Climate Risks in Housing Markets: Evidence from News Shocks*

Rajdeep Chakraborti†, Pedro Gete‡

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Abstract

We study the effects of news about sea level rise on housing markets. We exploit a natural experiment in Spain. In 2014, Greenpeace published an alarming report predicting catastrophic consequences for La Manga, a tourist peninsula. The report was widely cited in the local news. We find that the report caused an immediate and persistent 5% to 10% drop in housing prices. It had no effect on housing rents. Difference-in-differences regressions with different control groups confirm the results. We also find spillover effects to neighboring locations as if markets price future population retreat to safe areas. Home sales were not impacted, buyers take the risk of rising sea level if they can buy properties at lower prices.

Keywords: Climate Change, Home Sales, Housing Prices, News Shocks, Sea-level.

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†Email: rajchakraborti2021@gmail.com. IE Business School, IE University. Maria de Molina 12, 28006 Madrid, Spain.

‡Email: pedro.gete@ie.edu. IE Business School, IE University. Maria de Molina 12, 28006 Madrid, Spain. +34 915689727.

1 Introduction

Sea level rise (SLR) is a major physical risk associated with climate change. It is a long-run menace and there is wide debate on how and when housing markets will price it. For example, Bernstein et al. (2019) or Giglio et al. (2021) show that flood risk exposure, or mentions to climate risks, reduce property prices. On the other hand, Murfin and Spiegel (2020) fail to find any impact of flood risk on coastal property prices, while Keys and Mulder (2020) show a positive relationship between climate risk and housing prices for 2013-2018 that only recently has moderated. In this paper we use a natural experiment to shed light on this ongoing debate. This is the first paper to study climate news in the spirit of those studied by the macro news literature as Barsky and Sims (2011) or Schmitt-Grohe and Uribe (2012). That is, impactful news about a future shock, sea level rise. We show that such news cause housing prices to fall immediately and persistently. Housing rents do not react. Thus, awareness of climate risks seems to be the key factor driving price reaction to climate threats.

La Manga del Mar Menor (La Manga) is a spit of sandy, low-lying coastal land in Spain (see Figure A1 in the Appendix). It is a popular beach resort and has an active real estate market. Because of these reasons, to raise awareness about climate change in Spain, Greenpeace has focused its campaigns on La Manga. First, in 2007 Greenpeace published modified photos of a submerged La Manga with only the upper sections of the hotels and the apartment blocks emerging from the sea (see Figure A2 in the Appendix). This report generated alarm and La Manga's real estate companies sued Greenpeace claiming that the report caused housing prices to plummet.[1] Then, on Earth Day of 2014 (April 22nd) Greenpeace published another impactful report stressing that La Manga will be submerged in a not-so-distant future as the melting of the polar ice-caps rises the sea level. This new report created again wide controversy and was widely discussed in the local press.[2] Both reports were completely unexpected. We lack data for the period around the first report but we have created a database covering the 2014 report. Thus, we focus on this second report as an exogenous climate news shock.

We find that housing prices in La Manga drop immediately with the publication of the 2014 Greenpeace report. The fall is approximately around 12% per square meter. Housing rents are not affected. We also observe a structural fall in the price-to-rent ratio. This evidence is exactly what we would expect from news about a long-term shock to the housing stock. Prices of the housing stock react, but prices of the current consumption flow (housing rents) are not affected as tenants are not worried about distant climate risks. Tests for structural breaks post 2014 Greenpeace report confirm these results.

We do many things to confirm the robustness of the findings. First, we compare the impact

[1] https://www.expatica.com/es/uncategorized/estate-owners-sue-greenpeace-for-prediction-38994/

[2] https://murciatoday.com/greenpeace-warn-la-manga-is-under-threat-from-global-warming_20899-a.html

of the 2014 Greenpeace report with the impact of an algal bloom that hit La Manga in 2016. Garcia-Lorenzo et al. (2021) and Banco de Espana (2021) study this other shock. The algal bloom is a different type of shock because it is actual, not future, therefore it affects immediately both homeowners and tenants. The algal bloom caused a fall in both rents (by 12.5%) and prices (by 3%). It increased the price-to-rent ratio even if both rents and prices fall. These results show that looking at both rents and prices allows to differentiate the impact of the news shock from other types of environmental shocks.

Second, we conduct difference-in-differences regressions comparing La Manga with four different control groups. The first control group consists of five locations on the Mediterranean coast that face existential threats like La Manga and have similar socioeconomic characteristics.[3] However, unlike La Manga, these locations are not exposed to Greenpeace awareness campaigns highlighting sea level rise threats. We denote this control group as the "coastal control group". The second control group is composed by two neighboring municipalities only 50 kilometers away from La Manga which are very similar to La Manga in socioeconomic characteristics. These two locations are not known as locations facing any serious threat of sea level rise. We denote this control group as the "neighboring control group". Moreover, for robustness, we also study two additional control groups used by Garcia-Lorenzo et al. (2021) and Banco de Espana (2021) to study the 2016 algal bloom in La Manga.

Prior to 2014, the treatment and the control groups satisfy the parallel trends assumption. They do not differ in the key housing variables. The publication of the 2014 Greenpeace report was unexpected and exogenous. In addition, all our regressions control for fixed effects, and for economic variables that affect housing markets. We also control for the global financial crisis that spanned from 2008 to 2014, and for the global sea level, these are alternative factors that can cause coastal housing prices to fall.

No matter against what control group we compare, housing prices in La Manga fall between 5% and 10% post-publication of the 2014 Greenpeace report. Thus, the core finding of the paper is very strong. Prices remain steady in the coastal control group but increase in the neighboring locations. This suggests that markets price future population retreat to safe areas. We do not find significant results on home sales. Thus, it seems that buyers take the risk of a rising sea level if they can buy properties at lower prices.

This paper contributes to the growing literature on the effects of sea level rise on housing prices. As discussed earlier, the literature on this topic is divided. On one side, papers such as Baldauf et al. (2020), Bernstein et al. (2019), Giglio et al. (2021) or Ortega and Taspinar (2018) show a negative effect. On the other hand, Murfin and Spiegel (2020) show no effect. Keys and Mulder (2020), using data from coastal Florida real estate, show that for 2013-2018, home

[3] https://www.cntraveler.com/galleries/2016-06-18/the-most-beautiful-coastal-towns-in-spain

prices grew in the most-SLR-exposed communities, only in 2018-2020 prices declined by roughly 5% from their 2016 peak. Stroebel and Wurgler's (2021) survey of academics, policymakers and practitioners find that future climate risks are likely underestimated when pricing real estate.

Our study differs from the previous literature on an important dimension. We focus on an information shock that alters beliefs about sea level rise. To our knowledge, other than Agarwal et al. (2021), no other paper has looked at shocks that change climate beliefs. The literature has studied how current beliefs alter the effects of climate risks on housing prices. The literature measures such beliefs with different proxies. For example, Bernstein et al. (2019) and Ilhan (2021) use political beliefs as proxy, Baldauf et al. (2020) use the Yale survey on Climate Change, Bakkensen and Barrage (2021) conduct their own survey amongst coastal residents. We are able to identify a news shock that directly changes climate risk beliefs. This climate news shock is equivalent to the productivity news shocks studied in macro since Beaudry and Portier (2006). Agarwal et al. (2021) also study a climate news shock, the impact on housing prices of a speech about climate risk by the prime minister of Singapore. Our results support the view that climate risk awareness is a necessary and sufficient condition for housing prices to reflect climate risk concerns.

The paper is organized as follows: Section 2 studies housing prices and housing rents in La Manga. Section 3 contains the diff-in-diff analysis. Section 4 shows robustness tests. Section 5 investigates the impact of the 2014 Greenpeace report on home sales. Section 6 concludes.

2 Housing Prices and Rents in La Manga

We analyze monthly data on housing prices and housing rents from Idealista, the leading real estate platform in Spain. We use listing prices and not final sale prices. This dataset is the most popular source of information for investors and home buyers in Spain. We focus on the period from 2013 to 2015. The Greenpeace report was published on April 22, 2014. We want to avoid the algal bloom that hit La Manga since 2016 as documented by Carvalho-Machando Saez (2020), Garcia-Lorenzo et al. (2021) and Banco de Espana (2021).

Figure 1 plots housing prices and housing rents in La Manga around the 2014 Greenpeace report. Two facts are striking: the report causes a significant drop in housing prices but it has no effect on housing rents. Figure 2 shows the consequent collapse in the price-to-rent ratio.

To rigorously check the visual findings from Figures 1 and 2, we test for structural breaks like McConnell and Perez-Quiros (2000) or Smith (2008). We do the cumulative sum test for parameter stability (CUSUM). This test uses the cumulative sum of OLS residuals to determine whether there is a structural break. Under the null hypothesis that the coefficients are stable over time, the cumulative sum of residuals will have mean zero. There is parameter instability

if the cumulative sum of the residuals goes outside the confidence interval.

Figure 3 plots the CUSUM test with 95% confidence intervals for housing prices while Figure 4 reports the test for housing rents. Figure 3 shows a structural break in housing prices in La Manga around the publication of the 2014 Greenpeace report (April 2014). However, Figure 4 suggests no structural break for housing rents.

Table 1 reports the results from the Wald test which tests the null hypothesis of no structural break. This test is robust to the presence of unknown heteroskedasticity. Table 1 shows a significant effect for housing prices (Column 1), while no effect for housing rents (Column 2). Thus, Table 1 together with Figure 3 strongly suggest that the Greenpeace report caused a structural break in housing prices. However, Table 1 and Figure 4 show that the Greenpeace report had no effect on housing rents.

These findings are consistent with an asset pricing view of housing prices as risk-adjusted present-discounted-value of future rents. Sea level rise is a distant shock that will affect future rents when it materializes, but such distant threat of sea level rise is not preventing people from enjoying the beach amenities in La Manga. Thus, rents are not being affected.

It is important to stress that the 2014 Greenpeace report is a news shock, that is, it is news about a shock occurring in a distant future. Our findings exactly confirm this theory. The price of the asset reacts (housing prices) but the price of the current service flow (housing rents) is unaffected by the news shock. Bernstein et al. (2019) find the same result and argue that only prices react to the news of a distant climate risk.

To further confirm that we are identifying a news shock, Figures 5 and 6 study the algal bloom that hit La Manga since 2016. An algal bloom is a current shock that should impact both the ownership and the rental markets. This is exactly what we find. Figure 5 shows that the 2016 algal bloom causes a significant drop in both housing prices (by 12.63%) and housing rents (by 2.70%) in La Manga. On the other hand, Figure 6 shows a sudden increase in the housing price-to-rent ratio (by 2.89%) post July 2016, when the algal bloom was at one of its worst conditions.

Comparing Figures 1 and 2 with Figures 5 and 6 show the different nature of a sea-level rise news shock versus an actual pollution shock (i.e., the algal bloom). The news shock only moves prices and it causes a fall in the price-to-rent ratio. The algal bloom increases this ratio. Thus, the implications for search-for yield investors are very different. The news shock attract search-for yield investors who are short-term oriented. On the contrary, a pollution shock is unlikely to attract any search-for yield investors in the immediate future.

3 Diff-in-Diff Analysis

In the previous section we studied housing prices and rents in La Manga after the 2014 Greenpeace report. We showed evidence of structural change in housing prices but no effect on rents. Now we will complement the study following a difference-in-differences methodology. First we discuss the control groups, then we present the analysis and the results.

Our identification assumption is that, in the absence of the exogenous shock (i.e., the 2014 Greenpeace report), the differences in the dynamics of the treatment and control groups post-2014 will be the same as those before the shock. Any change in the differences between treatment and control groups between the pre- and post-shock trends is caused by the exogenous shock.

3.1 Treatment and Control Groups

Our treatment group is La Manga.[4] We use two benchmark control groups. Our first control group is a "coastal control group" that includes locations in the Mediterranean coastline with similar socioeconomic characteristics to those of La Manga. Similar to La Manga, these locations also face similar existential threat due to future sea level rise. These locations are: Alicante, Malaga, Marbella, Nerja and Torrevieja. As second control group, we use two neighboring locations (Guardamar del Segura and Pilar de la Horadada) that are socioeconomically similar to those of La Manga. These two locations are 50 kilometers away from La Manga but they are not as exposed to the threat of rising sea level as La Manga. They are not also cited in any Greenpeace report. In the robustness section we will compare La Manga with the other two control groups (i.e., Torrevieja and South Torrevieja).

Table 2 compares the two control groups with La Manga across a set of socioeconomic variables. The goal is to ensure that both control groups have similar characteristics to those of La Manga before the publication of the 2014 Greenpeace report. We use monthly data at the municipality level from January 2013 to April 2014 for house prices and population. For home sales, due to the lack of monthly data, we use quarterly data at the municipality level from the first quarter of 2013 to the first quarter of 2014. We also use monthly data at the province level to control for inflation and unemployment.

Table 2 shows that the control groups and La Manga are quite similar during the pre-shock period for the variables of interest. All tests of equality of pre-shock means reject any significant differences across La Manga and the control groups. The only exception is population change relative to the neighboring control group. This is not much of a worry as we control for

[4] La Manga belongs to two municipalities. The south part belongs to Cartagena, the middle and the north to San Javier. For housing data we have data from all areas of La Manga. For the remaining variables the data are from San Javier.

population change in all of our specifications.

3.2 Housing Prices

Figures 7 and 8 check the parallel trends assumption for housing prices. Figure 7 compares La Manga and the coastal control group, while Figure 8 confronts La Manga with the neighboring control group. The parallel trends assumption holds perfectly in both cases. The dynamics of housing prices for La Manga and the control groups are very similar before the 2014 report.

Post-publication of the Greenpeace report, housing prices experience a significant drop in La Manga, while for the coastal control group, prices remain stable at the pre-shock level (see Figure 7). Housing prices in the neighboring control group show an upward trend post-report that seems to be a spillover effect from the shock (see Figure 8). This suggests that the neighboring locations benefit from a higher demand due to their proximity to La Manga and relative safety from the threat of sea level rise.

To quantify the effect of the 2014 Greenpeace report we estimate the following specification on the 2013 to 2015 sample:

$$Log(Housingprices_{i,t}) = \beta_0 + \beta_1 LaManga + \beta_2 Postreport + \beta_3 LaManga \times Postreport + \\ + \sum_k \beta_k Controls_{i,t,k} + \mu_i \quad (1)$$

where, $Log(Housingprices_{i,t})$ refers to the percentage change in housing prices at location i in time t. The locations are La Manga and the two control groups. $LaManga$ is a dummy that takes the value of one for La Manga and zero for the locations in the control group. $Postreport$ is a dummy that takes the value of one from May 2014 onwards (i.e., the post-shock period), and zero otherwise. The interaction term $LaManga \times Postreport$ captures the effect of the report in La Manga during the post-shock period. Thus, β_3 is the coefficient of interest for us. $Controls_{i,t,k}$ are the k control variables at location i in time t. We control for inflation, population, and unemployment.[5] We also control for an increase in the sea level in the Mediterranean coast because a higher sea level could affect the housing markets by creating stranded assets.[6] We also control for the global financial crisis that lasted in Spain from 2008 to 2014. Since our sample covers the period from 2013 to 2015, we include a dummy from January 2013 to December 2014 to control for the financial shock during our sample period. Finally, μ_i captures the province fixed effect.

[5] These controls come from the Spanish National Statistical Institute database. For inflation and unemployment, the controls are at the province level.

[6] The sea level measure comes from Sealevels.org, which maintains a longitudinal data of global sea level rise.

Table 3 has summary statistics for all variables in the sample. Table 4 contains the results from estimating equation 1. Column 1 of Table 4 shows that in the post-shock period, housing prices are 7% lower in La Manga than in the coastal control group. Regarding the neighboring control group, Column 2 of Table 4 shows that housing prices are 5% lower in La Manga. Thus, news about sea level rise have immediate effects on housing prices.

3.3 Housing Rents

Figures 9 and 10 check the parallel trends assumption for housing rents. Figure 9 compares La Manga and the coastal control group, while Figure 10 confronts La Manga with the neighboring control group. The parallel trends assumption holds perfectly in both cases. The dynamics of housing rents for La Manga and the control groups are very similar before the 2014 report.

To quantify the effect of the 2014 Greenpeace report on housing rents we estimate the following specification on our 2013 to 2015 sample:

$$Log(Housingrents_{i,t}) = \beta_0 + \beta_1 LaManga + \beta_2 Postreport + \beta_3 LaManga \times Postreport + \\ + \sum_k \beta_k Controls_{i,t,k} + \mu_i \quad (2)$$

where, $Log(Housingrents_{i,t})$ refers to the percentage change in housing rents at location i in time t. Everything else is as discussed for the estimation (1) of housing prices.

Table 5 contains the results from the estimation. There is no significant difference in rents between La Manga and the coastal control group. However, the rent in La Manga increases by 8% relative to the safer neighboring control group (see Column 2 of Table 5). This suggests that potential investors prefer to rent in La Manga instead of purchasing houses in order to mitigate the future risk of climate change. This causes an increase in housing rents in La Manga. Thus, the 2014 Greenpeace report did not have any impact on La Manga housing rents relative to the coastal control group facing similar threats from sea level rise, but had a positive impact relative to the safer, neighboring control group.

4 Robustness Tests

We perform several robustness tests to validate the previous results.

4.1 Additional Control Groups

We check if results change when we use the control groups used by Garcia-Lorenzo et al. (2021) and Banco de Espana (2021) to study the 2016 algal bloom. They use first a municipal-

ity named Torrevieja. Second, a subsample of this municipality called South Torrevieja that includes Playa de Los Locos, Playa del Cura, Los Naufragos and Los Balcones.

Figures 11 and 12 plot housing prices in La Manga and in these additional control groups. Then Table 6 estimates the benchmark specification (1) but for La Manga and these control groups. The results are in line with the benchmark results discussed before. The 2014 Greenpeace report causes housing prices to drop in La Manga by approximately 9% relative to Torrevieja (see Column 1 of Table 6) and by approximately 10% relative to South Torrevieja (see Column 2 of Table 6). Thus, our original findings are robust to these alternative control groups.

4.2 Placebo Test

We do a placebo test to check the robustness of our results. We assume a random date, say March 2012, and redo the benchmark estimations taking this random date as the date of the shock. Since there was no Greenpeace report published on that random day, we should find no effect on housing prices in La Manga relative to the control groups.

Figures 13 and 14 plot the placebo and the actual shocks for La Manga and the two benchmark control groups. Table 7 shows the results from estimating equation 1 with the placebo shock replacing the Greenpeace shock. As expected, the placebo shock has no effects on housing prices of La Manga relative to the coastal control group. Relative to the neighboring control group, the placebo shock increases housing prices in La Manga by 11% (see Column 2 of Table 7). That is, the opposite result relative to the Greenpeace result. Thus, we can conclude that we are not confounding the Greenpeace shock with other types of shocks.

5 Home Sales

In this section we explore the reaction of home sales to the 2014 Greenpeace report. Unfortunately, the home sales data are quarterly, not monthly.[7] Figure A3 compares new home sales between La Manga and the coastal control group. The shock seems to decrease new home sales in La Manga relative to the coastal control group. To formally quantify, we estimate:

$$Log(Newhomesales_{i,t}) = \beta_0 + \beta_1 LaManga + \beta_2 Postreport + \beta_3 LaManga \times Postreport + \\ + \sum_k \beta_k Controls_{i,t,k} + \mu_i \quad (3)$$

[7]Data are at the municipality level from the Spanish Department of Transportation, Mobility and Urban Affairs.

where, $Log(Newhomesales_{i,t})$ represents the percentage change in new home sales at location i in time t. All other variables are as discussed in the estimation of equation 1. Table A1 contains the results of the impact of the 2014 Greenpeace report on home sales.

Although Figure A3 suggests a drop in new home sales in La Manga relative to the coastal control group, Column 1 of Table A1 does not show any significant change in new home sales in La Manga relative to the coastal control group.

Figure A4 compares second home sales between La Manga and the coastal control group. Again, the shock does not impact second home sales in La Manga relative to the coastal control group. To quantify, we estimate:

$$Log(Secondhomesales_{i,t}) = \beta_0 + \beta_1 LaManga + \beta_2 Postreport + \beta_3 LaManga \times Postreport + \\ + \sum_k \beta_k Controls_{i,t,k} + \mu_i \quad (4)$$

where, $Log(Secondhomesales_{i,t})$ denotes the percentage change in the second home sales in location i in time t. All other variables are as discussed in equation 1. Column 2 of Table A1 contains the results.

In the post-report period, Column 2 of Table A1 shows that second home sales in La Manga are not significantly different from those in the coastal control group. Thus, it seems that the 2014 Greenpeace report had no influence on the home sales in La Manga relative to the other coastal locations. That is, a set of buyers are still purchasing homes in La Manga but at the reduced price. These buyers may have different risk aversion, or, according to McNamara and Keeler (2013) these buyers may be less educated and less informed about the future risks of the properties they are investing in.

These findings suggest that in locations that will get inundated, the housing market remains active albeit at lower prices. That is, many buyers are willing to be exposed to the future threat of sea level rise in La Manga, but at lower prices in order to minimize risks from climate change.

6 Conclusions

There is disagreement in the literature about how much and when sea level rise will affect home prices. In this paper we show that prices react to impactful news. We exploit a Greenpeace report that received wide attention in an area of Spain (La Manga region) that is vulnerable to climate change.

We have high confidence that we are identifying the 2014 Greenpeace report shock. Consistent with theory, we show that house prices react to the report but housing rents do not change. Tests of structural breaks confirm these results. However, for the algal bloom that hit

the area in 2016, both rents and prices react.

We also do a diff-in-diff analysis to quantify the effects from the report. The parallel trends assumption holds well for housing prices and we also control for other possible drivers of the results. Again, we find significant drops in housing prices but no effect on housing rents. Housing prices fall by around 5% to 10% relative to the control groups. Moreover, we find evidence of spillover effects towards neighboring locations. This suggests that markets are pricing the future reallocation of population.

While the price effects are strong and statistically significant, for home sales, the report does not seem to have much effect. Home sales were immune to the report. Thus, we can conclude that, at least while sea level rise is more of a menace than a real danger, most of the effects will be felt in the prices, not in the quantities. A topic for future research is how construction and new buildings react.

References

Agarwal, S., Yu, Q., Sing, T. F. and Zhan, C.: 2021, Does climate change affect real estate? Evidence from government announcement.

Bakkensen, L. and Barrage, L.: 2021, Going underwater? Flood risk belief heterogeneity and coastal home price dynamics, *The Review of Financial Studies* .

Baldauf, M., Garlappi, L. and Yannelis, C.: 2020, Does climate change affect real estate prices? Only if you believe in it, *The Review of Financial Studies* **33**(3), 1256–1295.

Banco de España: 2021, The value of housing and ecological degradation: The case of the Mar Menor, *Financial Stability Report* pp. 112–114.

Barsky, R. B. and Sims, E. R.: 2020, News shocks and business cycles, *Journal of Monetary Economics* **58**(3), 273–289.

Beaudry, P. and Portier, F.: 2006, Stock prices, news, and economic fluctuations, *American Economic Review* **96**(4), 1293–1307.

Bernstein, A., Gustafson, M. T. and Lewis, R.: 2019, Disaster on the horizon: The price effect of sea level rise, *Journal of Financial Economics* **134**(2), 253–272.

Garcia-Lorenzo, M. L., Villasur, J. G., Lamas, M. and Perez-Quiros, G.: 2021, Environmental destruction and housing prices: The case of Mar Menor in Spain.

Giglio, S., Kelly, B. and Stroebel, J.: 2021, Climate finance.

Ilhan, E.: 2021, Sea level rise and portfolio choice.

Keys, B. J. and Mulder, P.: 2020, Neglected no more: Housing markets, mortgage lending, and sea level rise, *National Bureau of Economic Research* (No. w27930).

McConnell, M. M. and Perez-Quiros, G.: 2000, Output fluctuations in the United States: What has changed since the early 1980's?, *American Economic Review* **90**(5), 1464–1476.

McNamara, D. E. and Keeler, A.: 2013, A coupled physical and economic model of the response of coastal real estate to climate risk, *Nature Climate Change* **3**(6), 559–562.

Murfin, J. and Spiegel, M.: 2020, Is the risk of sea level rise capitalized in residential real estate?, *The Review of Financial Studies* **33**(3), 1217–1255.

Ortega, F. and Taspinar, S.: 2018, Rising sea levels and sinking property values: Hurricane Sandy and New York's housing market, *Journal of Urban Economics* **106**, 81–100.

Sáez, C. C. M.: 2020, Socio-economic impact of Mar Menor harmful algal bloom in 2015-2016.

Schmitt-Grohé, S. and Uribe, M.: 2012, What's news in business cycles, *Econometrica* **80**(6), 2733–2764.

Smith, D. R.: 2008, Testing for structural breaks in GARCH models, *Applied Financial Economics* **18**(10), 845–862.

Stroebel, J. and Wurgler, J.: 2021, What do you think about climate finance?, *Journal of Financial Economics* **142**(2), 487–498.

Figures

Figure 1. Housing Prices and Rents in La Manga. The solid line plots housing prices while the dashed line plots housing rents (annual). The vertical dashed-dotted line (March 2014) is the month before publication of the Greenpeace report. The sample period is from January 2013 to December 2015.

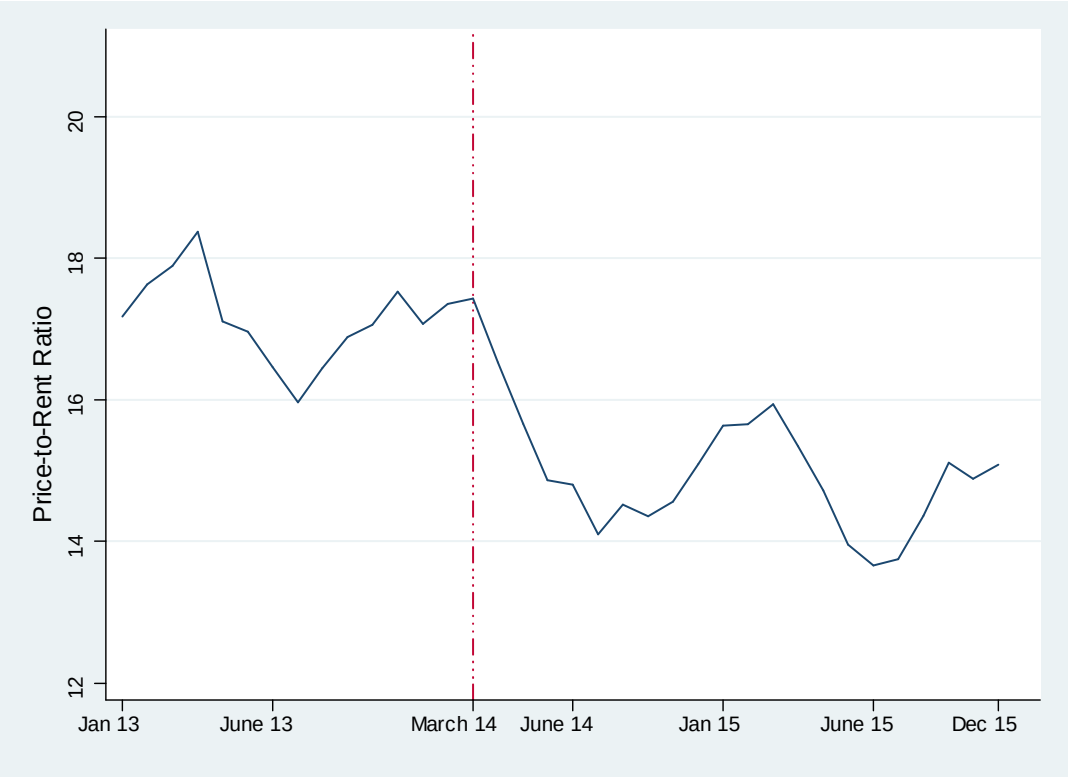

Figure 2. Price-to-Rent Ratio in La Manga. This figure plots the ratio of housing prices to housing rents (annual). The vertical dashed-dotted line and the sample period are as described in Figure 1.

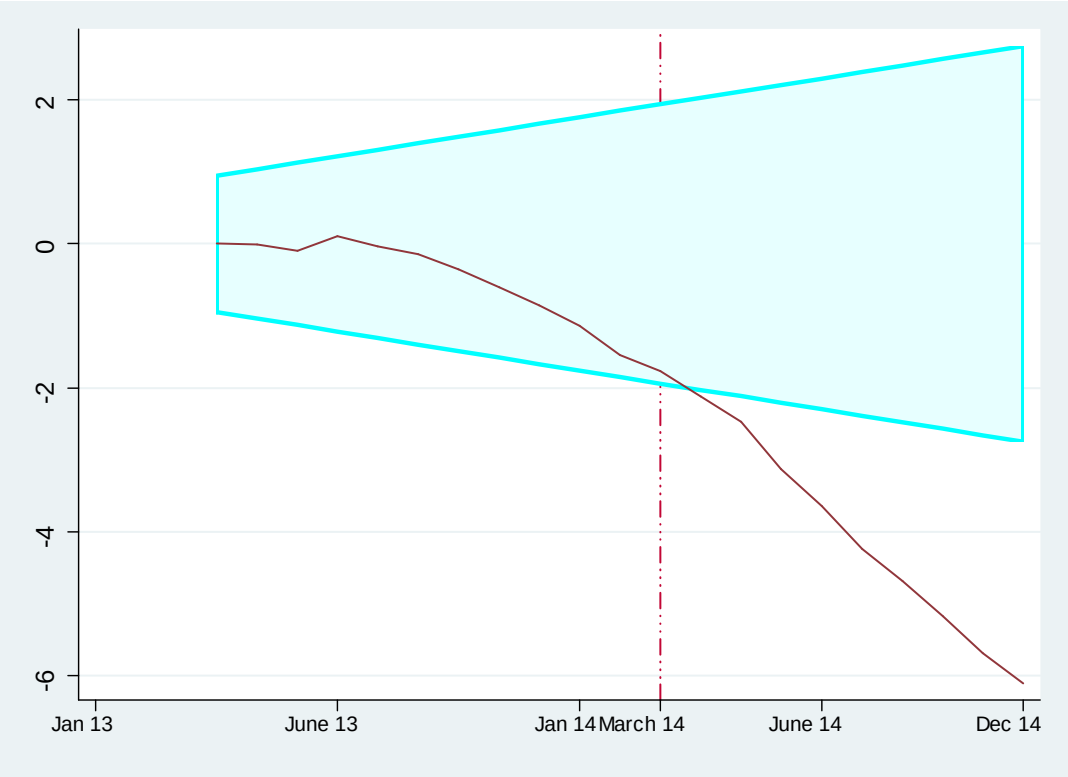

Figure 3. Testing for Structural Breaks in Housing Prices in La Manga. This figure plots the cumulative sum (CUSUM) test for parameter stability. The shaded area is the 95% confidence interval. The vertical dashed-dotted line (March 2014) is the month before publication of the Greenpeace report. The null hypothesis is coefficient constancy, values outside the confidence area suggest structural change over time. The sample period is from January 2013 to December 2014.

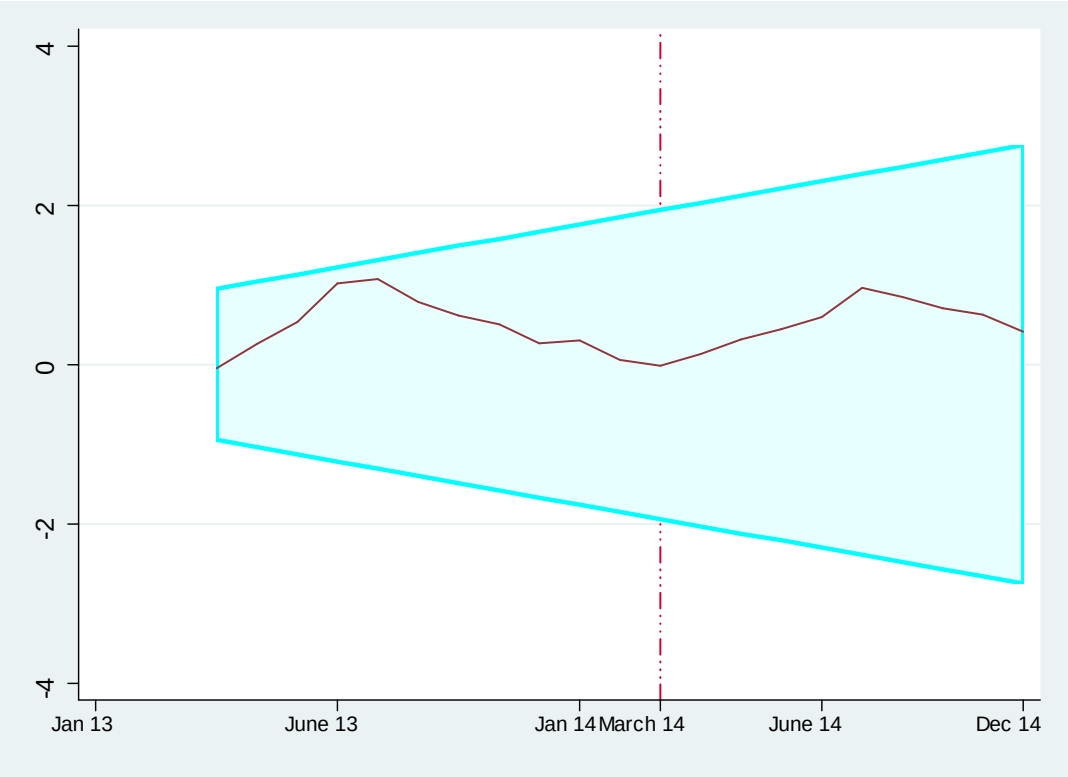

Figure 4. Testing for Structural Breaks in Housing Rents in La Manga. This figure redoes Figure 3 but for housing rents. The figure shows no structural break as discussed in Section 2.

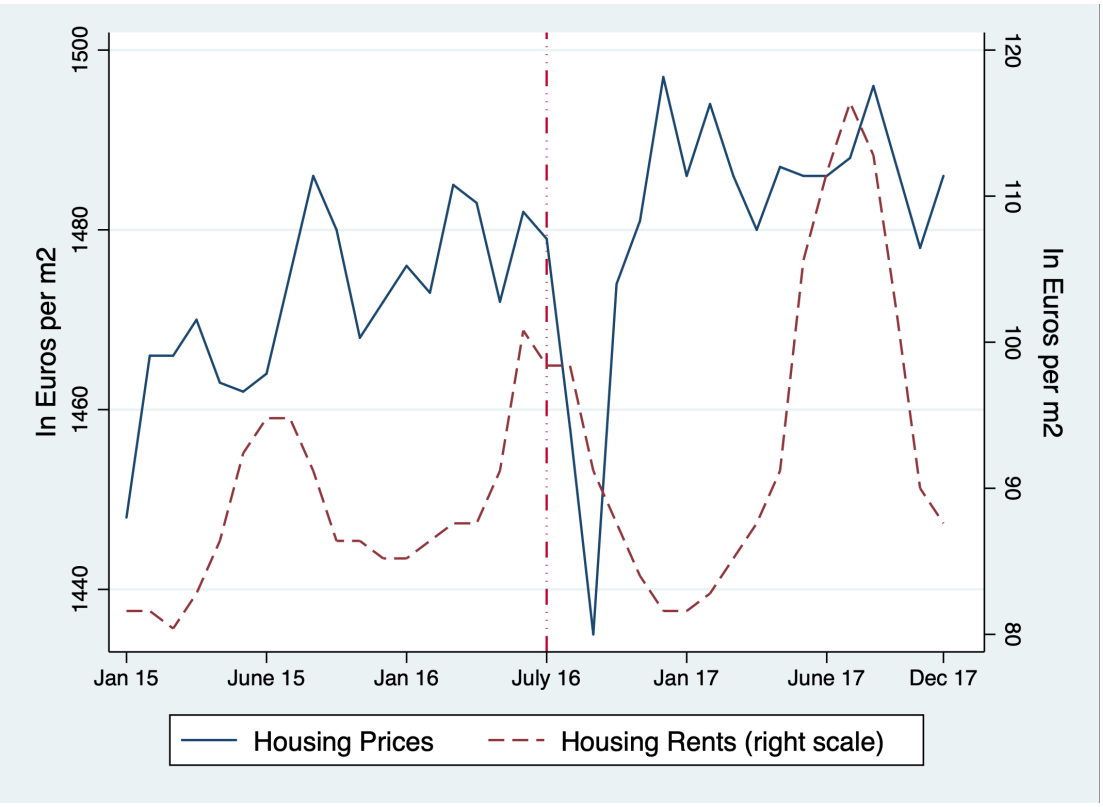

Figure 5. Housing Prices and Rents in La Manga: Algal Bloom. The solid line plots housing prices while the dashed line plots housing rents. The vertical dashed-dotted line is the 2016 algal bloom. The sample period is from January 2015 to December 2017.

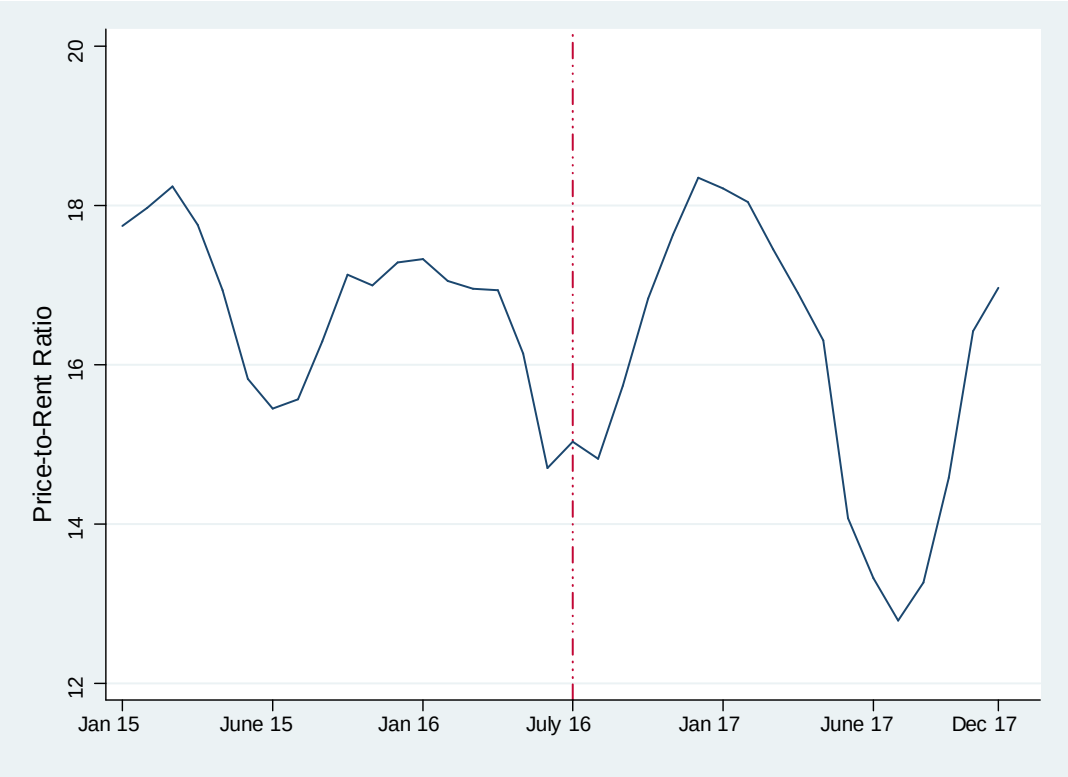

Figure 6. Price-to-Rent Ratio in La Manga: Algal Bloom. This figure plots the ratio of housing prices to housing rents (annual). The vertical dashed-dotted line and the sample period are as described in Figure 5.

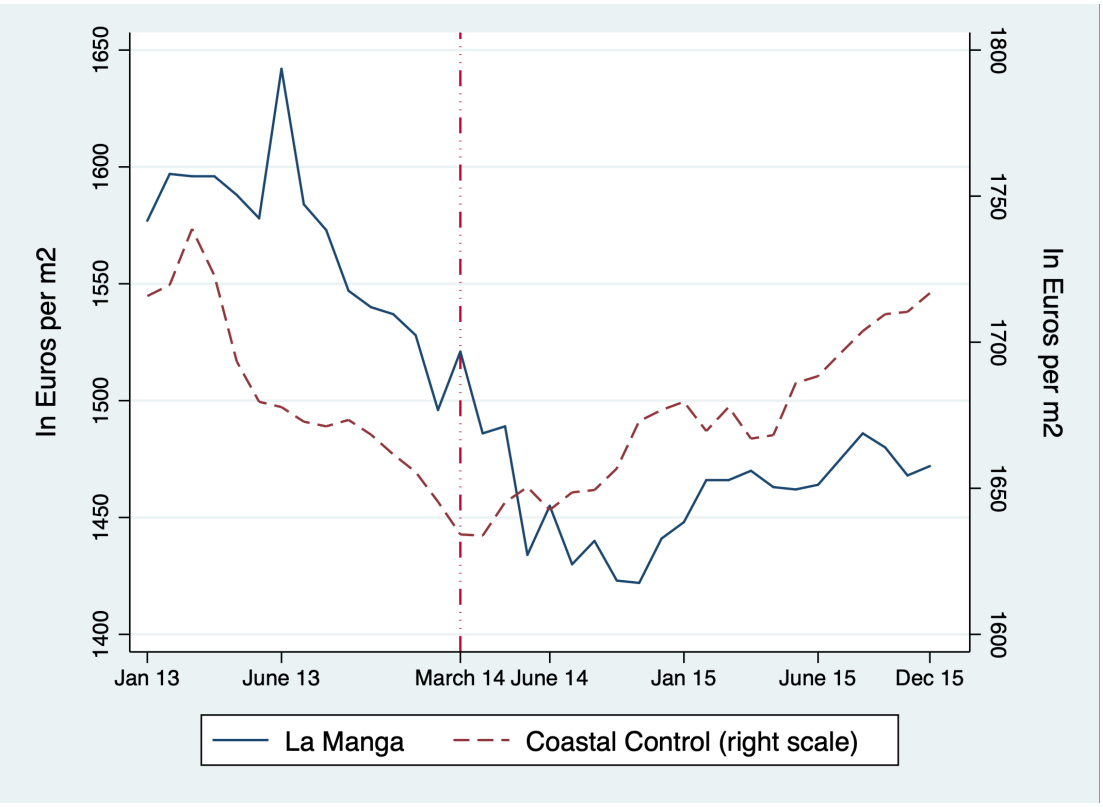

Figure 7. Housing Prices in La Manga and in the Coastal Control Group. The solid line plots housing prices in La Manga. The dashed line plots the housing prices in the coastal control group discussed in Section 3.1. The vertical dashed-dotted line and the sample period are as described in Figure 1.

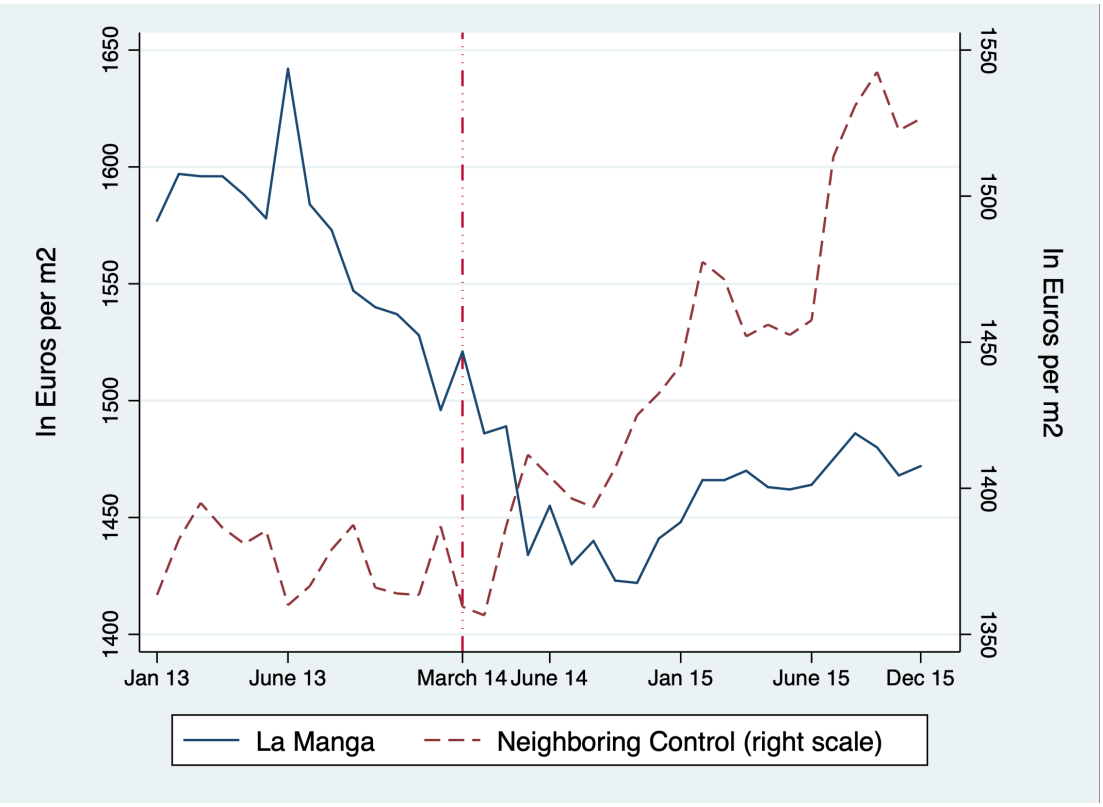

Figure 8. Housing Prices in La Manga and in the Neighboring Control Group. The solid line plots housing prices in La Manga. The dashed line plots housing prices in the neighboring locations discussed in Section 3.1. The vertical dashed-dotted line and the sample period are as described in Figure 1.

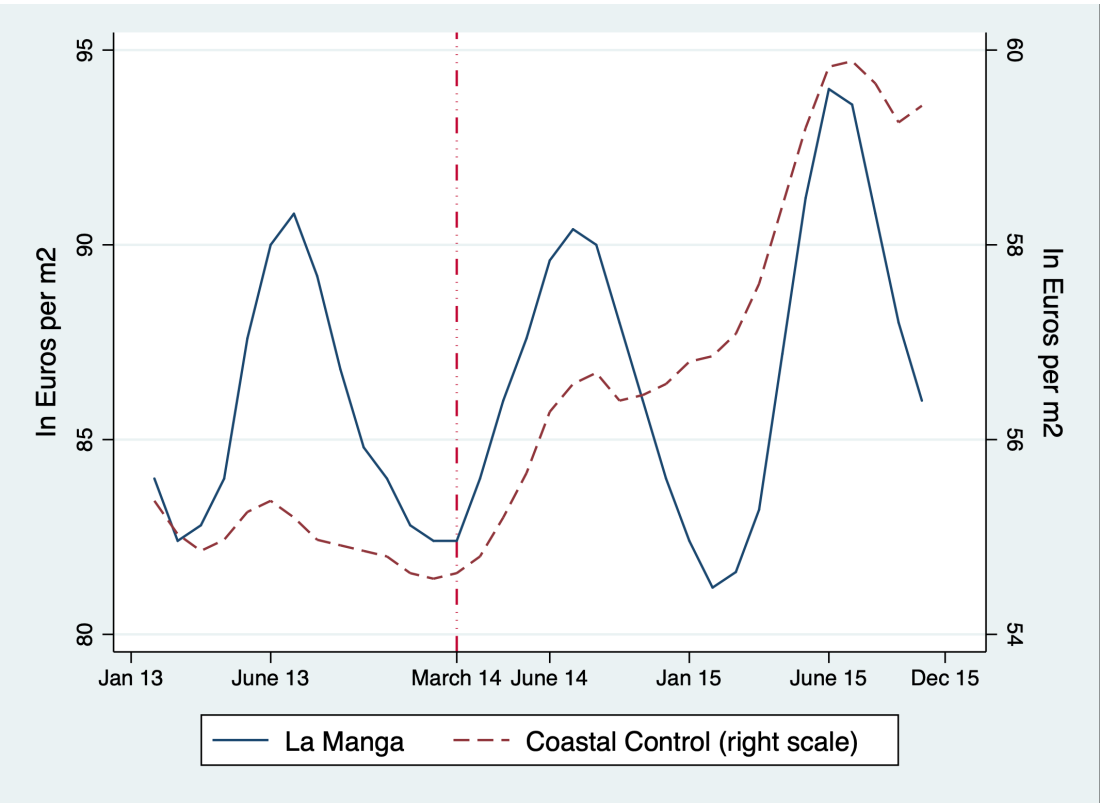

Figure 9. Housing Rents in La Manga and in the Coastal Control Group. The solid line plots housing rents in La Manga. The dashed line plots the housing rents in the coastal control group discussed in Section 3.1. The vertical dashed-dotted line and the sample period are as described in Figure 1.

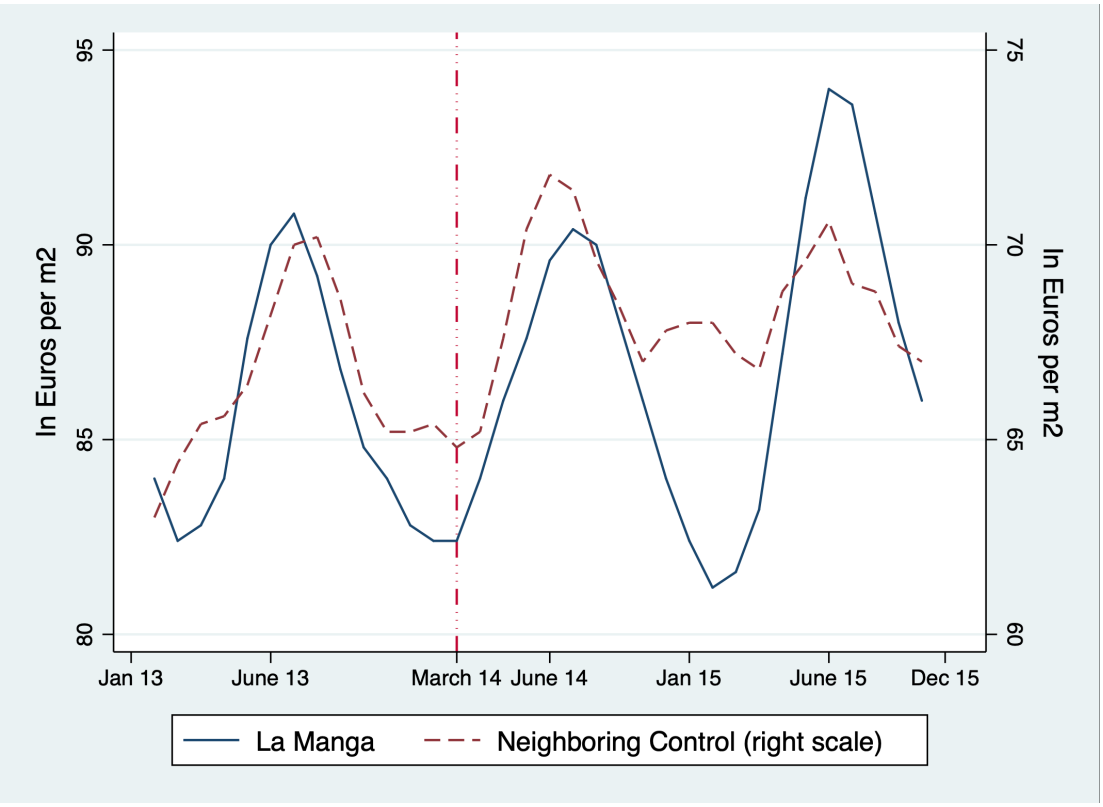

Figure 10. Housing Rents in La Manga and in the Neighboring Control Group. The solid line plots housing rents in La Manga. The dashed line plots housing rents in the neighboring control group discussed in Section 3.1. The vertical dashed-dotted line and the sample period are as described in Figure 1.

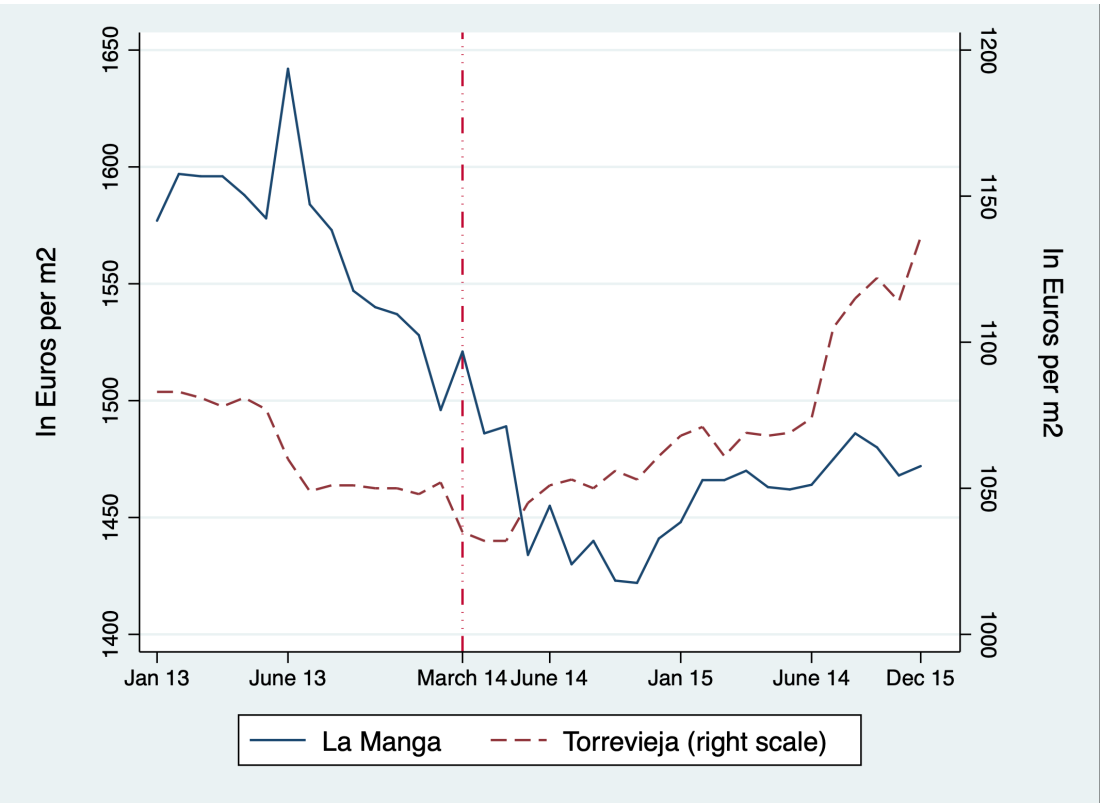

Figure 11. Housing Prices in La Manga and in Torrevieja. The solid line plots housing prices in La Manga. The dashed line plots housing prices in Torrevieja, which is a control group used by Bank of Spain (2021). The vertical dashed-dotted line and the sample period are as described in Figure 1.

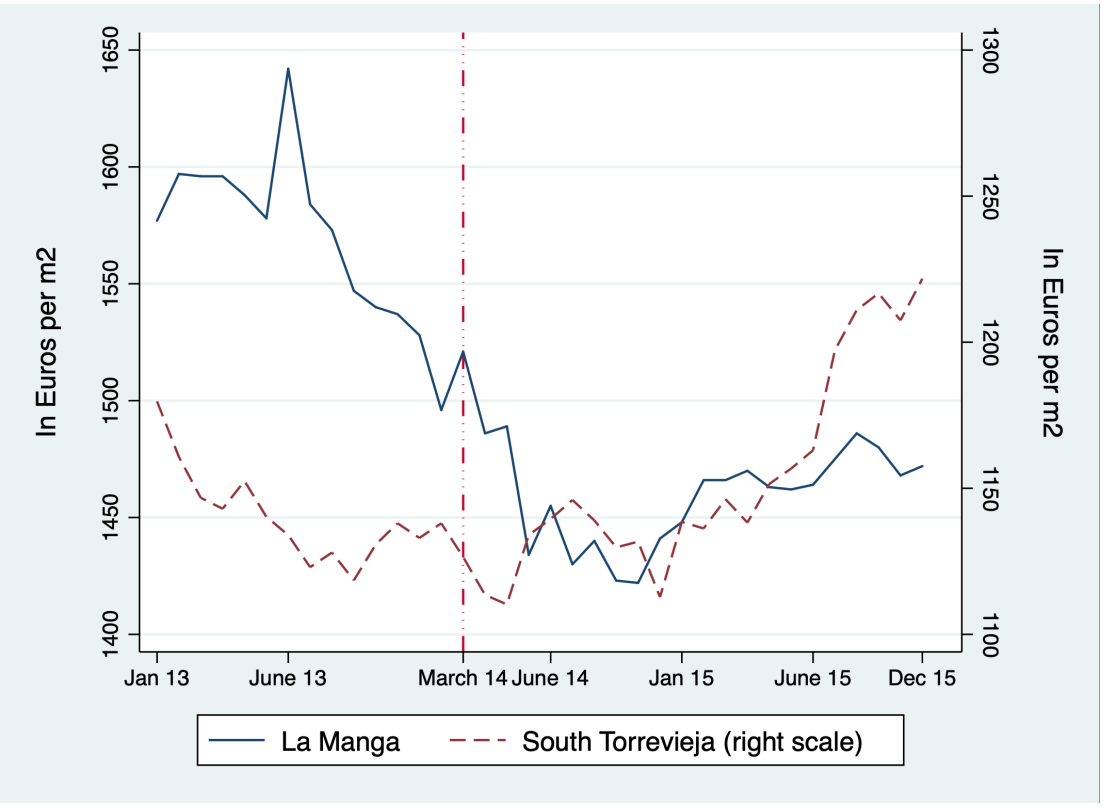

Figure 12. Housing Prices in La Manga and in South Torrevieja. The solid line plots the housing prices in La Manga. The dashed line plots housing prices in South Torrevieja, which is a control group used by Bank of Spain (2021). The vertical dashed-dotted line and the sample period are as described in Figure 1.

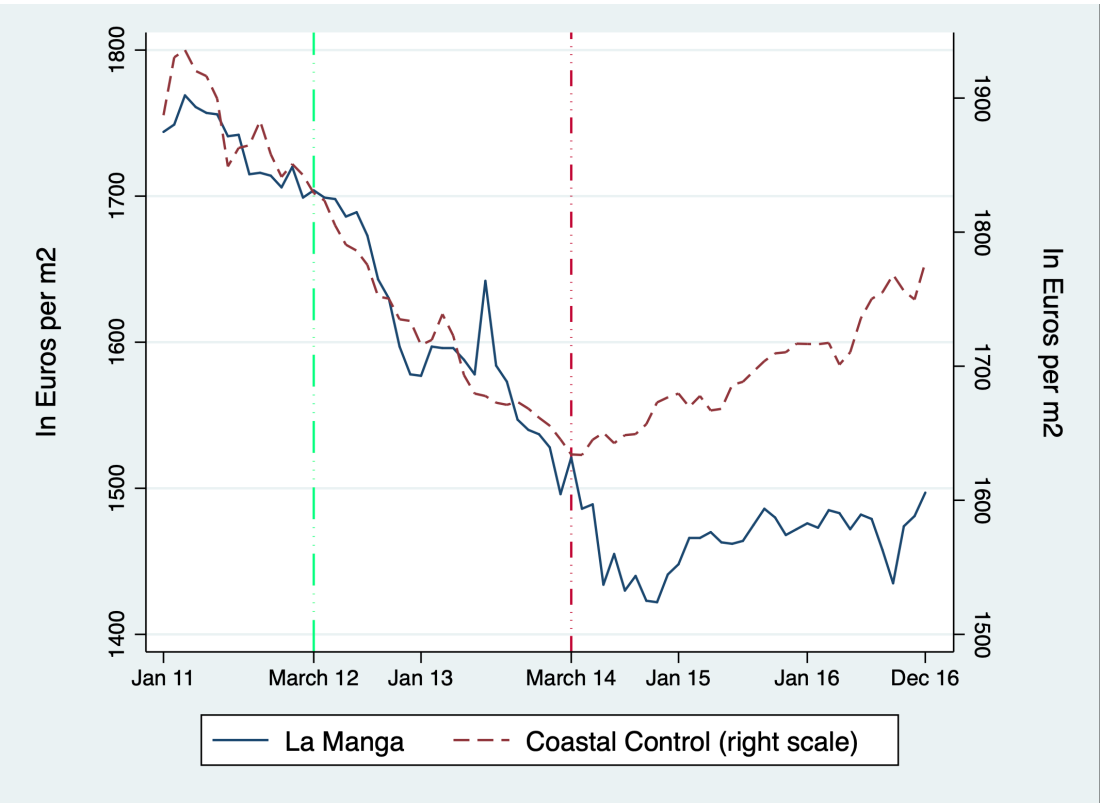

Figure 13. Comparing Placebo and Actual Shocks with the Coastal Control Group. This figure plots housing prices in La Manga (solid line) and in the coastal control group discussed in Section 3.1 (dashed line). The first vertical dashed-dotted line (March 2012) is the placebo shock discussed in Section 4.2 while the second vertical dashed-dotted line (March 2014) is the period after which the impact of the Greenpeace report (published in April 2014) on housing market could be observed. The sample period is from January 2011 to December 2016.

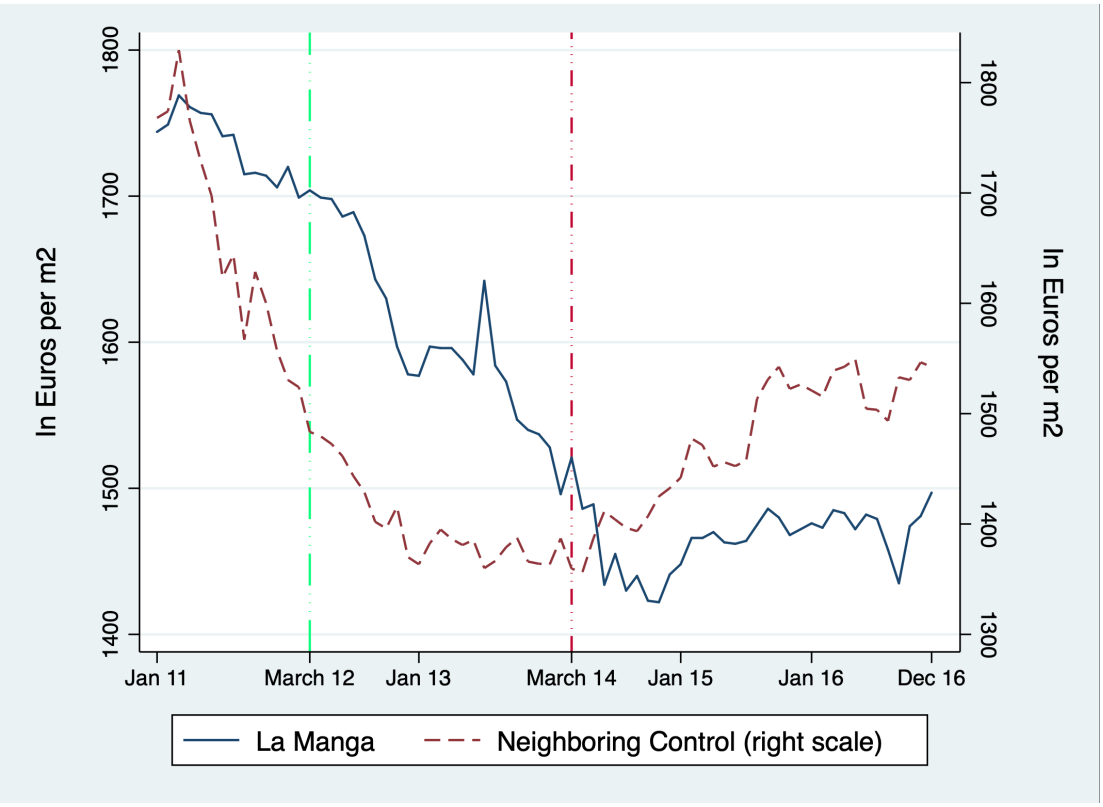

Figure 14. Comparing Placebo and Actual Shocks with the Neighboring Control Group. This figure redoes Figure 13 but for the neighboring control group (dashed line) discussed in Section 3.1.

Tables

Table 1. Wald Test for Structural Break

	Housing Prices	Housing Rents
Chi-Square	65.17***	1.23
	(0.000)	(0.541)
Observations	23	23

Note: This table does a structural break analysis using a Wald test with known break date (April 2014 when the Greenpeace report was published). The null hypothesis is no structural break at the specified breakpoint (i.e., April 2014). The sample consists of monthly observations from January 2013 to December 2014. P-values are in parentheses. *** means significant at 1% level.

Table 2. Testing the Equality of Pre-Shock Means

	Treatment		Control Groups					
	La Manga		Coastal			Neighboring		
Variables	Obs.	Mean	Obs.	Mean	t-stat	Obs.	Mean	t-stat
Housing Price Growth	16	-0.36	80	-0.38	-0.05	32	-0.10	0.50
Housing Rent Growth	16	-0.05	75	-0.12	-0.14	32	0.21	0.24
Inflation Rate	16	0.01	80	0.00	-0.05	32	0.00	-0.06
Population Growth	16	-0.02	80	-0.06	-0.49	32	0.04	1.85*

Note: This table tests the equality of the means of the key variables in the pre-shock period. The null hypothesis is that the means of these variables are equal between the treatment and the control groups. All variables are monthly growth rates in percentage. The control groups are defined in Section 3.1. The sample goes from the first quarter of 2013 to the first quarter of 2014. * means significant at 1% level.

Table 3. Summary Statistics for Diff-in-diff Analysis

	Observations	Mean	SD	Min.	Max.
Main Variables					
Housing Prices	288	1591.02	406.20	1032.00	2496.00
Housing Rents	288	77.07	12.02	54.00	115.20
New Home Sales	104	105.68	64.84	2.00	962.00
Second Home Sales	104	428.72	421.80	37.00	1294.00
Control Variables					
Sea Level	288	19.86	0.68	19.10	21.19
Consumer Price Index (CPI)	288	100.73	0.69	98.62	101.92
Population (in thousands)	288	153.91	185.82	15.59	569.13
Unemployment Rate (in %)	288	23.25	3.15	16.74	27.55
Price Index for New Homes	104	108.16	11.42	91.98	138.79
Price Index for Second Homes	104	106.65	10.50	95.71	145.08

Note. Housing prices and housing rents are in Euros per square meter. New home sales and second home sales are the number of units sold. Sea Level is the global sea level measured in centimeters. CPI is an index with value 100 in 2016. Price indices and homes sales are only available at quarterly frequency.

Table 4. Log of Housing Prices 2013-15

	Coastal	Neighboring
La Manga×PostReport	–0.07***	-0.05**
	(0.00)	(0.02)
Economic Controls	Yes	Yes
Other Controls	Yes	Yes
Observations	216	108
R-squared	0.77	0.84

Note: This table estimates Equation 1 with the log of housing prices as the dependent variable. P-values are in parentheses. The economic controls and other controls are as in Table 3. The independent variable is the interaction term (LaManga×PostReport) that takes the value of one for observations in La Manga post April 2014, and zero otherwise. The sample consists of monthly observations from January 2013 to December 2015. *** and ** mean significant at 1% and 5% level respectively. The control groups are as defined in Section 3.1. All specifications use robust standard errors.

Table 5. Log of Housing Rents 2013-15

	Coastal	Neighboring
La Manga×PostReport	–0.16	0.08***
	(0.34)	(0.00)
Economic Controls	Yes	Yes
Other Controls	Yes	Yes
Observations	216	108
R-squared	0.85	0.78

Note: This table estimates equation 2 with the log of housing rents as the dependent variable. P-values are in parentheses. The economic controls and other controls are as in Table 3. The independent variable is the interaction term (LaManga×PostReport) that takes the value of one for observations in La Manga post April 2014, and zero otherwise. The sample consists of monthly observations from January 2013 to December 2015. *** means significant at 1% level. The control groups are as defined in Section 3.1. All specifications use robust standard errors.

Table 6. Log of Housing Prices 2013-15 with Other Control Groups

	Torrevieja	South Torrevieja
La Manga×PostReport	–0.09***	-0.10***
	(0.00)	(0.00)
Economic Controls	Yes	Yes
Other Controls	Yes	Yes
Observations	72	180
R-squared	0.99	0.65

Note: This table estimates equation 1 and uses the log of housing prices as the dependent variable. P-values are in parentheses. The economic controls and other controls are as in Table 3. The independent variable is the interaction term (LaManga×PostReport) that takes the value of one for observations in La Manga post April 2014, and zero otherwise. The sample consists of monthly observations from January 2013 to December 2015. *** means significant at 1% level. The control groups are as defined in Section 4.1. All specifications use robust standard errors.

Table 7. Log of Housing Prices with Placebo Shock 2011-13

	Coastal	Neighboring
La Manga×PostReport	0.04	0.11**
	(0.10)	(0.03)
Economic Controls	Yes	Yes
Other Controls	Yes	Yes
Observations	216	108
R-squared	0.81	0.75

Note: This table estimates equation 1 and uses log of housing prices as the dependent variable. P-values are in parentheses. The economic controls and other controls are as in Table 3. The independent variable is the interaction term (LaManga×PostReport) that takes the value of one for observations in La Manga post April 2012, and zero otherwise. The sample consists of monthly observations from January 2011 to December 2013. ** means significant at 5% level. The control groups are as defined in Section 3.1. All specifications use robust standard errors.

APPENDIX

Figures

Panel A

Panel B

Figure A1. La Manga Aerial View and Map. Panel A is an aerial view of La Manga while Panel B shows the map of La Manga.

Figure A2. Greenpeace Inundation Projections for La Manga. This figure shows the projections for inundations in La Manga according to Greenpeace.

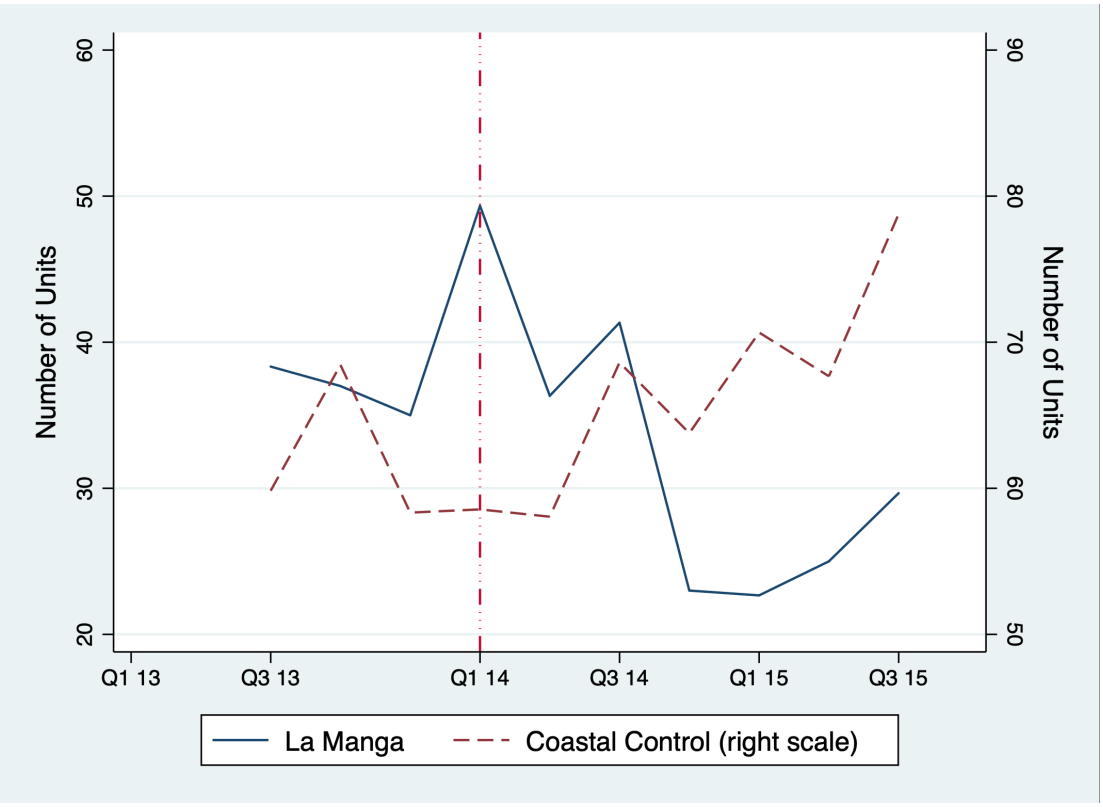

Figure A3. New Home Sales in La Manga and in the Coastal Control Group. The solid line plots the new homes sold in La Manga, the dashed line plots the same variable for the coastal control group discussed in Section 3.1. The vertical dashed-dotted line is the first quarter of 2014 (Q1 14 in the figure) when the 2014 Greenpeace report was published.

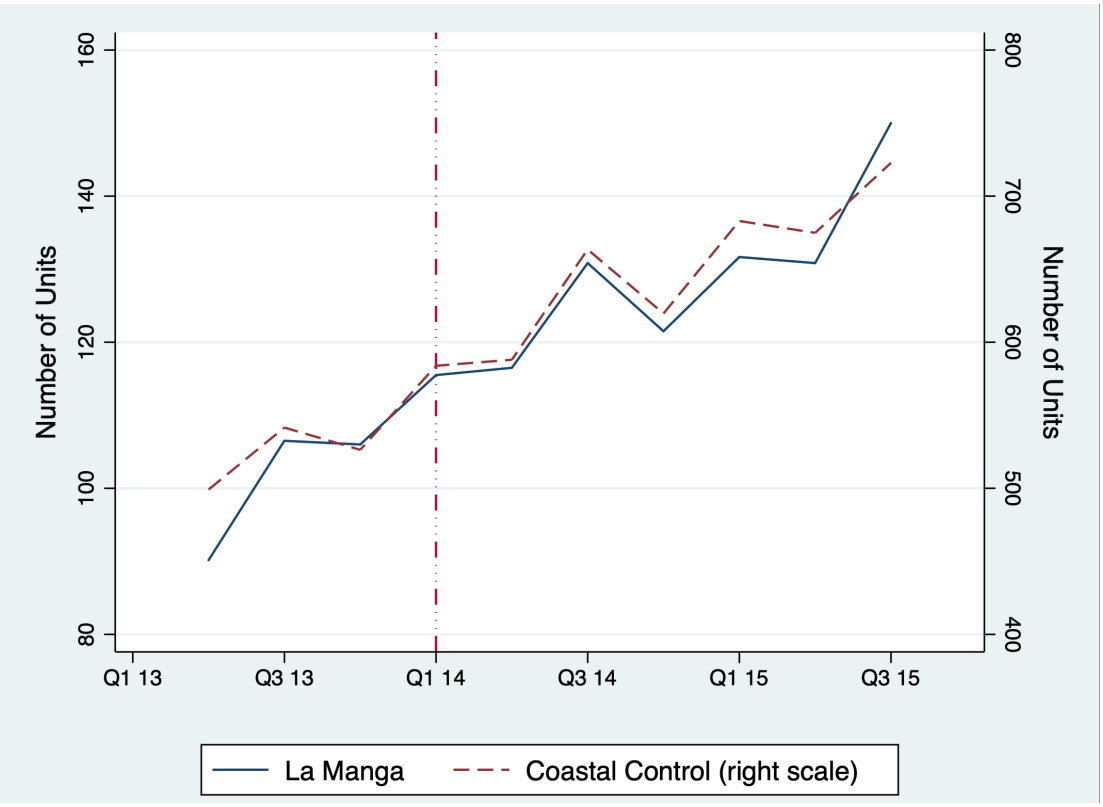

Figure A4. Second Home Sales in La Manga and in the Coastal Control Group. The solid line plots the second homes sold in La Manga while the dashed line plots the same variable for the coastal control group discussed in Section 3.1. The vertical line is as described in Figure A3.

Tables

Table A1. Home Sales In La Manga Relative to The Coastal Control Group

	New Home Sales	Second Home Sales
La Manga×PostReport	-0.58	-0.18
	(0.29)	(0.53)
Economic Controls	Yes	Yes
Other Controls	Yes	Yes
Observations	72	72
R-squared	0.24	0.47

Note: This table estimates equation 3 with log of new home sales (in column 1) and equation 4 with log of second home sales (in column 2) as the dependent variables. P-values are in parentheses. The coastal control group is as defined in Section 3.1. The independent variable, economic controls, other controls are same as described in Table 3. The sample period is from first quarter of 2013 to the last quarter of 2015. Two additional province level controls used to estimate equation 3 are price indices for new and second homes. None of the results are significant at 10%, 5% or at 1% levels. All specifications use robust standard errors.