

Housing Market Responses to Information Revelation: Evidence from TSMC's New Fab

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PRELIMINARY AND INCOMPLETE. COMMENTS ARE GREATLY APPRECIATED.

Abstract

This paper studies informational efficiency in housing market. We use TSMC's new fab announcements as a series of natural experiments to investigate how housing market incorporate these information. Focusing on both pre-owned and pre-sale transactions, our difference-in-differences event-study estimates indicate that price responses are rapid regardless of negative or positive information. 15% increase in transaction prices was found after initial announcement. But prices had dropped after TSMC downsized investment plan. Besides, transaction volumes surged in the beginning of the event but settled down afterwards.

JEL Codes: G14, R11, R21

Keywords: Information revelation; TSMC; Housing prices; Pre-sale housing

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1 Introduction

The housing market is one of the most significant sectors of the economy, accounting for a substantial portion of households' net worth. However, due to information asymmetries, transaction costs, market psychology, and human emotion, the housing market is prone to inefficiencies that can lead to significant welfare losses. As a result, understanding efficiency or inefficiency in the housing market is critical for policymakers, investors, and market participants. Unfortunately, limited data availability and a lack of significant exogenous shocks have made it challenging to conduct empirical studies that can help inform our understanding of the market's functioning.

This paper aims to contribute to our understanding of informational efficiency in the housing market by studying the price responses to a series of natural experiments. Specifically, we focus on TSMC's new fab announcements and investigate how the housing market incorporates this information into transaction prices and volumes. Using a difference-in-differences event-study approach, we estimate the price responses of pre-owned and pre-sale transactions before and after the TSMC announcements.

Our analysis shows that the housing market responds rapidly to TSMC's announcements, regardless of whether the information is positive or negative. After the initial announcement, we found a 15% increase in transaction prices. However, prices dropped when TSMC downsized its investment plan. We also observed a surge in transaction volumes in the beginning of the event, which settled down over time.

Our study highlights the importance of considering informational efficiency in the housing market. Our findings suggest that the market responds rapidly to new information, but the magnitude and duration of the responses may depend on the type of information and the overall economic conditions. Policymakers, investors, and market participants can benefit from a better understanding of how the housing market processes information, which can inform their decisions and risk management strategies.

Overall, this research contributes to the literature on the housing market by providing empirical evidence on the price responses to a series of natural experiments. By focusing

on TSMC’s announcements, we demonstrate the rapid and dynamic nature of the housing market’s response to new information, which has important implications for policymakers and investors alike.

2 Related Literature

work in progress

3 Setting and Data

Taiwan Semiconductor Manufacturing Company (TSMC) is the world’s largest semiconductor foundry, and is responsible for producing the chips that power many of the world’s electronic devices, including smartphones, laptops, and game consoles. In November 2021, TSMC announced plans to build a new semiconductor fab with the advanced 7-nanometer process and the mature 28-nanometer in Nazi District, Kaohsiung, which is expected to be completed in 2024. However, due to weak demand, in October 2022, TSMC delayed the construction plan of 7-nanometer fab. Anecdotal evidence indicated that housing prices increased significantly after the announcement but dropped when there were rumors of potential delay.

In Figure 1, we plot the time series of google search intensity on “TSMC Kaohsiung” in Chinese. Note that before the official announcement of TSMC’s fab construction plan in Kaohsiung there was a spike in September 2021. We find that some local news reports already point out the potential plan of TSMC, indicating information leakage before public announcement in November 2021. Similarly, we find related news reports about potential adjustments before October 2022. Therefore, we leverage the initial announcement and subsequent adjustments as a series of exogenous shocks to local housing market in Nazi District.

The primary dataset used in this paper is the housing transaction records from the Actual Price Registration System (APRS). The APRS contains the universe of housing sale records

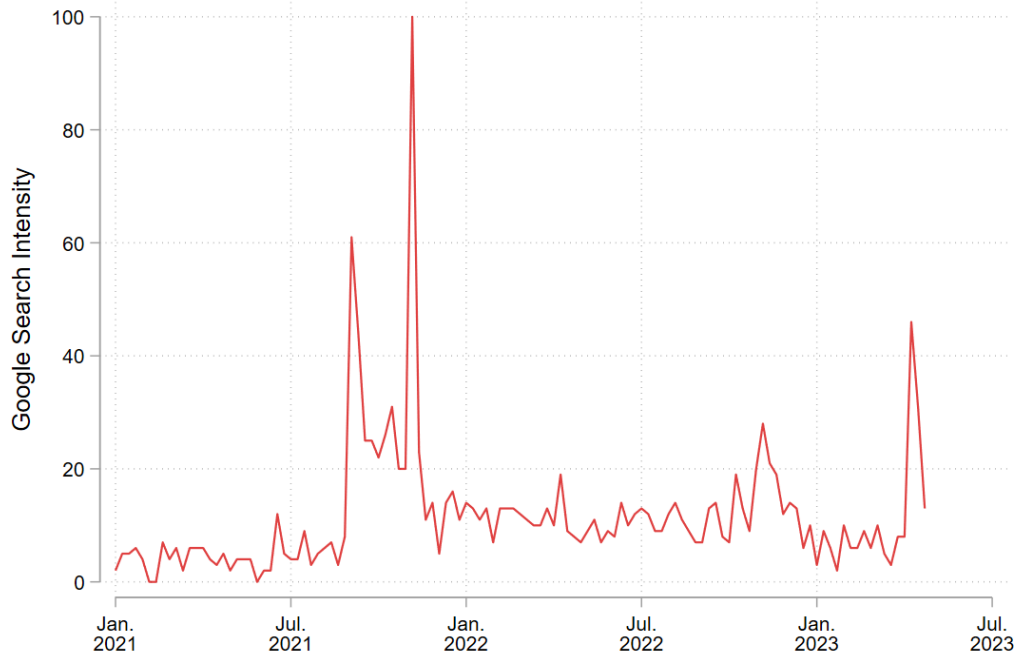


Figure 1: Google Search Intensity

Notes: This figure plots weekly search intensities of “TSMC Kaohsiung” in Chinese on Google search from January 2021 to April 2023. The search intensity ranges from 0 to 100. The intensities, ranging from 0 to 100, do not reflect actual numbers of searches as Google normalizes the highest search number of a keyword to 100 during the sample periods. Source: <https://trends.google.com.tw/trends>.

since August 2012. In particular, since mid 2019, amended regulation further required transactions on pre-sale housing to be reported to the APRS. The newly-added regulation allows us to compare transaction prices between spot and future in the housing market.

Figure 2 show the binscatter plots for average monthly price of pre-owned and pre-sale housing transactions in Nanzi District. The average prices in pre-sale market is higher than those in pre-owned market because of higher construction costs, future expectations, or lack of wear and tear. Using September 2021 as the separating month, we find descriptive evidence that the average prices exhibit structural changes with increases in slopes and jumps at the event month.

In Figure 3, we investigate the transaction volumes in Nazi District. Figure 3a show monthly volumes in pre-owned market. On average, the numbers are between 300 to 400. On

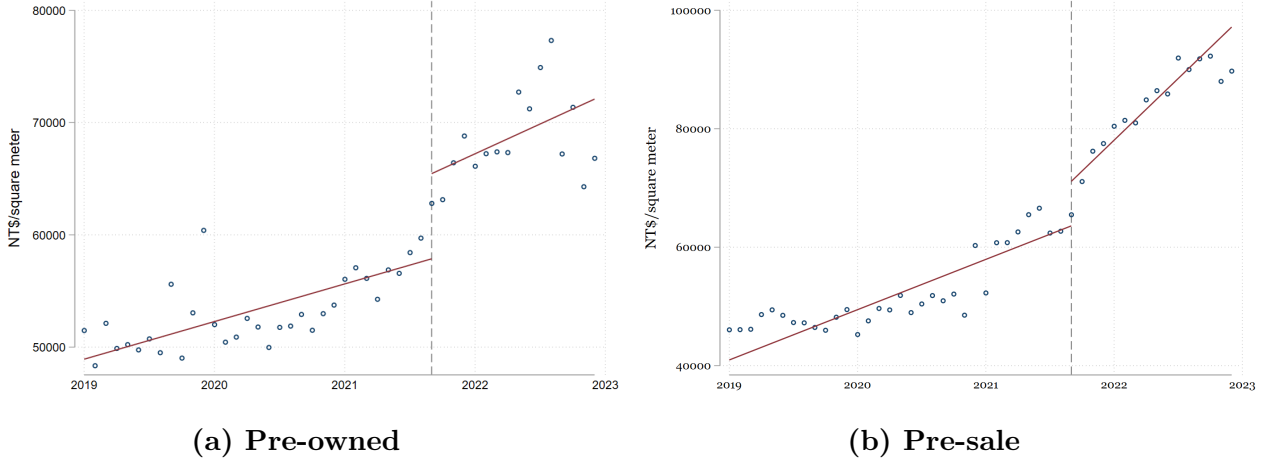


Figure 2: Average monthly price

September 2021, the transaction volume jumped to over 600, well above pre-event average. However, the volumes have dropped below pre-event levels since then. It could be attributed to limited housing supply in the district. More drastic jump is found in Figure 3b as the number of transactions in Nanzi’s pre-sale increased from less than a hundred to over 400 in two months.

The above descriptive patterns in both transaction prices and volumes show strong and rapid responses to new information. This also motivates us to further investigate the differentials in price dynamics between Nanzi District and other places as the next section introduce our empirical framework.

4 Empirical Analysis

4.1 DID Event-Study Approach

To estimate housing market responses to a series information revelations, we use a difference-in-differences (DID) event-study model to trace the dynamics of treatment effects over time. While conventional DID specification summarizes treatment effects using one single coefficient through interaction term between post and treated indicators, event-study specification can captures the differentials between treated and untreated groups before and after treat-

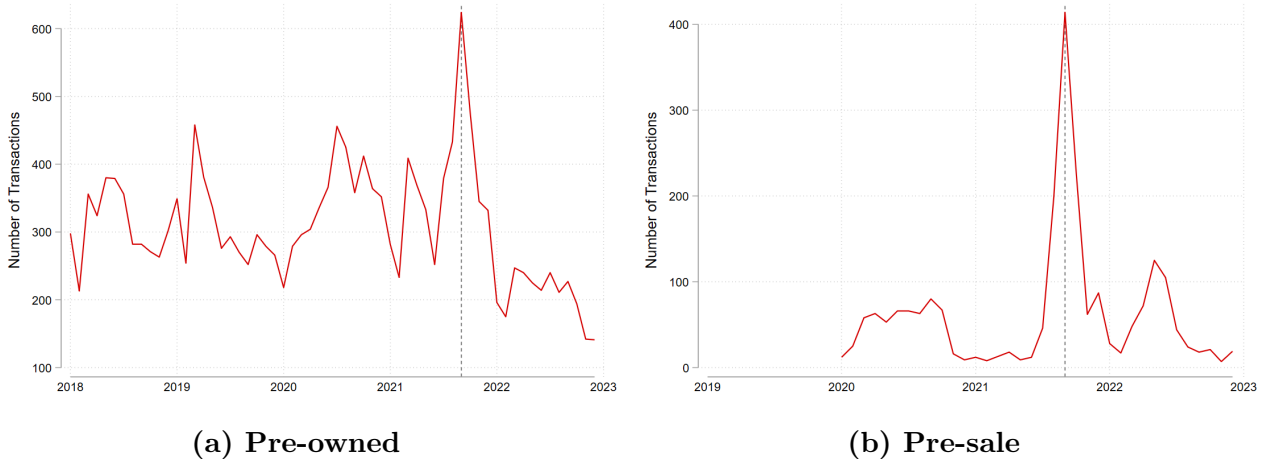


Figure 3: Average monthly volume

ment. Specifically, we estimate the following econometric model:

$$\log(p_{ijkt}) = \sum_{\substack{\tau=-q \\ \tau \neq -1}}^m \beta_{\tau} \cdot D_k \cdot \mathbf{1}(t - t_j^* = \tau) + \mathbf{x}_{ijkt}\boldsymbol{\beta} + \gamma_{jk} + \delta_t + \epsilon_{ijkt} \quad (1)$$

where $\log(p_{ijkt})$ is the natural log of the house price for the i^{th} transaction with property type j located in township k and time t . \mathbf{x}_{ijkt} is a set of observed property characteristics such as age, number of rooms, and size. Main independent variables are interaction terms between D_j and $\mathbf{1}(t - t_j^*)$. D_j is a binary indicator equal to 1 if the property is located at treated district, Nanzi district. $\mathbf{1}(t - t_j^*)$ is a dummy variable indicating specific number of months relative to t_j^* , September 2021. Accordingly, τ represents the number of months before or after the event.

Coefficients of interest are β_{τ} , which capture the differentials, relative to the omitted month $\tau = -1$, in log price between treated and untreated properties at different month. Estimates of β_{τ} when $\tau < -1$ are used to assess the pre-trend similarities.

We also control for unobserved heterogeneity using various levels of fixed effects. Time-invariant market and property type heterogeneity will be absorbed by γ_{jk} while δ_t captures time-specific shocks, such as interest rates, roll-outs of new regulations, or pandemic situations, common to all properties. Finally, ϵ_{ijkt} is an unobserved error terms. I would use

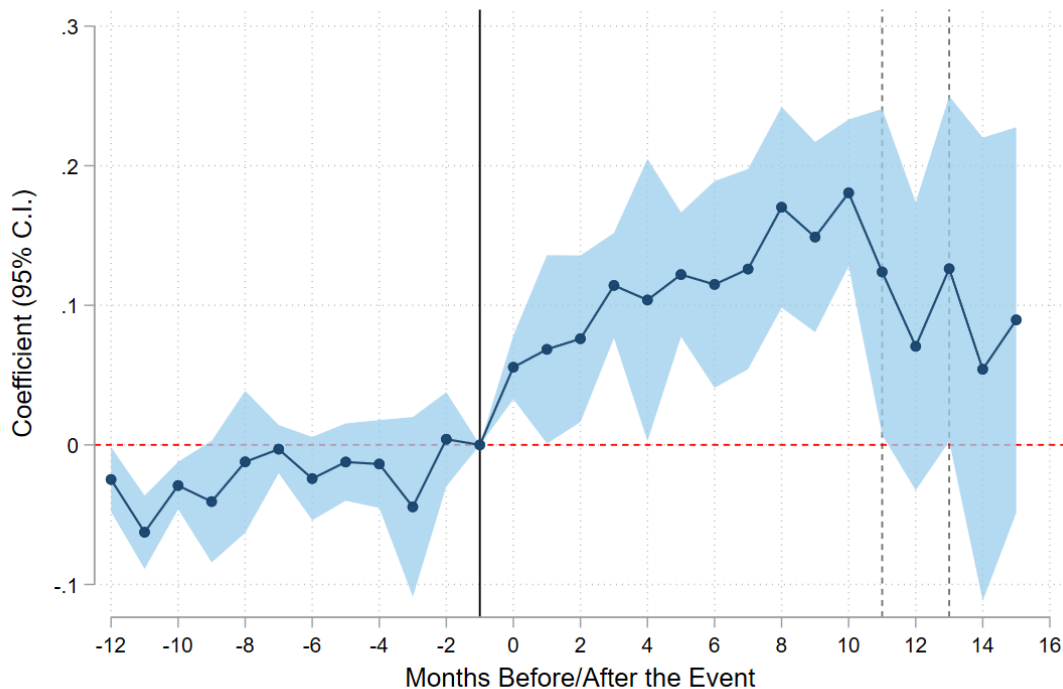


Figure 4: Event-study results for pre-owned properties

Notes: This figure plots estimated coefficient β_τ along with their 95% confidence intervals for Equation (1). Outcome variable is the log of sale prices for pre-owned properties.

robust standard errors clustered at market and property levels to allow for heteroskedasticity and correlations within clusters.

4.2 Results

To explore the dynamic responses to a series information revelation, we first estimate Equation (1) using pre-owned transactions and plot estimated coefficients, β_τ , along with their 95% confidence intervals in Figure 4. The evolution of estimated β_τ immediately provides several insights. First, point estimates in post-announcement periods are all positive and most of them are statistically significant. In particular, we find around 5% decreases of average transaction prices in Nanzi District relative to other untreated areas. The price differentials continue to increase gradually to around 15% until rumors of potential adjustments

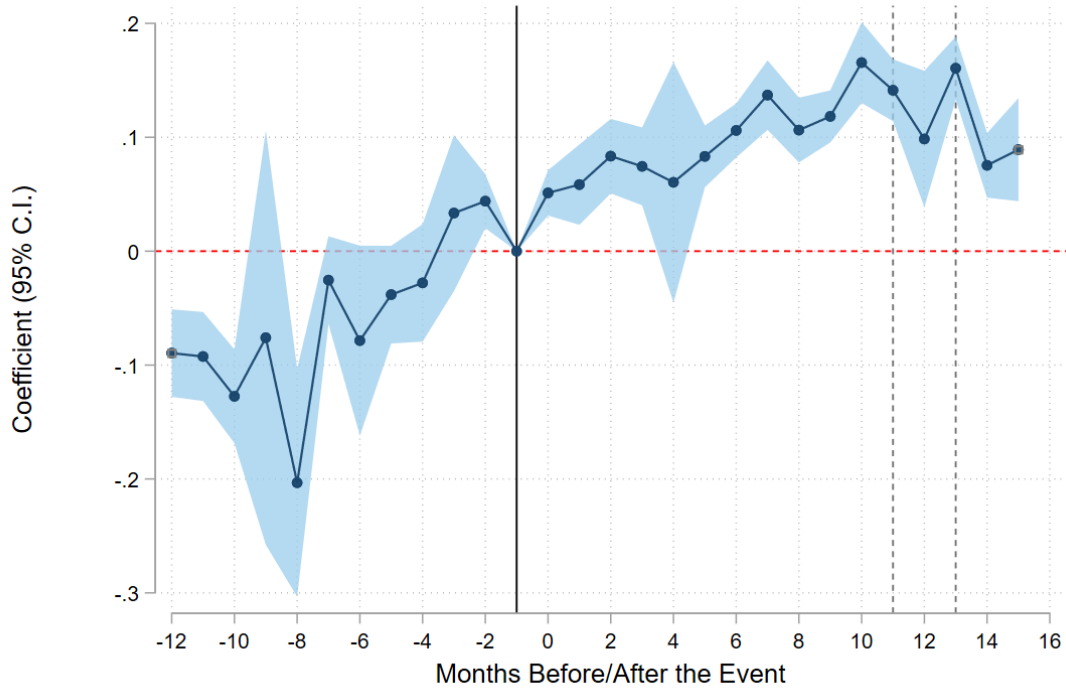


Figure 5: Event-study results for pre-sale properties

Notes: This figure plots estimated coefficient β_τ along with their 95% confidence intervals for Equation (1). Outcome variable is the log of sale prices for pre-sale properties.

to the construction plan. The largest drop took place right after October 2022 when TSMC announced cuts in capital expenditures including delay of 7nm fab in Nazi.

Figure 5 shows differentials in pre-sale market. The evolution of point estimates are similar to those in pre-owned market despite the fact 95% confidence intervals in pre-sales market are much tighter. Drops in price differentials are also larger around 10% in November 2022.

5 Concluding Remarks

work in progress

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