

Ruiz, Miguel Haro; Schult, Christoph; Wunder, Christoph

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

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The Effects of the Iberian Exception Mechanism on Wholesale Electricity Prices and Consumer Inflation: A Synthetic-controls Approach

Miguel Haro Ruiz, Christoph Schult, Christoph Wunder

Authors

Miguel Haro Ruiz

Corresponding author

Martin Luther University Halle-Wittenberg

E-mail: m.haroruiz@gmail.com

Christoph Schult

Halle Institute for Economic Research (IWH) –

Member of the Leibniz Association,

Department of Macroeconomics

E-mail: christoph.schult@iwh-halle.de

Tel +49 345 7753 806

Christoph Wunder

Martin Luther University Halle-Wittenberg

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Editor

Halle Institute for Economic Research (IWH) –

Member of the Leibniz Association

Address: Kleine Maerkerstrasse 8

D-06108 Halle (Saale), Germany

Postal Address: P.O. Box 11 03 61

D-06017 Halle (Saale), Germany

Tel +49 345 7753 60

Fax +49 345 7753 820

www.iwh-halle.de

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The Effects of the Iberian Exception Mechanism on Wholesale Electricity Prices and Consumer Inflation: A Synthetic-controls Approach

Abstract

This study employs synthetic control methods to estimate the effect of the Iberian exception mechanism on wholesale electricity prices and consumer inflation, for both Spain and Portugal. We find that the intervention led to an average reduction of approximately 40% in the spot price of electricity between July 2022 and June 2023 in both Spain and Portugal. Regarding overall inflation, we observe notable differences between the two countries. In Spain, the intervention has an immediate effect, and results in an average decrease of 3.5 percentage points over the twelve months under consideration. In Portugal, however, the impact is small and generally close to zero. Different electricity market structures in each country are a plausible explanation.

Keywords: Iberian exception mechanism, inflation, policy evaluation, synthetic controls, wholesale electricity prices

JEL classification: E31, L51, Q41, Q48

1 Introduction

Among the various policies implemented to tackle the recent episode of energy inflation in Europe, the correction mechanism of the Iberian electricity market (MIBEL) 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 electricity market. The IbEx sets a limit to the price of electricity that gas generators can offer 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 investigates the interaction between energy markets and economic activity ([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 approximately 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 19 percentage points on average over the first twelve months of the policy. This effect, in turn, contributed greatly to a decrease of 3.5 percentage points 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 IbEx came into effect on June 15, 2022, with the aim of decoupling the price of electricity from international gas prices. The intervention achieves this by imposing a limit on the price that gas-firing electricity generators can offer. To prevent them from operating at a loss, gas generators are enti-

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

led 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. As a result, market agents can incorporate this information and bear the cost of the intervention. Additionally, the IbEx is financed through revenues from electricity exports to France (Jefatura de Estado, 2022; Ambiente e Ação Climática, 2022; MIBGAS, 2022).

Governments across Europe have tackled the volatility in energy prices through various ways, including tax reductions, direct transfers, or retail market regulations. However, 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 EU Energy Directives and Guidelines in their integrity. This provides an ideal opportunity for conducting a natural experiment study to assess the impact of the IbEx on inflation with causal implications.

3 Methods and Data

We use SC methods to determine the causal impact of the IbEx by comparing the outcome of the treated unit with a SC unit. SC units are obtained as the weighted average from a pool of untreated units (see Abadie, 2021, for details).²

We take into account 23 European countries for the donor pool.³ The treatment effect is estimated individually for Spain and Portugal, and to construct the SC unit for Spain, we exclude Portugal from our analysis and

²The estimation of SC units is done in R using the *limSolve* package (Soetaert et al., 2009), and inference is conducted with the *scinfer* package (Wuthrich, 2021). A deployable tool to replicate our results is available at <https://github.com/mharoruiz/ibex>.

³All 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 donor 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 IbEx affected its day-ahead electricity market (Schlecht et al., 2022). When estimating a counterfactual unit for the day-ahead price, Croatia, Hungary, and Ireland are removed from the donor pool as their data is subject to inconsistencies.

vice versa. We base our estimations on monthly average day-ahead prices (DAP) (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, 2023b).

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 considerably larger than that of the post-treatment period, T_1 . Specifically, $T_0 = 108$ 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. We only take into account full intervention months; thus, the pre-treatment period goes up to May 2022, and the post-treatment period begins in July 2022. Furthermore, we use inference procedures proposed by Chernozhukov et al. (2022) for counterfactual and synthetic control methods.

4 Results

Figures 1 through 4 show the results. The left side of each figure shows the results for Spain, and the right side displays the results for Portugal. Furthermore, each figure is divided into an upper and a lower panel. The upper panels present the observed time series for Spain (ES) and Portugal (PT), along with their corresponding SC counterfactual (SC_{ES} and SC_{PT}). Generally, the counterfactuals closely approximate the observed series before the start of the IbEx, which is indicated by the dashed vertical line. The lower panels show the difference between the observed and counterfactual series, which provides an estimate of the causal effect of the IbEx on each price outcome. This estimate is accompanied by 90% point-wise confidence intervals in the post-treatment period (green shaded area), computed according to Chernozhukov et al. (2021).

Figure 1 displays the results for the day-ahead price. The lower panels show that the estimated effect is almost identical in both countries. The results indicate that the IbEx achieves an average reduction of about 60 Euros/MWh in the day-ahead price of electricity between July 2022 and June 2023, approximately equivalent to a 40% decline.

Moving onto the impact of the IbEx on energy-only CPI, Figure 2 shows notable differences in the treatment effect between the two countries. In Spain, the IbEx has an immediate and strong negative effect, particularly until December 2022. Over its first twelve months, the intervention results in

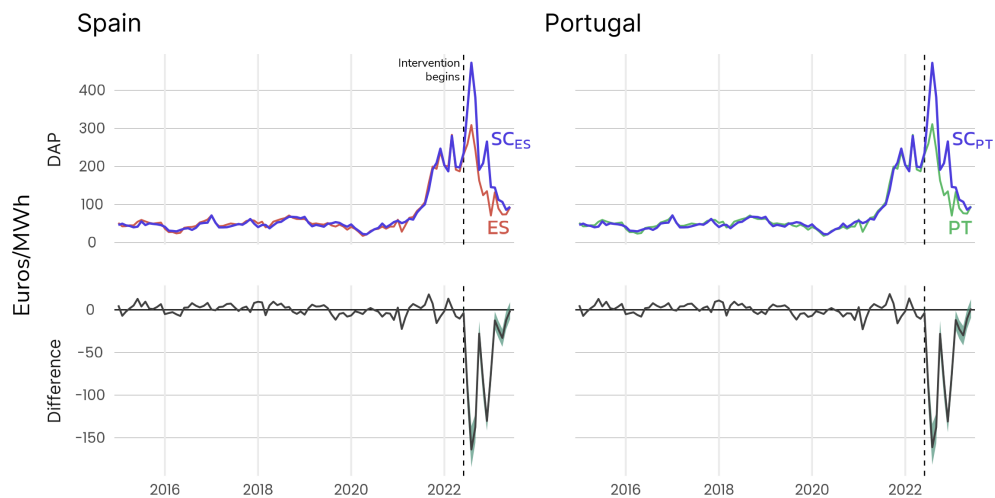


Fig. 1. Results for the day-ahead price of electricity.

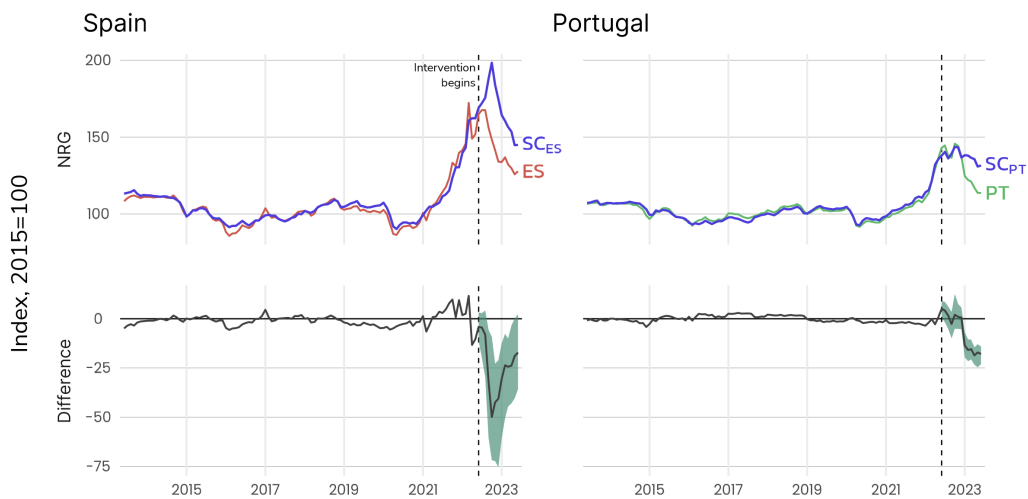


Fig. 2. Results for energy-only CPI.

an average decline of 22 index points (-15%), which translates into a reduction in the energy-only annual inflation rate of 19 percentage points.⁴ In Portugal, the IbEx has virtually no effect on the energy-only CPI until December 2022. However, from January to June 2023, the energy-only inflation rate declines

⁴See [B](#) for details on this calculation.

by 13% on average.

The different results can be explained through differences in the retail market of electricity in each country. The PVPC tariff in Spain, which serves 40% of households and firms, is indexed by MIBEL day-ahead prices (IEA, 2021b). This creates a direct link between the day-ahead price and the energy CPI in the short term. In contrast, Portuguese retailers prefer longer-term electricity contracts as price references (IEA, 2021a). Consequently, it takes longer for retail prices to reflect consolidated changes in the wholesale market in Portugal than in Spain.

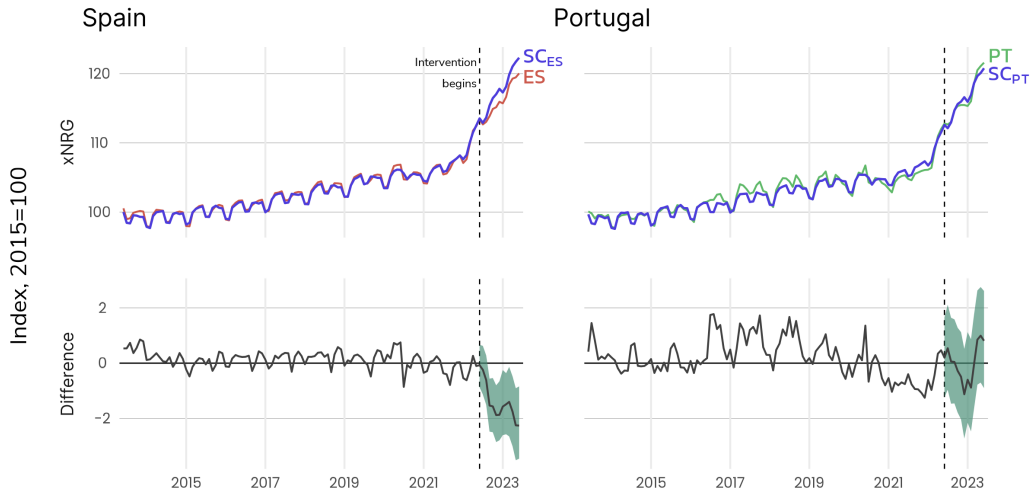


Fig. 3. Results for non-energy CPI.

Figure 3 illustrates the effect of the IbEx on non-energy CPI. In Spain, this indicator decreases by an average of 1.7 index points (-1.5%), which translates into a reduction of 1.4 percentage points in the annual non-energy inflation rate over the initial twelve-month period of the IbEx. In Portugal, the average effect on the index is almost negligible (-0.025 index points) between July 2022 and June 2023.

Next, we examine the effect on the all-items CPI, as shown in Figure 4. In Spain, the IbEx prompts this indicator to decline by 3.7 index points (-3.1%), and the overall annual inflation rate by 3.5 percentage 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 1.7 index points over the period under consideration. However, this estimate is subject to

large uncertainty and not statistically different from zero.⁵

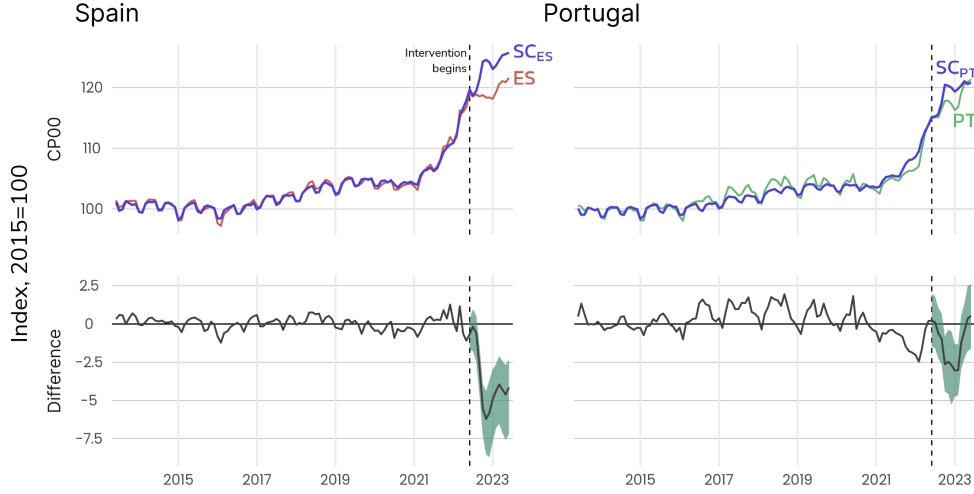


Fig. 4. Results for all-items CPI.

We further investigate the reduction in Spain’s all-items CPI by decomposing it among contributions from energy and non-energy items as follows:

$$\Delta\text{CP00}_t \approx w_t \Delta\text{NRG}_t + (1 - w_t) \Delta\text{xNRG}_t \quad (1)$$

Equation 1 approximates the total effect of the IbEx (ΔCP00_t) as the weighted sum of direct contributions from energy items ($w_t \Delta\text{NRG}_t$) and indirect contributions from non-energy items ($(1 - w_t) \Delta\text{xNRG}_t$). The weight w_t reflects the share of energy goods in the all-items CPI.⁶

Figure 5 illustrates the decomposition. Between July and October 2022, the effect on energy items fully accounts for the effect on the all-items CPI. After October 2022, the effect on energy-only CPI loses strength, which prompts the effect on all-items CPI to decrease in size. Throughout this time, the effect on non-energy CPI becomes stronger, such that by June 2023, the direct and indirect effects of the IbEx contribute equally to the overall effect. Thus, we can infer that four months after the implementation of the IbEx, the intervention led to lower prices for non-energy goods.

⁵See A.

⁶In Spain, the weights assigned to NRG were 0.12 in 2022 and 0.10 in 2023 (Eurostat, 2023a).

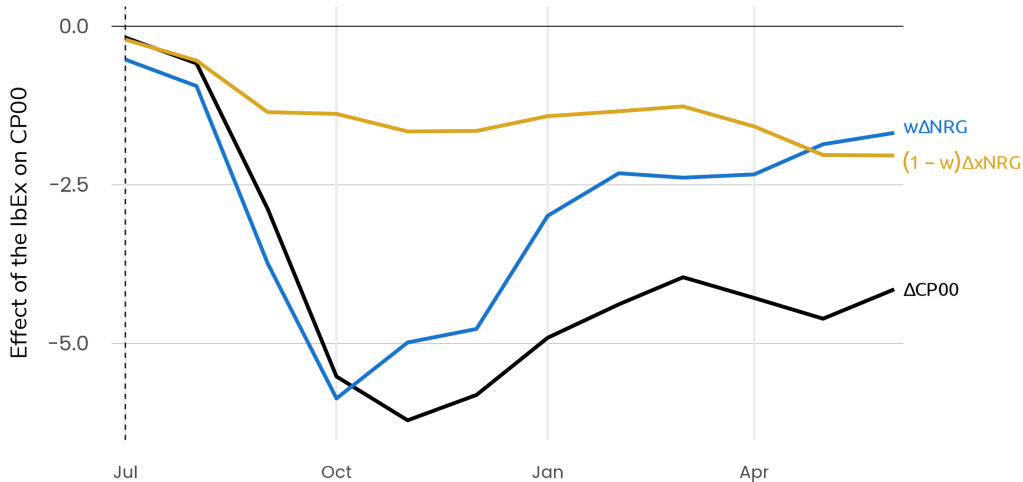


Fig. 5. Decomposition of the effect of the IbEx on Spain's CP00.

This may reflect that firms relying on energy-intensive processes to produce non-energy goods and services face lower input costs compared to a situation without the IbEx.

5 Conclusion

This paper has estimated the effect of the IbEx on the day-ahead price of electricity and inflation. The wholesale price of electricity declined approximately by 40% in both countries. However, the analysis of consumer prices highlights significant differences in each country. In Spain, the IbEx has an immediate and strong negative effect, as the overall inflation rate declines, on average, by 3.5 percentage 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 following months, the direct effect of the IbEx spread to non-energy goods and services, which bear growing responsibility for the effect on all-items CPI. In Portugal, the effect of the policy kicked in with a six-month delay, and while it reduces the energy inflation rate by an average of 12 percentage points between January and June 2023, the effect on overall inflation is small and generally close to zero. 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.

This study highlights the vulnerability of Spanish consumer prices to short-term fluctuations in electricity spot prices. Prior to the introduction of the IbEx, energy-only inflation in Spain was notably higher than in Portugal.⁷ While the IbEx has been successful in bringing inflation down in Spain, it may not have been necessary with a different price-setting mechanism for the regulated PVPC tariff. In this sense, Spanish consumers can reduce their exposure to price volatility by choosing longer-term contracts.

Another aspect to consider for future applications of unilateral price caps in electricity markets is that the price of electricity in one country depends on the level of interconnectivity with other national markets. In the case of the Iberian Peninsula, its relatively low interconnectivity is a critical factor driving divergent electricity prices and the potential effectiveness of unilateral price caps (Schlecht et al., 2022). European governments implementing similar price caps in electricity markets that are more interconnected are likely to experience lower effectiveness.

⁷In May 2022, just before the IbEx came into effect, the energy-only annual inflation rate stood at 41.6% in Spain compared to 34.7% in Portugal.

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A Average treatment effects over the post-treatment period

Table A1 summarizes the average causal effect of the IbEx over the full post-treatment period (July 2022 - June 2023). The estimates are presented in absolute (Euros/MWh or CPI) as well as percentage changes. Absolute estimates are accompanied by standard errors (SE) in parenthesis and 90% confidence intervals (CI) in brackets, all of which are computed according to Chernozhukov et al. (2022). Additionally, estimates for CPI outcomes are also presented as changes in the annual inflation rate ($\Delta\pi$) expressed in percentage points (see B for details).

		Spain	Portugal
DAP	Δ Euros/MWh	-63.002	-62.157
	SE	(7.236)	(7.287)
	90% CI	[-108.686, -17.317]	[-108.167, -16.148]
	$\Delta\%$	-42.779	-41.9276
NRG	Δ CPI	-21.552	-9.259
	SE	(1.950)	(10.971)
	90% CI	[-33.862, -9.243]	[-78.530, 60.012]
	$\Delta\%$	-15.200	-7.127
	$\Delta\pi$	-18.847	-5.984
xNRG	Δ CPI	-1.722	-0.025
	SE	(0.176)	(0.553)
	90% CI	[-2.832, -0.612]	[-3.514, 3.464]
	$\Delta\%$	-1.481	-0.022
	$\Delta\pi$	-1.405	-0.020
CP00	Δ CPI	-3.721	-1.732
	SE	(0.219)	(0.875)
	90% CI	[-5.102, -2.340]	[-7.256, 3.793]
	$\Delta\%$	-3.116	-1.469
	$\Delta\pi$	-3.506	-1.262

Note: DAP: day-ahead price; NRG: Energy-only CPI; xNRG: Non-energy CPI; CP00: all-items CPI.

Table A1. Average treatment effect of the IbEx

B Effect on the inflation rate

Given any CPI series, the year-on-year inflation rate on month m is computed as follows:

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

In order to compute the synthetic inflation rate series, we modify Equation 2 as follows:

$$\pi_m^{CPI,SC} = \frac{CPI_m^{SC} - CPI_{m-12}}{CPI_{m-12}} \cdot 100 \quad (3)$$

Equation 3 computes the counterfactual annual inflation rate in the absence of the IbEx by comparing synthetic CPI series (CPI_m^{SC}) in the post-treatment period with the observed series in the pre-treatment period (CPI_{m-12}). This approach yields a meaningful counterfactual series because the post-treatment period considered in this paper is not longer than 12 months. The average effect of the annual inflation rate reported throughout the paper and in Table A1 result from taking the post-treatment average of the difference between the observed inflation series, computed via Equation 2, and the synthetic inflation series, computed via Equation 3.

Halle Institute for Economic Research –
Member of the Leibniz Association

Kleine Maerkerstrasse 8
D-06108 Halle (Saale), Germany

Postal Adress: P.O. Box 11 03 61
D-06017 Halle (Saale), Germany

Tel +49 345 7753 60
Fax +49 345 7753 820

www.iwh-halle.de

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