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The retail dynamics of Business Improvement Districts:

A quantitative analysis of the relationship between Dutch BIDs and retail mix

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ABSTRACT

Business Improvement Districts (BIDs) are place-based policies targeting underdeveloped business areas by enhancing employment, spatial quality, and real estate values in target areas. Dutch BIDs are unique in the way they are entrepreneur-driven, law-protected, and reduce free-rider behaviour among businesses. This research analyses the relationship between Dutch "Bedrijveninvesteringszones" and the retail diversity in BIDs versus shopping areas using difference-in-differences methods. Retail diversity as urban amenity is defined through a reciprocal of the Herfindahl-Hirschman Index, MIX. Data are collected on retail and catering industry businesses, BIDs, and shopping areas from the period 2008-2021. Results of this research conclude that BID cause shopping areas to become more homogenous, indicating an overall decreasing amount of retail diversity in Dutch shopping areas with an even greater decrease in BIDs. Moreover, findings suggest spillover effects from BIDs into neighbouring shopping areas, as retail diversity develops more similar than the retail diversity compared to non-adjacent shopping areas. BIDs in large cities such as Amsterdam, Rotterdam and The Hague have been found to retain their retail diversity better than BIDs in other urban areas. By providing these insights, this research makes valuable contributions to existing literature on the effectiveness of BIDs and their relationship with development trends of commercial real estate.

Keywords: Business Improvement Districts, shopping areas, retail diversity, difference-in-differences

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1 INTRODUCTION

1.1 Motivation

Shopping areas form an indispensable part of our built environment. They are locations where supply and demand meet most directly. Despite the rise of e-shopping, physical shopping areas in the form of high streets, malls and markets are often located in strategic, central locations. This is the result of retail firms benefitting from a concentration of shops (Koster et al., 2019). While some shopping areas thrive however, others decline, with contemporary shopping areas competing with modern shopping centres for customers (Ozuduru et al., 2014). Knowledge of how a shopping area succeeds is therefore highly relevant. Factors that affect shopping areas have been studied extensively. The success of a shopping area depends on a multitude of factors, with the most important ones being location, property values and the diversity of the retail mix (Jones et al., 2016; Ng, 2003; Teller & Elms, 2010). Next to this, high concentrations of stores resulting in higher footfall and overall spatial attractiveness play valuable roles. Furthermore, a diverse retail mix contributes to an area's resilience to economic fluctuations, revitalizing undeveloped shopping areas. While more homogenous shopping areas might have businesses with more aligned interests, a lack of diversification does expose these shopping areas to the risk of sector-specific economic downturns. Recent trends in the Netherlands reveal an increasing amount of shops from large brands which fall under a small number of corporate umbrellas dictating the retail landscape (RTL Nieuws, 2024). Despite consumers having access to a greater diversity of goods than ever, shopping malls and high streets appear to become more standardized than ever. Policy-makers have employed various strategies in an effort to revitalize underdeveloped shopping areas or further strengthen shopping areas that are succeeding. Place-based policies, and more specifically Business Improvement Districts (BIDs), are important instruments within these efforts (Hack, 2013; Neumark & Simpson, 2014; Kudla, 2022). Using these instruments, specific types of businesses can be attracted to or withheld from BIDs, through for example subsidies, in order to balance the retail diversity and therefore enhance the performance of shopping areas.

Business Improvement Districts (BIDs) have emerged as place-based policies that specifically aim to improve the performance of businesses in target areas. They emerged in the 1970s in Canada, were introduced in the United States the years after and later adapted all around the world. BIDs are targeted towards improving business, combatting crime or the enhancement of wealth (Kudla, 2022). These policies do not replace services provided through the public domain, but rather serve as an add-on for further improvement (Cellini & Nobre, 2023). Studies find BIDs to contribute to real estate values in neighbourhoods (Ellen et al.,2007; Elmedni et al., 2018). These are the result of demand effects from neighbourhood improvements through BIDs. It is therefore also argued that they could pave the way for gentrification processes, as increased property values reduce the share of social housing (Cellini & Nobre, 2023). While beneficial, these initiatives however introduce the risk of free-rider behaviour,

where businesses reap the benefits without contributing to the costs. Free-rider behaviour arises when there is no strong relationship between the contribution that is made and the good or service that is enjoyed through this contribution (Hansmann, 1980). BIDs attempt to mitigate this problem with the clear definition of the boundaries of a geographical target area, mandating participating businesses in the target area to make contributions by law. Therefore, a stronger connection is developed between the contribution that a business makes and the benefits that can be reaped as a result of this. This research aims to uncover the effectiveness of Dutch BIDs in shopping areas in relationship to the retail diversity in these designated areas when compared to shopping areas.

1.2 Academic relevance

In urban economics, place-based policies (PBPs) are generally referred to as governmental interventions to improve the economic performance of a given area (Neumark & Simpson, 2014). They are intended to help the residents of an area by fostering economic growth and social wealth, for example by combatting unemployment through the creation of jobs or improve living quality through investments in public infrastructure (Duranton & Venables, 2018). Recent literature finds that PBPs targeted towards areas that typically tend to underperform compared to surrounding areas, as they often are deteriorating CBDs or disadvantaged regions (Bartik, 2020). The performance of place-based policies however is subject to discussion in academic literature, as their effectiveness is heavily disputed. The potential benefits of PBPs are both financial and non-financial. While financial benefits are well-quantifiable, non-financial benefits however are more difficult to measure. It is challenging to prove that benefits outweigh costs, and therefore researchers question the effectiveness of PBPs (Andini & Blasio, 2016; Duranton & Venables, 2018). Despite this, BIDs can be a valuable tool for urban regeneration, with their flexibility allowing them to adapt to local conditions and focus on crime prevention, environmental improvements, and promoting local businesses (Symes & Steel, 2003). Faggio (2022) examines the impact of BIDs on crime in England and Wales. This research finds that BID formation leads to a significant decrease in crime, particularly in shoplifting, anti-social behavior, and public order-related offenses, while also noting evidence of crime diversion to neighboring commercial areas. Adverse effects of BIDs are also prevalent. For example, Sutton (2014) finds that BIDs in New York City depress retail sales volumes and employment within BIDs regardless of area size. Problems in the establishment of BIDs can arise in disadvantaged neighbourhoods. Low-income neighbourhoods in Los Angeles face challenges in forming business improvement districts due to disengaged property owners, spatial conflicts, and scepticism towards government agencies (Lee, 2016). Another studied effect of BIDs are stigmas. A risk of the focus of BIDs on underperforming or deteriorating areas is that it may induce a stigma on the targeted area, as the fact that place-based policies are implemented points towards spatial disparities between the target area and other areas. In extreme cases this stigma effect could even lead to a decrease in housing prices (Koster & Van Ommeren, 2023). In the Netherlands, a specific type of BID is aimed towards the improvement of both industrial and retail areas, known as the

"Bedrijveninvesteringszone". These aim to address some of the previously discussed problems with BID establishment and organization. Though prior research has extensively examined BIDs abroad, Dutch BIDs and their respective effects remain understudied (De Vries, 2016; Schneider, 2023).

1.3 Context

The Dutch "Bedrijveninvesteringszone" or 'BIZ' is unique in the way it is proposed, structured and organized. These zones consist of two different groups: industrial and retail, with this research being focused on the latter. They were introduced in the Netherlands in 2009 through an experimental law, becoming an official law in 2015 (Berndsen et al., 2012; Wettenbank, 2015). Where originally local governments can be recognized as the main driving force behind contemporary Business Improvement Districts, business owners themselves can be considered the driving force behind these particular BIDs (Schneider, 2023). Once a target area has been delineated, businesses can vote for or against the implementation of the BID, requiring a majority under at least a 66% attendance rate. If successful, the BID is in place for 5 years, mandating participating businesses to contribute between twenty-five to multiple thousands of euros annually (BedrijvenInvesteringsZone, 2016). The height of this contribution is often derived from the "WOZ-waarde" or property value of the building a business is situated in (Berndsen et al., 2012). Another voting round is held after these five years to decide upon an extension of the BID. In the majority of cases, the BID is extended for another five years while in some cases the BID ceases to exist (Schneider, 2023). The objectives of these Dutch BIDs or "Bedrijveninvesteringszones" are in line with other BIDs, with investments in security, greenery, promotion or events. From both the perspective of municipalities and businesses it is generally agreed upon that the benefits of BIDs outweigh the costs, though this is difficult to quantify (Berndsen et al., 2012). Further research into the effects of BIDs, particularly in the context of retail diversity, could assist in answering this important question regarding the costs and benefits of BIDs. This could make a valuable contribution to the decision-making process of policy-makers, businesses and municipalities when it comes to the establishment and operation of PBPs such as BIDs.

1.4 Research problem statement

While previous studies have examined the economic effects of BIDs abroad, few instances of these efforts exist within the Netherlands. In the Netherlands, previous research has mainly been concerned with the effect of BIDs on rental prices and vacancy rates of commercial real estate (De Vries, 2016; Schneider, 2023). This research aims to build upon the evidence presented by these papers and other existing literature. This paper aims to explore a different potential effect of shopping area BIDs, namely on the retail diversity of these areas when compared to other shopping areas. Do Business Improvement Districts cause shopping areas to become more homogenous or heterogeneous? Can similar effects be observed in shopping areas surrounding BIDs and how does this compare to other shopping areas in the Netherlands? Can varying results be observed in different types of cities? By

conducting this research, important insights into the Dutch retail landscape can be gained, providing further explanation on how retail and BIDs are related to each other. A valuable contribution to the justification of PBPs such as BIDs can therefore be made. Based on the societal and academic relevance surrounding the research problem as described above, the following main research question is proposed. This question has been subdivided into three sub-questions.

What is the relationship between Dutch shopping area Business Improvement Districts and the development of retail mix in the retail and catering industry of BIDs?

1. *What is the theory on BIDs and the diversity of retail properties in these zones?*

This sub-question is concerned with the theoretical component of this research. A connection is drawn between existing research on the effects of BIDs on property values, vacancy rates and retail activity in the Netherlands and abroad.

2. *What is the relationship between Dutch BIDs and the retail diversity in shopping areas expressed by the MIX?*

The empirical analysis of this research is highlighted by the second sub-question. Three datasets will be combined to obtain a unique combination of data on Dutch retail BIDs, shopping areas and businesses in these areas. Using difference-in-differences methods, a quantitative analysis will be conducted. Insights into the development of the retail diversity in the research areas over the years will be gained while also accounting for factors such as large cities and business size.

3. *Can different effects be observed that can be attributed to this relationship, such as spillovers or differences between large Dutch cities and other urban areas?*

With the third and final sub-question, this research aims to conduct deeper empirical analysis in an effort to uncover the potential spillover effects of Dutch retail BIDs, as these areas may have linear borders but their effects do not. By making a distinction between potential spillover shopping areas and non-spillover shopping areas and comparing results this sub-question can be answered. Furthermore, distinctions will be made between the three largest Dutch cities with BIDs and other areas in an effort to compare between larger and smaller urban areas to potentially uncover differing effects depending on spatial context.

1.5 Paper outline

The remainder of this paper is organized as follows. In next chapter, the theoretical framework is established, a literature review is conducted and hypotheses are proposed. A research model will also be provided. The methodology and data are discussed in Chapter 3. The results are presented and discussed in Chapter 4. Limitations of this research will also be addressed in this chapter. This paper wraps up by presenting conclusions in Chapter 5.

2 THEORY, LITERATURE REVIEW & HYPOTHESES

In this chapter, a theoretical framework and hypotheses will be established for the research topic of interest, which will form the basis for the quantitative analysis of this paper. An explanation of place-based policies along with their benefits and drawbacks will be provided. The position of Dutch shopping area BIDs and their opportunities and risks will be discussed within the context of place-based policies. Connections with existing literature will be made. This chapter will therefore provide an answer for the first sub-question of this paper.

2.1 Retail diversity

It has been theorized that consumers prefer shopping areas with a greater diversity to those with lower diversity (Glaeser et al., 2001). Diversity is viewed as an urban amenity, as it attracts consumers to cities. Furthermore, a concentration of retailers can create a shopping area that attracts more customers collectively than individual stores would in isolation (Koster et al., 2019). A higher retail diversity should therefore contribute to higher amounts of customers in shopping areas, resulting in improved real estate performance in terms of rents and vacancy rates. While increased diversity can be observed store types and locations, a trend towards homogenization through global brands and chain stores is also prevalent (Barata-Salgueiro & Erkin, 2014). Whereas BIDs are generally found in city centres, a trend of retail diversity moving towards more peripheral locations is observed. It can therefore be theorized that overall retail diversity does not disappear, it merely moves to a different location. Diverse BIDs typically experience lower vacancy rates compared to less diverse shopping areas. A study by Sutton (2014) finds that BIDs with a mix of at least 8 different retail categories had 15% lower vacancy rates on average than comparable non-BID areas. BIDs with higher retail diversity command higher rental rates. Research by Mitchell (2008) shows that for every additional retail category present in a BID, average commercial rents increased by 2-3%. Zhang et al. (2020) study the relationship between tenant mix and retail rents in high street shopping districts in the Netherlands. This was achieved by establishing shopping areas from a certain threshold of shopping activity, followed by calculating the tenant mix for each of these shopping areas. They argue that greater diversity in retail tenants contributes to the image and attractiveness of these districts, ultimately leading to higher retail rents. BIDs been theorized to have a relationship with retail diversity in shopping areas. Successful BIDs often lead to higher retail rents and increased business activity, but challenges in formation and management can limit their effectiveness, particularly in disadvantaged neighbourhoods (Lee, 2016). While they generally enhance the attractiveness and economic value of retail districts through improved safety and environment, their impact on retail diversity can be mixed, similar to the impact of place-based policies in general (Kline & Moretti, 2013). The defined geographical boundaries of BIDs may not always align with functional economic areas, potentially leading to inefficiencies or spillover effects and therefore free-rider problems (Meltzer, 2012). While the free-rider problem within the BID may be resolved,

businesses may however choose to strategically locate themselves in areas directly surrounding BIDs. By doing so, these businesses can reap the benefits of BIDs without contributing to the costs. This negative impact makes it challenging to fully rid BIDs from free-rider behaviour, a problem which they specifically aim to resolve. Overall, BIDs are a valuable tool for urban regeneration, but their implementation and outcomes need careful consideration to maximize benefits for all stakeholders, including policy-makers, landowners and tenants. Existing literature demonstrates that, within place-based policies, BIDs with greater retail diversity tend to outperform both non-BID shopping areas and BIDs with less diverse retail mixes in several key metrics of commercial real estate performance. BIDs have the ability to either increase or decrease retail diversity depending on the shared interests of involved stakeholders.

2.2 Place-based policies

Place-based policies or PBPs have emerged as a significant approach in urban planning and economic development, with particular relevance to retail and catering industry (Neumark & Simpson, 2014). They are an important tool for policy-makers when developing agglomeration economies efforts to enhance welfare (Glaeser & Gottlieb, 2008). This makes them suitable for shopping areas, where concentrations of economic activity and employment are prevalent. They have been found to contribute to employment rates, though challenges persist in terms of targeting distressed areas and high job creation costs (Bartik, 2020). Place-based policies can improve local economic development, but their effectiveness depends on the specific policies and their effectiveness in addressing geographical differences in wages, income, and unemployment rates (Kline & Moretti, 2013). It is disputed which stakeholders experience the benefits of enhanced welfare which PBPs promise. Landowners may capitalize the benefits of PBPs into rents. While this contributes to real estate values, it comes at the cost of tenants. This could lead to spatial displacement effects, underlining the challenge of balancing local benefits with broader economic efficiency (Glaeser & Gottlieb, 2008). PBPs in general offer numerous benefits, with more targeted PBPs having emerged in the form of BIDs, which specifically address the previously mentioned risks and limitations.

2.3 Business Improvement Districts (BIDs)

When it comes to the revitalization and growth of retail areas, Business Improvement Districts (BIDs) play a crucial role. BIDs can help internalize positive shopping externalities as described by Koster et al. (2016). They are common within urban areas with high commercial activity, with the purpose of addressing a decline in public resources and competition with suburban retail developments (Stokes, 2006). Early studies of BIDs point out that they can positively impact the entry, growth, and exit of retail establishments in downtown areas (Weisbrod, 1984). They also contribute to the growth of neighbourhood-level retail clusters, and their presence can influence land value and property

development (Yoon, 2018). BIDs are more likely to form in neighborhoods with more commercial space, homogeneity in service and spending preferences, and signs of appreciation and growth (Meltzer, 2012). The Dutch government capitalized on these BID characteristics by introducing and experimental law in 2009, (Berndsen et al., 2012). The official law on Dutch BIDs was introduced in 2015 (Wettenbank, 2015). Since, research has been conducted on Dutch BIDs and the relationship with commercial real estate (De Vries, 2016; Schneider, 2023). Berndsen et al. (2012) finds high diversity to be counterproductive towards the establishment of BIDs because of differing sizes, business types and ambitions. Since these BIDs are entrepreneur-driven the initial idea of forming one heavily relies on the ambitions of businesses in a given shopping area. The municipality plays a crucial role in the generation support for BID establishment and facilitating the organizational infrastructure required for such a policy (Berndsen et al., 2012).

De Vries (2016) is the first to conduct research into the economic impact of BIDs on the rental prices of commercial real estate in the Netherlands. Traditionally, Dutch business associations invest contributions in public goods, such as security and promotion of the shopping district. However, the non-excludable nature of these public goods leads to a free-rider behaviour, potentially causing the dissolution of business associations. BIDs aim to address this problem by making participation fees mandatory throughout the area. The study found that while industrial estate BIDs have a positive impact on rents, shopping area BIDs have a negative impact. Unprofitable BIDs have not been voted out over time in the Netherlands, indicating challenges in the voting process. The negative impact of shopping area BIDs on rental prices may be caused by the coordination advantage they bring, allowing businesses to lobby collectively for lower rents. The research suggests the importance of investigating the impact of BIDs on retail vacancy rates. The interplay between rents and vacancy rates significantly influences the dynamics of retail and industrial real estate sectors. Higher rents, while advantageous for property owners and investors, may impose burdens on tenants, particularly small businesses. Conversely, lower rents have the potential to enhance market stability by attracting a diverse tenant base, therefore potentially enhancing retail diversity. Vacancy rates serve as indicators of the balance between property supply and demand, affecting property values and serving as economic parameters. Low vacancy rates foster investor confidence and support local businesses, whereas high vacancy rates present challenges for existing businesses.

Schneider (2023) investigates the impact of Business Improvement Districts (BIDs) on rents and vacancy rates in the Netherlands, a research topic which is pointed out by De Vries (2016). BIDs represent a policy strategy aimed at optimizing the provision of public goods within municipalities, requiring firms to contribute an additional mandatory contribution. This contribution is then invested in local public goods specific to the shopping area, with the primary goal of overcoming free-rider behaviour. Examples of such goods include security facilities, public spaces maintenance, and district branding. The empirical analysis employed difference-in-differences methods to measure the economic

effects of BIDs, comparing commercial property rents and vacancy rates in districts with and without BIDs, which were found to be significant. Commercial property rents are chosen as the primary measure, reflecting the anticipated impacts of BIDs, while vacancy rates provide additional insights into market dynamics.

2.4 Hypotheses

Even though customers might favour a great diversity of shops in close proximity to each other according to Glaeser et al. (2001), the organizational structure of BIDs in shopping areas favours businesses with aligned interests and greater cohesiveness (Berndsen et al., 2012). BIDs operate on a collective decision-making model where property owners and businesses within a defined area agree to pay additional fees to fund improvements and services (De Vries, 2016; Schneider, 2023). This shared investment creates an incentive for businesses to support initiatives that benefit the majority (Kudla, 2022). This collective approach naturally favours businesses with similar goals and interests, as they need to agree on shared priorities whereas other shopping areas do not have this obligation. Combined with trends towards more homogenous high streets with large brands rather than smaller shops and trends towards decentralized retail diversity (Barata-Salgueiro & Erkin, 2014) the first hypothesis can be derived:

Hypothesis 1*: There is a negative relationship between the establishment of BIDs in Dutch shopping areas and retail diversity.*

The negative relationship from Hypothesis 1 may vary depending on spatial context however. While the overall trend may be decreasing retail diversity, the extent of this development could for example be more prevalent in smaller urban areas as compared to large cities. These large cities with strong agglomeration economies and high concentrations of urban amenities could stand a better chance at retaining their retail diversity given their high concentration of shopping areas, offering greater shopping externalities to retail firms in large cities (Glaeser et al., 2001; Koster et al., 2016). Therefore the following hypothesis can be derived:

Hypothesis 2*: The retail diversity trends of BIDs differ between large Dutch cities and other urban areas.*

3 DATA AND METHODOLOGY

3.1 Context

In this chapter, the data, methods and model utilized in this research are discussed. In an effort to answer the main research question and sub-questions, a quantitative research approach is performed using difference-in-differences method. It is therefore valuable in answering the research question concerning the relationship between the input variable, Dutch shopping area BIDs, and the outcome variable, the retail diversity, as compared to other shopping areas. Three secondary datasets have been compiled, which have been used for analysis in both ArcGIS Pro and Stata.

3.2 Data collection

LISA data

The first dataset is compiled by Stichting Lisa (LISA, 2024), spans from 2008 to 2021 and contains 1,851,908 observations. Landelijk InformatieSysteem Arbeidsplaatsen (LISA) collects establishment level data on businesses located in the Netherlands. This dataset contains point level data of Dutch businesses with detailed information regarding location, employment and business type. This combination of geodata and socio-economic data is unique within the Netherlands. Together with the other two datasets included in this research, this allows for a unique analysis of BIDs and retail diversity. In the LISA data, companies have been organized according to the SBI-codes (Standaard Bedrijfsindeling), which specify the exact nature of a company's business to a great amount of detail (Chamber of Commerce, 2021). For this research, businesses from the retail and catering industry have been selected from this dataset corresponding to the 2- to 5-digit SBI-codes (Appendix A). Only businesses that are situated within the research areas in municipalities that contain BIDs have been considered for this research. (Figure 1). This results in 432,745 observations after cleaning the data such that it is limited to the research area.

BID data

The second dataset has been utilized in previous research by Schneider (2023), which is based on information on BIDs collected by Buisman (2023) throughout the existence of Dutch BIDs. This dataset contains a detailed list of both shopping and industrial area BIDs in the Netherlands that were started between 2010 and 2019. BIDs in industrial areas have been left out of this research, as the relationship between BIDs and retail diversity in shopping areas rather than industrial areas is the main focus of this research. For each of the 208 shopping area BIDs, the municipality, start year, end year,

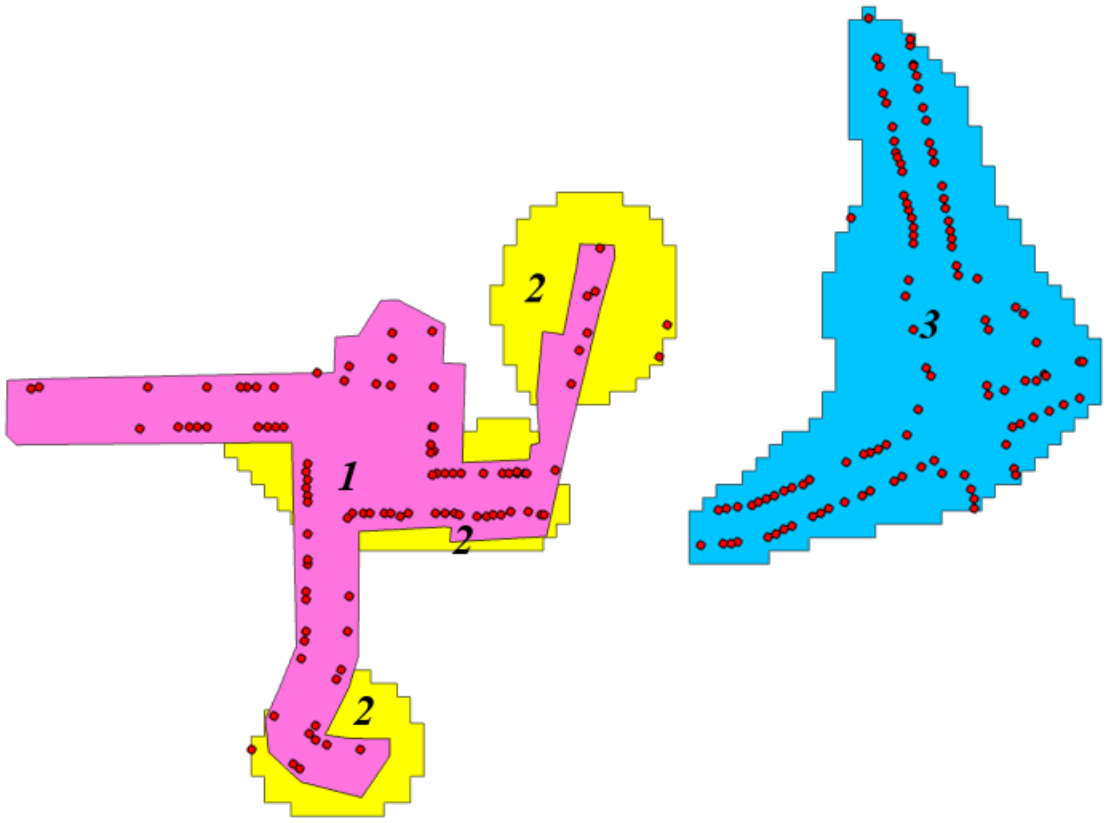
BID type (industrial or retail) along with a shapefile has been reported.[1] The research is limited to Dutch municipalities containing BIDs (Appendix B). Though BIDs themselves have a linear border, their effects might go beyond these borders, as suggested by Meltzer (2012). These effects have been considered in the comparison with shopping areas.

Shopping area data

The third and final dataset concerns shopping areas in the Netherlands (Zhang et al., 2020). The polygons represent shopping areas based on granular data describing the density of shopping activity in Dutch cities. A threshold of the concentration of shopping activity has to be reached in order for businesses to be part of a shopping area. The shapefiles in this dataset detail 1,091 individual shopping areas from 2013 after data cleaning. These shopping areas form the control group of this research, being compared to the BIDs as treatment group.

[1] It should be noted that the total amount of retail and industrial BIDs of the Netherlands has increased by around 25% since 2019 to almost 400 BIDs. This growth is not covered by this research but does show further adoption of BIDs in the Netherlands.

3.3 Methodology



Note: Schematic map of the research area of interest: 1) BIDs, 2) Shopping areas intersecting BIDs, 3) Shopping areas not intersecting BIDs and red dots indicating LISA data points for businesses in the retail and catering industry.

FIGURE 1: SCHEMATIC MAP OF RESEARCH AREAS

By compiling all three datasets, it becomes possible to analyse retail diversity of BIDs compared to other shopping areas based on businesses that are situated in the BID- and shopping area-shapefiles from the second and third dataset using the XY-coordinates provided by the first dataset. While observations from both the businesses level and area level are collected, the statistical analysis is conducted on the area level. Using the coordinates, every business in the retail or catering industry within a Dutch retail BID can be plotted in one of three research area types. The first area type is the BID, the second is adjacent shopping areas and the third is non-adjacent shopping area types. The BID is the treatment group, while both adjacent and non-adjacent shopping areas function as control groups for the analysis. The manner in which these data points and areas are spatially related to each other in this paper are visualized by a schematic map (Figure 1). This map indicates the spatial relationship between the area level data and the point level data. A full extent of the research area can be viewed in Appendix B. This spatial analysis is conducted through ArcGIS Pro, while the statistical analysis has been conducted in Stata. The syntax for the statistical analysis can be observed in Appendix C. The spatial analysis results in three different area types as visualized in Figure 1. These can be compared to shopping areas

from Zhang et al. (2020) with their respective retail and catering industry businesses both adjacent and non-adjacent to BIDs. By making this distinction between different types of shopping areas, potential spillover effects of BIDs into surrounding shopping areas can be analysed. While spillover effects have been suggested by Melzer (2012) on the business level, this research aims to analyse this on the area level. While the Netherlands is described as the research focus area, only Dutch municipalities containing retail BIDs at any point in time from 2008 to 2021 have been included. As previously stated, LISA point data have been limited to businesses that are situated in one of the three area types (Figure 1).

Once these datasets have been combined in ArcGIS Pro, the merged dataset is transferred to Stata. By using difference-in-differences (DiD) methods on provided by Callaway & Sant'Anna (2021), the treatment effect of BIDs on retail and catering industry businesses can be analysed. The difference-in-differences (DiD) method is a commonly used quasi-experimental research design used to estimate causal effects. It compares outcomes between treated and untreated groups before and after treatment, capturing the difference in trends over time. It is therefore very suitable for measuring the effect of Dutch BIDs on the retail diversity. Older difference-in-differences methods have been deemed unsuitable for this research, as they wrongfully assume that the BID treatment happens at the same time across the treatment group (Donald & Lang, 2007). This is not the case, as areas become BIDs over the course of various years between 2010 and 2019. Using these older methods would therefore increase the risk of unreliable results as the models do not perfectly distinguish between the control and treatment group, as some areas that eventually become a BID will already have been treated as a BID or vice versa. A modernized difference-in-differences addresses this fundamental problem. This newer DiD method by Sant'Anna & Zhao (2020) and Callaway & Sant'Anna (2021) addresses this problem as it accepts different treatment times for the observations across the control and treatment groups for the models, making it extremely suitable for this research.

The definition of retail diversity used for this research is similar to the one defined by Zhang et al. (2020) through a reciprocal of the Herfindahl-Hirschman Index (HHI). The HHI is a quantitative tool used to measure market concentration and assess competitive dynamics within industries. It is therefore suitable for calculating retail diversity for every area across all three area types. Its calculation and interpretation provide valuable insights into the diversity of businesses in different retail areas. By using the SBI-codes from the LISA data, the market share of each type of business can be calculated per area type across the years. The calculation is as follows:

$$MIX_{jt} = \frac{1}{\sum_{t=1}^{m}(\frac{B_{ljt}}{B_{jt}})^2} \quad (1)$$

Where:

- MIX_{jt} represents the retail diversity, expressed through a reciprocal of the Herfindahl-Hirschman Index (HHI).
- B_{ljt} represents the count of retail properties in SBI sector *l* within shopping district *j* during year t
- B_{jt} denotes the total number of retail properties in shopping district *j* during year *t*

For this equation, the HHI is used as the denominator. The summation is performed over all m SBI sector classifications present in area *j* in year *t*. MIX_{jt} has a minimum value of 1. When MIX_{jt} equals 1, it indicates that all retail properties in shopping district *j* belong to a single SBI-class. As the retail activities in shopping district *j* become more diverse, the value of MIX_{jt} increases. A high MIX signifies a high diversity of retail and catering industry businesses in an area. It is a result of a multitude of SBI-codes in a given area. A BID or shopping area with a high MIX could therefore be described as heterogeneous. A low MIX indicates the opposite, hinting towards a more homogenous shopping area. The MIX captures fluctuations in retail diversity for all areas spread across the three area types from 2008 to 2021. By using this calculation on the defined research area, this research can contribute to existing research on BIDs as a whole, building on existing empirical research on retail rents and vacancy rates by introducing retail diversity per BID and shopping area as a new variable. Derived from the data and methods as described above, the empirical model is as follows:

$$Y_{it} = \alpha + \beta_1 bidpost + \mu_i + \theta_t + \varepsilon_{it} \quad (2)$$

Where:

- Y_{it} is the outcome variable for the retail diversity, expressed through the MIX per year *t* for area *i*.
- $\beta_1 bidpost$ is a dummy variable indicating the BID treatment per year *t* for an observation, based on the start year of the BID and the years after.
- μ_i is a dummy variable for BID or shopping area fixed effects *i*.
- θ_t denotes the time dummy variable for every year *t* from 2008 to 2021.
- ε_{it} is the error term capturing unobserved factors.

This empirical model examines the relationship between Dutch BIDs and the diversity of retail properties within these zones while controlling for other variables such as large cities, year of BID origination and the area type. The retail diversity, the outcome variable, is based off SBI-codes on the macro-level provided by the LISA data. It is expressed through the MIX, a reciprocal of the HHI. An

outcome of zero implies that there is no relationship between Dutch BIDs and the retail diversity. A positive outcome variable would suggest that Dutch BIDs cause retail properties within these zones to become more heterogeneous according to SBI-codes of retail properties located within these BIDs, while a negative outcome variable would suggest the opposite. The first area type, the BID, is the treatment group which is compared to different sets of control groups in Chapter 4.

3.4 Descriptive statistics

Tables 1-3 and Figure 2 describe the main characteristics of the data utilized in this research. In Table 1, the area types correspond with those illustrated in Figure 1. As area types 1 and 3 contain larger area sizes than area type 2, these capture more LISA data points than area type 2 (Figure 1). This uneven distribution will have implications for the results of this research. Table 1 shows BID data points regardless of whether a BID is active or not. LISA point data on retail and catering industry businesses has been distributed according to area type and year. The distribution of data across is relatively stable, contributing to the consistency of results. More than half of the LISA data points are situated in BIDs (Area type 1), while the smallest group of LISA data points can be found in shopping areas adjacent to BIDs (Area type 2), leaving 143,887 observations of the in total 432,745 observations in shopping areas not adjacent to BIDs (Area type 3).

TABLE 1: FREQUENCY OF LISA DATA POINTS ACROSS AREA TYPES PER YEAR

	AREA TYPE			
YEAR	**1**	**2**	**3**	**Total**
2008	16,862	3,866	9,895	30,623
2009	16,667	3,781	9,932	30,380
2010	16,814	3,802	10,095	30,711
2011	17,460	4,137	10,881	32,478
2012	17,431	4,098	10,881	32,410
2013	17,216	4,088	10,892	32,196
2014	17,043	4,049	10,645	31,737
2015	16,991	4,031	10,501	31,523
2016	16,785	3,973	10,412	31,170
2017	16,497	3,850	10,147	30,494
2018	16,436	3,882	10,093	30,411
2019	16,125	3,836	10,004	29,965
2020	15,864	3,813	9,802	29,479
2021	15,700	3,761	9,707	29,168
TOTAL	**233,891**	**54,967**	**143,887**	**432,745**

Note: N = 432,745 || 1) BIDs, 2) Shopping areas adjacent to BIDs, 3) Shopping areas not adjacent to BIDs

Table 2 describes the amount of areas per area type. Regardless of the year they were started, 208 retail BIDs have existed in the Netherlands up until 2019. The area type with the smallest sample size is adjacent shopping areas with 110 areas, while non-adjacent shopping areas is the largest with 981 areas for a total of 1299 different individual areas spread across the three different area types.

TABLE 2: FREQUENCY DISTRIBUTION OF AREAS ACROSS AREA TYPES

AREA TYPE	FREQ.	PERCENT
1	208	16.01
2	110	8.47
3	981	75.52
TOTAL	**1299**	**100.00**

Note: N = 1299 || 1) BIDs, 2) Shopping areas adjacent to BIDs, 3) Shopping areas not adjacent to BIDs.

Table 3 shows the increasing amount of LISA data points or businesses that become part of a BID over the course of time. The total frequency of 233,891 observations is the same as the total amount of businesses in area type 1 in Table 1. Since BIDs were started since 2010, no businesses fell within these areas in the years 2008 and 2009. In 2020 and 2021, a small decrease in the amount of businesses in BIDs can be observed, which can be attributed to some of the BIDs being voted out by their users.

TABLE 3: FREQUENCY DISTRIBUTION ACTIVE AND NON-ACTIVE BIDS PER YEAR

YEAR	NOT ACTIVE	ACTIVE	TOTAL
2008	16,862	0	16,862
2009	16,667	0	16,667
2010	16,024	790	16,814
2011	13,033	4,427	17,460
2012	10,453	6,978	17,431
2013	10,344	6,872	17,216
2014	10,251	6,792	17,043
2015	8,457	8,534	16,991
2016	7,206	9,579	16,785
2017	4,662	11,835	16,497
2018	2,645	13,791	16,436
2019	0	16,125	16,125
2020	0	15,864	15,864
2021	0	15,700	15,700
TOTAL	116,604	117,287	233,891

Note: N = 233,891 || 1) BIDs, 2) Shopping areas adjacent to BIDs, 3) Shopping areas not adjacent to BIDs.

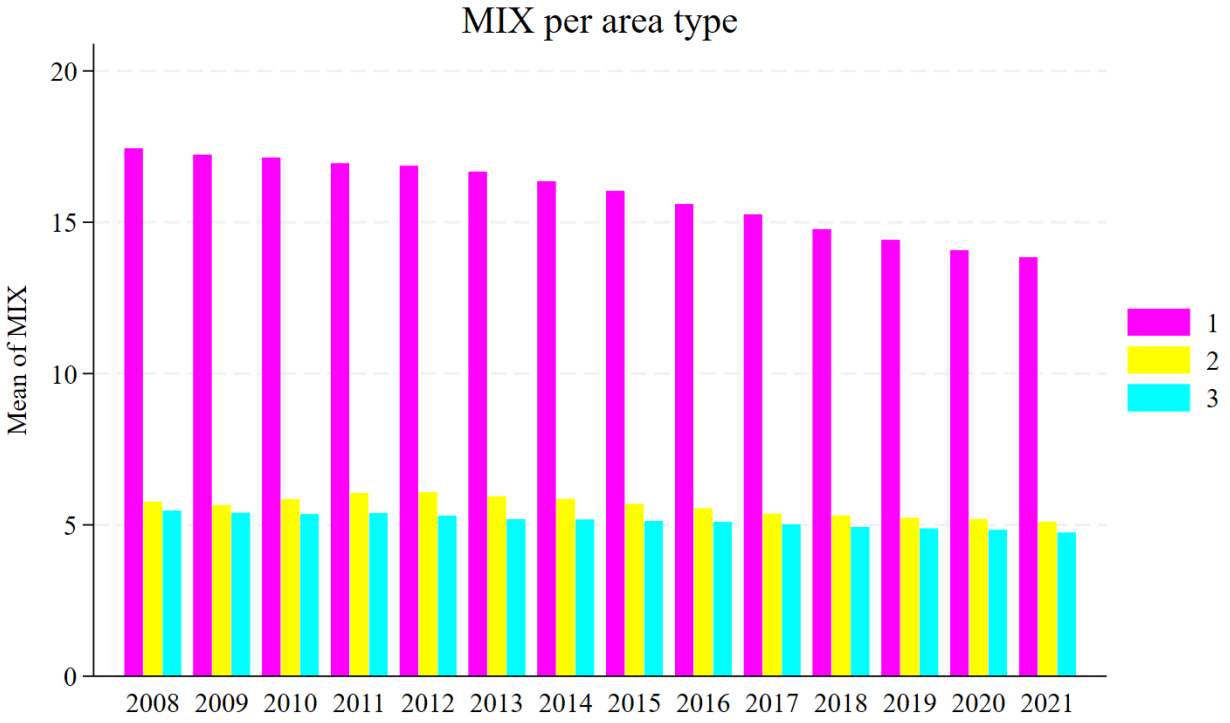


FIGURE 2: MEAN OF MIX PER AREA TYPE 2008-2021

Note: N = 18,490 || 1) BIDs, 2) Shopping areas adjacent to BIDs, 3) Shopping areas not adjacent to BIDs.

Figure 2 shows the mean MIX of all areas per area type over the period 2008-2021. The amount of observations (N = 18,490), which is the population considered for the statistical analysis, indicates the yearly replication of all areas (N = 1299) across the time period of this research. What can be observed is that the MIX of BIDs is considerably higher than that of both adjacent and non-adjacent shopping areas. The retail diversity of BIDs is therefore higher than other shopping areas. In 2008, the mean MIX for BIDs is 17.2, while in 2021 it has decreased to a value of 14.1. Though this is a decrease, the retail diversity is still generally high, especially compared to the other two area types. It could however be partially attributed to declining high streets, where many shops and stores have disappeared in favor of more peripheral retail locations that rely on car-dependency (Barata-Salgueiro & Erkin, 2014). Retail diversity is moving out of city centers, where BIDs are typically found. The mean MIX of the second and third area types, adjacent and non-adjacent shopping areas respectively, remains stable from 2008 to 2021. The MIX of area types 2 and 3 very slowly decreases from just above to just below 5. This is a considerable difference in retail diversity between the treatment and control groups. These numbers are important when reporting results in the following chapter, as they serve as the basis for signifying changes in the outcome variable.

3.5 Ethical considerations

Though this research does not contain data on the individual level, it does deal with sensitive information on the micro-economic level, from small to large businesses. The LISA dataset contains sensitive information on employment figures of Dutch retail and catering industry businesses across the period 2008-2021. This is information concerning the total amount of jobs along with full-time and part-time division, but also numbers on the amount of male and female employees. It is therefore important that careful considerations are being made to maintain full research integrity. This research has therefore removed all sensitive data such as business names and employment figures from the analysed dataset for privacy purposes, since these do not contribute to the results. The BID dataset and the shopping area dataset have, together with the LISA dataset, been used for academic purposes limited to this research only. These ethical considerations are in accordance with the "Netherlands Code of Conduct for Research Integrity" (VSNU, NFU, KNAW, NWO, VH., 2018).

4 RESULTS AND DISCUSSION

In this section, empirical findings from the analysis using the difference-in-differences (DiD) methods by Callaway & Sant'Anna (2021) are presented. This method allows us to estimate the effect of a shopping area becoming a BID on the retail diversity, expressed through the MIX, comparing the changes in outcomes over time between the treatment retail BIDs and the control shopping areas. The results are interpreted in the context of the estimated coefficients, focusing on the interaction term between the treatment and time indicators, which captures the differential effect of the intervention. Additionally, the implications of the findings are discussed in relation to the existing literature as discussed in the second chapter. In doing so, this chapter aims answers the second and third sub-question of this research.

Table 4 describes four different models that have been used for this research in this chapter. The first baseline model compares retail BIDs to both adjacent and non-adjacent shopping areas. This model serves to establish the main results, providing answers to the main research question and the second sub-question of this research. The second model compares retail BIDs to adjacent shopping areas as a means of uncovering potential spillover effects. The third model compares retail BIDs to non-adjacent shopping areas, therefore addressing the third sub-question. The third model serves multiple purposes. Firstly, it allows for a direct comparison between BIDs and non-adjacent shopping areas. Secondly, it serves as a comparison to the second model to measure the degree of potential spillover effects. The fourth and final model directly addresses the third sub-question. More specifically, it compares between the full set of control and treatment groups from the baseline model and a subset with identical parameters, which is limited to the three largest cities with BIDs: Amsterdam, Rotterdam and The Hague.

TABLE 4: EXPLANATION OF DIFFERENCE-IN-DIFFERENCES MODELS

Model	**Description**	**Explanation**
1	Area type 1 vs. Area type 2 and 3	BIDs vs. Adjacent and non-adjacent shopping areas
2	Area type 1 vs. Area type 2	BIDs vs. Adjacent shopping areas
3	Area type 1 vs. Area type 3	BIDs vs. Non-adjacent shopping areas
4	Area type 1 vs. Area type 2 and 3	Identical to model 1, large cities only

4.1 Main results

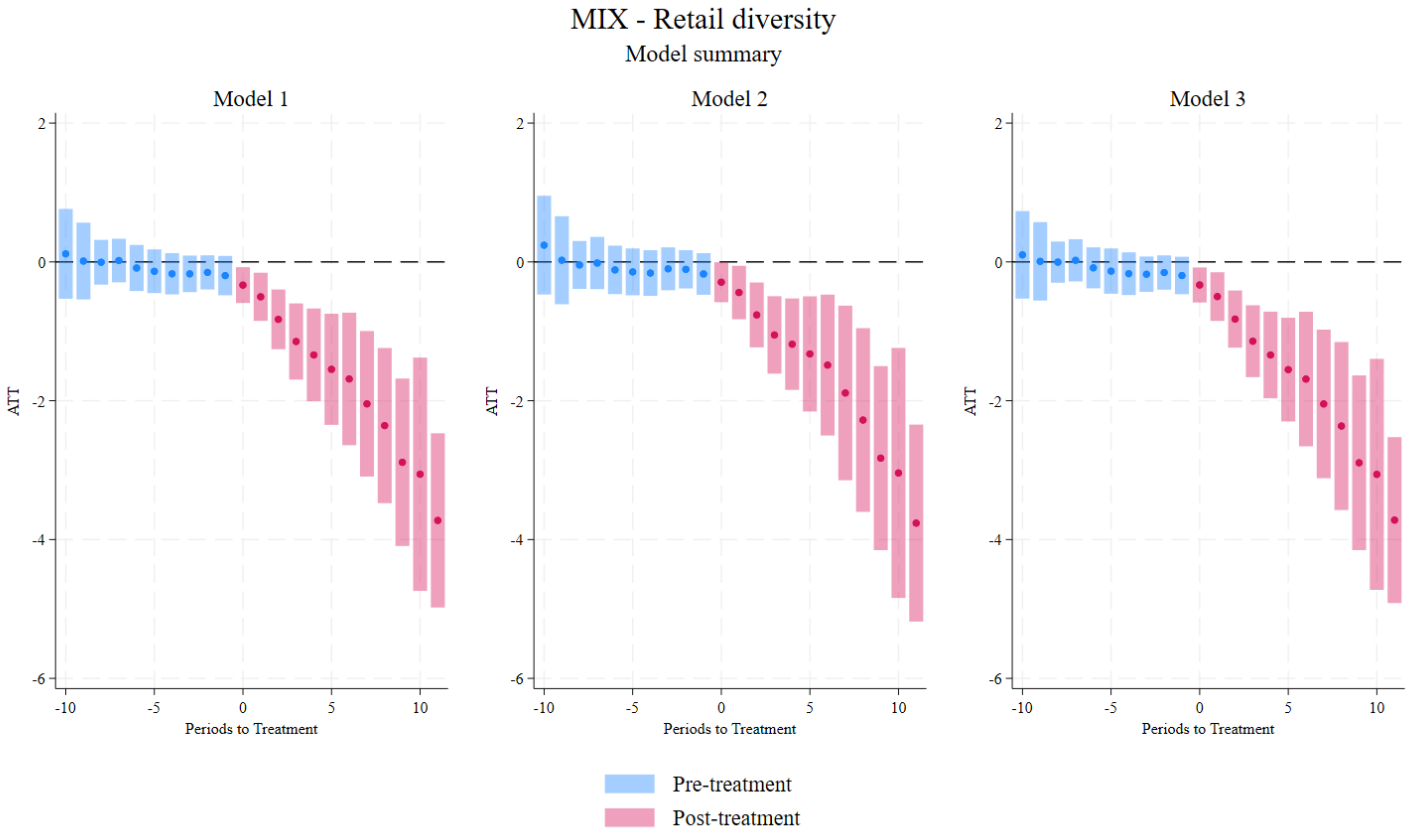


FIGURE 3: DID EVENT-STUDY GRAPH – MODEL 1, 2 & 3

Note: Event-study graph of the relationship between BIDs and the retail diversity. Models according to Table 4. ATT describes changes in the MIX of the treatment group compared to the control group. Periods to treatment in years.

Figure 3 is an event-study graph that visualizes the ATT (Average Treatment effect on the Treated) of the treatment group compared to the control groups, before and after the treatment effect of becoming a BID. The point estimates report the ATT relative to the treatment period, with the vertical bars representing the confidence interval for each point estimate. An ATT of 0 represents the retail diversity development expressed through the MIX that is identical to the control group. Prior to becoming a BID, the figure shows that the retail diversity develops in a similar way between treatment and control groups, given the stable ATT level around 0 and the narrow confidence intervals. This is important as it suggests non-violation of the parallel trend assumption, with the treatment and control groups showing similar retail diversity trends prior to treatment. After the BID treatment, BIDs as a treatment group start to deviate from the control group, showing an increasingly downward trend in the years following the BID treatment. The point estimates for years following BID treatment are paired with greater confidence intervals, showing increased variability over time. Model 2 has slightly larger confidence intervals, which can be attributed by the greater uncertainty which results from the smaller

sample size of this model compared to the other two models. These are summarized event-study graphs where the several different years of BID treatments have been combined into one plot. The results provide strong evidence for a negative impact of the treatment on retail diversity. This is underlined by the consistency across models and the clear divergence in trends post-treatment between BIDs and both adjacent and non-adjacent shopping areas. Detailed, per-year graphs for each of the three models capturing the treatment effect of BIDs providing further evidence have been reported in Appendix D. For every year new BIDs have been established, a separate event-study graph has been created. They provide further evidence for the decreasing trends in retail diversity as observed in Figure 3.

Table 5 reports the DiD estimates of the effect of Dutch retail BIDs on the retail diversity. The three models have the same parameters to those reported in Figure 3. The ATT is reported for each of the three models, along with the standard error. The treatment group is area type 1 representing the BIDs, which is same across the three models. The control group differs, with both area type 2 and 3 included in model 1. Model 2 and 3 treat area type 2 and 3 as individual control groups. The amount of observations varies across the models since each compares a different set of areas. Each of the three models is significant at $P < 0.001$. Model 1(-1.250***) and Model 3 (-1.250***) report the highest coefficient compared to Model 2 (-1.150***) reporting a lower ATT. As all ATTs are negative, the results can be interpreted as a decrease in the MIX and therefore the retail diversity of the areas. Standard errors for all three models are small, which is indicative of precise estimates. Next to the ATT, the Chi-square has also been reported in order to test for parallel assumptions. It assesses whether or not treatment and control groups were following similar trends before an intervention, which is the BID treatment in the case of this research. The Chi-square results of 75.9720, 56.7573 and 76.8680, combined with p-values of 0.0036, 0.1329 and 0.0029 respectively. This means that Model 1 and 3 have significant chi-square values while Model 2 has a non-significant chi-square. While Figure 3 reports very similar trends between treatment and control groups prior to treatment, the Table 5 suggests potential violations of the parallel trends assumption regarding Model 1 and 3. Therefore, the reported results require careful consideration. The parallel trends assumption is best satisfied by Model 2, as the value is non-significant. However, this could partially be attributed to the considerably smaller sample size compared to the other models. These models have been elaborated with greater detail in Appendix E, where per-year ATTs and standard errors are provided for all of the three models, along with period average ATTs from the first BID treatment year (2010) and onwards.

TABLE 5: DiD ESTIMATES - MODEL 1, 2 & 3

	(1)	(2)	(3)
Treatment	1	1	1
Control	2, 3	2	3
ATT	-1.250***	-1.150***	-1.250***
	(0.173)	(0.196)	(0.166)
Chi2	75.9720	56.7573	76.8680
Chi2 p-value	0.0036	0.1329	0.0029
Observations	18490	4435	16956
Shopping Area - Fixed effects	Yes	Yes	Yes
Year - Fixed effects	Yes	Yes	Yes

Standard errors in parentheses
** p < 0.05, ** p < 0.01, *** p < 0.001*

When compared to adjacent and/or non-adjacent shopping areas, retail in BIDs becomes more homogenous over time. This is especially interesting for policy-makers, landowners and tenants in commercial real estate interested in establishing BIDs. Since Berndsen et al. (2012) pointed out that the formation of BIDs is hindered by high amounts of diversity among businesses, it is surprising to observe that these results suggest that BIDs are capable of causing a shift in retail diversity trends towards a more homogenous shopping area. This could potentially lead to better cooperation among businesses in these shopping areas, as the interests of shops in more homogenous shopping areas become more aligned. These aligned interests could even result in influences over rent to a certain extent (De Vries, 2016). This is instrumental in the success of a BID (Melzer, 2012). Given the results that have been reported in Figure 3 and Table 5, the first hypothesis of this research can be confirmed: There is a significant negative relationship between the establishment of Dutch shopping area BIDs and the retail diversity in these areas when expressed through the MIX over the period 2008-2021.

4.2 Secondary results

Spillover effects

Though BIDs and shopping areas might have clear borders, their effects could possibly go beyond these borders. It is therefore important to consider spillover effects of BIDs. As reported in Table 5, the difference between BIDs and non-adjacent shopping areas in this regard is the greatest, with the difference between BIDs and adjacent shopping areas being less great. This suggests potential spillover effects of BIDs into adjacent shopping areas. A similar effect has been observed by Melzer (2012) on

the business level. The third model reports the same ATT as the baseline model (-1.250), with the second model deviating from this (-1.150). A z-test is performed to test for statistical significance between the two coefficients, which returns a z-statistic of 0.387 (Appendix C). The P-value of 0.699 indicates that the difference between the two coefficients is not statistically significant. This further underlined by the great overlaps in confidence intervals between the two models in Figure 3. While small differences in results occur between the models, the treatment effect remains relatively consistent across all subgroups. It does however indicate that the development of retail diversity is more similar between BIDs and adjacent shopping areas than between BIDs and non-adjacent shopping areas. Given the close geographical proximity, this suggests spillover effects from BIDs into neighbouring shopping areas. This could be attributed to far greater number of areas from area type 3 (N = 981) as compared to areas from area type 2 (N = 110). These numbers suggest an unfavourable balance in the number of observations across the different types of shopping areas. This effect could be further studied by developing a new model which allows for direct comparisons between adjacent and non-adjacent shopping areas. Within the current model however, this is not possible as this would be rejected because of collinearity since both types of shopping areas never become receive the BID treatment.

Large cities effects

For the third and final sub-question of research a deepened analysis using the methods from the second sub-question is required. While a negative relationship between the establishment of BIDs and the retail diversity in these shopping areas has been uncovered in the previous sub-chapter, other effects could also be at play in this relationship. One of these effects comes in the form of agglomeration sizes. Dutch BIDs are prevalent in both small towns and large cities, which could result in varying effects. Therefore, a subset of observations from the three largest Dutch cities with BIDs has been made. These cities are Amsterdam, Rotterdam and The Hague. Table 6 reports the DiD estimates of the baseline model (1) and the large cities model (4) which has the same parameters as the baseline model, but only contains observations from the largest three Dutch cities. The results are significant at the significance level $p < 0.001$. This indicates a very high relationship between the DiD estimates and the observations. The ATT of the fourth model is -1.030, which is a less negative value than the reported -1.250 by the baseline model. Similar to Table 5, the small standard errors in Table 6 indicate precise estimates. When comparing the coefficients for statistical significance through a z-test, a Z-statistic of 0.668 and a P-value of 0.504 are reported. Similar to the spillover effects, these results indicate that the coefficients are statistically insignificant from each other. Treatment effects across the different models remain consistent despite small differences in results. Given these results, the second hypothesis with relation to differing effects for large cities can be partially verified. This could be a result of the strong economic position of large Dutch cities and their agglomeration economies compared to other smaller urban areas in the Netherlands.

TABLE 6: DiD ESTIMATES - LARGE CITIES FIXED EFFECTS

	(1)	(4)
Treatment	1	1
Control	2, 3	2, 3
ATT	-1.250***	-1.030***
	(0.173)	(0.280)
Observations	18490	5229
Shopping Area - Fixed effects	Yes	Yes
Year - Fixed effects	Yes	Yes
Large cities - Fixed effects	No	Yes

Standard errors in parentheses
** p < 0.05, ** p < 0.01, *** p < 0.001*

4.3 Discussion and limitations

While the results report a decrease in retail diversity within both BIDs and shopping areas, this does have to mean that the retail diversity in an entire municipality or the entire country is in decline. It could be the case that retail diversity has simply moved elsewhere, for example to a peripheral area which is not captured within the spatial extent of this research (Barata-Salgueiro & Erkin, 2014).

What could be theorized is that a decrease in retail diversity is a result of the collaborative nature of BIDs themselves. Since businesses in these areas contribute towards similar goals, it therefore could cause these areas to become more homogenous when the interests of businesses in the areas become aligned (Berndsen et al., 2012). Therefore businesses gain the ability to strengthen their positions with regard to rents established in BIDs (De Vries, 2016). A significant influence of BIDs on commercial real estate rents is therefore concluded by existing literature (Schneider, 2023). The results that have been reported in this research support these earlier findings. Though the effects of an area becoming a BID on the retail diversity have been extensively covered by this research, the effects of a BID ceasing to exist have not been covered. This would introduce a second type of treatment. It has been left out of this research due to very low sample size (N = 11), as the vast majority of BIDs were still active in the final year provided by the BID data (2011-2019). Therefore no conclusions can be drawn on the effects of a shopping area not being a BID anymore. Other potential heterogeneous effects between BIDs and shopping also might have not been captured by the models presented in this research. Employment figures, business sizes and overall economic strength of shopping areas are other effects that have been theorized to partially influence the relationship that has been analysed.

One analysis problem that could be pointed out in this research is regraded to the parallel trends assumption. The location of BIDs within cities and towns across is mainly central, as the highest concentration of shops and therefore main shopping areas can be found in the centres of cities and towns throughout the country. The higher concentration of retail and catering industry businesses could be interpreted as a higher chance of observing higher retail diversity in these areas. This would hint towards a selection bias, as BIDs would have a higher retail diversity, expressed through the MIX, and therefore more retail diversity to lose by default, invalidating the results reported in this chapter. The event-study graph in Figure 3 however shows that prior to BID treatment, retail diversity remains on a similar level to very high degree of certainty across both control and treatment groups across models 1, 2 and 3. Careful consideration is required however, as the chi-square tests in Table 5 point towards potential violation of this parallel trend assumption. This does however disregard the idea that BIDs lose more retail diversity compared to other shopping area simply because they are more diverse to begin with. The reason for this is that the development of retail diversity based on the MIX is similar across both control and treatment groups as observed in Figure 3.

5 CONCLUSION

The goal of this research was to build upon existing research on the effectiveness of Business Improvement Districts (BIDs), particularly in the Netherlands. It therefore builds on existing research on the influence of BIDs on commercial real estate. Through the combination of three different datasets, a unique combination of data offered an opportunity to gain a deeper understanding of the relationship between shopping area BIDs and the retail diversity in these areas as compared to shopping areas in Dutch municipalities containing BIDs. This has been achieved by calculating MIX, a reciprocal of the Herfindahl-Hirschman Index (HHI) for retail diversity in each of the research areas and using modern difference-in-differences methods to measure the treatment effects over the research period spanning from 2008 to 2021, comparing between treatment and control groups. The treatment group consists of the BIDs, while the control group consists of adjacent and non-adjacent shopping areas.

The results of this research show that BIDs cause shopping areas to become significantly more homogenous as compared to both adjacent and non-adjacent shopping areas between 2008 and 2021. While existing literature suggests that consumers prefer diverse shopping areas, other research underlines that the collaborative and local nature of BIDs is the most effective when businesses in target areas are similar to an extent that their interests are aligned. It is more effective for similar shops to agree on shared interests within a BID. The baseline model (1) revealed that the MIX of a BID decreases by -1.250 more over the same period than the MIX of adjacent and non-adjacent shopping areas. The mean MIX for BIDs decreased from 17.2 in 2008 to 14.1 in 2021, a decrease of 3.1 points. The reported ATT of -1.250 suggests that 40,2% (1.250 / 3.1) of this decrease can be attributed to the BID treatment, compared to the control groups. When distinguishing between adjacent and non-adjacent shopping areas in model (2) and model (3), a difference in effects becomes between the two control groups. While non-adjacent shopping areas retain the same -1.250 as the baseline model (1), model (2) reports an ATT of -1.150. The -1.150 ATT indicates that BIDs experienced a greater decrease in retail diversity compared to non-adjacent shopping areas, despite this area type showing little change in diversity over time. Given that the initial MIX for BIDs was considerably higher with a mean of 17.2 compared to the control groups, with a mean of around 5-5.5, the ATTs represent a significant reduction in retail diversity for BIDs as the treatment group, bringing them closer to the diversity levels of the control groups over time. However, even with this decrease, BIDs still maintain a much higher retail diversity by the end of the period compared to the other area types. Though the difference between these ATTs is statistically insignificant, this does suggest that the MIX trend in the period 2008-2021 is more similar between BIDs and adjacent shopping areas than BIDs and non-adjacent shopping areas. It is therefore suggested that BIDs have moderate spillover effects into neighbouring shopping areas to some extent on the area level, which reflects previous research into this effect on the business level. The observed difference is larger between BIDs and non-adjacent shopping areas than between BIDs and adjacent shopping areas, indicating that a spillover effect from BIDs to retail and catering industry in shopping areas in close

proximity might be prevalent. In addition to this, BIDs in larger cities such as Amsterdam, Rotterdam and The Hague tend to retain their retail diversity better than smaller cities as smaller decreases have been observed. This is likely the result of a strong economic position in the Dutch retail landscape. Given these suggested effects, policy-makers, landowners and tenants have to make careful considerations when considering setting up a BID for a shopping area, since this will have implications for retail diversity as an urban amenity. Retail diversity is an important factor to consider for BIDs in shopping areas as it directly affects resilience to changing economic conditions and the attraction of customers. The spatial context is also very much relevant, as city size is also found to have an impact on the effects of BIDs on retail diversity.

Future research could build upon the results that have been presented in this research by extending the timeline to more recent years. New BIDs could be incorporated, along with new trends in retail diversity to see whether shopping areas have become more homogenous or heterogeneous instead in the years since 2021. Additional research is required to address these effects in greater detail on the business-level. Effects on employment and specific business types and sizes could be the subject of further empirical studies using LISA data. On an international level, comparisons could be drawn between the influence of Dutch BIDs on shopping areas to similar place-based policies abroad and their respective retail and catering industry. Furthermore, the effect of the COVID-19 pandemic on the relationship between BIDs and retail diversity in Dutch shopping areas could be captured. This would be the subject of an entirely worthwhile research project. While this research has limited itself to retail BIDs in the Netherlands, industrial area BIDs could be also be a research topic of interest. While the dynamics may differ from the retail and catering industry business, the trends of diversity of businesses in industrial area BIDs in the Netherlands could be studied using similar difference-in-differences methods, drawing comparisons with non-BID industrial areas across the country.

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APPENDICES

APPENDIX A: SBI-CODES

Selection of SBI-codes taken from Chamber of Commerce (2021). The MIX has been calculated using these SBI-codes. A selection of SBI-codes have been crossed through since certain types of retail and catering industry businesses were deemed unsuitable for this research.

47	**DETAILHANDEL (NIET IN AUTO'S)**
47.1	Supermarkten, warenhuizen en dergelijke winkels met een algemeen assortiment
47.11	Supermarkten en dergelijke winkels met een algemeen assortiment voedings- en genotmiddelen
47.19	Warenhuizen en dergelijke winkels met een algemeen assortiment non-food
47.19.1	Warenhuizen
47.19.2	Winkels met een algemeen assortiment non-food (geen warenhuizen)
47.2	Gespecialiseerde winkels in voedings- en genotmiddelen
47.21	Winkels in aardappelen, groenten en fruit
47.22	Winkels in vlees en vleeswaren, wild en gevogelte
47.22.1	Winkels in vlees en vleeswaren
47.22.2	Winkels in wild en gevogelte
47.23	Winkels in vis
47.24	Winkels in brood, banket, chocolade en suikerwerk
47.24.1	Winkels in brood en banket
47.24.2	Winkels in chocolade en suikerwerk
47.25	Winkels in dranken
47.26	Winkels in tabaksproducten
47.29	Gespecialiseerde winkels in overige voedings- en genotmiddelen
47.29.1	Winkels in kaas
47.29.2	Winkels in natuurvoeding en reformartikelen
47.29.3	Winkels in buitenlandse voedingsmiddelen
47.29.9	Gespecialiseerde winkels in overige voedings- en genotmiddelen (rest)
47.3	~~Benzinestations~~
47.30	~~Benzinestations~~
47.4	Winkels in consumentenelektronica
47.41	Winkels in computers, randapparatuur en software
47.42	Winkels in telecommunicatieapparatuur
47.43	Winkels in audio- en videoapparatuur of in een algemeen assortiment van wit- en bruingoed
47.43.1	Winkels in audio- en videoapparatuur
47.43.2	Winkels in een algemeen assortiment van wit- en bruingoed
47.5	Winkels in overige huishoudelijke artikelen

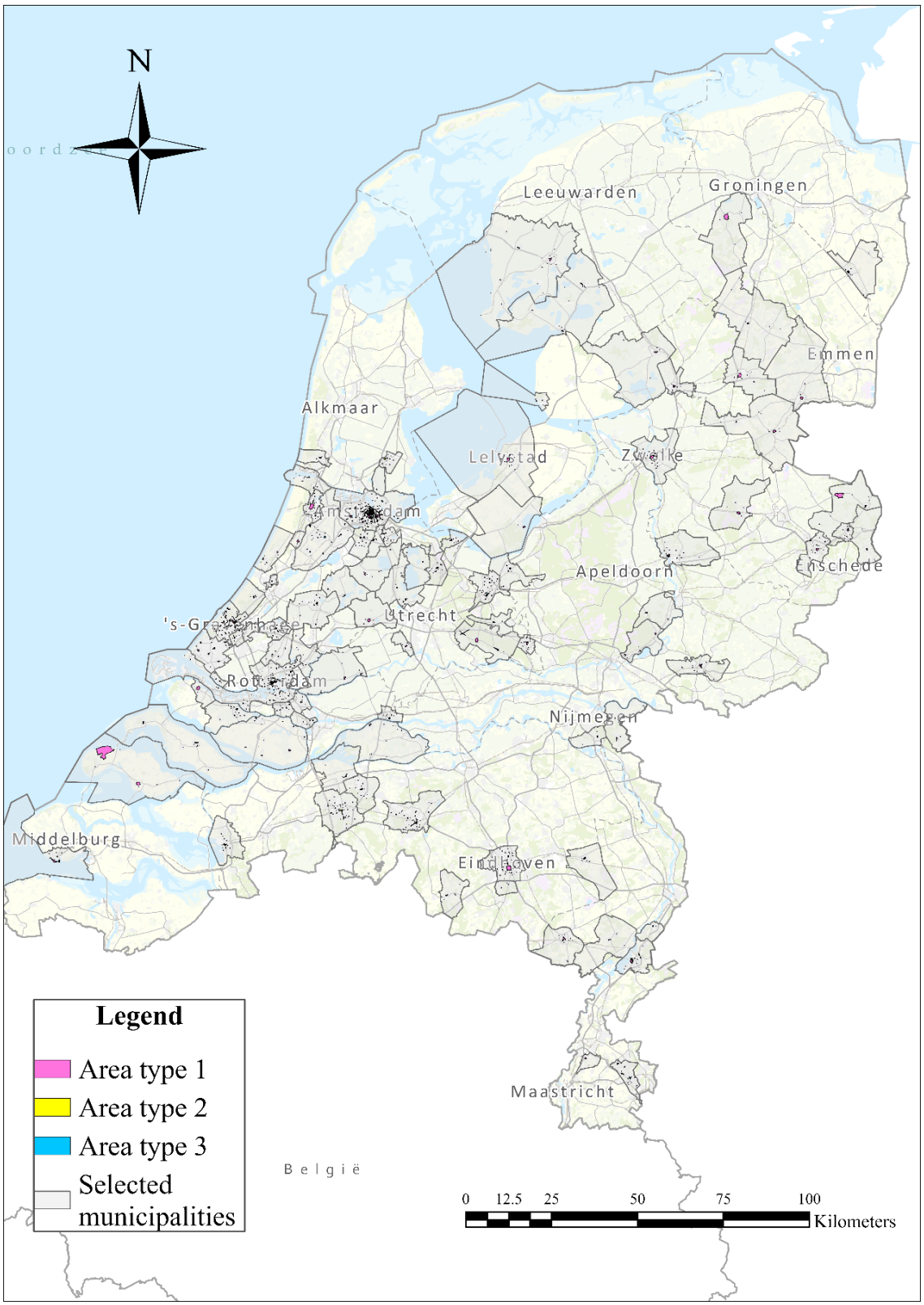
47.51	Winkels in kledingstoffen, huishoudtextiel en fournituren
47.51.1	Winkels in kledingstoffen
47.51.2	Winkels in huishoudtextiel
47.51.3	Winkels in breiwol, handwerken en fournituren
47.52	Winkels in doe-het-zelfartikelen
47.52.1	Winkels in ijzerwaren en gereedschappen
47.52.2	Winkels in verf, verfwaren en behang
47.52.3	Winkels in houten bouw- en tuinmaterialen
47.52.4	Winkels in tegels
47.52.5	Winkels in keukens
47.52.6	Winkels in parket-, laminaat- en kurkvloeren
47.52.7	Winkels gespecialiseerd in overige doe-het-zelfartikelen
47.52.8	Bouwmarkten en andere winkels in bouwmaterialen algemeen assortiment
47.53	Winkels in vloerbedekking en gordijnen
47.54	Winkels in elektrische huishoudelijke apparatuur en onderdelen daarvoor
47.54.1	Winkels in witgoed
47.54.2	Winkels in naai- en breimachines
47.54.3	Winkels in overige elektrische huishoudelijke apparatuur
47.54.4	Winkels in onderdelen voor elektrische huishoudelijke apparatuur
47.59	Winkels in meubels, verlichting en overige huishoudelijke artikelen (rest)
47.59.1	Winkels in meubels
47.59.2	Winkels in verlichtingsartikelen
47.59.3	Winkels in artikelen voor woninginrichting algemeen assortiment
47.59.4	Winkels in muziekinstrumenten
47.59.5	Winkels in glas-, porselein- en aardewerk
47.59.6	Winkels gespecialiseerd in overige huishoudelijke artikelen (rest)
47.59.7	Winkels in huishoudelijke artikelen algemeen assortiment
47.6	Winkels in lectuur, sport-, kampeer- en recreatieartikelen
47.61	Winkels in boeken
47.62	Winkels in kranten, tijdschriften en kantoorbehoeften
47.63	Winkels in audio- en video-opnamen
47.64	Winkels in fietsen en bromfietsen, sport- en kampeerartikelen en boten
47.64.1	Winkels in fietsen en bromfietsen
47.64.2	Winkels in watersportartikelen
47.64.3	Winkels in sportartikelen (geen watersport)
47.64.4	Winkels in kampeerartikelen (geen caravans)
47.65	Winkels in speelgoed
47.7	Winkels in overige artikelen
47.71	Winkels in kleding en modeartikelen; textielsupermarkten
47.71.1	Winkels in herenkleding
47.71.2	Winkels in dameskleding
47.71.3	Winkels in bovenkleding en modeartikelen (algemeen assortiment)
47.71.4	Winkels in baby- en kinderkleding
47.71.5	Winkels in babyartikelen algemeen assortiment
47.71.6	Winkels in onderkleding, lingerie e.d.
47.71.7	Winkels in modeartikelen

47.71.8	Textielsupermarkten
47.72	Winkels in schoenen en lederwaren
47.72.1	Winkels in schoenen
47.72.2	Winkels in lederwaren en reisartikelen
47.73	Apotheken
47.74	Winkels in drogisterij-, medische en orthopedische artikelen
47.74.1	Winkels in drogisterij-artikelen
47.74.2	Winkels in medische en orthopedische artikelen
47.75	Winkels in parfums en cosmetica
47.76	Winkels in bloemen, planten, zaden, tuinbenodigdheden, huisdieren en dierbenodigdheden
47.76.1	Winkels in bloemen en planten, zaden en tuinbenodigdheden
47.76.2	Tuincentra
47.76.3	Winkels in dieren, dierbenodigdheden en hengelsportartikelen
47.77	Winkels in juweliersartikelen en uurwerken
47.78	Winkels in overige artikelen (rest)
47.78.1	Winkels in fotografische artikelen
47.78.2	Winkels in optische artikelen
47.78.3	Winkels in schilderijen, lijsten, prenten, kunstvoorwerpen en religieuze artikelen
47.78.9	Winkels gespecialiseerd in overige artikelen (rest)
47.79	Winkels in antiek en tweedehands goederen
47.79.1	Winkels in antiek
47.79.2	Winkels in tweedehands kleding
47.79.3	Winkels in tweedehands goederen (geen kleding)
47.8	~~Markthandel~~
47.81	~~Markthandel in voedings- en genotmiddelen~~
47.81.1	~~Markthandel in aardappelen, groenten en fruit~~
47.81.9	~~Markthandel in overige voedings- en genotmiddelen~~
47.82	~~Markthandel in textiel, kleding en schoenen~~
47.89	~~Markthandel in non-food artikelen (geen textiel, kleding en schoenen)~~
47.89.1	~~Markthandel in bloemen, planten, zaden en tuinbenodigdheden~~
47.89.2	~~Markthandel in tweedehands goederen~~
47.89.9	~~Markthandel in overige goederen~~
47.9	~~Detailhandel niet via winkel of markt~~
47.91	~~Detailhandel via internet~~
47.91.1	~~Detailhandel via internet in voedingsmiddelen en drogisterijwaren~~
47.91.2	~~Detailhandel via internet in consumentenelektronica~~
47.91.3	~~Detailhandel via internet in boeken, tijdschriften, cd's, dvd's~~
47.91.4	~~Detailhandel via internet in kleding en mode-artikelen~~
47.91.5	~~Detailhandel via internet in huis- en tuinartikelen~~
47.91.6	~~Detailhandel via internet in vrijetijdsartikelen~~
47.91.8	~~Detailhandel via internet in overige non-food~~
47.91.9	~~Detailhandel via internet in een algemeen assortiment non-food~~
47.99	~~Colportage, straathandel en detailhandel via overige distributievormen~~
47.99.1	~~Colportage~~
47.99.2	~~Straathandel~~

47.99.9	~~Detailhandel via overige distributievormen~~

56	**EET- EN DRINKGELEGENHEDEN**
56.1	Restaurants, cafetaria’s e.d.
56.10	Restaurants, cafetaria’s e.d. en ijssalons
56.10.1	Restaurants
56.10.2	Fastfoodrestaurants, cafetaria's, ijssalons, eetkramen e.d.
56.2	~~Kantines en catering~~
56.21	~~Eventcatering~~
56.29	~~Kantines en contractcatering~~
56.3	Cafés
56.30	Cafés

APPENDIX B: MAP OF FULL EXTENT OF RESEARCH AREA



APPENDIX C: STATA SYNTAX

```
*******Master Thesis RES - BIDs and Retail diversity*******

*Frenk van Stipriaan*
*DO-file of statistical analysis*
*Date: 20240627*

***1. DATA SOURCES***

*1.1 SCHNEIDER (2023)*
*1.2 STICHTING LISA (2024)*
*1.3 ZHANG ET AL. (2020)*

***2. PREPARING STATA***

clear all
cd "C:\Users\Frenk\OneDrive\UNI\RES\Master's Thesis\MT DATA\MT Stata"
import excel "C:\Users\Frenk\OneDrive\UNI\RES\Master's Thesis\MT DATA\MT
Stata\MT_GEMBIZSHP_STATA", sheet("TABLE") firstrow

***3. DATA EXPLORATION***

browse
describe
summarize

***4. DROPPING, LABELING AND CHECKING EXISTING VARIABLES***

*DROP*

drop P

*LABEL*

label variable OBJECT_ID "Object ID"
label variable ZIP "ZIP-code"
label variable TOWN "Town"
label variable SBI "SBI-class"
label variable SIZE "Business size"
label variable LISA_ID "LISA ID"
label variable M2 "BAG Surface area"
label variable COROP_CODE "COROP Code"
label variable COROP "COROP"
label variable SBI_TYPE "Retail and catering industry type"
label variable YEAR "Year"
label variable GEM "Municipality"
label variable GEM_ID "Municipality ID"
label variable PROV_ID "Province ID"
label variable PROV "Province"
label variable BID_STATUS "BID - Status"
label variable BID_STATUSTYPE "BID - Status (Type)"
```

```
label variable BID_STARTYEAR "BID - Start year"
label variable BID_ENDYEAR "BID - End year"
label variable TYPE "Area type"
label variable TYPE_ID "Area ID"

*CHECK*

browse
describe
summarize

***5. DESCRIPTIVES (POINT DATA LEVEL)***

*Distribution of LISA data points across area types per year

tab YEAR TYPE
tabout YEAR TYPE using "Table1.txt", replace
graph bar (count), over(TYPE) over(YEAR)

***6. DATA PROCESSING***

*6.1 GENERATE DUMMY VARIABLES - BIZ, Shopping area, large cities, active*

*1) BID, 2) Shopping area/BID and 3) Shopping area/non-BID

tab TYPE, gen(TYPE_)
label variable TYPE_1 "Dummy - BID"
label variable TYPE_2 "Dummy - SHP/BID"
label variable TYPE_3 "Dummy - SHP/non-BID"

*Large cities - Amsterdam, Rotterdam and The Hague

gen dum_AMS = 0
replace dum_AMS = 1 if GEM == "Amsterdam"
gen dum_RTD = 0
replace dum_RTD = 1 if GEM == "Rotterdam"
gen dum_THG = 0
replace dum_THG = 1 if GEM == "'s-Gravenhage"
label variable dum_AMS "Dummy - Amsterdam"
label variable dum_RTD "Dummy - Rotterdam"
label variable dum_THG "Dummy - The Hague"

gen LARGE_CITY = 0
replace LARGE_CITY = 1 if dum_AMS == 1
replace LARGE_CITY = 1 if dum_RTD == 1
replace LARGE_CITY = 1 if dum_THG == 1
label variable LARGE_CITY "Large city - Fixed effects"

*BID - Active, Active since year x

replace BID_STARTYEAR = 0 if missing(BID_STARTYEAR)

gen BID = 0
replace BID = 1 if TYPE == 1
label variable BID "Dummy - Active BIDs (Ever)"
```

```
tab BID
gen BIDPOST = 0
replace BIDPOST = 1 if YEAR >= BID_STARTYEAR
label variable BIDPOST "Dummy - Active BIDs (Since)"
tab YEAR BIDPOST
tabout YEAR BIDPOST if TYPE == 1 using "Table3.txt", replace

*6.2 CALCULATE HERFINDAHL INDEX*

egen Total_TypeID_Year=count(LISA_ID), by(TYPE_ID YEAR)
egen SBI_TypeID_Year=count(LISA_ID), by(SBI TYPE_ID YEAR)
gen HHI_Step1=(SBI_TypeID_Year/Total_TypeID_Year)^2
br
bysort TYPE_ID YEAR SBI: gen ID_TEMP=_n if _n==1
replace HHI_Step1=. if ID_TEMP==.
egen HHI=sum(HHI_Step1),by(TYPE_ID YEAR)
bysort TYPE_ID YEAR: gen HHI_INDEX=1/HHI
collapse HHI_INDEX, by(YEAR BID_STARTYEAR TYPE TYPE_ID dum_AMS dum_RTD
dum_THG TYPE_1 TYPE_2 TYPE_3 BID BIDPOST)
label variable HHI_INDEX "HHI Index"
tab TYPE

save "C:\Users\Frenk\OneDrive\UNI\RES\Master's Thesis\MT DATA\MT Stata\MT DATASET
(collapsed).dta"
clear all
use "C:\Users\Frenk\OneDrive\UNI\RES\Master's Thesis\MT DATA\MT Stata\MT DATASET
(collapsed).dta"

***7. DESCRIPTIVES (AREA LEVEL)***

net install grc1leg, from( http://www.stata.com/users/vwiggins/)

rename HHI_INDEX HHI
browse

*Try log-transformation (unsuitable)

hist HHI, name(h01, replace) title("HHI") subtitle("per area")
gen lnHHI = ln(HHI)
label variable lnHHI "HHI Index (log)"

hist HHI, percent norm name(h01, replace) title("HHI") subtitle("per area")
hist lnHHI, percent norm name(h02, replace) title("HHI (log)") subtitle("per area")
grc1leg h01 h02, name(h0102, replace)
graph save h01h02, replace

*HHI descriptives

graph bar (mean) HHI, over (TYPE) over (YEAR) ascategory asyvars bar(1, fcolor(magenta)) bar(2,
fcolor(yellow)) bar(3, fcolor(cyan)) bargap(5) name(g01, replace) title ("HHI per area type") ytitle
("Mean of HHI")
graph bar (mean) lnHHI, over (TYPE) over (YEAR) ascategory asyvars bar(1, fcolor(magenta)) bar(2,
fcolor(yellow)) bar(3, fcolor(cyan)) bargap(5) name(g02, replace) title ("HHI per area type (log)")
ytitle ("Mean of HHI (log)")
grc1leg g01 g02, name(g0102, replace)
```

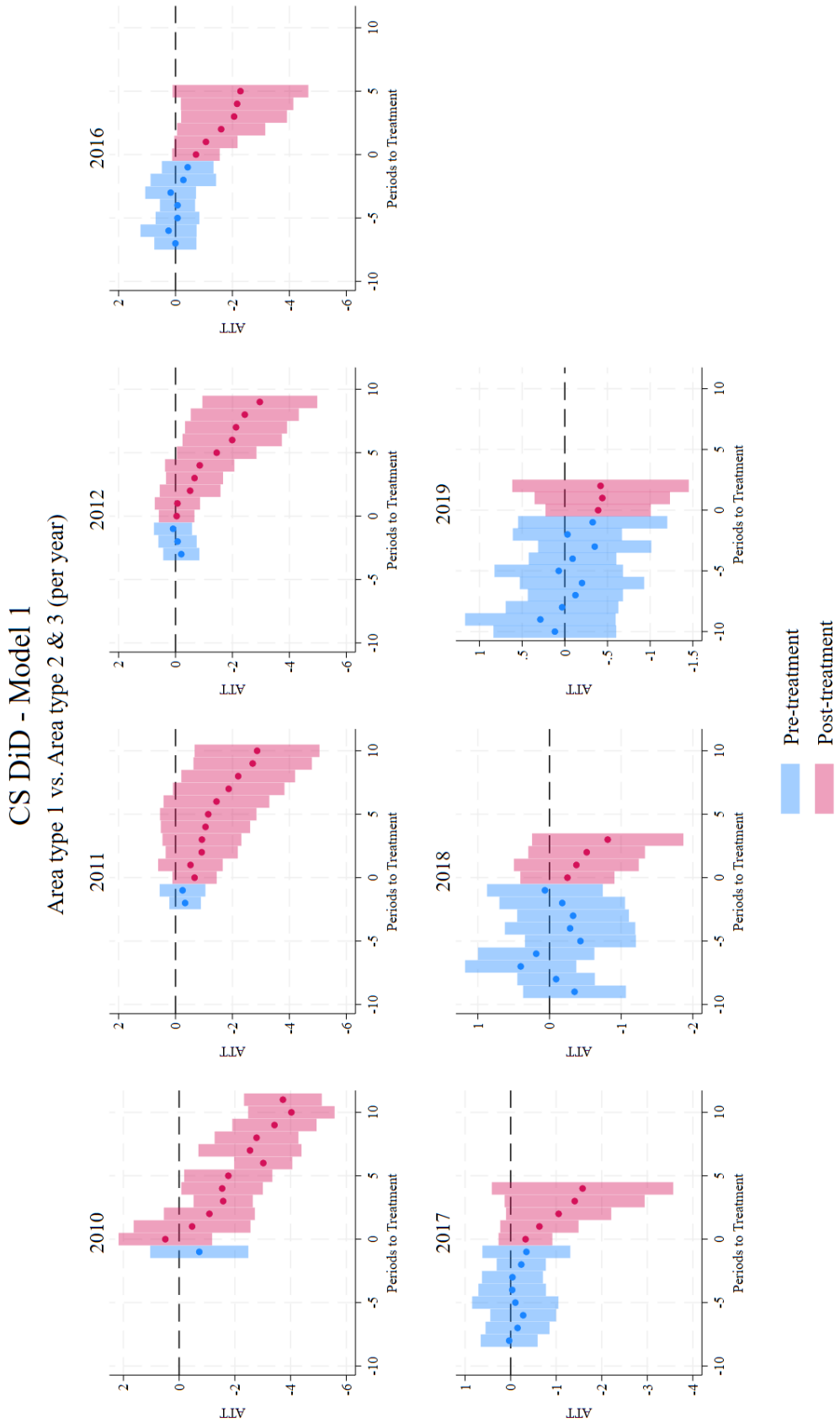
```
graph save g0102, replace

***8. STATISTICAL ANALYSIS***

ssc install estout
ssc install drdid
ssc install csdid
ssc install event_plot, replace
ssc install addplot

save "C:\Users\Frenk\OneDrive\UNI\RES\Master's Thesis\MT DATA\MT Stata\MT DATASET
(CSDID).dta", replace
clear all
use "C:\Users\Frenk\OneDrive\UNI\RES\Master's Thesis\MT DATA\MT Stata\MT DATASET
(CSDID).dta"

*8.1 Main results - Event-study graphs*

*Model 1

csdid HHI, ivar(TYPE_ID) time(YEAR) gvar(BID_STARTYEAR) method(dripw) notyet agg(simple)
saverif(CSDID_MODEL1) wboot replace rseed(1)
estimates store csmodel1

use "CSDID_MODEL1.dta", clear
csdid_stats simple , wboot rseed(1)
csdid_stats calendar, wboot rseed(1)
csdid_stats group, wboot rseed(1)
csdid_stats event, wboot rseed(1)
qui:csdid_stats event, wboot rseed(1)
csdid_plot, name(m10, replace) title ("Model 1")

qui:csdid_stats attgt, wboot rseed(1)
csdid_plot, group(2010) name(m11,replace) title("2010")
csdid_plot, group(2011) name(m12,replace) title("2011")
csdid_plot, group(2012) name(m13,replace) title("2012")
csdid_plot, group(2016) name(m14,replace) title("2016")
csdid_plot, group(2017) name(m15,replace) title("2017")
csdid_plot, group(2018) name(m16,replace) title("2018")
csdid_plot, group(2019) name(m17,replace) title("2019")
grc1leg m11 m12 m13 m14 m15 m16 m17, cols(4) xcommon scale(0.7) title("CS DiD - Model 1")
subtitle("Area type 1 vs. Area type 2 & 3 (per year)") legendfrom(m11)
graph save csdid01, replace

*Model 2

clear
use "C:\Users\Frenk\OneDrive\UNI\RES\Master's Thesis\MT DATA\MT Stata\MT DATASET
(CSDID).dta"

csdid HHI if TYPE==1 | TYPE==2, ivar(TYPE_ID) time(YEAR) gvar(BID_STARTYEAR)
method(dripw) notyet agg(simple) saverif(CSDID_MODEL2) wboot replace rseed(1)
estimates store csmodel2

use "CSDID_MODEL2.dta", clear
```

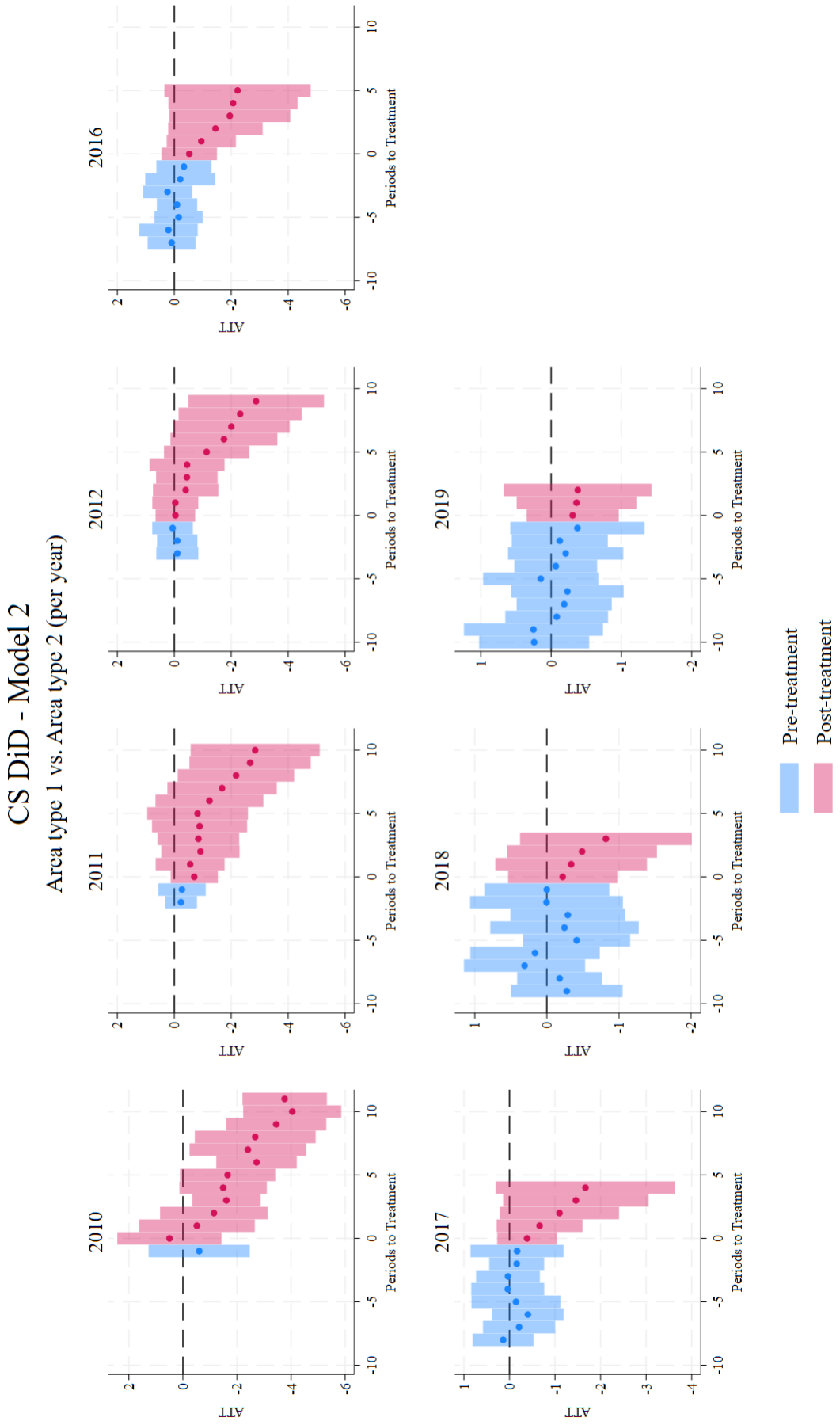
```
csdid_stats simple , wboot rseed(1)
csdid_stats calendar, wboot rseed(1)
csdid_stats group, wboot rseed(1)
csdid_stats event, wboot rseed(1)
qui:csdid_stats event, wboot rseed(1)
csdid_plot, name(m20, replace) title ("Model 2")

qui:csdid_stats attgt, wboot rseed(1)
csdid_plot, group(2010) name(m21,replace) title("2010")
csdid_plot, group(2011) name(m22,replace) title("2011")
csdid_plot, group(2012) name(m23,replace) title("2012")
csdid_plot, group(2016) name(m24,replace) title("2016")
csdid_plot, group(2017) name(m25,replace) title("2017")
csdid_plot, group(2018) name(m26,replace) title("2018")
csdid_plot, group(2019) name(m27,replace) title("2019")
grc1leg m21 m22 m23 m24 m25 m26 m27, cols(4) xcommon scale(0.7) title("CS DiD - Model 2")
subtitle("Area type 1 vs. Area type 2 (per year)") legendfrom(m21)
graph save csdid02, replace

*Model 3

clear
use "C:\Users\Frenk\OneDrive\UNI\RES\Master's Thesis\MT DATA\MT Stata\MT DATASET
(CSDID).dta"

csdid HHI if TYPE==1 | TYPE==3, ivar(TYPE_ID) time(YEAR) gvar(BID_STARTYEAR)
method(dripw) notyet agg(simple) saverif(CSDID_MODEL3) wboot replace rseed(1)
estimates store csmodel3

use "CSDID_MODEL3.dta", clear
csdid_stats simple , wboot rseed(1)
csdid_stats calendar, wboot rseed(1)
csdid_stats group, wboot rseed(1)
csdid_stats event, wboot rseed(1)
qui:csdid_stats event, wboot rseed(1)
csdid_plot, name(m30, replace) title ("Model 3")

qui:csdid_stats attgt, wboot rseed(1)
csdid_plot, group(2010) name(m31,replace) title("2010")
csdid_plot, group(2011) name(m32,replace) title("2011")
csdid_plot, group(2012) name(m33,replace) title("2012")
csdid_plot, group(2016) name(m34,replace) title("2016")
csdid_plot, group(2017) name(m35,replace) title("2017")
csdid_plot, group(2018) name(m36,replace) title("2018")
csdid_plot, group(2019) name(m37,replace) title("2019")
grc1leg m31 m32 m33 m34 m35 m36 m37,cols(4) xcommon scale(0.7) title("CS DiD - Model 3")
subtitle("Area type 1 vs. Area type 3 (per year)") legendfrom(m31)
graph save csdid03, replace

esttab csmodel1 csmodel2 csmodel3, se wide label title("CS") mtitle("Area type 1 vs. Area type 2&3"
"Area type 1 vs. Area type 2" "Area type 1 vs. Area type 3")

grc1leg m10 m20 m30, cols(3) xcommon scale(0.7) title("HHI - Diversity of retail") subtitle("Model
summary") legendfrom(m10)
```

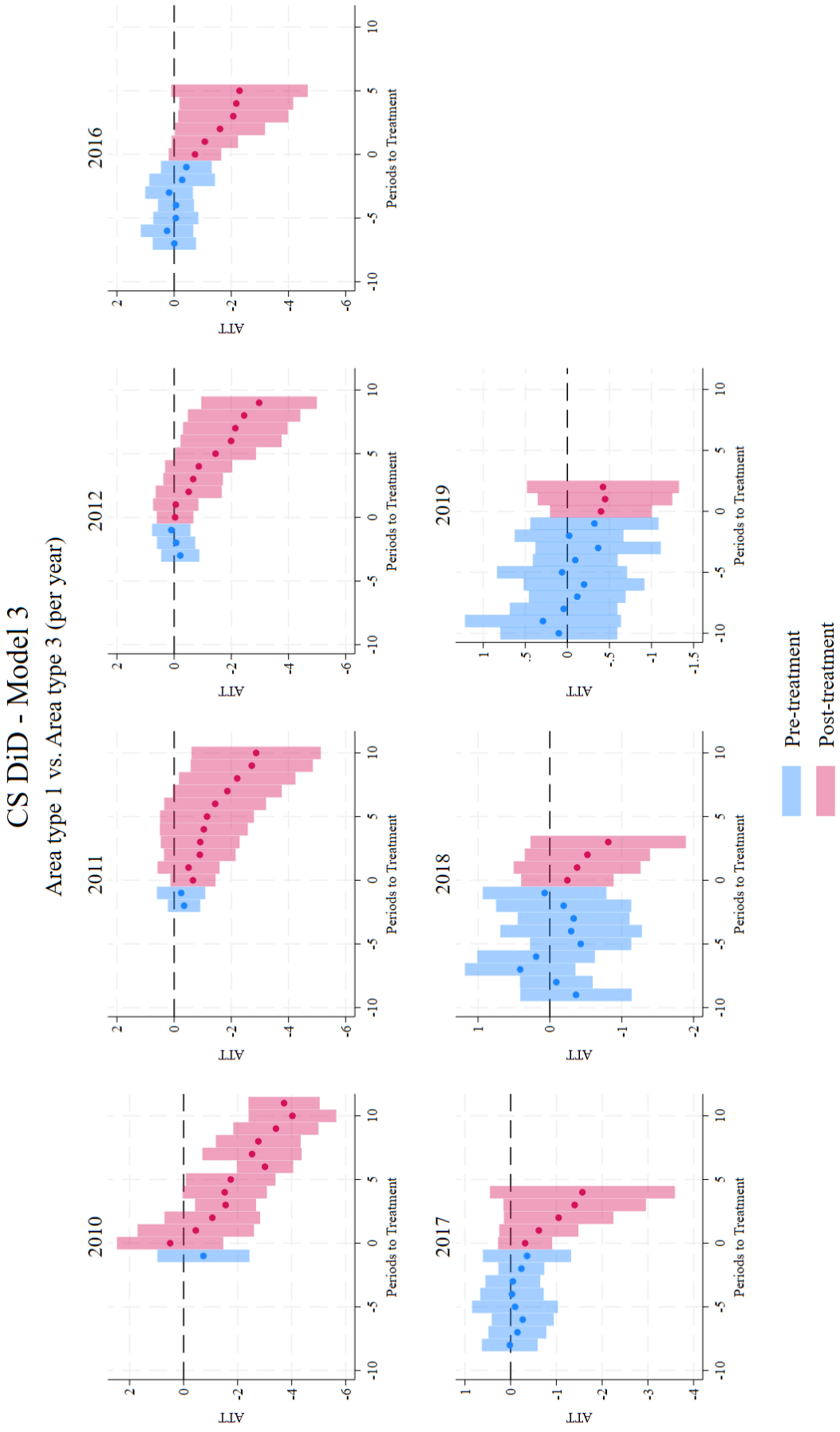
```
*8.2 Main results - DiD estimate tables

*TABLE 5 (SIMPLE)

csdid HHI, ivar(TYPE_ID) time(YEAR) gvar(BID_STARTYEAR) method(dripw) notyet agg(simple)
saverif(CSDID_MODEL1) wboot replace rseed(1)
estimates store csmodel01
estadd local Treatment "1"
estadd local Control "2, 3"
estadd local shp "Yes"
estadd local year "Yes"
esttab , s(N shp year, label("Observations" "Shopping Area - Fixed effects" "Year - Fixed effects"))
estimates store csmodel01

csdid HHI if TYPE==1 | TYPE==2, ivar(TYPE_ID) time(YEAR) gvar(BID_STARTYEAR)
method(dripw) notyet agg(simple) saverif(CSDID_MODEL2) wboot replace rseed(1)
estimates store csmodel2
estadd local Treatment "1"
estadd local Control "2"
estadd local shp "Yes"
estadd local year "Yes"
esttab , s(N shp year, label("Observations" "Shopping Area - Fixed effects" "Year - Fixed effects"))
estimates store csmodel02

csdid HHI if TYPE==1 | TYPE==3, ivar(TYPE_ID) time(YEAR) gvar(BID_STARTYEAR)
method(dripw) notyet agg(simple) saverif(CSDID_MODEL3) wboot replace rseed(1)
estimates store csmodel03
estadd local Treatment "1"
estadd local Control "3"
estadd local shp "Yes"
estadd local year "Yes"
esttab , s(N shp year, label("Observations" "Shopping Area - Fixed effects" "Year - Fixed effects"))
estimates store csmodel03

esttab csmodel01 csmodel02 csmodel03 using "CS NEW MODEL.html", s(Treatment Control N shp
year, label("Treatment" "Control" "Observations" "Shopping Area - Fixed effects" "Year - Fixed
effects")) replace se obslast label title("CS DiD - HHI Diversity of retail")

*Testing for parallel assumptions and statistical significance – Z-test, P-value and chi2

csdid HHI, ivar(TYPE_ID) time(YEAR) gvar(BID_STARTYEAR) method(dripw) notyet agg(simple)
saverif(CSDID_MODEL1) wboot replace rseed(1)
estat pretrend
csdid HHI if TYPE==1 | TYPE==2, ivar(TYPE_ID) time(YEAR) gvar(BID_STARTYEAR)
method(dripw) notyet agg(simple) saverif(CSDID_MODEL2) wboot replace rseed(1)
estat pretrend
csdid HHI if TYPE==1 | TYPE==3, ivar(TYPE_ID) time(YEAR) gvar(BID_STARTYEAR)
method(dripw) notyet agg(simple) saverif(CSDID_MODEL3) wboot replace rseed(1)
estat pretrend

local b1 = -1.150468
local b2 = -1.249986
local se1 = .1960613
local se2 = .1664676
```

```
local z = (`b1' - `b2') / sqrt(`se1'^2 + `se2'^2)
local p = 2*(1-normal(abs(`z')))

display "Z-statistic: " `z'
display "P-value: " `p'

*8.3 Secondary results*

*Large city - Fixed effects

clear all
use "C:\Users\Frenk\OneDrive\UNI\RES\Master's Thesis\MT DATA\MT Stata\MT DATASET
(CSDID).dta"

csdid HHI, ivar(TYPE_ID) time(YEAR) gvar(BID_STARTYEAR) method(dripw) notyet agg(simple)
saverif(CSDID_MODEL1) wboot replace rseed(1)
estimates store csmodel1
estadd local shp "Yes"
estadd local year "Yes"
estadd local city "No"
esttab , s(N shp year city, label("Observations" "Shopping Area - Fixed effects" "Year - Fixed effects"
"Large city - Fixed effects"))
estimates store csmodel111

csdid HHI if LARGE_CITY==1, ivar(TYPE_ID) time(YEAR) gvar(BID_STARTYEAR)
method(dripw) notyet agg(simple) saverif(CSDID_EFFECTS) wboot replace rseed(1)
estimates store cslarge
estadd local shp "Yes"
estadd local year "Yes"
estadd local city "Yes"
esttab , s(N shp year city, label("Observations" "Shopping Area - Fixed effects" "Year - Fixed effects"
"Large city - Fixed effects"))
estimates store cslarge1

esttab csmodel111 cslarge1 using "CS Large cities v2.html", s(N shp year city, label("Observations"
"Shopping Area - Fixed effects" "Year - Fixed effects" "Large cities - Fixed effects")) replace se
obslast wide label title("CS DiD - Large cities (Fixed effects)") mtitle("Model 1" "Large cities")

local b1 = -1.029785
local b2 = -1.249986
local se1 = .2804219
local se2 = .1733799

local z = (`b1' - `b2') / sqrt(`se1'^2 + `se2'^2)
local p = 2*(1-normal(abs(`z')))

display "Z-statistic: " `z'
display "P-value: " `p'
*****END OF DO-file*****
```

APPENDIX D: DID EVENT-STUDY GRAPHS PER BID TREATMENT YEAR




CS DiD - Model 2
Area type 1 vs. Area type 2 (per year)
2010
2011
2012
2016
2017
2018
2019
ATT
Periods to Treatment
Pre-treatment
Post-treatment


CS DiD - Model 3
Area type 1 vs. Area type 3 (per year)
2010
2011
2012
2016
2017
2018
2019
ATT
Periods to Treatment
Pre-treatment
Post-treatment

APPENDIX E: CS DID ESTIMATES: PERIOD AVERAGE AND YEARLY ATT

	(1)	(2)	(3)
Period average ATT	-0.932***	-0.848***	-0.928***
	(0.172)	(0.179)	(0.159)
2010	0.496	0.499	0.499
	(0.528)	(0.564)	(0.598)
2011	-0.635**	-0.669**	-0.623**
	(0.226)	(0.235)	(0.213)
2012	-0.363	-0.383	-0.350
	(0.204)	(0.218)	(0.181)
2013	-0.607**	-0.593*	-0.589**
	(0.227)	(0.249)	(0.205)
2014	-0.803**	-0.709*	-0.792**
	(0.250)	(0.286)	(0.254)
2015	-0.745***	-0.574*	-0.738***
	(0.222)	(0.241)	(0.214)
2016	-0.980***	-0.666**	-0.988***
	(0.205)	(0.232)	(0.211)
2017	-1.160***	-0.994***	-1.160***
	(0.199)	(0.233)	(0.188)
2018	-1.380***	-1.240***	-1.375***
	(0.195)	(0.248)	(0.194)
2019	-1.453***	-1.386***	-1.460***
	(0.190)	(0.236)	(0.188)
2020	-1.708***	-1.643***	-1.715***
	(0.204)	(0.247)	(0.205)
2021	-1.847***	-1.816***	-1.851***
	(0.229)	(0.270)	(0.228)
Treatment	1	1	1
Control	2, 3	2	3
Observations	18490	4435	16956
Shopping Area - Fixed effects	Yes	Yes	Yes
Year - Fixed effects	Yes	Yes	Yes

Standard errors in parentheses
** p < 0.05, ** p < 0.01, *** p < 0.001*