

Locked in the House, Free Again: The Impact of COVID-19 on Fertility in Spain

Libertad González

(UPF and BSE)

Sofia Trommlerová

(Comenius University and UPF-CRES)

COVID-19 in Spain

- Spain was the second European country that was heavily affected by the COVID-19 pandemic in spring 2020 (after Northern Italy)

COVID-19 in Spain

- Spain was the second European country that was heavily affected by the COVID-19 pandemic in spring 2020 (after Northern Italy)
- On Saturday evening, March 14, 2020, the prime minister announced state of alarm and a nationwide lockdown effective in 24 hours
 - Stay-at-home order except to buy food or medicine, go to work, go to the hospital, or other emergencies.
 - Closure of nonessential shops and businesses.
 - Support package of roughly 20% of GDP, including measures to help workers and companies affected by the lockdown.

COVID-19 in Spain

- Spain was the second European country that was heavily affected by the COVID-19 pandemic in spring 2020 (after Northern Italy)
- On Saturday evening, March 14, 2020, the prime minister announced state of alarm and a nationwide lockdown effective in 24 hours
 - Stay-at-home order except to buy food or medicine, go to work, go to the hospital, or other emergencies.
 - Closure of nonessential shops and businesses.
 - Support package of roughly 20% of GDP, including measures to help workers and companies affected by the lockdown.
- From March 15, 2020, through May 10, 2020, Spain remained under the strictest lockdown in Europe.
 - **Strict lockdown: March 15-May 10, 2020**
 - **State of alarm: March 15-June 21, 2020**
 - Second state of alarm: October 25, 2020 (6 months long)

Fertility Determinants and Data

- Pandemic started 3 years ago → Look at effects on fertility
 - It takes 9 months from conception to birth
 - Birth microdata are published with a delay of 1 year

Fertility Determinants and Data

- Pandemic started 3 years ago → Look at effects on fertility
 - It takes 9 months from conception to birth
 - Birth microdata are published with a delay of 1 year
- Determinants of fertility at individual level:
 1. Sexual activity
 2. Use of contraception
 3. Intention to conceive
 - **Pregnancy**
 4. Abortion
 5. Miscarriage
 - **Birth**

Fertility Determinants and Data

- Pandemic started 3 years ago → Look at effects on fertility
 - It takes 9 months from conception to birth
 - Birth microdata are published with a delay of 1 year
- Determinants of fertility at individual level:
 1. Sexual activity
 2. Use of contraception
 3. Intention to conceive
 - **Pregnancy**
 4. Abortion
 5. Miscarriage
 - **Birth**
- High-quality administrative data on births in Spain:
 - Micro data on births up to December 2021
 - (Conceptions up to February 2021)

Fertility Determinants and Data

- Pandemic started 3 years ago → Look at effects on fertility
 - It takes 9 months from conception to birth!
 - Birth microdata are published with a delay of 1 year
- Determinants of fertility at individual level:
 1. Sexual activity
 2. Use of contraception
 3. Intention to conceive
 - **Pregnancy**
 4. **Abortion**
 5. Miscarriage
 - **Birth**
- High-quality administrative data on births in Spain:
 - Micro data on births up to December 2021
 - (Conceptions up to February 2021)

Literature on COVID and Reproductive Behavior

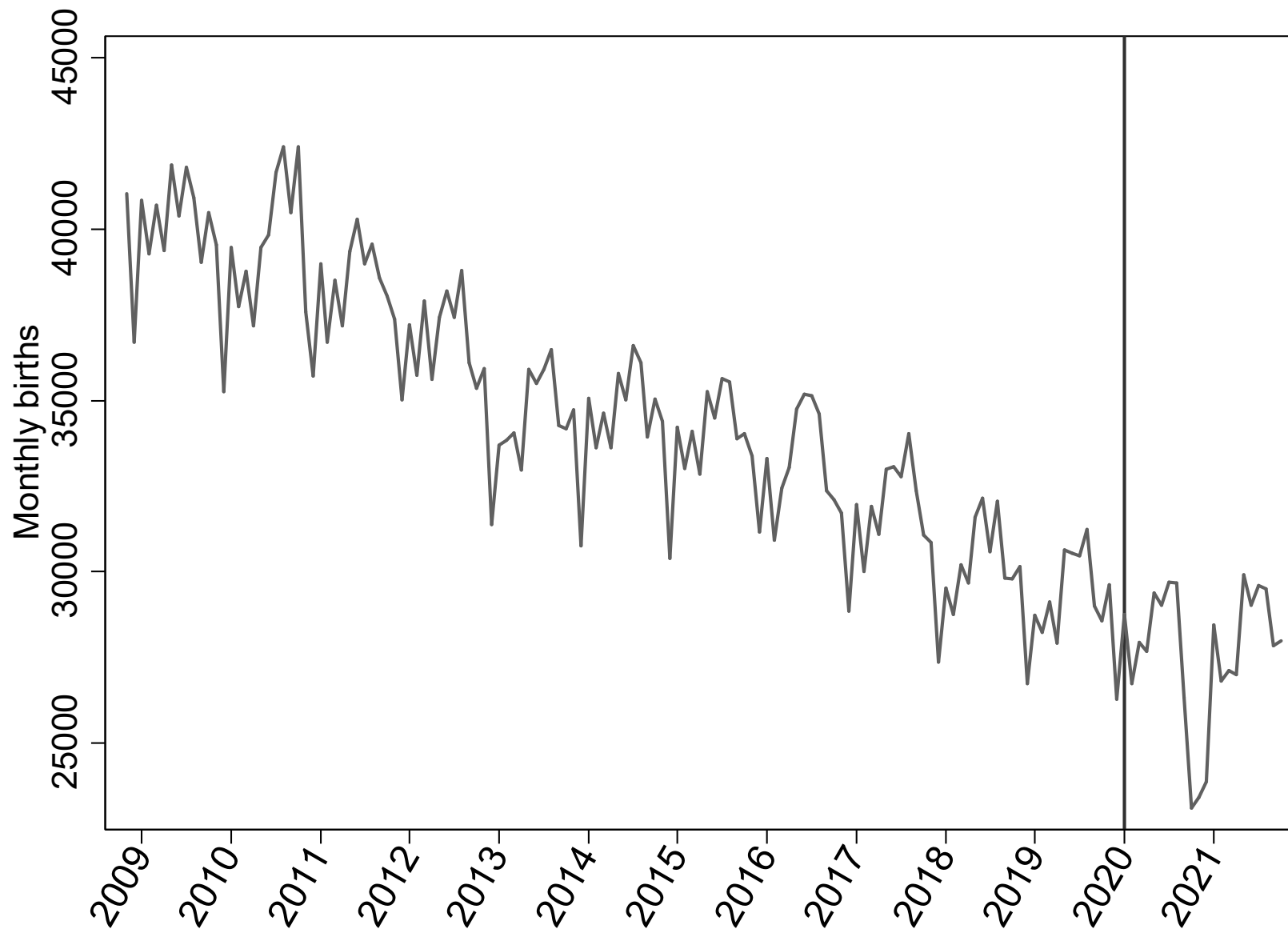
- Impact of lockdown on births
 - High-income countries
 - Demography:
 - Published: Aassve et al. 2021; Sobotka et al. 2023
 - Work in progress: Brée and Breton 2021
 - Economics (NBER working papers):
 - Bailey et al. 2022, Kearney and Levine 2022
 - Decrease in the number of births in late 2020 and early 2021 ~ fewer new pregnancies during the first wave of the pandemic.
- Impact of lockdown on abortions
 - Cross-country comparisons of policies regulating abortion access
 - Bojovic et al. 2021, Moreau et al. 2021
 - Impact of COVID-19 on number of abortions
 - Marquez-Padilla and Saavedra 2022, González and Trommlerová 2022, Andersen et al. 2022

Potential Channels

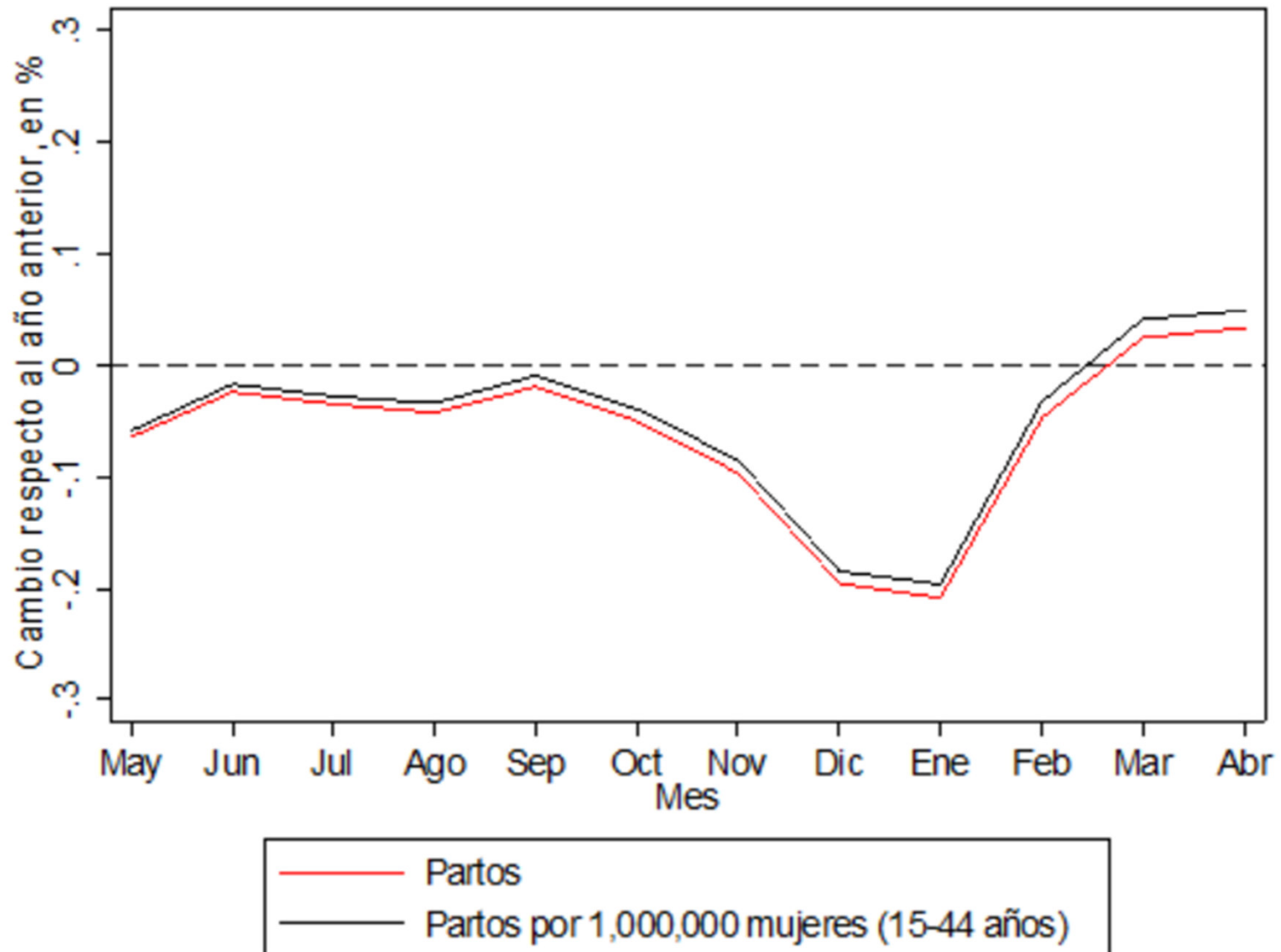
- Sexual activity:
 - Fewer **conceptions** during lockdown due to lack of physical contact with other people (single, non-cohabiting women).
- Fertility intentions:
 - More **conceptions** due to people staying at home:
 - more sexual activity (couples)
 - comfort of working from home (high-earners)
 - Fewer **conceptions** due to uncertainty:
 - economic uncertainty (low-earners)
 - health-related concerns (everyone)
 - fear of a COVID infection during pregnancy
 - potential inability to get all antenatal checks
- Access to IVF:
 - IVF clinics were closed during lockdown.
 - Approximately 10% of births in Spain through IVF.

Preliminary Evidence on Births

Monthly births in Spain, 2009-2021



Change in # of births in May 2020-April 2021 wrt the same month in the previous year



Methodology

Methodological challenges

- Estimation of the counterfactual (number of births in the absence of the pandemic) is extremely sensitive to:
 1. the length of the period included in the prediction model (number of years),
 2. the starting point of the period included in the prediction model (calendar month),
 3. the functional form of the long-term trend (linear or quadratic).

- ➔ We estimate 14 different models and choose the best one based on four accuracy criteria (cross-validation).

Model

$$births_{my} = \alpha + \beta * t + (\delta * t^2) + \gamma_m + \varepsilon_{my}$$

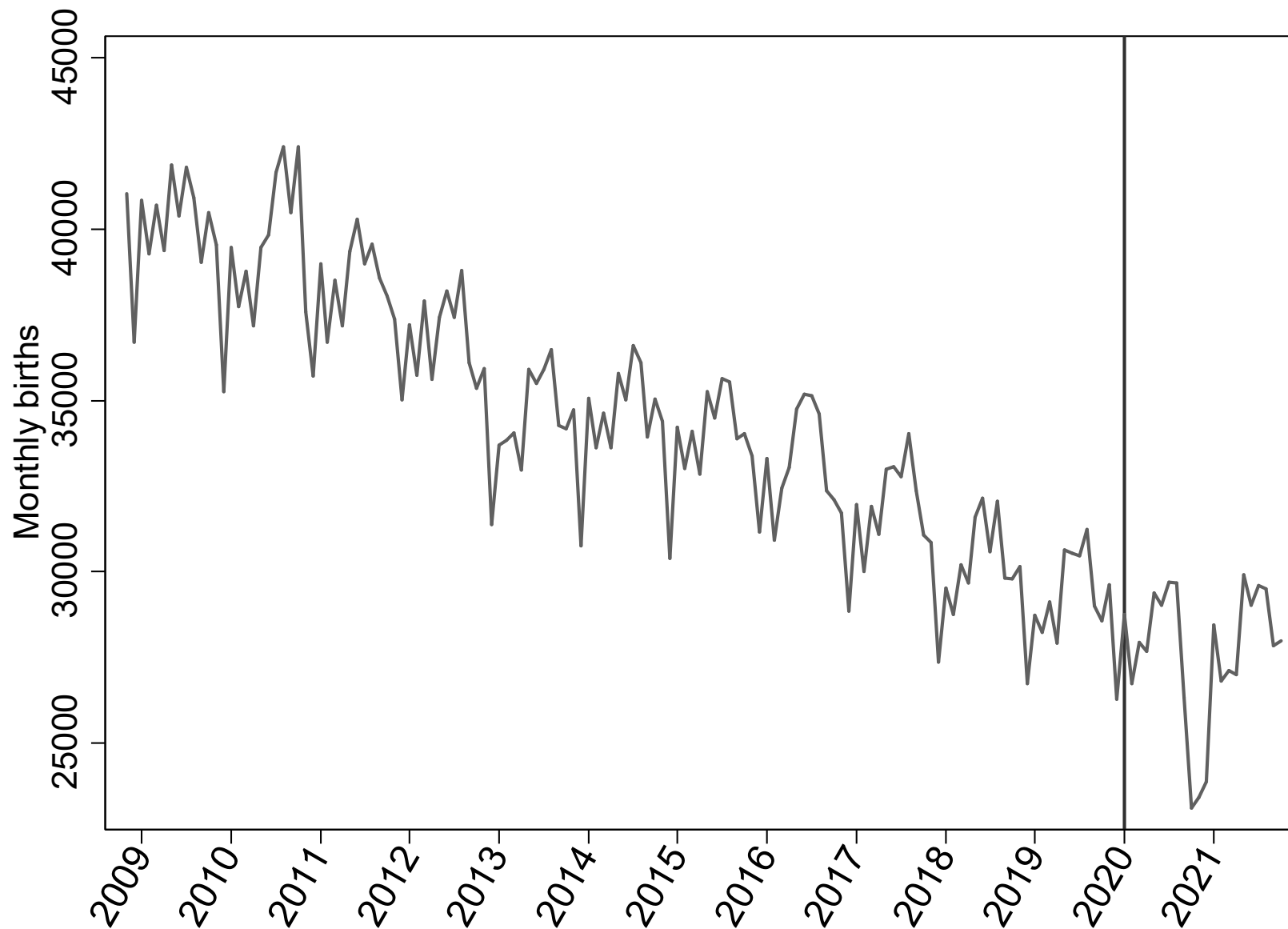
- $births$ = monthly number of births in calendar month m and year y
- t = long-term trend in monthly births (linear or quadratic)
- γ_m = calendar month fixed effects (seasonality of births throughout the calendar year)

Cross-validation

- 14 competing models:
 - Functional form:
 - 7 models linear trend, 7 models quadratic trend
 - Time period used to train the model:
 - starts in March of years 2009 to 2015, and runs until February 2019
 - period length included in the training models varies between 4 and 10 years
- Prediction quality of the model:
 - calculate predictions for March 2019-February 2020, i.e. months that are unaffected by the pandemic.
- 4 measures of prediction quality for this 12-month period:
 - Mean Squared Error (MSE, squared differences between the prediction and reality),
 - Mean Absolute Error (MAE, absolute differences between the prediction and reality),
 - Mean Absolute Percent Error (MPE, absolute differences between the prediction and reality as a percentage of the predicted value),
 - Mean Error (MER, simple differences between the prediction and reality).
- Rank the models based on each of these 4 criteria separately, and then calculate the average rank. We choose the model with the highest rank.

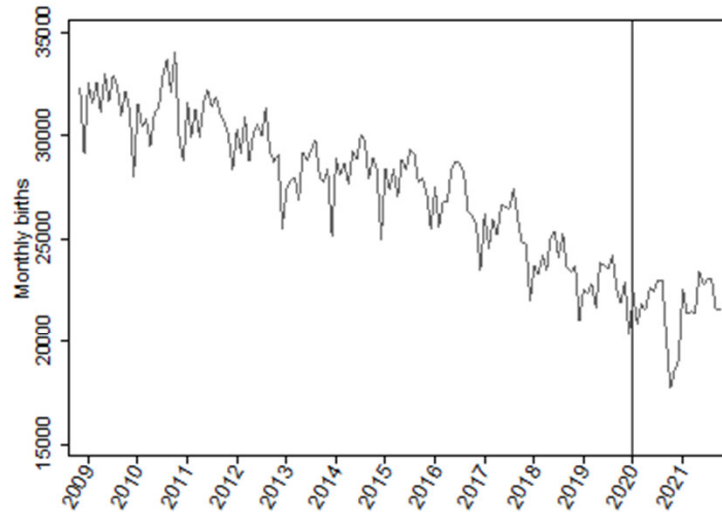
Detailed Analysis of Births

Monthly births in Spain, 2009-2021

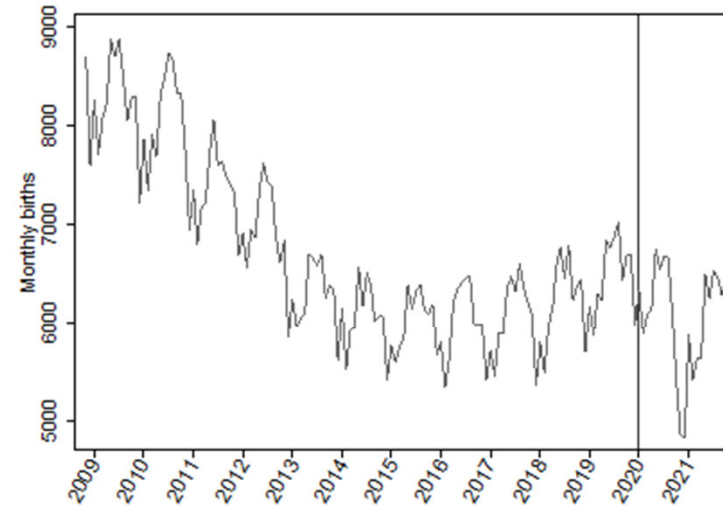


Monthly births in subgroups

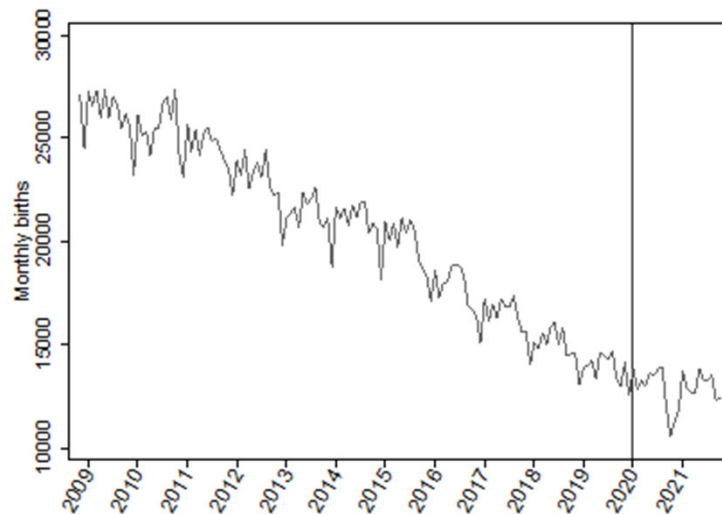
B. Spanish nationality



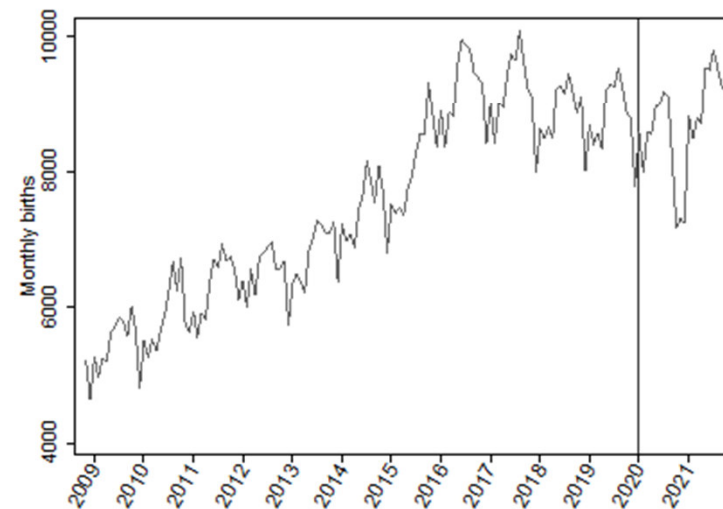
C. Foreign nationality



D. Spanish Cohabiting

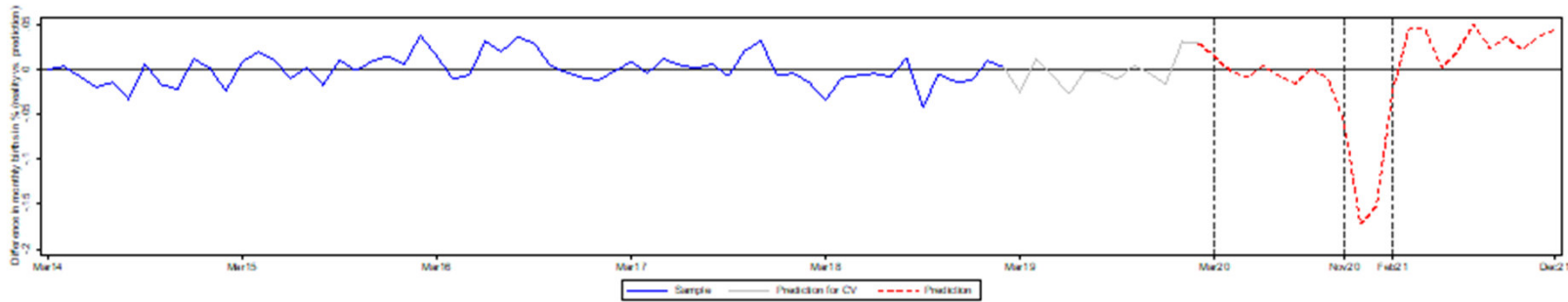


E. Spanish Non-Cohabiting

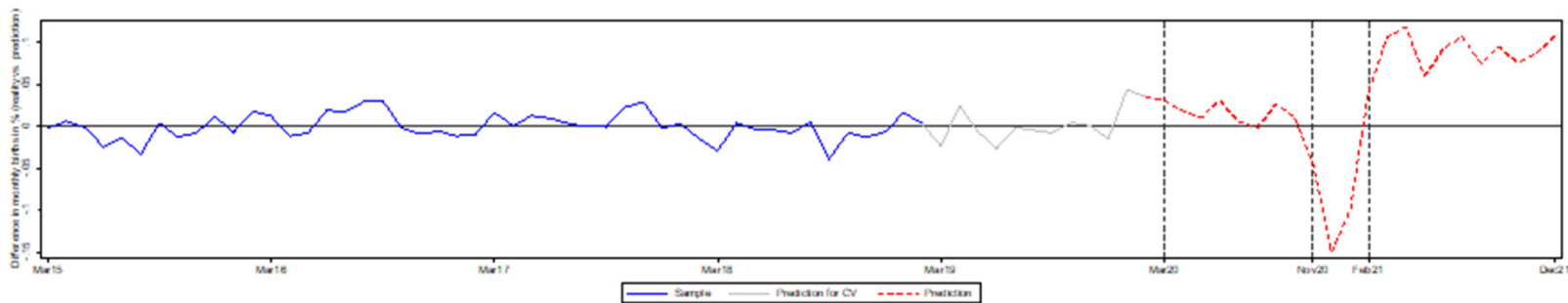


Selected models (1)

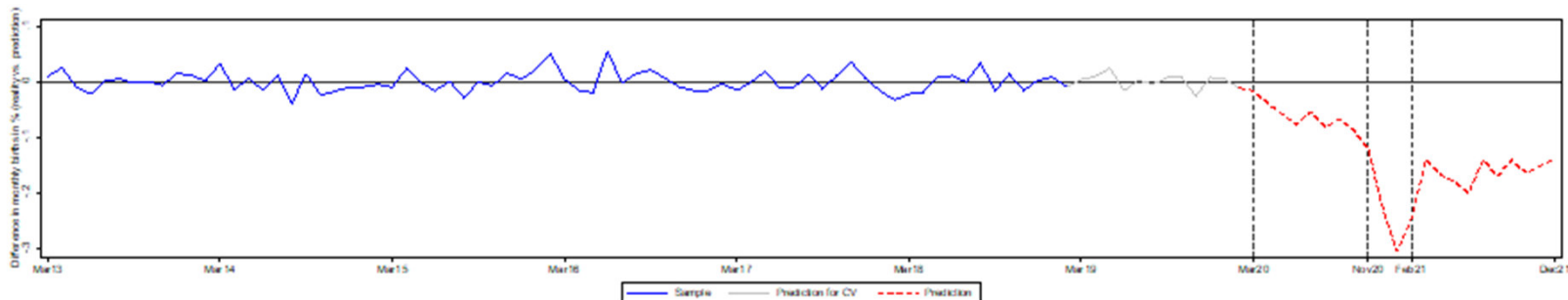
A. Spain (March 2014 – February 2019/December 2021, linear trend)



B. Spanish nationality (March 2015 – February 2019/December 2021, linear trend)

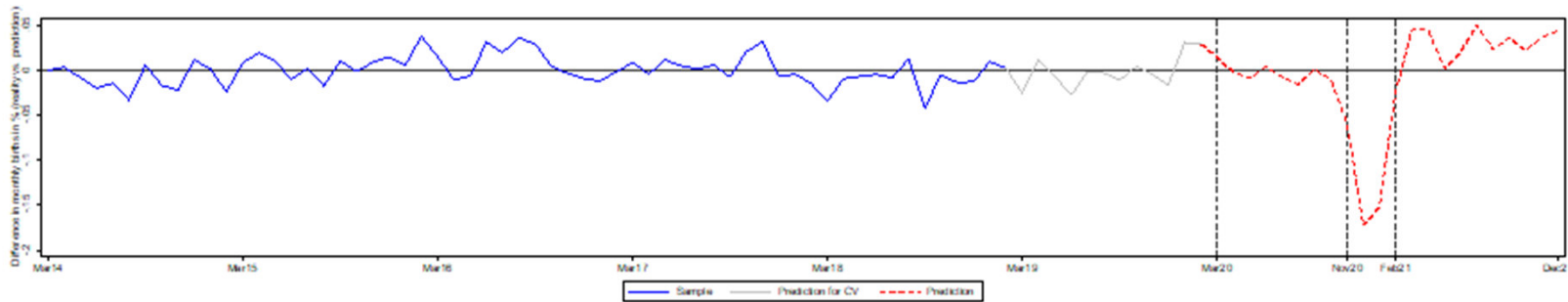


C. Foreign nationality (March 2013 – February 2019/December 2021, quadratic trend)

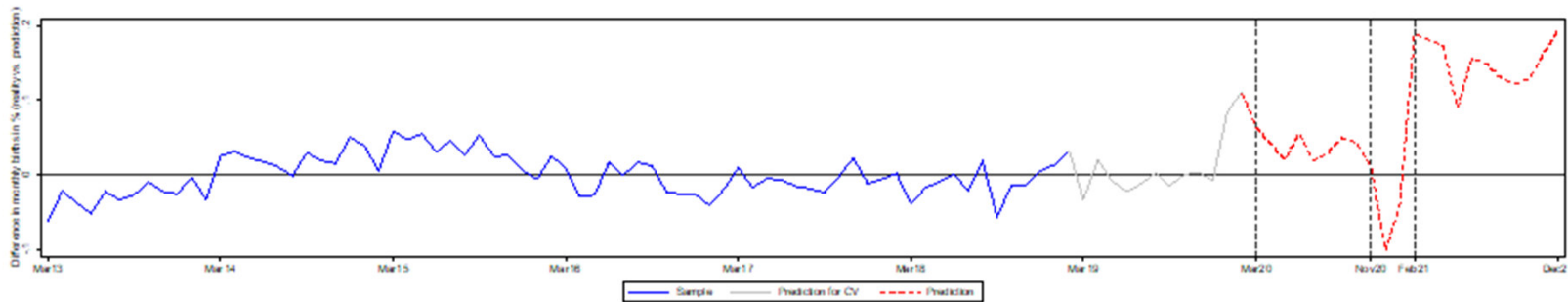


Selected models (2)

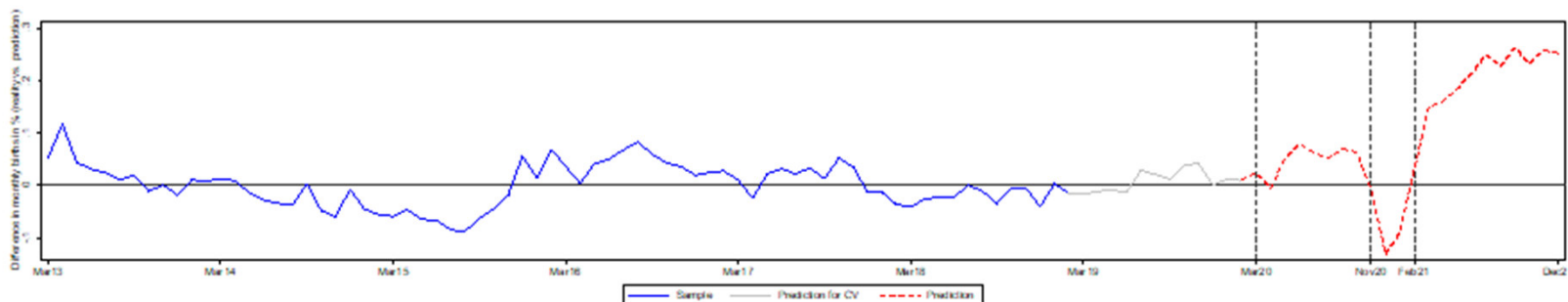
A. Spain (March 2014 – February 2019/December 2021, linear trend)



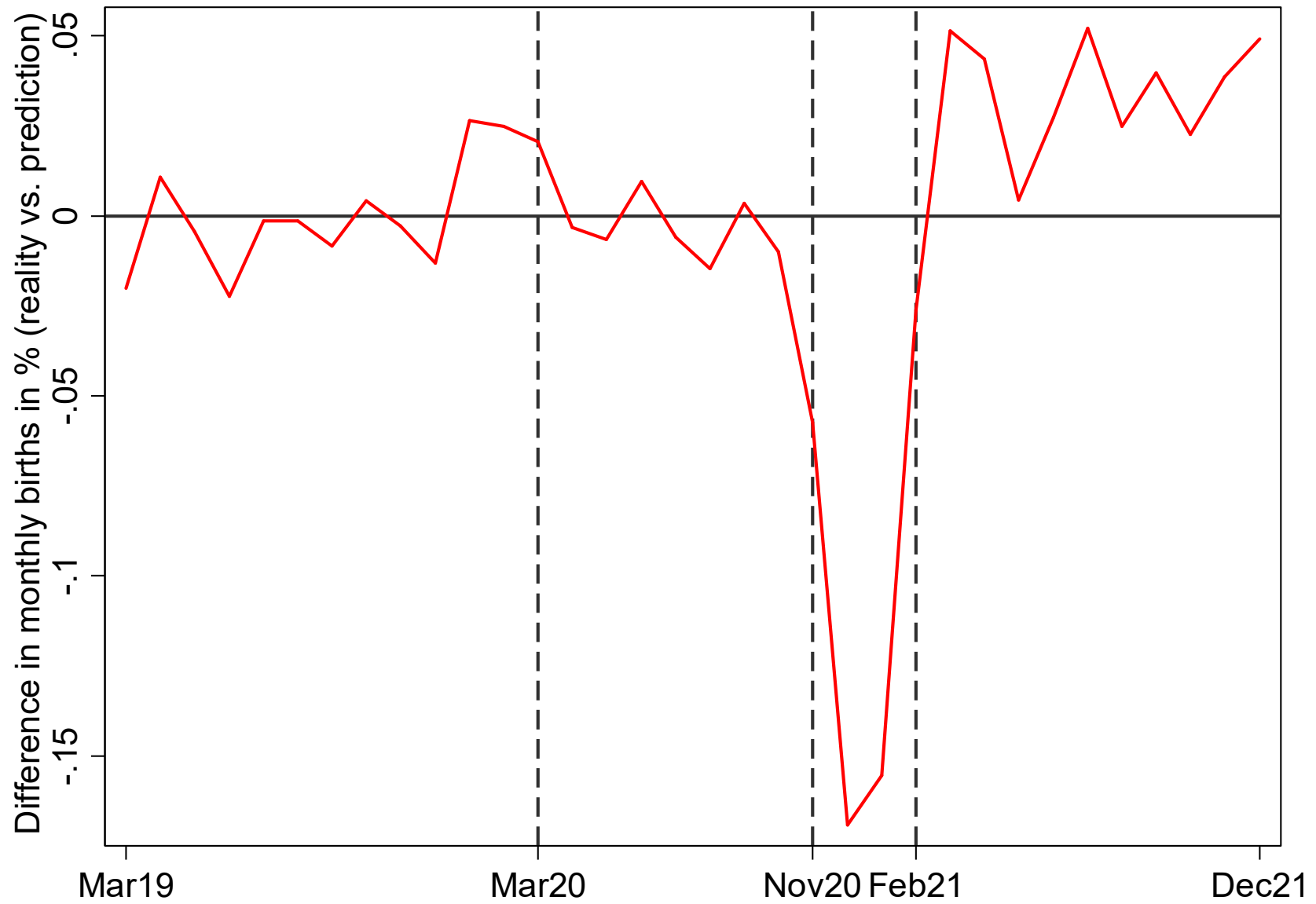
B. Spanish Cohabiting (March 2013 – February 2019/December 2021, linear trend)



C. Spanish Non-Cohabiting (March 2013 – February 2019/Dec. 2021, quadratic trend)



Effect of lockdown and post-lockdown relief on births



Effect of lockdown and post-lockdown relief on births

Month	Year	Absolute effect	Relative effect
3	2020	579	2.1%
4	2020	-85	-0.3%
5	2020	-184	-0.7%
6	2020	262	1.0%
7	2020	-174	-0.6%
8	2020	-431	-1.5%
9	2020	106	0.4%
10	2020	-301	-1.0%
11	2020	-1,605	-5.7%
12	2020	-4,704	-16.9%
1	2021	-4,312	-15.5%
2	2021	-643	-2.6%
3	2021	1,391	5.1%
4	2021	1,117	4.3%
5	2021	121	0.4%
6	2021	721	2.7%
7	2021	1,478	5.2%
8	2021	701	2.5%
9	2021	1,131	4.0%
10	2021	653	2.3%
11	2021	1,032	3.8%
12	2021	1,312	4.9%

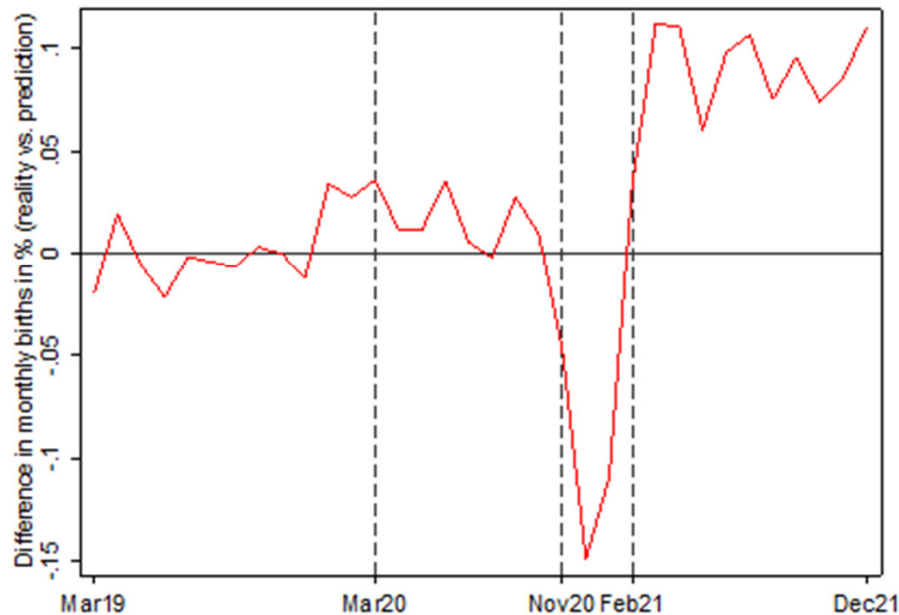
Overall effects on births in Spain

Period	All months	Per month	Overall effect
<i>03/2020-10/2020</i>	<i>-227</i>	<i>-28</i>	<i>-0.1%</i>
<i>11/2020-02/2021</i>	<i>-11,264</i>	<i>-2,816</i>	<i>-10.4%</i>
<i>03/2021-12/2021</i>	<i>9,656</i>	<i>966</i>	<i>3.5%</i>
11/2020-12/2021	-1,608	-115	-0.4%

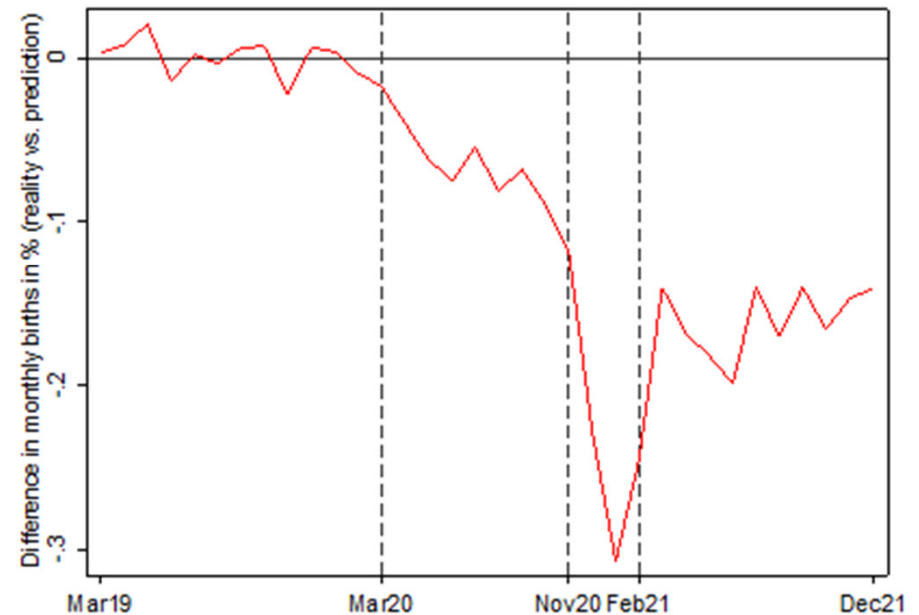
Effects are calculated as differences between actual and predicted values of monthly births, expressed as percentages of predicted values.

Spanish versus foreign mothers

B. Spanish nationality



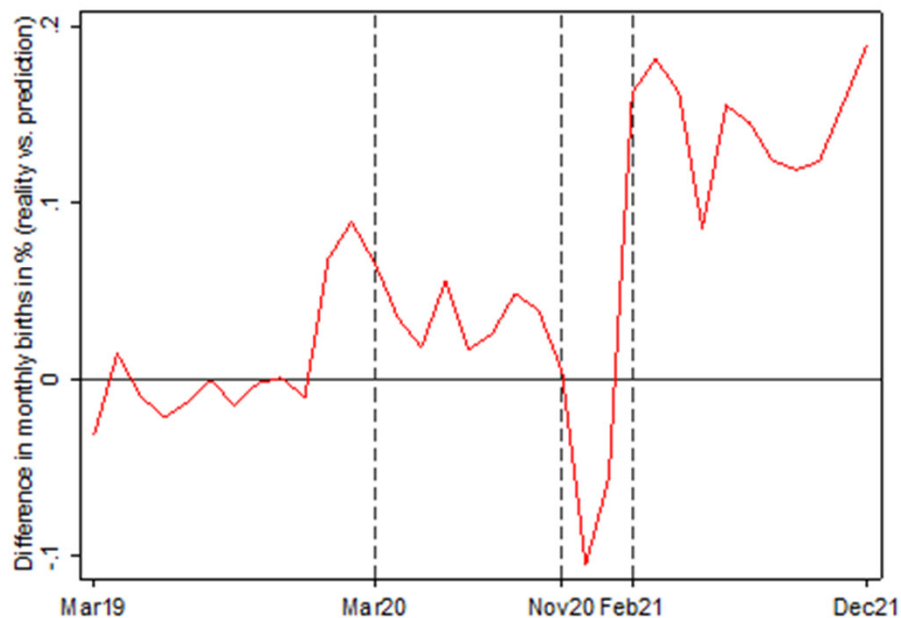
C. Foreign nationality



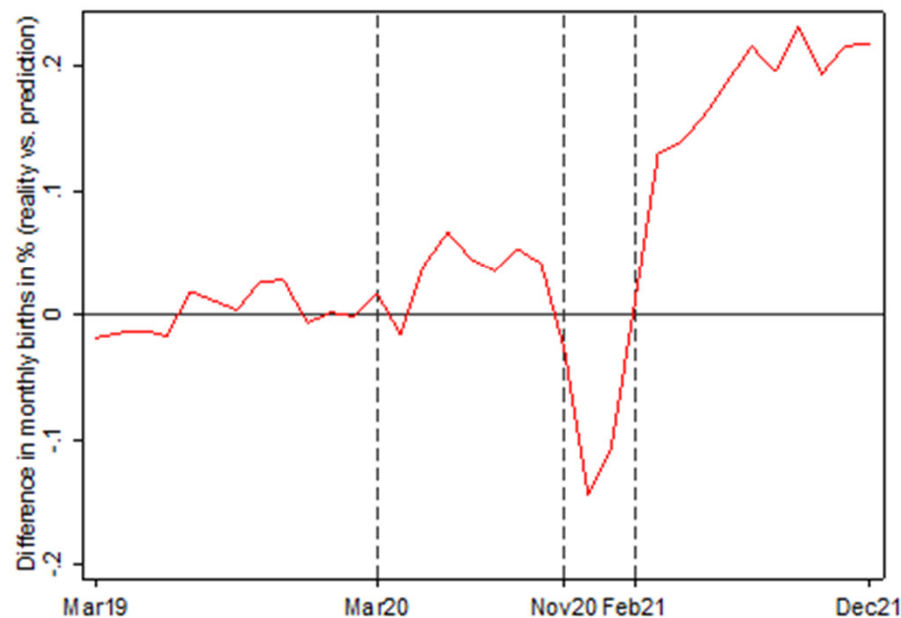
Period	Spanish			Foreigner		
	Cumulative effect	Effect per month	Relative effect	Cumulative effect	Effect per month	Relative effect
12/2020		-3,093	-14.9%		-1,604	-22.9%
1/2021		-2,276	-10.9%		-2,165	-30.7%
03/2020-10/2020	2,923	365	1.7%	-3,377	-422	-6.2%
11/2020-02/2021	-5,720	-1,430	-7.0%	-6,166	-1,541	-22.5%
03/2021-12/2021	18,842	1,884	9.3%	-11,572	-1,157	-15.9%
11/2020-12/2021	13,123	937	4.6%	-17,737	-1,267	-17.7%

Spanish cohabiting versus non-cohabiting mothers

D. Spanish Cohabiting



E. Spanish Non-Cohabiting



Period	Spanish Cohabiting			Spanish Non-Cohabiting		
	Cumulative effect	Effect per month	Relative effect	Cumulative effect	Effect per month	Relative effect
12/2020		-1,233	-10.5%		-1,208	-14.5%
1/2021		-659	-5.5%		-864	-10.6%
<i>03/2020-10/2020</i>	<i>3,936</i>	<i>492</i>	<i>3.8%</i>	<i>2,391</i>	<i>299</i>	<i>3.5%</i>
11/2020-02/2021	-180	-45	-0.4%	-2,244	-561	-7.0%
03/2021-12/2021	16,391	1,639	14.4%	14,559	1,456	18.9%
11/2020-12/2021	16,211	1,158	10.1%	12,315	880	11.3%

Spanish mothers by age

Period	Spanish Age 15-19			Spanish Age 20-24			Spanish Age 25-29		
	Cumulative effect	Effect per month	Relative effect	Cumulative effect	Effect per month	Relative effect	Cumulative effect	Effect per month	Relative effect
12/2020		-74	-19.7%		-209	-15.5%		-322	-10.2%
1/2021		-70	-18.9%		-326	-24.5%		-201	-6.5%
03/2020-10/2020	116	15	3.9%	-20	-3	-0.2%	157	20	0.6%
11/2020-02/2021	-105	-26	-7.3%	-812	-203	-15.7%	-545	-136	-4.5%
03/2021-12/2021	124	12	3.5%	-301	-30	-2.3%	1,743	174	5.6%
11/2020-12/2021	19	1	0.4%	-1,112	-79	-6.1%	1,198	86	2.8%

Period	Spanish Age 30-34			Spanish Age 35-39			Spanish Age 40-49		
	Cumulative effect	Effect per month	Relative effect	Cumulative effect	Effect per month	Relative effect	Cumulative effect	Effect per month	Relative effect
12/2020		-612	-9.1%		-1,319	-19.2%		-717	-28.9%
1/2021		-149	-2.2%		-932	-13.5%		-601	-25.1%
03/2020-10/2020	1,159	145	2.0%	358	45	0.6%	444	55	2.3%
11/2020-02/2021	-52	-13	-0.2%	-2,658	-665	-9.9%	-1,594	-398	-16.7%
03/2021-12/2021	8,900	890	13.4%	5,062	506	7.6%	2,975	297	13.2%
11/2020-12/2021	8,849	632	9.6%	2,404	172	2.6%	1,381	99	4.3%

Spanish mothers by parity

Period	Spanish Parity 1			Spanish Parity 2			Spanish Parity 3		
	Cumulative effect	Effect per month	Relative effect	Cumulative effect	Effect per month	Relative effect	Cumulative effect	Effect per month	Relative effect
12/2020		-2,048	-18.1%		-699	-9.8%		-219	-9.7%
1/2021		-1,435	-12.9%		-489	-6.7%		-212	-9.5%
<i>03/2020-10/2020</i>	<i>3,451</i>	<i>431</i>	<i>3.8%</i>	<i>84</i>	<i>10</i>	<i>0.1%</i>	<i>-298</i>	<i>-37</i>	<i>-1.6%</i>
11/2020-02/2021	-3,698	-925	-8.5%	-817	-204	-2.9%	-459	-115	-5.2%
03/2021-12/2021	9,654	965	9.0%	10,657	1,066	15.1%	1,981	198	9.1%
11/2020-12/2021	5,956	425	3.9%	9,839	703	10.0%	1,522	109	5.0%