisis", was marked by a sharp output contraction, a collapse in investment, and a dramatic rise in unemployment. The downturn was triggered by the 1992–1993 European Exchange Rate Mechanism crisis and reinforced by domestic structural rigidities, particularly in the labour market. As documented by Franks (1994) and Taguas et al. (1995), the coexistence of high wage rigidity and a dual employment structure — characterized by widespread temporary contracts — magnified the cyclical impact of the shock. Bentolila and Dolado (1994) show that this combination led to disproportionate employment losses, especially among temporary workers, while wage-setting institutions slowed the recovery. In the framework of Blanchard and Wolfers (2000), the Spanish experience fits the pattern in which common adverse shocks produce heterogeneous outcomes through their interaction with country-specific institutions. Within the BCA methodology, these dynamics would be reflected in shifts in the labour wedges — capturing distortions in labour supply and demand — and potentially in the investment wedge, as financial and market frictions constrained capital accumulation.

The decomposition of the 1991–1994 recession presented in Fig. 11 aligns closely with the findings of the empirical literature on the Spanish experience during the *European Exchange Rate Mechanism* crisis. Panel (c) shows that the contraction in output is primarily accounted for by the household labour wedge, consistent with the sharp deterioration in employment conditions and rising unemployment documented during the period. Panel (d) confirms this pattern, as hours worked decline markedly in line with the household labour wedge's contribution, while other wedges contributions remain comparatively stable. In contrast, investment (Panel (e)) collapses mainly due to the investment wedge, in line with the tightening of financial conditions and the rise in uncertainty triggered by speculative attacks on the peseta and successive devaluations. Finally, Panel (f) indicates that the decline in the labour share is driven by the firm labour wedge and, to a lesser extent, the rest of wedges, reflecting both wage restraint policies and fiscal consolidation measures implemented in the run-up to European Monetary Union convergence. Overall, the wedge decomposition highlights the combined role of adverse labour market dynamics and investment-specific distortions in amplifying the downturn, in agreement with historical assessments of the European crisis in Spain.



(a) Output, hours worked and investment. (b) Output and four wedges. (c) Output and its components.

(d) Hours worked and its components. (e) Investment and its components. (f) Labour share and its components.

Fig. 12. The *Great Recession.*

Table 6
ϕ-statistics. The great recession.

Variable	$\phi^{\mathbf{y}}_{\pi_l^h}$	$\phi^{\mathbf{y}}_{\gamma}$	$\phi^{\mathbf{y}}_{\pi_l^f}$	$\phi^{\mathbf{y}}_{\pi_x}$	$\phi^{\mathbf{y}}_{\pi_g}$
			2007–2013		
h	0.986	0.004	0.004	0.004	0.002
y	0.790	0.081	0.043	0.062	0.024
x	0.058	0.663	0.179	0.036	0.065
$1-\varepsilon$	0.198	0.158	0.336	0.153	0.156

7.5. The Great Recession

The crisis that originated in the United States in mid-2007 has been analysed by Rodríguez-López and Solís García (2016), who demonstrate that the labour wedge effectively accounts for the observed fluctuations in output, hours worked, and investment. Similarly, applying the BCA methodology to the U.S. *Great Recession*, Brinca et al. (2016) conclude that the efficiency wedge played a minimal role in explaining the evolution of output, investment, and labour.

In my accounting exercise, the trajectories of output and hours worked are predominantly driven by the household labour wedge, which accounts for 79% and 98% of their respective variations, underscoring the critical influence of labour supply shocks, as illustrated in Fig. 12 panels (c), (d), and detailed in Table 6.

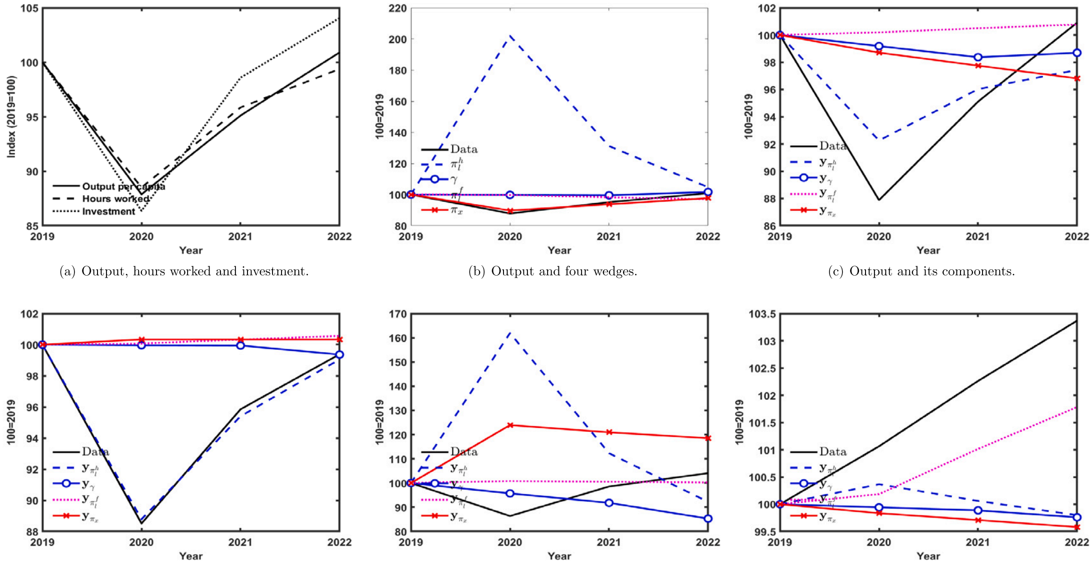
The decline in investment relative to its trend is primarily attributable to the efficiency wedge, which explains nearly 67% of its variation, as shown in Fig. 12 panel (e). However, the investment and household labour wedges mitigated this downturn. Additionally, Fig. 12 panel (f) reveals that the labour share increased until 2010, largely propelled by the firm labour wedge.

Kehoe et al. (2018), building on Romer and Romer (2017), classify the U.S. *Great Recession* as a financial recession characterized by significant financial distress, in contrast to the U.S. *Great Stagflation*, deemed a non-financial recession lacking such distress. Kehoe et al. (2018) highlight the larger decline in hours worked and the smaller drop in TFP during the *Great Recession* as key distinctions from the *Great Stagflation* in the U.S. In Spain, however, no discernible difference emerges between the *Great Stagflation* and the *Great Recession*, both of which were predominantly driven by the household labour wedge.

7.6. The COVID-19 recession

The repercussions of the COVID-19 pandemic extended far beyond health concerns, profoundly disrupting global supply chains, plunging financial markets into uncertainty, and prompting governments worldwide to implement social distancing measures to curb the virus's spread and mitigate loss of life. In Spain, as in most countries, the initial and most acute phases of the pandemic saw stringent restrictions on economic activities, severely disrupting consumption channels and labour markets.

Insightful observations emerge from an examination of Fig. 13. The household labour wedge significantly depressed output in 2020, as depicted in panel (c) of Fig. 13. Similarly, panel (d) of Fig. 13 illustrates that hours worked were predominantly



(a) Output, hours worked and investment.
(b) Output and four wedges.
(c) Output and its components.
(d) Hours worked and its components.
(e) Investment and its components.
(f) Labour share and its components.

Fig. 13. The COVID-19 Recession.

Table 7
ϕ-statistics. The COVID-19 recession.

Variable	$\phi^{\mathbf{y}}_{\pi^h_l}$	$\phi^{\mathbf{y}}_{\gamma}$	$\phi^{\mathbf{y}}_{\pi^f_l}$	$\phi^{\mathbf{y}}_{\pi_x}$	$\phi^{\mathbf{y}}_{\pi_g}$
			2019–2022		
h	0.990	0.003	0.002	0.002	0.002
y	0.562	0.125	0.100	0.128	0.085
x	0.020	0.247	0.525	0.056	0.152
$1-\varepsilon$	0.132	0.120	0.494	0.107	0.147

influenced by the household labour wedge. Regarding investment, panel (e) of Fig. 13 reveal that the household and investment wedges counteracted the negative impact exerted by the efficiency wedge.

Fernandes (2022) employs the BCA framework to analyse the COVID-19 recession in the Euro Area and the United States using quarterly data. This study finds that the labour wedge — calculated as a single measure — would have led to a greater output decline than observed, yet the investment wedge acted as a countercyclical buffer, mitigating the crisis's severity. This author concludes that in the Euro Area, the efficiency wedge played the most significant role, followed by the labour and investment wedges, whereas in the United States, the labour wedge was predominant, with the investment wedge ranking second in importance.

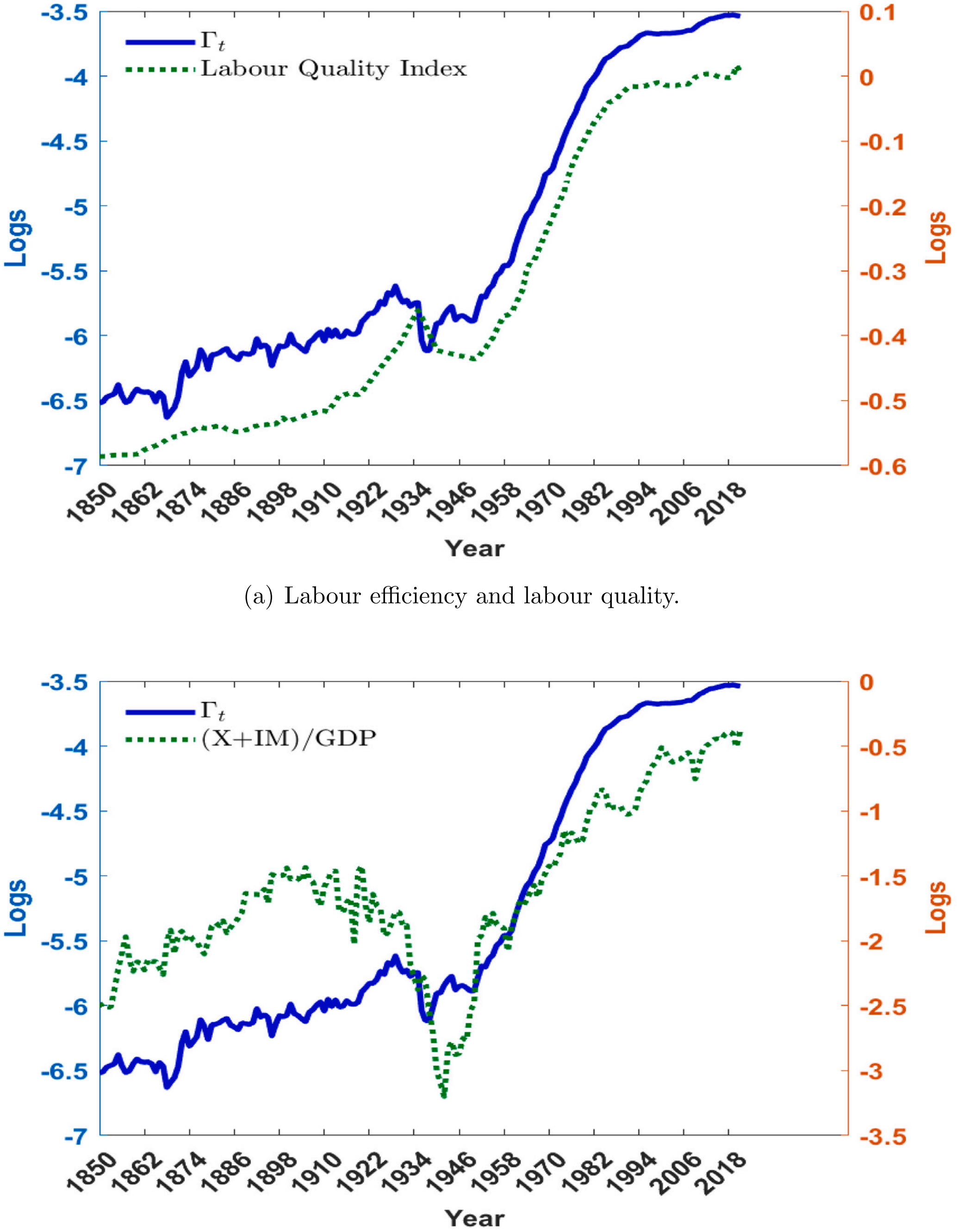
The Spanish COVID-19 recession diverges from its European counterparts, where the household labour wedge emerged as the sole shock absorption mechanism, with no other wedge substantially offsetting its impact. Brinca et al. (2021) report that in the U.S., two-thirds of the aggregate decline in the growth rate of hours between March and April 2020 can be attributed to labour supply. Similarly, the Spanish COVID-19 recession reflects a substantial labour supply shock, with no compensatory effect from other wedges to alleviate the economic downturn.

8. Explaining wedges

The previous sections have pointed out the importance of the different wedges in the economic fluctuations of the Spanish economy over the last 170 years. Accounting methods, such as the one presented here, do not identify the source of the shocks and focus on pointing out the transmission mechanisms. In this section, I discuss some sources of frictions that may be linked to wedges during the period under analysis.

8.1. Labour efficiency: Long-run and short-run dynamics

The labour-augmenting efficiency component Γ_t plays a central role in the model, serving both as the engine of long-run economic growth and as a source of short-run fluctuations. In the long term, sustained increases in Γ_t drive balanced growth in output per capita, consistent with the predictions of neoclassical growth theory. However, in the short run, variations in its growth rate can also induce business cycle dynamics by affecting factor productivity and the marginal conditions of equilibrium. This dual role of Γ_t



(a) Labour efficiency and labour quality.

(b) Labour efficiency and trade openness.

Fig. 14. Drivers of Labour Efficiency.
Note: The labour quality index is the income-weighted index from Prados de la Escosura and Rosés (2021). Openness is measured as the sum of exports and imports over GDP.

lends the model a hybrid character: it goes beyond standard growth accounting by allowing time variation in structural efficiency, yet remains grounded in the framework of business cycle analysis through its dynamic propagation mechanisms.

To better understand the forces behind the evolution of Γ_t, this section explores its long-run relationship with structural variables such as labour quality and trade openness using cointegration techniques. Cointegration establishes a stable long-run equilibrium relationship among non-stationary time series, meaning that even if the individual series are integrated of order one, I(1), a linear combination of them can be stationary, I(0). This reflects an equilibrium condition among the variables that holds over time.

Simultaneously, the associated error correction mechanism introduces short-run dynamics by modelling how deviations from the long-run equilibrium are corrected. Thus, cointegration analysis, like the model itself, occupies an intermediate position between growth theory and business cycle analysis, capturing both secular and cyclical components of labour efficiency.

Growth theory has long emphasized the role of human capital and trade openness in shaping TFP and long-run output growth (Acemoglu et al., 2014; Benhabib & Spiegel, 2005; Hall & Jones, 1999; Miller & Upadhyay, 2000). Human capital accumulation enhances the absorptive capacity of an economy, facilitating technological adoption, while greater openness to international trade fosters efficiency through competition, scale effects, and knowledge spillovers (Alcalá & Ciccone, 2004; Coe & Helpman, 1995). These mechanisms may manifest in the evolution of labour efficiency over time.

To explore these connections, I examine the long-run relationship between $\log(\Gamma_t)$, a labour quality index (LQI), and the degree of openness (measured as the trade-to-GDP ratio). Prados de la Escosura and Rosés (2021) construct two indices of labour quality. I use the income-weighted index, which captures broader labour market efficiency factors beyond formal education. Fig. 14 displays the co-movement between Γ_t and these two variables, suggesting the possibility of common long-run trends.

Given the nonstationary nature of the series, I test for cointegration among $\log(\Gamma_t)$, LQI, and openness, following standard time-series procedures (see Johansen, 1991). The estimation is detailed in Section IV in the online appendix. The cointegration vector, normalized on $\log(\Gamma_t)$, yields the following long-run relationship:

$$\log(\Gamma_t) = -3.443 + 0.275\ \log\left(\frac{\mathrm{X}_t + \mathrm{IM}_t}{\mathrm{GDP}_t}\right) + 4.184\ \log(\mathrm{LQI}_t) \tag{18}$$

with both coefficients positive and significant, in line with theoretical expectations. The elasticity with respect to LQI is notably larger, suggesting that changes in the composition and remuneration of employment have been the dominant structural force behind long-run movements in Γ_t. For example, the slowdown in both LQI and Γ_t since the 1980s points to weaker improvements in labour quality and job creation at the upper end of the wage distribution.

During other periods, such as the "Golden Age" of Spanish economy (1960–1975), the rapid rise in LQI coincided with sharp increases in Γ_t. However, in the 1920s and 1930s, LQI rose substantially while openness fell, offsetting gains in labour quality. This pattern underscores the importance of viewing Γ_t as the result of multiple structural forces. Of course, a relevant concern is the potential endogeneity of the explanatory variables, particularly labour quality. It is plausible that labour quality is partly determined by the state of the economy and therefore not fully exogenous. By using the index constructed by Prados de la Escosura and Rosés (2021), which is based on income-weighted measures, I attempt to capture slow-moving structural features of the labour market composition. These features evolve gradually and are less sensitive to short-run business cycle fluctuations, although they can still influence the trajectory of Γ_t. In contrast, openness is more responsive to short-term shocks — such as trade disruptions — and can therefore transmit high-frequency fluctuations to labour efficiency.

$$\begin{aligned}
&\Delta \log(y_t) = c + AB' \log(y_{t-1}) + B_1 \Delta \log(y_{t-1}) + B_2 \Delta \log(y_{t-2}) + \epsilon_t = \\
&= \begin{pmatrix} \underset{(.1866)}{-0.3628} \\ \underset{(.3744)}{1.92} \\ \underset{(.0133)}{0.0235} \end{pmatrix} + \begin{pmatrix} \underset{(.0542)}{-0.1054} & \underset{(.0149)}{0.0289} & \underset{(.2268)}{0.4409} \\ \underset{(.1088)}{0.5585} & \underset{(.0299)}{-0.1535} & \underset{(.4551)}{-2.3372} \\ \underset{(.0039)}{0.0068} & \underset{(.0011)}{-0.0019} & \underset{(.0162)}{-0.0286} \end{pmatrix} \log(y_{t-1}) + \\
&+ \begin{pmatrix} \underset{(.0873)}{0.1996} & \underset{(.0355)}{0.0769} & \underset{(1.1572)}{1.9269} \\ \underset{(.1752)}{-0.4650} & \underset{(.0711)}{-0.0261} & \underset{(2.3215)}{0.4437} \\ \underset{(.0062)}{0.0174} & \underset{(.0054)}{0.0025} & \underset{(.0827)}{0.5037} \end{pmatrix} \Delta \log(y_{t-1}) + \begin{pmatrix} \underset{(.0894)}{0.0374} & \underset{(.0362)}{-0.0429} & \underset{(1.0999)}{-0.0774} \\ \underset{(.1793)}{-0.1246} & \underset{(.0726)}{-0.0182} & \underset{(2.2067)}{1.8322} \\ \underset{(.0064)}{-0.0002} & \underset{(.0026)}{0.0037} & \underset{(.0786)}{0.2403} \end{pmatrix} \Delta \log(y_{t-2}) + \epsilon_t
\end{aligned} \tag{19}$$

The full vector error correction model, (19), confirms the adjustment dynamics consistent with the cointegrating relationship: lagged changes in LQI and openness positively influence γ_t, the growth rate of Γ_t. The full vector error correction model estimated by maximum likelihood is depicted in (19), where $y_t = [\Gamma_t,\ (\mathrm{X}_t + \mathrm{IM}_t)/\mathrm{GDP}_t,\ \mathrm{LQI}_t]^T$. An asterisk above the coefficient indicates that it is not significant at 10%. The first row of the matrix (B_1) multiplying the vector $\Delta \log(y_{t-1})$ gives the coefficients relating γ_t (i.e. the growth rate of Γ_t) to the lagged changes in the degree of openness and the labour quality index, the signs of the coefficients are consistent with theory.

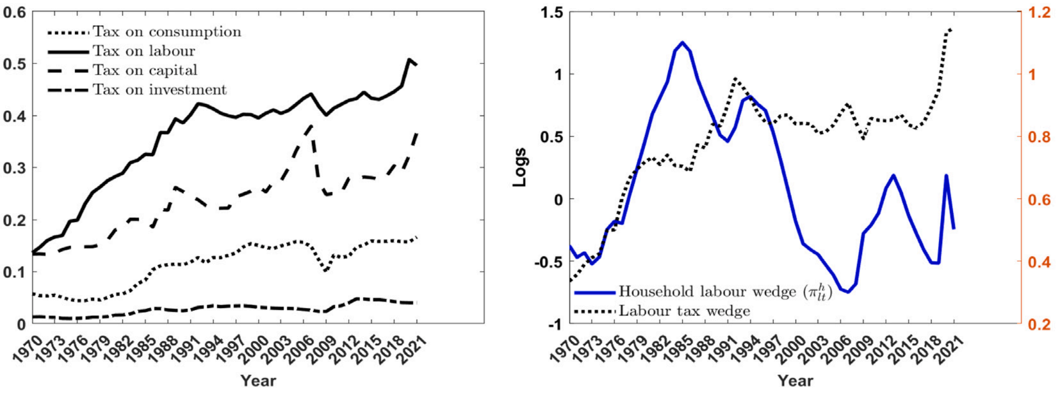
8.2. Household labour wedge

The existence of consumption and labour income taxes that distort the consumption–leisure margin is a natural candidate to explain the dynamics of the household labour wedge. Consider the budget constraint, expressed in detrended per capita terms, of the representative household facing a consumption tax rate (τ_t^c), an investment tax rate (τ_t^x), a labour income tax rate (τ_t^ℓ), a capital income tax rate (τ_t^k), and lump-sum government transfers (b_t):

$$(1+\tau_t^c)c_t + (1+\tau_t^x)\left[\eta\gamma_{yt}k_{t+1} - (1-\delta)k_t + \Psi\left(\frac{x_t}{k_t}\right)k_t\right] = (1-\tau_t^\ell)w_t h_t + (1-\tau_t^k)r_t k_t + b_t. \tag{20}$$

The household maximizes utility subject to this sequence of constraints, choosing consumption and hours such that at each date the tax-adjusted marginal rate of substitution equals the real wage:

$$-\left(\frac{1+\tau_t^c}{1-\tau_t^\ell}\right)\frac{u_h(c_t,h_t)}{u_c(c_t,h_t)} = w_t.$$



(a) Effective marginal tax rates. (b) π^h_{lt} and the tax wedge.

Fig. 15. Evolution of Effective Marginal Tax Rates.

In this setup, the labour tax wedge, $\left(1-\tau^{\ell}_t\right) / \left(1+\tau^{c}_t\right)$, is directly equivalent to the household labour wedge in the accounting model, π^h_{lt}.

I estimate effective marginal tax rates following a methodology similar to Conesa and Kehoe (2017), using Spanish data from the OECD database. My approach, however, is adapted to the structure of the model economy. First, I allow for a non-constant labour share to disentangle labour from capital income, which smooths the large pre-*Great Recession* peak in capital taxation reported by Conesa and Kehoe (2017). Second, I follow Prescott (2004) in reallocating part of the indirect taxes on consumption to investment taxation. Full details of these calculations are provided in Section V of the online appendix.

Fig. 15 panel (a) shows the evolution of the four effective tax rates, highlighting the substantial increase in Spanish taxation since 1970. This rise, particularly pronounced between 1970 and the 1990s, led to a marked increase in the labour tax wedge, as shown in Fig. 15 panel (b). Conesa and Kehoe (2017), using a perfect foresight model with a much higher Frisch elasticity than in my exercise, found that this tax evolution significantly reduced labour supply. In their sensitivity analysis with a Frisch elasticity closer to mine (0.75 vs. my 0.3), they estimate that higher taxes lowered hours worked by 17.5% between 1974 and 2015.

To quantify the role of taxation, I perform a counterfactual assuming that the household labour wedge evolved exclusively due to the labour tax wedge. Fig. 16 reports the resulting contributions to output per capita, hours worked, investment per capita, and the labour share. The results indicate that, between 1970 and 1991, the labour tax wedge accounts for a 20% decline in output (15% between 1974 and 1991), a 15% decline in hours (13% between 1974 and 1991), and a 2% reduction in the labour share. While other frictions clearly contribute to the overall dynamics of the household labour wedge, these results for the *Great Stagflation* underscore the significant role of tax policy in shaping Spanish labour market performance.

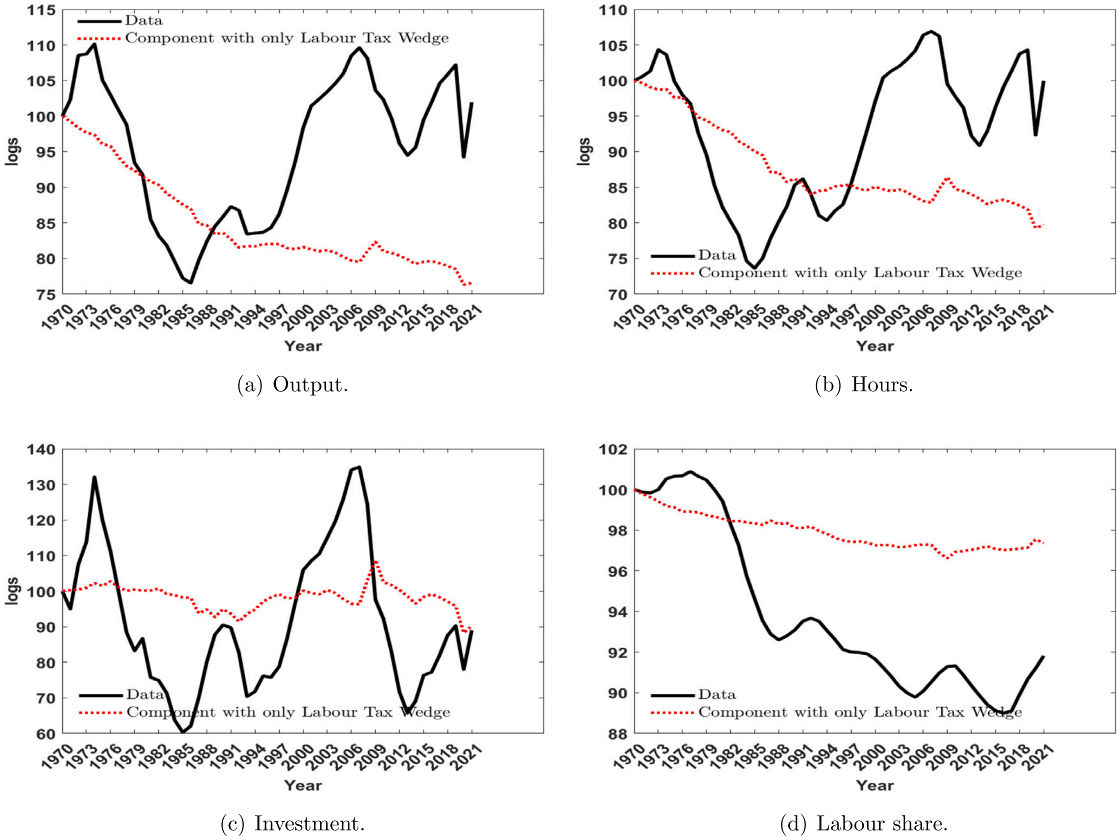
These findings reinforce the central message of this paper: the household labour wedge is a key transmission channel of shocks in the Spanish economy. The *Great Stagflation* episode illustrates how persistent distortions in the consumption–leisure margin, driven in large part by tax policy, can generate long-lasting effects on output, labour supply, and income distribution, a pattern echoed in other recessions studied in this work. Similar mechanisms have been documented in other advanced economies, where shifts in effective tax rates and related fiscal policies have amplified downturns through labour market channels (see, e.g., Ohanian et al., 2008; Prescott, 2004).

8.3. Investment wedge

In the economy where the household budget constraint is given by (20), intertemporal consumption and saving decisions are governed by the first-order condition

$$\frac{\frac{1+\tau^x_t}{1+\tau^c_t} u_c(c_t,h_t)}{1-\Psi\left(\frac{x_t}{k_t}\right)} = \beta\gamma_{yt}^{-\sigma} E_t \left\{ u_c(c_{t+1},h_{t+1}) r_{t+1}(1-\tau^k_{t+1}) - \frac{\frac{1+\tau^x_{t+1}}{1+\tau^c_{t+1}}}{1-\Psi\left(\frac{x_{t+1}}{k_{t+1}}\right)} \cdot \right.$$
$$\left. \cdot \left[\Psi\left(\frac{x_{t+1}}{k_{t+1}}\right) - \Psi'\left(\frac{x_{t+1}}{k_{t+1}}\right)\frac{x_{t+1}}{k_{t+1}} - (1-\delta)\right] \right\}.$$

In this setting, the investment tax wedge, $\left(1+\tau^x_t\right) / \left(1+\tau^c_t\right)$, corresponds to the inverse of the investment wedge in my model (π_{xt}). Additionally, intertemporal choices are distorted by the taxation of capital income $(1-\tau^k_t)$, which in my accounting framework is incorporated into the rental rate of capital (see Fig. 17).



(a) Output. (b) Hours.

(c) Investment. (d) Labour share.

Fig. 16. Contribution of Labour Tax Wedge to Variables.

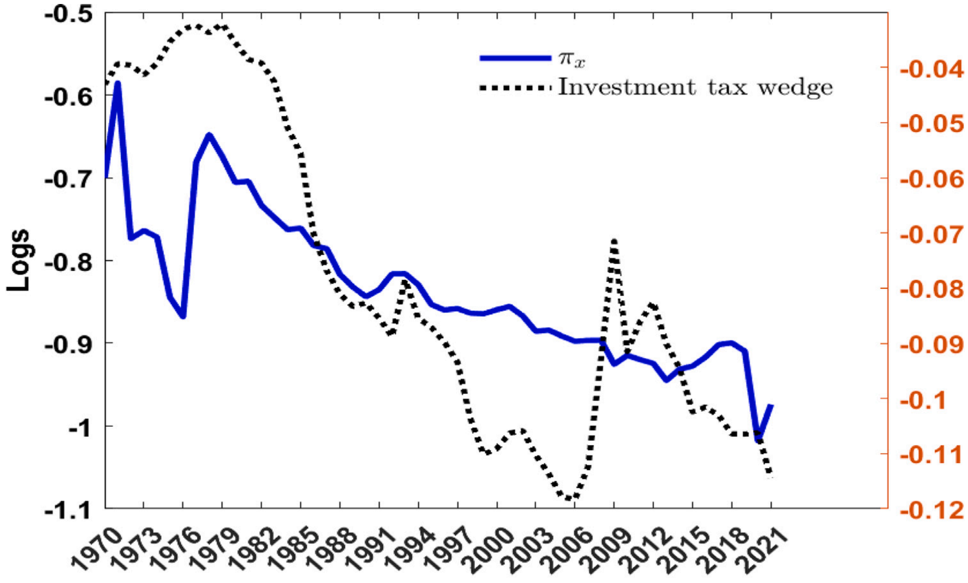
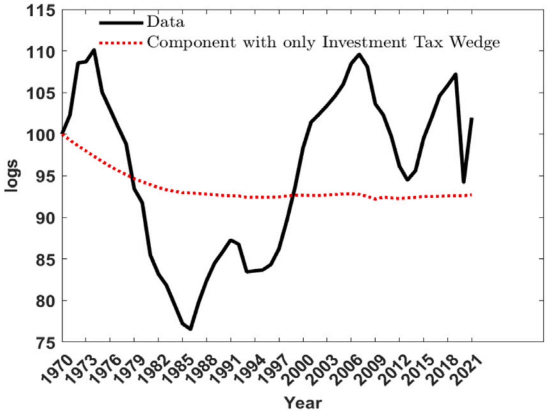
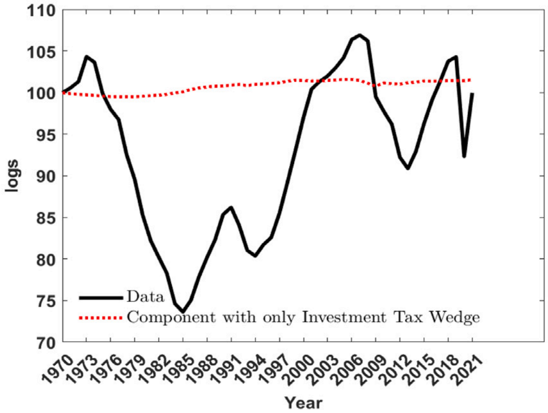


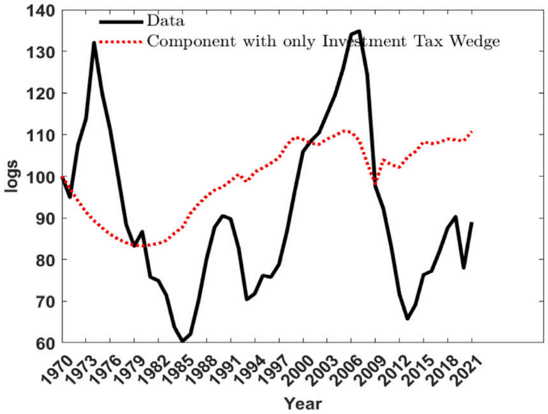
Fig. 17. The Investment Wedge and the Investment Tax Wedge.



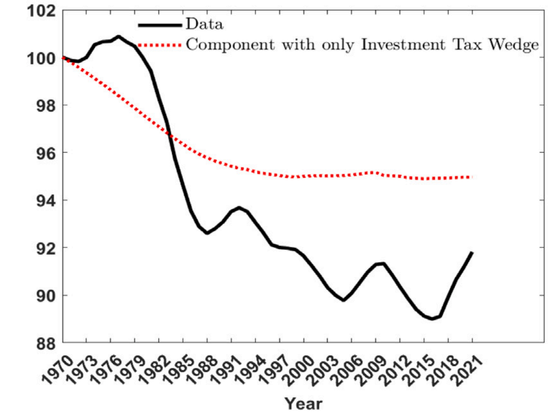
(a) Output.



(b) Hours.



(c) Investment.



(d) Labour share.

Fig. 18. Contribution of the Investment Tax Wedge to Variables.

Following the same procedure as in the previous section, I assess the quantitative effects on macroeconomic variables of attributing the observed behaviour of the investment tax wedge entirely to the evolution of π_x. Fig. 18 reports the contribution of the investment tax wedge to output per capita, hours worked, investment per capita, and the labour share.

The results show that the impact of the investment tax wedge on hours worked is negligible. However, it accounts for a decline in output of approximately 7.5% and a reduction in the labour share of around 5% between 1970 and 1991. The most pronounced effect is on investment: the investment tax wedge induced a contraction of about 10% between 1970 and 1980, followed by a strong expansion of roughly 20% from 1980 to 2006.

The patterns observed in Fig. 18 are consistent with empirical evidence on the adverse effects of taxation on capital accumulation. Vartia (2008) documents that higher corporate and personal taxes increase the user cost of capital, thereby reducing both investment and productivity growth. Sorbe and Johansson (2017) further show that, while international tax planning can partially offset these effects for multinational firms, such mechanisms were largely absent in the Spanish economy during most of the historical period considered. Consequently, the investment tax wedge likely exerted a stronger influence on domestic investment dynamics, as reflected in the substantial declines in investment and output during periods of high taxation, and in the subsequent expansion when the wedge diminished.

8.4. Correlation analysis between wedges and structural indicators

In Tables 8 and 9, I present complementary evidence connecting the estimated wedges with a broad set of macroeconomic and structural indicators. These include measures of price dynamics — such as the GDP deflator and the consumer price index (CPI), together with their respective inflation rates — as well as housing prices. Labour market conditions are represented by the unemployment rate, trade union density, collective bargaining coverage, the ratio of temporary to permanent employment, and the net replacement rate in unemployment benefits after two months. Financial and structural dimensions are captured by the ratio

Table 8
Spearman's rank order correlation coefficients. Long periods.

Variables	π^h_{lt}	γ_t	π^f_{lt}	π^{-1}_{xt}	π_{gt}
			1850–1918		
(1)	0.30 (0.011)	−0.34 (0.004)	0.28 (0.022)	0.18 (0.139)	−0.10 (0.407)
(2)	0.23 (0.062)	−0.37 (0.002)	0.14 (0.239)	0.13 (0.278)	0.00 (0.995)
(12)	−0.14 (0.235)	0.23 (0.055)	−0.28 (0.019)	−0.17 (0.163)	−0.02 (0.846)
(13)	0.05 (0.711)	0.00 (0.976)	0.05 (0.680)	0.01 (0.949)	0.06 (0.634)
			1918–1954		
(1)	−0.23 (0.176)	0.19 (0.250)	0.22 (0.197)	−0.26 (0.120)	0.28 (0.091)
(2)	−0.22 (0.184)	0.04 (0.813)	0.25 (0.132)	−0.14 (0.416)	0.36 (0.029)
(12)	−0.52 (0.001)	0.76 (0.000)	−0.10 (0.571)	−0.53 (0.001)	0.16 (0.331)
(13)	−0.01 (0.936)	0.07 (0.694)	−0.09 (0.599)	−0.04 (0.830)	0.11 (0.518)
			The golden age. 1954–1974.		
(1)	−0.45 (0.044)	−0.35 (0.124)	−0.16 (0.498)	−0.16 (0.480)	0.21 (0.367)
(2)	−0.38 (0.092)	−0.10 (0.661)	−0.28 (0.226)	0.32 (0.161)	0.53 (0.014)
(3)	−0.47 (0.035)	−0.51 (0.023)	−0.11 (0.659)	−0.23 (0.319)	0.20 (0.405)
(4)	−0.76 (0.000)	−0.58 (0.009)	−0.04 (0.887)	−0.08 (0.737)	0.54 (0.017)
(7)	0.03 (0.931)	−0.02 (0.948)	0.72 (0.008)	−0.31 (0.319)	−0.42 (0.175)
(12)	−0.25 (0.272)	0.20 (0.377)	−0.20 (0.389)	−0.00 (0.993)	0.23 (0.309)
(13)	0.07 (0.754)	−0.02 (0.930)	−0.50 (0.024)	0.16 (0.487)	0.26 (0.257)
			1974–2021		
(1)	0.03 (0.863)	0.08 (0.569)	0.02 (0.873)	−0.37 (0.010)	−0.38 (0.008)
(2)	−0.38 (0.009)	−0.15 (0.323)	−0.07 (0.631)	−0.12 (0.425)	0.18 (0.229)
(3)	0.01 (0.925)	−0.07 (0.656)	0.06 (0.696)	−0.33 (0.022)	−0.24 (0.096)
(4)	−0.37 (0.010)	−0.14 (0.352)	−0.13 (0.376)	−0.23 (0.118)	0.31 (0.033)
(6)	−0.62 (0.000)	−0.11 (0.456)	−0.20 (0.166)	−0.25 (0.081)	0.32 (0.028)
(7)	0.62 (0.000)	0.34 (0.019)	−0.12 (0.428)	0.12 (0.404)	−0.63 (0.000)
(8)	0.15 (0.337)	0.41 (0.007)	−0.32 (0.035)	−0.31 (0.042)	−0.43 (0.004)
(9)	0.10 (0.525)	−0.07 (0.685)	−0.17 (0.275)	0.06 (0.723)	−0.25 (0.108)
(10)	−0.69 (0.000)	−0.28 (0.103)	0.09 (0.601)	−0.01 (0.935)	0.79 (0.000)
(11)	−0.42 (0.057)	−0.15 (0.504)	−0.52 (0.017)	−0.64 (0.002)	0.38 (0.089)
(12)	−0.02 (0.907)	0.05 (0.744)	0.12 (0.428)	0.22 (0.141)	−0.10 (0.504)
(13)	0.33 (0.022)	0.08 (0.586)	0.15 (0.315)	0.11 (0.452)	−0.19 (0.193)

Note: Series in logs filtered using the hp filter with smoothing parameter equal to 6.25, as proposed by Ravn and Uhlig (2002). In brackets the p-values for testing the hypothesis of no correlation against the alternative hypothesis of a non-zero correlation. **(1)** gdp Deflactor. 1850-2021. Source: Prados de la Escosura (2017). **(2)** Inflation Rate gdp Deflactor. 1851-2021. **(3)** Consumer Price Index. 1955–2021. Source: ine. **(4)** Inflation Rate cpi. 1956–2021. **(6)** Housing Prices. 1971–2021. The real house price index is given by the ratio of the nominal house price index to the consumers expenditure deflator from the OECD national accounts database. **(7)** Unemployment Rate. 1964–2021. Source: Carreras and Tafunell (2005). **(8)** Trade Union Density. 1977–2019. Source: OECD/AIAS database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS). **(9)** Collective Bargaining Coverage. 1977–2018. Source: OECD/AIAS database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS). **(10)** Temporary over permanent employment. 1987–2021. Source: Labour Force Statistics OECD. **(11)** Net replacement rates in unemployment after 2 moths. 2001–2021. Source: Society at a Glance OECD. **(12)** 1+(Land Share/Capital Share). 1850-2021. Source: Own elaboration based on the data in Prados de la Escosura (2022). **(13)** Share of the value of residential capital services in the value of total capital services. 1850-2021. Source: Prados de la Escosura (2022).

Table 9
Spearman's rank order correlation coefficients. Recessions.

Variables	π^{h}_{lt}	γ_t	π^{f}_{lt}	π^{-1}_{xt}	π_{gt}
		The fin de siècle recession. 1877–1887.			
(1)	0.28 (0.402)	−0.40 (0.225)	0.23 (0.503)	−0.31 (0.356)	−0.08 (0.818)
(2)	0.05 (0.881)	−0.35 (0.286)	0.05 (0.903)	−0.48 (0.137)	−0.25 (0.468)
(12)	−0.17 (0.614)	−0.19 (0.576)	−0.21 (0.539)	−0.10 (0.776)	0.24 (0.485)
(13)	−0.25 (0.451)	0.35 (0.299)	−0.56 (0.076)	−0.28 (0.402)	−0.03 (0.946)
		The great depression. 1930–1945.			
(1)	−0.18 (0.512)	0.10 (0.721)	0.05 (0.848)	−0.15 (0.579)	0.35 (0.184)
(2)	0.04 (0.882)	−0.12 (0.648)	0.20 (0.463)	0.16 (0.541)	0.21 (0.443)
(12)	−0.66 (0.007)	0.71 (0.003)	−0.25 (0.349)	−0.74 (0.001)	0.30 (0.258)
(13)	−0.36 (0.169)	0.59 (0.019)	−0.59 (0.017)	−0.35 (0.180)	0.46 (0.078)
		The great stagflation. 1973–1984.			
(1)	−0.18 (0.573)	0.13 (0.683)	0.13 (0.683)	−0.66 (0.024)	−0.62 (0.037)
(2)	−0.48 (0.115)	0.10 (0.766)	0.25 (0.430)	−0.42 (0.177)	−0.24 (0.457)
(3)	−0.10 (0.766)	−0.03 (0.921)	0.24 (0.457)	−0.52 (0.084)	−0.57 (0.055)
(4)	−0.38 (0.227)	−0.21 (0.514)	−0.03 (0.939)	−0.23 (0.471)	0.19 (0.558)
(6)	−0.51 (0.094)	0.15 (0.635)	−0.28 (0.379)	−0.81 (0.002)	−0.41 (0.193)
(7)	0.27 (0.404)	0.20 (0.543)	−0.31 (0.319)	−0.05 (0.886)	−0.25 (0.430)
(8)	−0.02 (0.977)	0.05 (0.935)	0.12 (0.793)	−0.12 (0.793)	−0.57 (0.151)
(9)	0.39 (0.396)	0.25 (0.595)	−0.18 (0.713)	−0.18 (0.713)	−0.11 (0.840)
(12)	−0.40 (0.201)	0.25 (0.430)	0.01 (0.974)	−0.31 (0.331)	−0.15 (0.635)
(13)	0.24 (0.444)	−0.04 (0.904)	0.45 (0.147)	0.03 (0.921)	−0.03 (0.921)
		The great recession. 2007–2013.			
(1)	−0.36 (0.444)	−0.29 (0.556)	−0.14 (0.783)	−0.32 (0.498)	0.29 (0.556)
(2)	−0.29 (0.556)	−0.57 (0.200)	0.71 (0.088)	−0.07 (0.906)	0.64 (0.139)
(3)	−0.18 (0.713)	−0.68 (0.110)	0.64 (0.139)	0.00 (1.000)	0.43 (0.354)
(4)	−0.50 (0.267)	−0.82 (0.034)	0.36 (0.444)	−0.32 (0.498)	0.54 (0.236)
(6)	−0.71 (0.088)	−0.11 (0.840)	−0.50 (0.267)	−0.71 (0.088)	0.50 (0.267)
(7)	0.79 (0.048)	0.82 (0.034)	−0.36 (0.444)	0.50 (0.267)	−0.93 (0.007)
(8)	0.79 (0.048)	0.64 (0.139)	−0.04 (0.963)	0.61 (0.167)	−0.71 (0.088)
(9)	0.36 (0.444)	0.18 (0.713)	−0.29 (0.556)	0.25 (0.595)	−0.61 (0.167)
(10)	−0.82 (0.034)	−0.68 (0.110)	0.18 (0.713)	−0.57 (0.200)	0.89 (0.012)
(11)	−0.50 (0.267)	0.04 (0.963)	0.00 (1.000)	−0.54 (0.236)	0.68 (0.110)
(12)	0.07 (0.906)	0.29 (0.556)	−0.21 (0.662)	−0.25 (0.595)	−0.14 (0.783)
(13)	0.25 (0.595)	−0.04 (0.963)	0.86 (0.024)	0.36 (0.444)	0.29 (0.556)

Note: Series in logs filtered using the hp filter with smoothing parameter equal to 6.25, as proposed by Ravn and Uhlig (2002). In brackets the p-values for testing the hypothesis of no correlation against the alternative hypothesis of a non-zero correlation. **(1)** gdp Deflactor. 1850-2021. Source: Prados de la Escosura (2017). **(2)** Inflation Rate gdp Deflactor. 1851-2021. **(3)** Consumer Price Index. 1955–2021. Source: ine. **(4)** Inflation Rate cpi. 1956–2021. **(6)** Housing Prices. 1971–2021. The real house price index is given by the ratio of the nominal house price index to the consumers expenditure deflator from the OECD national accounts database. **(7)** Unemployment Rate. 1964–2021. Source: Carreras and Tafunell (2005). **(8)** Trade Union Density. 1977–2019. Source: OECD/AIAS database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS). **(9)** Collective Bargaining Coverage. 1977–2018. Source: OECD/AIAS database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS). **(10)** Temporary over permanent employment. 1987–2021. Source: Labour Force Statistics OECD. **(11)** Net replacement rates in unemployment after 2 moths. 2001–2021. Source: Society at a Glance OECD. **(12)** 1+(Land Share/Capital Share). 1850-2021. Source: Own elaboration based on the data in Prados de la Escosura and Rosés (2021). **(13)** Share of the value of residential capital services in the value of total capital services. 1850-2021. Source: Prados de la Escosura (2022).

of the land share to the capital share and by the share of residential capital services in total capital services. For each variable, I compute Spearman's rank-order correlations with the Hodrick–Prescott filtered wedge series. Owing to data availability, the analysis is carried out over four main subperiods—1850–1918,1918–1954, 1954–1974, and 1974–2021—as well as for four major recessions. Full definitions, data sources, and methodological details are provided in the table notes.

8.4.1. Prices, unemployment and labour efficiency

The data in Table 9 show that, during recessions, the growth rate of labour-augmenting efficiency (γ_t) exhibits a negative correlation with inflation measures (variables **(2)** and **(4)**), while being positively correlated with the unemployment rate—particularly pronounced during the *Great Recession*. In other periods, however, the correlation with unemployment tends to vanish; for instance, during the *Golden Age* (1954–1974), the unemployment rate **(7)** displays virtually zero correlation with the growth of labour-augmenting efficiency.

The negative correlation between inflation and labour-augmenting efficiency has been repeatedly documented in the literature. For example, Cooley and Ohanian (1991) find evidence against the procyclicality of inflation in the U.S. economy since 1820, with the notable exception of the interwar years. The direction of causality, however, remains debated. In the RBC framework, improvements in labour-augmenting efficiency translate into lower production costs for firms, which in turn reduce prices. By contrast, theories incorporating goods and labour market frictions—such as Berentsen et al. (2011)—suggest that higher inflation can depress labour-augmenting efficiency through two channels. First, inflation erodes households' real balances, reducing consumption and generating a negative demand shock that lowers the expected productivity of a labour match. Second, as the expected productivity of vacancies declines, firms reduce vacancy creation, lowering workers' job-finding rates. Prolonged unemployment then erodes workers' skills, deteriorating the composition of the labour force and reducing average labour market output. Consequently, labour-augmenting efficiency falls due to both lower net output in the goods market and a decline in the average skill level of workers.

8.4.2. Investment and financial frictions

Another notable pattern in Table 9 is the strong negative correlation between the relative house price **(6)** and both labour wedges as well as the investment wedge, particularly during the *Great Stagflation* and the *Great Recession*. In contrast, its relationship with the growth of labour-augmenting efficiency is negligible. If relative house prices are interpreted as proxies for financial distortions, this evidence aligns with theoretical frameworks in which financial frictions are transmitted primarily to labour wedges and the investment wedge. Bentolila et al. (2018) show that solvency problems in parts of the Spanish banking sector during the *Great Recession* triggered substantial declines in employment among non-financial firms.

Arellano et al. (2019) propose a mechanism through which financial frictions propagate to efficiency wedges and the firm labour wedge. In their explanation of aggregate dynamics during the *Great Recession*, a key driver is the surge in financial distress combined with the inability to insure against idiosyncratic risk in the market. This leads firms to deviate wages from the marginal productivity of labour, generating a firm labour wedge. The creation of such a wedge is a central feature of macroeconomic models incorporating financial frictions, as reviewed comprehensively by Quadrini (2011). However, the evidence for Spain's *Great Recession* indicates that it was the household labour wedge, rather than the firm labour wedge, that played the predominant role in the downturn.

8.4.3. Labour frictions

Unemployment rate **(7)**, union density **(8)**, and collective bargaining coverage **(9)** display a strong positive correlation with the household labour wedge, particularly during the *Great Recession*, whereas their association with the firm labour wedge is weaker and less systematic. In contrast, the ratio of temporary to permanent employment **(10)** and the generosity of unemployment benefits **(11)** are negatively correlated with the household labour wedge and show virtually no relationship with the firm labour wedge. This pattern suggests that the decline in the household labour wedge during the *Great Recession* was linked to a combination of higher temporary employment and more generous unemployment benefits, alongside reductions in union protection, collective bargaining coverage, and the unemployment rate.

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8.4.4. Structural change

Given the extended time span under analysis, it is essential to account for potential structural transformations within the economy. To this end, I include in Table 9 two variables designed to capture significant shifts in the sectoral composition: **(12)** the ratio of the land factor's share to the capital factor's share in total income, and **(13)** the proportion of residential capital services relative to the total value of capital services.

During the 19th century and the first half of the 20th century — particularly throughout the *Great Depression* — the land-to-capital income ratio exhibited a positive correlation with labour-augmenting efficiency growth and a negative correlation with the investment wedge. These findings highlight periods of pronounced sectoral reconfiguration in the economy.

Furthermore, the composition of the capital stock **(13)** reveals a correlation of 0.86 with the firm labour wedge and 0.35 with the investment wedge during the *Great Recession*, underscoring the pivotal role of the real estate sector in shaping the dynamics of that crisis.

9. Conclusion

This study has conducted an accounting exercise to identify the key forces driving the Spanish economy during six major recessions. The analysis offers a framework to guide explanatory theories and contributes to a deeper understanding of the causes behind economic downturns in Spain and comparable economies.

The *fin de siècle Depression* appears to have been primarily driven by the efficiency wedge, which accounts for the observed declines in output and investment. Similarly, the Spanish *Great Depression* was also shaped by the efficiency wedge, although the investment and resource wedges played a mitigating role, cushioning the impact of falling efficiency and household labour wedges at the onset of the Civil War.

In contrast, the more recent recessions in Spain are closely linked to the dynamics of the household labour wedge. Notably, during the *Great Stagflation*, changes in taxation significantly influenced both the household labour wedge and the investment wedge. However, this pattern does not extend to the *European Crisis*, the *Great Recession*, or the COVID-19 crisis, where other factors were more prominent.

The ultimate aim of this accounting approach is to provide practitioners with plausible structural interpretations of wedge behaviour. The cointegration analysis of labour-augmenting efficiency suggests a slowdown in its growth rate since the 1980s, coinciding with a deceleration in the creation of relatively higher-paid jobs—a trend that persists to this day. Several institutional features of the Spanish labour market, such as temporary employment, unemployment benefits, and the collective bargaining system, appear to be closely associated with the evolution of the household labour wedge.

Finally, the significance of the household labour wedge in explaining macroeconomic fluctuations has been emphasized by Galí et al. (2007) and Karabarbounis (2014), among others. These authors adopt preferences consistent with a balanced growth path and constant hours worked, as formalized by King et al. (1988) (KPR), which have become standard in applied macroeconomics. When hours worked exhibit a downward trend, accounting exercises based on KPR preferences attribute this trend to the household labour wedge. Even when alternative preferences allow for declining hours worked, the household labour wedge remains a central factor in aggregate fluctuations—at least in the Spanish context. The key takeaway from this analysis is that developing theories to explain the evolution of the tax-adjusted household labour wedge and its relationship with macroeconomic dynamics represents a promising avenue for future research.

Appendix A. Data

To apply the accounting method for this period, I use data constructed by Prados de la Escosura (2017, 2022) and Prados de la Escosura and Rosés (2021). The data are available in Fundación Rafael del Pino. Population, L_t, is population between $16 - 65$ years at time t. Hours Worked at time t, H_t, are total hours worked at time t. Therefore, the fraction of time devoted to work, $\tilde{h}_t$, equals the hours worked per capita divided by the available hours per person (2/3 of the total, 8760 h per year, $H_A = 5840$), $\tilde{h}_t = H_t/(L_t H_A)$.

Real output, real consumption and real investment are computed deflating the corresponding nominal magnitudes by the implicit deflator of GDP: $Y_t = Y_{N,t}/P_t$, $C_t = C_{N,t}/P_t$ and $X_t = X_{N,t}/P_t$. The anual depreciation rate is obtained as the percentage that the consumption of fixed capital represents of the net capital stock provided by Prados de la Escosura (2022). I detrend real output, real investment, real consumption by $\Gamma_{y,t-1}$ and the fraction of time per capita devoted to work by $\Gamma_{h,t-1}$. Values of $\Gamma_{y,t-1}$ and $\Gamma_{h,t-1}$ are obtained in Section 5.

Finally, I have smoothed the time series of the labour share using a moving average filter. The original series is highly volatile suggesting the existence of a lot of noise. In some periods the observations in the original series show very sharp changes that are transmitted to the wedges influencing the interpretation of the quantitative results. For example, the labour share goes from 56.26% in 1953 to 72.65% in 1954. Fig. A.19 shows the original and the smoothed labour share series.

Appendix B. Testing for structural instability

In the BCA framework employed in this paper, wedges are interpreted as residual objects that capture not only economic distortions — such as taxes, markups, or financial frictions — but also any deviation from the benchmark neoclassical growth model. This includes, by construction, possible structural changes in the economy that the model does not explicitly account for. As a result, if the underlying data-generating process shifts due to institutional reforms, policy regime changes, or technological transformations, the estimated wedges may absorb such structural breaks. This raises concerns about the validity of estimating the model over the full historical sample: if structural instability is present, the wedges may reflect spurious adjustments, potentially biasing the interpretation of the results.

To address this concern, I conduct a robustness analysis by re-estimating the VAR(1) model on alternative subsamples informed by the literature. Rodríguez-López and Solís García (2016) split their dataset into two periods—1973:3–1994:4 and 1995:1–2011:2—to reflect key institutional and macroeconomic changes associated with Spain's democratic transition and integration into the European Union. Additionally, Prados de la Escosura (2017) identifies three distinct growth regimes in Spanish GDP per capita: 1850–1950,1950–1974, and 1974–2021, with a level shift attributed to the Civil War (1936–1939). Combining both perspectives, I divide the sample into four subsamples for robustness purposes: 1850–1950,1951–1974, 1975–1994, and 1995–2023.

To formally test the structural stability of the estimated VAR(1) model across these periods, I implement a Chow-type test for multiple breaks. The test compares the residual sum of squares (RSS) from the restricted model estimated over the full sample with the RSS from unrestricted models estimated separately on each subsample.

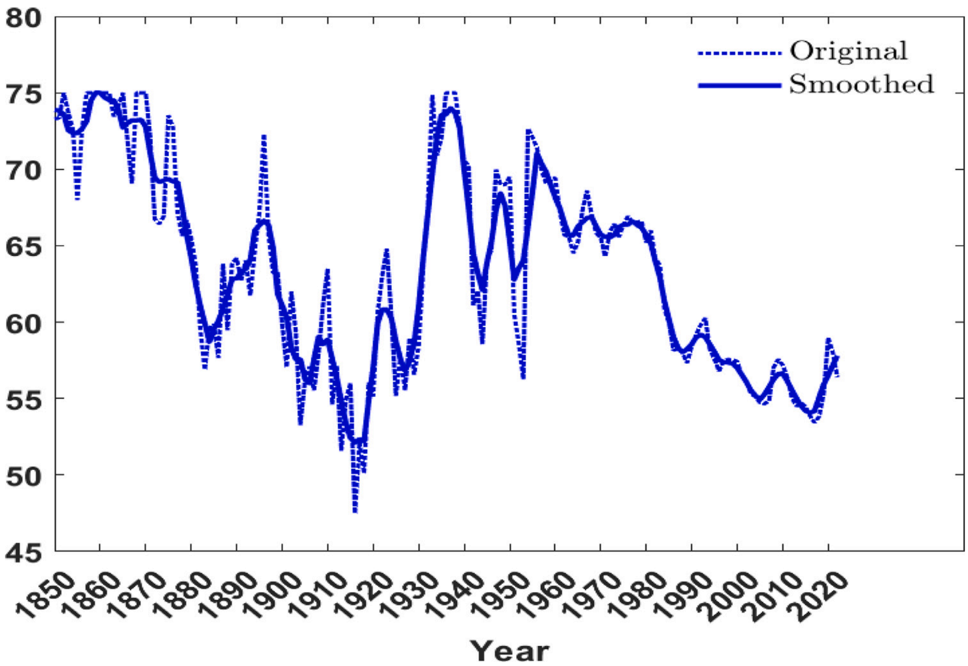

Fig. A.19. The Labour Share.

Table 10
Chow test for structural breaks across subsamples.

	$RSS_{restricted}$	$RSS_{unrestricted}$	F-stat	Critical Value 5%
Full Sample vs. Subsamples	5.1240	7.3179	0.2569	1.5146

H_0 : Stability of var(1) coefficients.
H_1 : No stability of the var(1) coefficients.
Note: The test compares the restricted model estimated over the full sample (1850–2023) to unrestricted models estimated separately over the four subsamples: 1850–1950, 1951–1974, 1975–1994, and 1995–2023. The test statistic follows an $F_{k\cdot(n-1),T-k\cdot n} = F_{90,54}$ distribution under the null hypothesis.

The data, consisting of time series of the wedges obtained using the model, are divided into subsamples. The Chow test assesses whether the autoregressive dynamics of the VAR(1) remain consistent across these subsamples or if structural breaks are present.

The test relies on the Sum of Squared Residuals (SSR) to compare model fits: - The SSR of the unrestricted model (SSR_{full}) measures the residual variance when the VAR(1) is estimated using all available data, assuming no breaks. - The SSR of the restricted model ($SSR_{\text{restricted}}$) is the sum of the SSRs from each subsample, reflecting the fit when parameters are allowed to differ at the break dates.

The Chow statistic is computed as:

$$F = \frac{(SSR_{\text{full}} - SSR_{\text{restricted}})/(k \cdot (n-1))}{SSR_{\text{restricted}}/(T - k \cdot n)},$$

where k is the number of parameters per equation (including the constant and autoregressive coefficients), n is the number of subsamples, and T is the total number of observations. The degrees of freedom are $df_1 = k\cdot(n-1)$ for the numerator and $df_2 = T-k\cdot n$ for the denominator.

To determine significance, the F-statistic is compared to a critical value from the F-distribution at a 5% significance level, or equivalently, a p-value is calculated. If the F-statistic exceeds the critical value or the p-value is less than 0.05, the null hypothesis of parameter stability is rejected. This would imply that the dynamics of the wedges have shifted at the specified break dates, potentially due to changes in economic policy, productivity shocks, or other structural factors.

The results, reported in Table 10, show that the F-statistic falls below conventional critical values, and the associated p-value is insufficient to reject the null hypothesis. This suggests that there is no statistically significant evidence of structural instability in the estimated VAR(1), and supports the use of the full-sample specification for the baseline analysis.

Appendix C. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.iref.2026.104953.

Data availability

Data will be made available on request.

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