The effects of the Iberian Exception mechanism on wholesale electricity prices and consumer inflation. A synthetic-controls approach

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Abstract

This study employs synthetic control methods to estimate the effect of the Iberian exception mechanism on wholesale electricity prices and different aggregations of consumer inflation, for both Spain and Portugal. We find that the intervention achieved a 43% reduction in the spot price of electricity in both Spain and Portugal between July 2022 and June 2023, with almost identical results. When considering the impact of the policy on inflation, significant differences between the two countries arise. On one hand, the effect on Spain's overall inflation is immediate and amounts to a 3.7-percentage point drop over the period under consideration. By contrast, the effect of the policy in Portugal kicks in with a six-month lag, and while energy inflation drops significantly, the effect on overall inflation is undetectable. Different electricity market structures in each country are a plausible explanation.

Keywords: Iberian exception mechanism, Inflation, Wholesale electricity prices, Synthetic controls, Policy evaluation

JEL Classification: E31, L51, Q41, Q48

1 Introduction

Among the various policies implemented to address the impact of the recent energy price inflation in Europe, the correction mechanism in the Iberian wholesale electricity market is particularly noteworthy.[1] This policy, referred to as the Iberian exception mechanism (IbEx), stands out as the only direct intervention in the day-ahead market. The IbEx sets a limit on the price that gas generators can offer in the auction and establishes a mechanism to offset their losses when international gas prices exceed this limit.

This paper examines the effectiveness of the IbEx in reducing the day-ahead price of electricity and inflation by employing synthetic control (SC) methods, as introduced by Abadie and Gardeazabal (2003) and Abadie et al. (2010). Through our investigation, we contribute to a vast body of empirical literature that explores the interaction of energy markets on inflation and economic activity by introducing SC methods to the field (Barsky and Kilian, 2002; Kilian, 2008; Clark and Terry, 2010; Baumeister and Kilian, 2016; Kilian and Zhou, 2022). We find that the intervention reduced the day-ahead price of electricity by more than 40% in both countries, with almost identical results. The effect on energy items was felt immediately in Spain, as the energy-only inflation rate declined by 22 points on

[1] **Abbreviations**: CP00: all-items CPI; xNRG: Non-energy CPI; DAA: day-ahead price; EU: European Union; IbEx: Iberian exception mechanism; MIBEL: Iberian Electricity Market; NRG: Energy-only CPI; SC: Synthetic controls.

average over the first twelve months of the policy. This effect, in turn, contributed greatly to a 3.7-point drop in the overall inflation rate. In Portugal, however, we do not find evidence of an important effect on consumer prices. We argue that this divergence is explained by different retail electricity contract types in each country; while the regulated tariff in Spain is directly indexed by wholesale prices, there is no direct link between wholesale and retail prices in Portugal in the short term.

2 The Iberian Exception Mechanism

The Iberian Electricity Market (MIBEL) uses a market coupling algorithm to produce a single day-ahead price for Spain and Portugal. While the two countries share a wholesale market, their retail structures differ significantly. On one hand, Spanish consumers may choose to receive their electricity from retail providers or through the PVPC regulated tariff, which is directly indexed by MIBEL day-ahead prices and serves roughly 40% of households and firms using up to 10kW of power (IEA, 2021b). By contrast, most Portuguese consumers source their electricity from private retailers and less than 5% adhere to the regulated tariff, whose price is based on MIBEL prices from the previous year (IEA, 2021a).

The IbEx was approved by the governments of Spain and Portugal and entered into force on June 15, 2022. The intervention aims at decoupling the price of electricity from international gas prices. This is done by imposing a limit on the price that gas-firing electricity generators can offer at the auction. To prevent them from operating at a loss, gas generators are entitled to adjustment payments on days when international gas prices go above the cap. The adjustment cost is computed based on a daily market price, which is published before the day-ahead auction begins, such that market participants can submit their bids and offers with this knowledge. The adjustment cost is borne by market agents buying electricity indexed by the day-ahead price, and also financed through revenues from electricity exports to France (Jefatura de Estado, 2022; Ambiente e Ação Climática, 2022; MIBGAS, 2022).

While countries across Europe have taken action to address the volatility in energy prices in various ways, the IbEx is the only measure that directly intervenes in the spot price of electricity (Sgaravatti et al., 2023). As a result, while the MIBEL day-ahead market has been operating under special circumstances since June 15, all other European markets continue to follow the EU energy directives and guidelines in their integrity. This creates an ideal natural experiment to study the impact of the IbEx on inflation with causal implications.

3 Methods and Data

SC methods create a counterfactual for the treated unit by generating a weighted average of similar untreated units.[2] By comparing the outcome of the treated unit with the synthetic counterfactual, SC methods allow for causal inference regarding the impact of the intervention (see Abadie, 2021, for more details).

We take into account 23 European countries for the donor pool.[3] The treatment effect is estimated individually for Portugal and Spain, and to construct the SC unit for Spain, we exclude Portugal from our analysis and vice versa. We base our estimations on monthly average day-ahead prices (DAA) (OMIE, 2022; Energy-Charts, 2022), and three consumer price indices at constant taxes: energy-only CPI (NRG), non-energy CPI (xNRG), and all-items CPI (CP00) (Eurostat, 2023a). This approach allows us to, firstly, determine whether the IbEx affected inflation and, secondly, to disaggregate the effect among energy and non-energy items.

Following Ferman et al. (2020), all our SC specifications include all pre-treatment outcome lags as predictors. The length of the pre-treatment period, T_0, is consider-

[2] The estimation of SC units is done in R using the limSolve package (Soetaert et al., 2009), while confidence intervals are computed with the scinference package (Wuthrich, 2021). A deployable tool to replicate the results in available at `https://github.com/mharoruiz/ibex`

[3] All EU-27 countries plus Norway are considered, as they all operate under the EU Electricity Directives and the Guideline on Capacity Allocation and Congestion Management, as well as engage in market coupling through the Single Day-ahead Coupling mechanism. Cyprus and Malta are removed from the control pool because they do not operate a wholesale electricity market of their own. France is also removed, as we cannot rule out the possibility that the intervention affected its day-ahead electricity market (Schlecht et al., 2022).

ably larger than that of the post-treatment period, T_1.[4] We only take into account full intervention months; thus, the post-treatment period spans from July 2022 to June 2023. Furthermore, we use inference procedures proposed by Chernozhukov et al. (2021) for counterfactual and synthetic control methods, which recast the causal inference problem as a counterfactual prediction problem.

4 Results

The results are presented in four figures with the same structure. Each figure shows the results for Spain on the left side and for Portugal on the right side, as indicated by the labels at the top. Furthermore, each country has an upper and a lower panel. The upper panels display the observed time series for Spain (ES) and Portugal (PT), along with their corresponding SC units (SC_{ES} and SC_{PT}). The dashed vertical line indicates the beginning of the IbEx. The lower panels show the difference between the observed and synthetic series, providing an estimate of the causal effect of the IbEx on each price outcome. This estimate is accompanied by a 90% confidence interval in the post-treatment period.

Fig. 1 displays the results for the day-ahead price. The pre-treatment fit suggests that the SC units closely approximate the observed day-ahead prices before the

[4] Specifically, we have $T_0 = 108$ and $T_1 = 12$ months for the CPI series, and $T_0 = 89$ and $T_1 = 12$ for the day-ahead price series due to lack of available data before 2015. Furthermore, Croatia, Hungary, and Ireland are removed from the donor pool as their day-ahead price data is subject to inconsistencies.

intervention. The lower panels show that the estimated effect is almost identical in both countries and indicates that the IbEx achieved an average reduction of 65 Euros/MWh in the day-ahead price of electricity between July 2022 and June 2023, equivalent to a 43% decline.

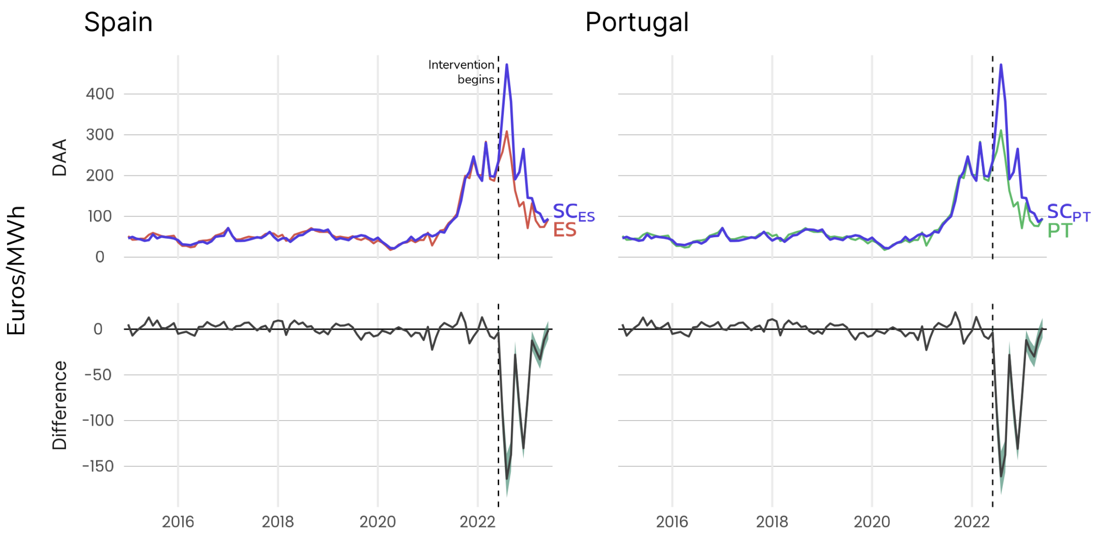

Fig. 1. DAA results.

Moving onto the impact on energy-only CPI, Fig. 2 shows notable differences in the treatment effect between the two countries. In Spain, the IbEx had an immediate and strong negative effect, particularly until December 2022. Over its first twelve months, the intervention resulted in an average decline of 26 index points (-19%) in energy-only CPI. This translated into a reduction in the energy-only annual inflation rate of 22 percentage points.[5] In Portugal, the IbEx had virtually no effect on the energy-only CPI until December 2022. However, from January to

[5]See B for detailed information on this calculation.

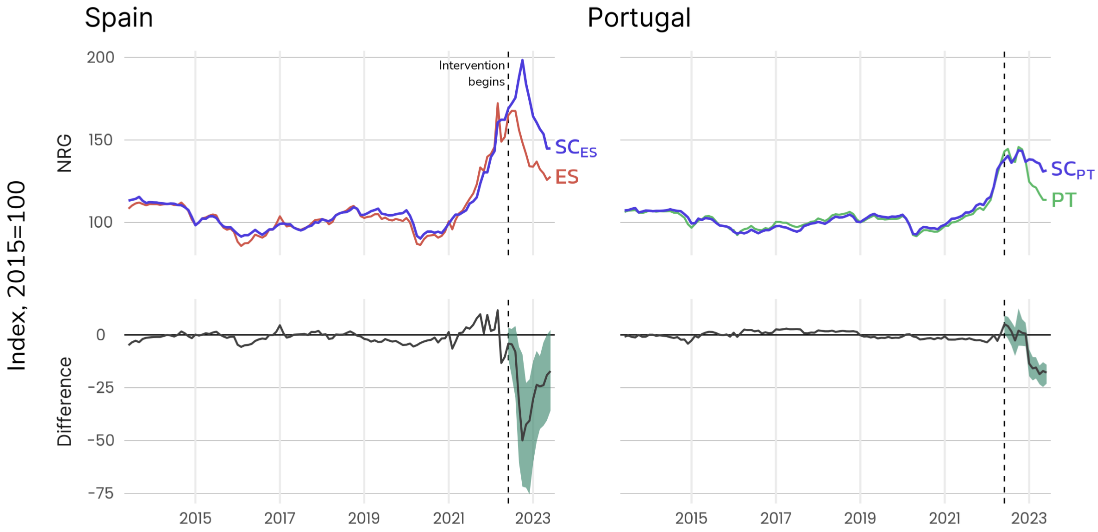

Fig. 2. NRG results

June 2023, we observe a decline of 16 index points (-14%) in the energy-only CPI and a 12-point drop in the annual energy inflation rate.

The different results can be explained through differences in the retail market of electricity in each country. As explained in section 2, Spanish consumers can index their electricity by the day-ahead market through the PVPC tariff, which creates a direct link between the wholesale markets and the energy CPI in the short term. In contrast, Portuguese retailers prefer longer-term electricity contracts as price references, for which it takes longer for retail prices to reflect consolidated changes in the wholesale market.

Fig. 3 summarizes the effect of the IbEx on the all-items CPI excluding energy. Spain's synthetic counterfactual is able to match the observed trend remarkably

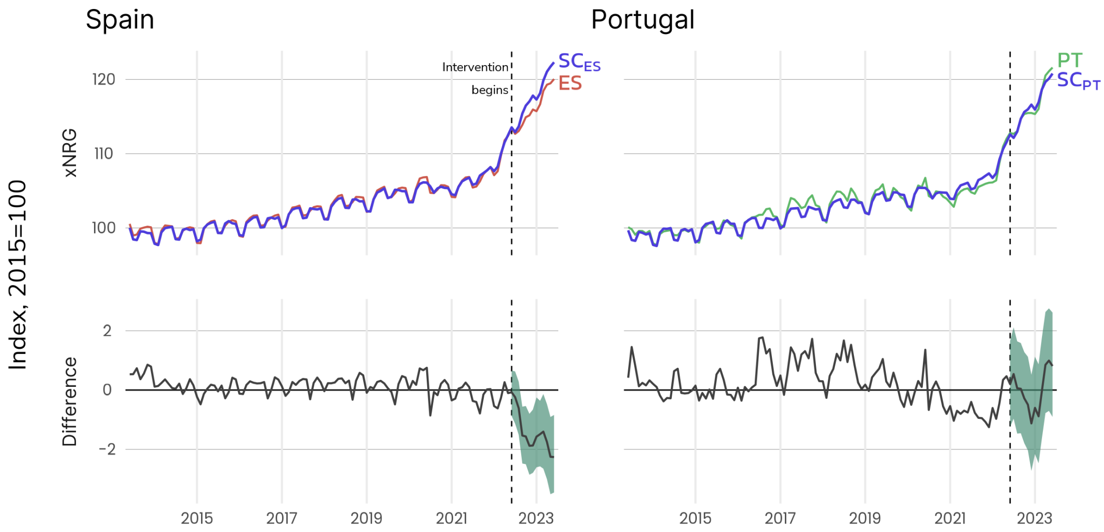

Fig. 3. xNRG results

well in the pre-treatment period, which contributes to the effect standing out in the post-treatment period, even as its magnitude is not particularly large. Throughout the first twelve months of the IbEx, the non-energy CPI declined by 1.5 index points (-1.3%), which translated into a 1.2-point decline in the annual non-energy inflation rate. In Portugal, the estimated effect is virtually zero between July 2022 and June 2023.

Next, we investigate the effect on the all-items CPI, presented in Fig. 4. In Spain, the IbEx prompted this indicator to decline by 4.0 index points (-3.3%), and the overall annual inflation rate by 3.7 points, on average over the first twelve months. In Portugal, the effect follows a U-shape that sits just under zero. On average, the index declines by less than 1.0% over the first six months of 2023, suggesting that there is no important effect.

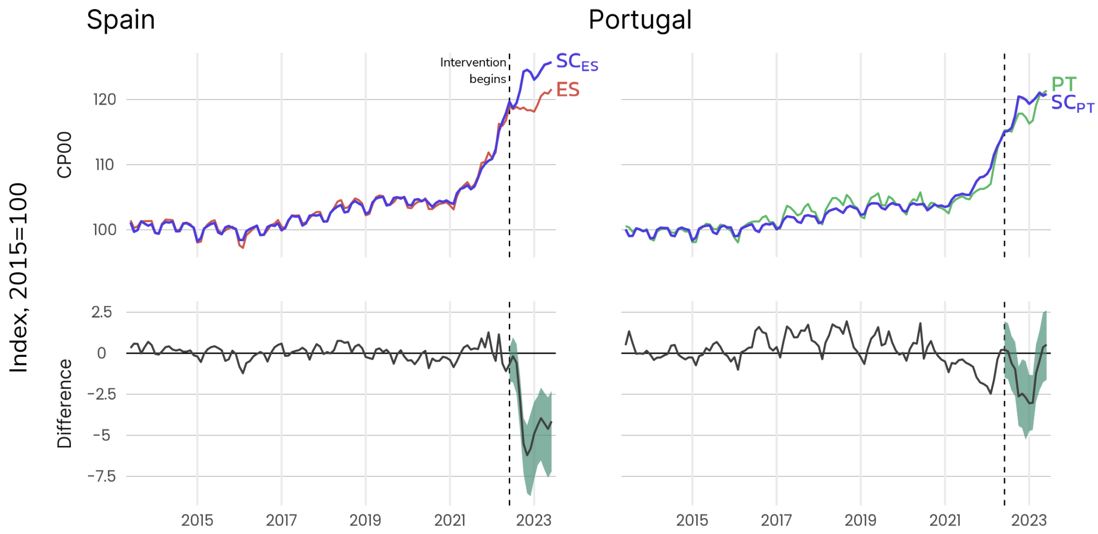

Fig. 4. CP00 results

To gain a deeper understanding of the impact of the IbEx on Spain's price level, we utilize equation 1 to decompose the change in the overall CPI into contributions from energy and non-energy items.

$$\Delta\text{CP00}_t^{SC} = w_t \Delta\text{NRG}_t^{SC} + (1 - w_t)\Delta\text{xNRG}_t. \tag{1}$$

The weight w_t reflects the share of energy goods in the overall CPI.[6]. In this sense, the weighted change in overall CPI (ΔCP00_t^{SC}) can be divided into the direct contribution from the IbEx on energy items, as estimated via SC ($w_t\Delta\text{NRG}_t^{SC}$) and the residual effect on non-energy items($w_t\Delta\text{xNRG}_t$).

Fig. 5 shows the decomposition of the effect on Spain's overall inflation between

[6]In Spain, the weights assigned to NRG were 0.12 in 2022 and 0.10 in 2023

energy and non-energy items. Between July and October 2022, the reduction in energy-only inflation caused by the IbEx is able to fully explain the reduction in overall CPI. As energy-intensive industries experience lower input costs thanks to the implementation of the IbEx, the effect spills over to non-energy items in the following months. As a result, from October 2022 onward, non-energy CPI bears increasing responsibility over the reduction in the overall CPI.

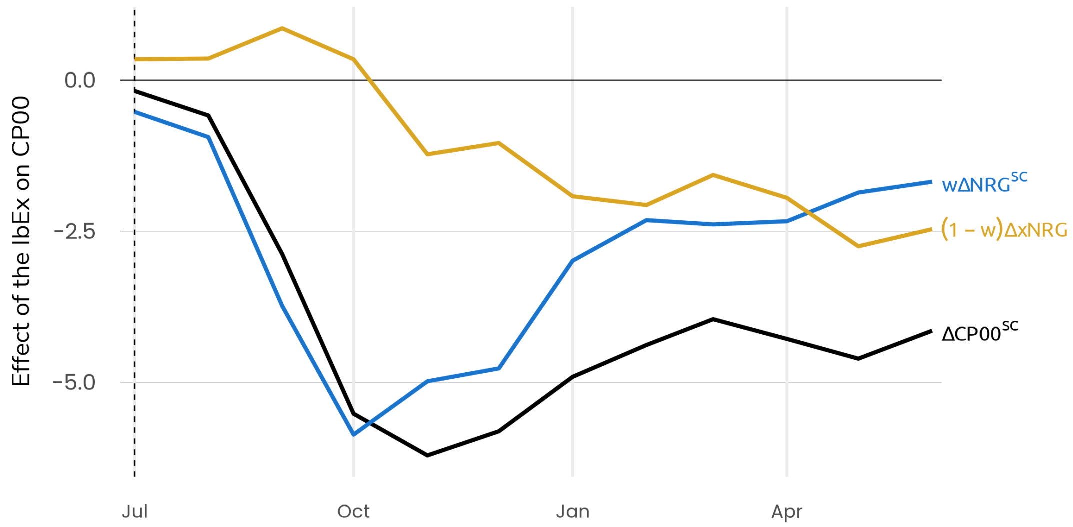

Fig. 5. Decomposition of the effect of the IbEx on Spain's CP00.

5 Conclusion

This paper has estimated the effect of the Iberian exception mechanism on the day-ahead price of electricity and inflation. In Spain, the intervention had an immediate and strong negative effect, as the overall rate of inflation declined by 3.7 points between July 2022 and December 2023. Throughout the first four months of the IbEx, the reduction in overall inflation is fully explained by the effect on the energy-only CPI. In the eight months that follow, as the effect of the IbEx spreads to non-energy goods and services, these bear growing responsibility for the effect on all-items inflation. In Portugal, the effect of the policy kicked in with a six-month delay, and while it reduced the energy inflation rate by 12 points between January and June 2023, the effect on overall inflation is undetectable. The explanation for the different results can be found in the retail electricity contract options available in each country. The regulated tariff in Spain creates a direct link between the wholesale price of electricity and the price paid by consumers, with immediate effects on inflation. By contrast, retail prices in Portugal reflect longer-term contracts.

The approach used in this study shows how Spanish consumer prices are highly exposed to fluctuations in the spot price of electricity in the short term. While the IbEx had a stronger effect on Spain's inflation, it must be noted that the energy crisis did not affect Portuguese consumer prices as much in the first place (see Fig. 2). Following this, it is advised that Spain revises the PVPC tariff to reflect electricity contracts with longer maturity as an effective way to shield consumers against future episodes of volatility in international gas markets. Furthermore, applications of similar price caps in other European countries are expected to have a delayed effect, as illustrated by Portugal. Another aspect to consider before implementing similar policies outside the Iberian peninsula is that other European countries have more cross-border interconnections than Spain or Portugal. As pointed out by Schlecht et al. (2022), this can lead to larger outflows of electricity produced in the country implementing the price cap.

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A Results summary

Table A1 reports the average effect of the IbEx over three different periods (the first full twelve months and two six-month halves) for the four outcomes presented throughout the paper. Each estimate is reported in absolute (Euros/MWh or index points), as well as percentage terms. Estimates for CPI outcomes are also reported in terms of percentage points of annual inflation rate.

		unit	Spain	Portugal
DAA	7/2022 - 6/2023	Euros/MWh	-66.023	-65.186
		%	-44.028	-43.087
	7/2022 - 12/2022	Euros/MWh	-106.063	-105.597
		%	-54.417	-54.292
	1/2023 - 6/2023	Euros/MWh	-25.982	-24.774
		%	-33.640	-31.883
NRG	7/2022 - 6/2023	CPI	-26.305	-7.621
		%	-18.921	-6.534
		p.p.	-21.825	-4.210
	7/2022 - 12/2022	CPI	-29.543	1.126
		%	-20.293	0.773
		p.p.	-29.623	-3.884
	1/2023 - 6/2023	CPI	-23.066	-16.369
		%	-17.550	-13.842
		p.p.	-14.027	-12.305
xNRG	7/2022 - 6/2023	CPI	-1.535	-0.012
		%	-1.313	-0.017
		p.p.	-1.152	0.529
	7/2022 - 12/2022	CPI	-1.283	-0.209
		%	-1.118	-0.179
		p.p.	-0.917	0.721
	1/2023 - 6/2023	CPI	-1.787	0.188
		%	-1.508	0.145
		p.p.	-1.388	0.336

CP00	7/2022 - 6/2023	CPI	-3.956	-1.342
		%	-3.313	-1.147
		p.p.	-3.668	-0.119
	7/2022 - 12/2022	CPI	-3.531	-1.542
		%	-2.979	-1.313
		p.p.	-3.762	-0.197
	1/2023 - 6/2023	CPI	-4.382	-1.143
		%	-3.646	-0.980
		p.p.	-3.574	-0.040

Table A1. Estimated effect of the IbEx

B Effect on the inflation rate

The year-on-year inflation rate for a given month m is computed directly from any CPI series, as follows:

$$\pi_m^{CPI} = \frac{CPI_m - CPI_{m-12}}{CPI_{m-12}} \cdot 100 \tag{2}$$

We use this equation to compute the year-on-year inflation rate from the observed and synthetic CPI series for both Spain and Portugal. Next, the effect on inflation rate is estimated as the difference between the two series.

Figures B1, B3, and B2 are analogous to Figures 2, 3 and 4 in the paper. In this case, the top panels display the observed and synthetic annual inflation rate series, derived using equation 2 from the different observed and synthetic CPI time series.

Naturally, the resulting observed inflation rate series are equivalent to the official year-on-year inflation rate (see Eurostat, 2023b), whereas the derived synthetic series provide with a counterfactual for the inflation rate under no intervention. As a result, the lower panels, which display the difference between the observed and synthetic series, give estimates of the causal effect of the IbEx on different aggregations of inflation rate.

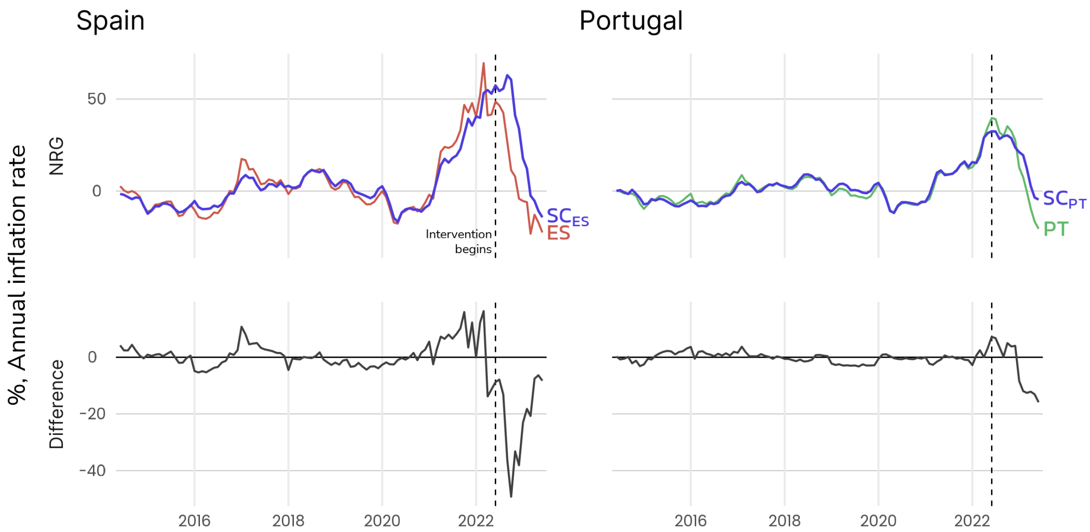

Fig. B1. Observed and synthetic energy inflation rate series, and difference between them.

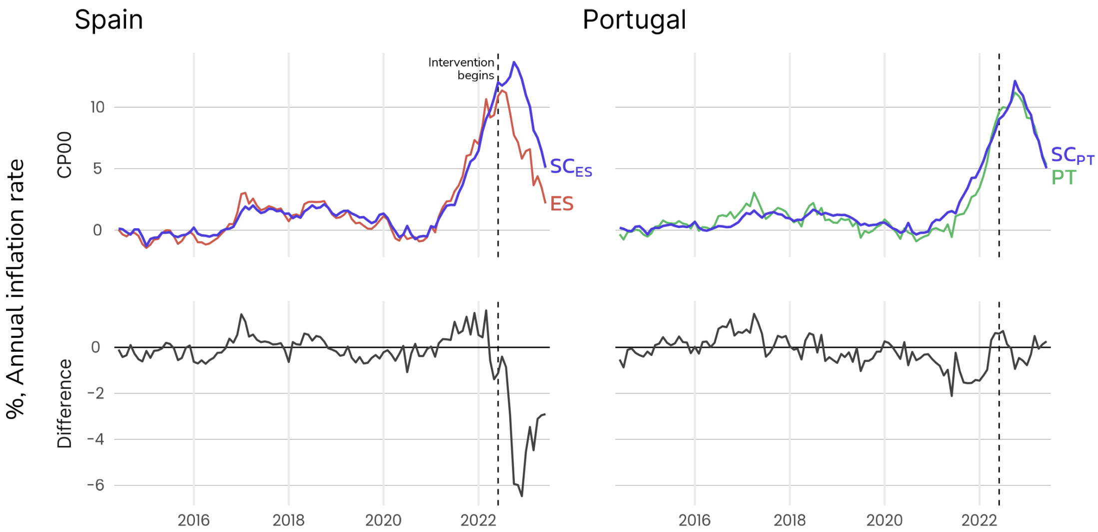

Fig. B2. Observed and synthetic overall inflation rate series, and difference between them.

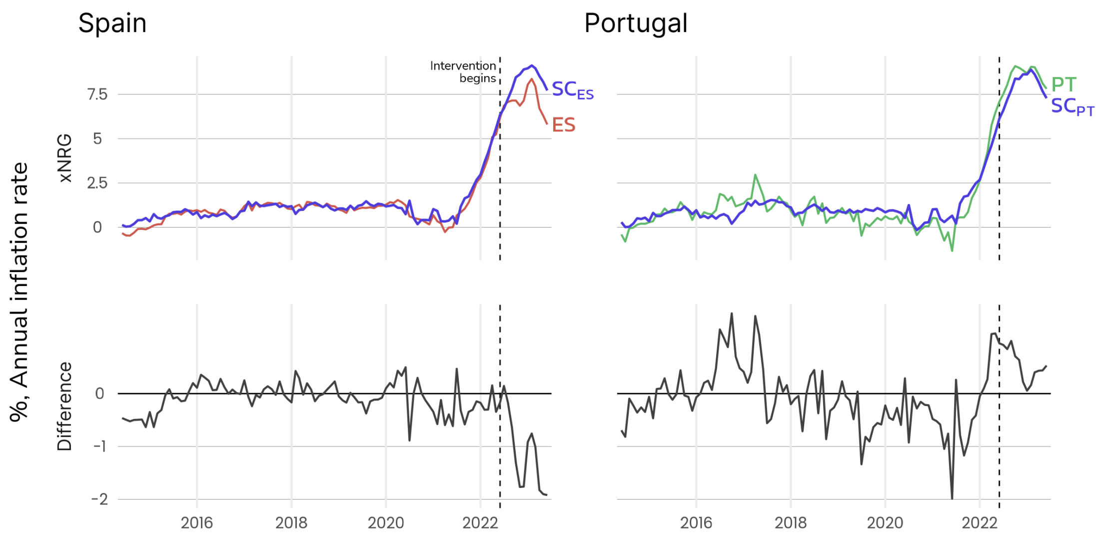

Fig. B3. Observed and synthetic overall inflation rate excluding energy series, and difference between them.