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# Industrial gentrification in West Chelsea, New York: Who survived and who did not? Empirical evidence from discrete-time survival analysis

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#### Abstract

This paper empirically tests the extent to which economic restructuring and gentrification affect viability and vulnerability businesses, with specific focus on arts and cultural industries in West Chelsea from 2000 through 2012. Based on the theoretical framework, gentrification stage model and adopting discrete-time survival analysis, we separately compare the risks of opening and closing between businesses established before/early stage of revitalisation (early-arrivers) and those established in the later stage (late-arrivers) within West Chelsea, versus their counterparts in the remainder of the study area in New York. We find that West Chelsea has been an advantageous location overall for late-arrivers in surviving in their market, while the early-arrived gallery and individual artists' enterprises have faced a higher risk of their operations closing. On the other hand, a higher proportion of new gallery and arts and cultural industries remain attracted to West Chelsea after 2000, suggesting that firms in those industries may be benefiting from the agglomeration effects and localisation economies associated with colocation. The higher opening probability of lodging venues (e.g. hotels) and other amenities signals an overall transformation of the neighbourhood and influx of new uses (and visitors) observed during this time frame.

#### **Keywords**

arts and cultural industry, gentrification, industrial restructuring, survival analysis, West Chelsea

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# Introduction

Economic restructuring or industrial gentrification is an ongoing discussion in the geographical and social science literature. Throughout history, new industries have emerged in areas formerly occupied by less

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competitive ones resulting in a transformation of the social, cultural and economic geography (Curran, 2007; Giloth and Betancur, 1988; Zukin, 1989). Particularly in the postindustrial era, city officials seek replacements for once-dominant, but lost manufacturing maintain fiscal industries to viability (Fainstein, 1999; Fainstein and Judd, 1999; Zukin, 1989). Managerial operations, legal services, and finance, insurance and real estate consulting are some of the industries that economic development practitioners tried to recruit in the wake of dramatic global economic restructuring (Drennan, 1991; Hudson, 1984; Hyra, 2008; Sassen, 1994). Demographic changes also accompany the appearance of these service industries, introducing middle class and white-collar workers who could provide an improved tax base to the city (Beauregard, 2009; Clay, 1979; Rose, 1984; Smith and Defilippis, 1999).

Creative, artistic and cultural industries are increasingly being recognised as a supplement or an equivalent urban economic base to the aforementioned industries, both as a part of the 'creative class' leitmotif and as a central force in and of themselves. Such industries have indeed contributed a robust share of values that cities generate (Currid, 2006: Markusen and Schrock, 2006;Markusen et al. 2004), and have also created unique environmental settings that further lure residents and visitors (Florida, 2002, 2005; Hutton, 2009). Unlike white-collar middle classes associated with managerial, capitalist services or 'the organisation man' (Whyte, 1956), members of the arts and cultural industries are characterised by their unique cultural inclinations, education pedigree and entrepreneurial ethos (Florida 2002; Lloyd, 2006, among others). This new urban elite has been anointed many titles: (a subset of ) the Super-Creative Core (Florida, 2005), the bobos (Brooks, 2010), the new cultural class (as a

stratum of the new middle class) (Ley, 1996).

However, there has not been a consensus that these industries are demonstrative of the final stage of economic restructuring, and whether their role is one of victim or victor in the gentrification process. Stage theory of demographic gentrification hypothesises that artists' groups and cultural producers are often pioneers in gentrification, and actively participate in reviving urban economies, but, as Zukin's seminal work on 'loft living' documents, their geographic territory is not safe from subsequent phase of gentrification in a longer term (Watt, 2005; Zukin, 1989). A similar theory applies to industrial gentrification process broadly speaking. The revitalisation of SoHo, Greenwich Village and the East Village in New York City are known widely as such examples, demonstrating the vulnerability of the arts and cultural industries amid active neighbourhood revitalisation and urban economic change in the postindustrial era (Abu-Lughod, 1994; Beard and Berlowitz, 1993; Hudson, 1984, 1987; Mele, 2000; Simpson, 1981; Smith and DeFilippis,1999; Soffer, 2010; Zukin, 1989; Zukin and Braslow, 2011).

West Chelsea has been deemed a successor to these neighbourhoods because of its recent agglomeration of art galleries, artists' live-work spaces, and the cultural atmosphere, after its long history as a manufacturing core in New York City (Fainstein, 2007;Molotch and Treskon, 2009). Celebrating and further enhancing this transformation, New York City's Department of City Planning (DCP) rezoned West Chelsea to protect the gallery district while promoting general revitalisation of the area (West Chelsea rezoning). While this public intervention has been highly regarded for its innovativeness (DCP, 2006b), some recent anecdotal evidence of commodification suggests that artistic enterprises, and their

companion industries, are now being priced out (Brozan, 2004; Kazakina, 2013; Moss, 2012a; Ouroussoff, 2006; Wilson, 2005).

A natural assumption is that West Chelsea is undergoing the repeated pattern shown in SoHo, Greenwich Village and the East Village neighbourhoods, becoming another example of arts and cultural industries as a significant variable in the beginning phase of neighbourhood economic restructuring. Yet, a competing hypothesis may be that West Chelsea has firmly stabilised itself as a creative, cultural cluster in New York City and will remain as so despite ongoing economic restructuring and gentrification of the neighbourhood. Put another way, is it possible for a neighbourhood to remain an artistic and cultural centre even after gentrification and redevelopment set in?

Extensive studies have explored the transformation of postindustrial neighbourhoods through the lens of artists and the cultural industries (Abu-Lughod, 1994; Beard and Berlowitz, 1993; Zukin, 1989, among others). Recent interest in West Chelsea's transformation from industrial to artistic and postindustrial neighbourhood has not yet prompted sufficient empirical studies. West Chelsea deserves particular attention since it represents one of the latest examples of such phenomena and one of the rare examples where active policy intervention aimed to preserve the arts and cultural industries from displacement. How have these industries fared, as a neighbourhood significantly has been impacted by economic restructuring and gentrification? Like SoHo, the arts and cultural industries were actively cultivated as early regenerators, but does the story of West Chelsea mimic that of its predecessor or does it present an alternative trajectory for pioneering artistic neighbourhoods? Also, how has the policy influenced the business landscape and economic geography of West Chelsea during the course? Could we learn something new from the case of West Chelsea?

Using а unique methodological approach and new data set, we empirically test the extent to which economic restructuring and gentrification affect viability and vulnerability of the industries, with specific focus on the arts and cultural industries in West Chelsea from 2000 through 2012, as they fared from the outset of the process. With discrete-time survival analysis, we measure the risk of closing business and probability of businesses opening pertaining to arts and cultural industries that entered West Chelsea at two the development stages in process. Comparisons will be made in between groups of such establishments that arrived to the neighbourhood in early and later phases of gentrification, versus their counterparts' arrival in a reference area defined in Manhattan during those two different timeframes. Other non-arts and cultural industries will be also analysed in the same format, to aid general understanding of the neighbourhood's postindustrial economic landscape.

# **Background and context**

# Theoretical background: Stage models of gentrification

Residential gentrification is often explained as stages or successions of a neighbourhood revitalisation cycle, from inception to final equilibrium (Kerstein, 1990; Lees, 2000; Ley 2003; Smith, 2012). Despite considerable diversity in types and phasing under this concept, the basic notion identifies differences in in-movers' socioeconomic and cultural dimensions based on their arrival timing to the subject neighbourhood. Generally, earlier arrivers are believed to be 'risk oblivious', as they gravitate to an obsolete neighbourhood and transform it to inhabitable shape. Later arrivers are 'risk averse', who tend to migrate to the neighbourhood when it is substantially improved (Gale, 1979; Kerstein, 1990).

Later arrivers are more likely to be the traditional middle classes represented by managerial and capitalist service that requires advanced education attainment and offers higher incomes. Earlier arrivers, in contrast, have relatively modest economic means and are much more diverse in their social and occupational characteristics, socalled 'richer in cultural capital than economic capital', borrowing Bourdieu's definition (Kerstein, 1990; Smith, 2002; Van Criekingen and Decroly, 2003). Rose's (1996, 1984) case studies of Canadian cities and Bondi's (1999) Edinburgh research identified 'marginal professionals' as earlyarrivers whose choice of location was largely lifestyle oriented. The authors observed that they worked for fragmented professions related to art or public affairs.

The invasion of the frontiers is critical in the early stage of the gentrification process, but their duration is challenged (Watt, 2005; Zukin, 1989). Smith (2012), Smith and DeFelippis (1999) and Cameron and Coaffee (2005) argued that these people come to former sweat equities to 'aestheticise' the neighbourhood (Ley, 2003) then give way to more affluent gentrifiers when these places become excessively valorised.

A similar cycle is found in industrial gentrification. The frontier industries, notably art and cultural industries, move to urban areas that used to be occupied by manufacturing industries (Philip Habib & Associates (PHA), 2005). Frontiers' quintessential culture appeals to gentrifier industries. For tourism enterprises, the image of this culture, so-called bohemian milieu, is a good ingredient to commodify the place to attract visitors who seek unique and authentic experiences (Fainstein and Judd, 1999), and want to 'consume' the arts (Zukin and Braslow, 2011: 132). Realising this phenomenon, some entrepreneur artists expand their businesses from the art-related to commercial enterprises such as café and restaurants and media play a role to increase the visibility of such changing neighbourhoods. Consequently the original arty enclaves become neither attractive nor affordable to the frontiers anymore, while whichever businesses that could pay higher rent displace them eventually (Lloyd, 2006; Zukin, 2010; Zukin and Braslow, 2011).

Wealthier residents also appear as gentrifiers in the later stage of industrial gentrification. Real estate developers have paid attention to this type of emerging art cluster to make a profit from the currently undervalued but soon-to-be appreciated land, and local governments are willing to allow them to increase housing stocks and ignite neighbourhood revitalisation (Zukin, 1989; Zukin and Braslow, 2011). In the heated real estate market, property owners get a windfall gain while renters – either residents or businesses – suffer from the threat of displacement.

Recent discourses began to view creative, cultural industries and their individuals as a more robust and established economic force who sustain themselves throughout the whole phase of gentrification and substantially contribute to city's economy. Currid (2006).Markusen et al. (2004)and Markusen and Schrock (2006) found that a greater concentration of creative and cultural employments explain better economic health of the cities. The Center for an Urban Future (2011) described the disproportionate growth of design and art enterprises in New York City that filled the fiscal void left by manufacturing sectors.

These industries are also acclaimed for their lead in setting up a business environment to further attract other industries (Florida, 2002, 2005; Hutton, 2009; Lloyd, 2006; Markusen and Schrock, 2006). Florida's (2002)research on 50 US Metropolitan Statistical Areas revealed that higher 'bohemian index'- quantified cultural milieu for artist cohorts, and the number of high-tech industries and their talented human capital – were likely to coexist, although causal relationship could not be corroborated. Lloyd (2006), in his chronology of industrial restructuring in Chicago's Wicker Park, observed relevance of artist workforces' presence in 1990s in explaining the current agglomeration of high-tech enterprises.

### Historic background

West Chelsea in the industrial era. West Chelsea, a former manufacturing core, is a newly emerged cluster of arts and cultural industry in New York City that has gained publicity since the 1990s. It is on the west side of 10th avenue in Chelsea, known as a neighbourhood bounded by W14th Street to the south, W34th Street to the north, and 6th Avenue to the east, and bordered by Hudson River waterfront to the west (DCP, 1999; NYbits, n.d.).

While New York City restructured itself to favour producer services in response to a global deindustrialisation process in Western cities, the progress of the postindustrial transformation of West Chelsea could not keep pace with other neighbourhoods, mainly because of its long-standing designation as a manufacturing district (PHA, 2005). Without embracing an influx of professional service industries or new residents, it has remained as a shell of light and unconsolidated manufacturing including meatpacking and auto repair until the late 1980s (David and Hammond, 2011; New York City Landmarks Preservation Commission (NYLMPC), 2008).

West Chelsea's revival followed SoHo's wake (Molotch and Treskon, 2009; NYLMPC, 2008). Like West Chelsea, SoHo also had been a historic manufacturing and commercial district before it began to gain the current reputation as an art district from

the 1960s, by accommodating in-migration of artists in its abundant derelict mills. West Chelsea underwent a similar cycle from the late 1980s, by initially hosting art collectors and dealers who moved from SoHo, then further attracting artists groups (Holusha, 1997; Morgan, 2012; PHA, 2005), ultimately becoming an art gallery district<sup>1</sup> (NYLMPC, 2008).

West Chelsea in the postindustrial era. Two institutional efforts weighed in Chelsea's postindustrial evolvement; Chelsea rezoning (1999) and West Chelsea rezoning (2005), along with the larger efforts to revive the west side of Midtown. The Chelsea Plan proposed by the Community Board 4 in 1996 and Far West Midtown – a framework for development conceived by the Department of City Planning in 2001 included projects such as Hudson Yard development, the extension of Number 7 Line and Hudson Park & Boulevard (DCP, 1996, 2001). While Chelsea rezoning mainly concerned the East side of Chelsea in accommodating demand for non-manufacturing spaces, it also opened up an official consideration on West Chelsea by up-zoning one and a half blocks of former manufacturing land (DCP, 2006a).

The West Chelsea rezoning of 2005 focused specifically on 13 blocks and two half-blocks of West Chelsea (Special West Chelsea district, roughly bounded by W16th Street to the south, W30th Street to the north, 10th and 11th Avenues to the east and west, respectively). The primary purpose of this rezoning was twofold: first, to encourage mixed-use development of the neighbourhood; second, to advance the development and use of the High Line as a public park.

To institute mixed-used development, land use change and density increment constituted a large part of the rezoning, in that more than six blocks were rezoned from manufacturing to commercial use with increased floor area ratio (FAR). Protecting and promoting art-related business was another emphasis. Non-commercial art exhibition and gallery use continued to be permitted as-of-right in the remaining manufacturing areas, where open floor plans and high ceilings of industrial venues were well suited for exhibitions, but less appealing to any other uses. In areas concentrated with existing galleries, such as between W20th Street to W22nd Street, and between W24th Street and W27th Street bounded by 10th and 11th Avenues, land use was not changed but remained as manufacturing districts, so art galleries could keep taking advantage of such architectural characteristics (PHA, 2005). In some portions of the newly established commercial district, non-commercial gallery use was still encouraged on the first floor of buildings (DCP, 2006a).

The High Line, former West Side Freight Line, was converted to a park. After 30 years of abandonment across West Chelsea and Meatpacking district, the city government announced to pursue the use of the High Line as a public amenity in 2004 (excluding the last section of the park), and completed the first and the second sections in 2009 and 2011, respectively. Between its conception and completion, the project attracted speculators' attention and induced an unprecedented amount of property development in West Chelsea – US\$2 billion of private investment as of 2011 (McGeehan, 2011).

# **Research design**

#### Research introduction

Based on the concept of the stage model, postindustrial restructuring of West Chelsea can be understood as a two-phase process; first, from the 1990s when frontier arts and cultural industries surfaced in a spontaneous manner (PHA, 2005), second when more diverse types of later arrivers are believed to alter the business landscape of West Chelsea since then, hypothetically. Unlike the former stages, it is less clear to discern the nature of the later arrivers, their precise timing and type of industry.

In defining a starting point of the later phase, it is critical to understand those public interventions as milestones. Even the transformation of West Chelsea is perceived as a gradual process at the beginning, the series of rezoning and public projects apparently took the pre-existing, largely spontaneous revitalisation process to another level. The Chelsea rezoning of 1999 had created a pro-development tone in overall Chelsea and implemented a pilot action in West Chelsea (DCP, 1996, 1999). The following West Chelsea rezoning of 2005 institutionalised the redevelopment of West Chelsea, further intensified the economic restructuring already in progress (Dawid, 2012; DCP, 2006a; Moss, 2012a, 2012b).

Given this backdrop, it is reasonable to establish the year 2000 as a tipping point toward active economic restructuring/gentrification, subsequently to define businesses that opened before and after 2000 as proxies for earlier and later arrivers, respectively. If this assumption is valid, businesses that opened after 2000 would differ from their forerunners with respect to industrial types, target customers and financial prowess. Businesses opened after 2000 may have been better equipped to survive in the upwardly shifting neighbourhood, because they could predict the fate of West Chelsea when they began. However, businesses that opened before 2000, who did not expect such transformation of the neighbourhood, were not necessarily of types and scales befitting the current West Chelsea.

To understand the business landscape of postindustrial West Chelsea, the gentrification process and its developmental impacts, we compare the risk of displacement/relocation and probability of opening between the arts and cultural industries within West Chelsea and their counterparts in other parts of Manhattan. The comparisons are made separately for three sets of subsample grouped by opening years as proxies of early-arrivers and late-arrivers, under the assumption that their viabilities and vulnerabilities differ. We specifically ask:

- (1) How did the active neighbourhood revitalisation process in West Chelsea (from 2000 to 2012) affect the occurrence of displacement/relocation of later-arrived business establishments in the West Chelsea, compared with that of business establishments in the chosen reference area of Manhattan?
- (2) Likewise, how does the occurrence of business displacement/relocation differ for early-arrivers in West Chelsea from that of their counterparts in the reference area?
- (3) What is the equivalent difference in the probabilities of opening businesses (later arrivers) in the West Chelsea as compared with the reference area in Manhattan?

The analytical unit is business establishment. The events we investigate are closing business establishments in the current location, including displacement, relocation and termination (closure hereafter), and opening new business establishments.

In analysing business gentrification in West Chelsea by observing the incidents of business closure and opening, we make two assumptions. First, we assume that if a neighbourhood undergoes revitalisation and becomes gentrified, firms within its boundary would exhibit a systematic change in their operation. If the existing firms could not afford the increased rent and operating cost, or their revenues fall because of loss of their customer base in such an upwardly shifted neighbourhood, then they may close their operations from the current location involuntarily. Or if the revitalisation leads to a disproportionally large amount of new property development or renovation in the neighbourhood, firms in old venues have to move out during the construction. Therefore in this neighbourhood, the probability of business closure may be larger than that of average firms in the same industry in other parts of the city. Also this threat may hit harder or appeal to specific industries unevenly, thus the industry composition in the neighbourhood would change (Curran, 2007).

Obviously there are other reasons for businesses in gentrifying West Chelsea to voluntarily end their operations, other than involuntary displacement or cessation. However, if there was not an effect of gentrification, and there was only a voluntary and non-location related reasons, the probability of business closure or new opening would not differ in the same industry located in West Chelsea versus other parts of the city.

In Figure 1, we describe subsamples and events of interest – closure or opening – for three subsequent analyses, and a brief timeline of planning interventions in Chelsea.

We made use of discrete-time survival analysis as a primary analytical tool. The analysis investigates whether a member of a sample experiences a designated event in a particular time point, and if so how long the member survived before experiencing the event (Singer and Willett, 1993; Yamaguchi, 1991). The outcome of the analysis is expressed as a conditional probability of survival, meaning not experiencing the event in a specific time point in the observation period, only under the condition that they have not experienced the event before. This conditionality enables an unbiased estimate of the population hazard probability in certain points of time, even in case the observation period is too short to fully record the time to events for every member of the sample, i.e. the presence of left-censored and



Figure 1. Subsample selection for Analysis 1, 2 and 3, and policy interventions and projects implemented in West Chelsea.

right-censored data (Aalen et al., 2008; Allison, 1984; Cox, 1972; Singer and Willett, 1991). This is possible because the probability is concerned based on the survivors from the event renewed in each point of the observation period, so-called risk set, meaning the members remaining in the sample and face the risk again in the next time point. Below we outline the site boundaries, data set and methodologies.

#### Site

In this study, both arts and cultural and non-arts and cultural industries in West Chelsea are compared with their counterparts in the reference area in Manhattan. For the sake of the analysis, we define West Chelsea (WCh) to encompass the core area, rezoned by West Chelsea rezoning and the extended area to include the entire span of the High Line to capture its spillover effects.

The West Chelsea analysed in this study is bounded by W34th Street to the north,

Gansevoort Street to the south, 9th Avenue to the east and the Hudson River waterfront to the west. We previously analysed the core area and the West Chelsea boundary that we currently adopt separately, and the results from both are not much discernable, helping us to conclude that the latter depicts the extent of the location effect made by West Chelsea rezoning, the High Line project and their spillover effect reasonably. The analytical result with the core West Chelsea will be available upon request to the authors.

For the reference site, we have established a study area to include the south part of Manhattan, below 59th Street, at the southern edge of Central Park (the study area). In order to distinguish the location effect of West Chelsea, this study could have taken the entire Manhattan as a reference site in order to make the control group represent a broad average of Manhattan. However, the area above and two sides of Central Park – Harlem, Upper West and East Side, respectively – are not normally considered as



**Figure 2.** Locations of West Chelsea (WCh), the reference area, the High Line, and the boundary indicating areas of Chelsea Rezoning and West Chelsea Rezoning considerations.

active commercial real estate market (Best Manhattan Offices, 2013; Costar Group, n.d.; Reis, n.d.), and their business pattern and trend change may be too discrete from the lower part of Manhattan, which would make the comparison result overstated. Therefore, the study area is limited within the southern part of Manhattan.

In Figure 2, we illustrate the site boundaries of the study area, the West Chelsea (WCh), affected area by Chelsea rezoning and West Chelsea rezoning, and the location of the High Line.

#### Data set and sample

The primary data sets are Info USA Business List collected in 2000, and the ESRI Business Location data collected between 2006 and 2012 to form a list of addresses that all business establishments have resided in the study area from 2000 to 2012. These data sets are collected every year, recording business address, classification information (North American Industry Classification System (NAICS)), names, geo-code and phone numbers. As these data sets are rigorously checked and updated every year, commercially used for the purpose of business location strategy, address information is fairly reliable.

From this pool of addresses, we took an additional step for better accuracy. Rather than using the population data, we drew a random sample of addresses and crosschecked the business location, opening year and their current status.

The initial sample was 25,000 with oversampling in West Chelsea and some minor industries to address potential issues posed by simple random sampling. First, since West Chelsea covers only a small fraction of the overall study area (4.8% of study area, as measured in ArcGIS 10), these areas would hold a small-sized sample as a consequence. And there is also a possibility that a disproportionately high number of samples may have been dropped in particular industries because of the absence of status record resulting from the causal manner in business registration. These circumstances together would negatively affect the precision of the statistical analysis and make oversampling inevitable, accordingly we applied two poststratification weighting in selective analyses. After this procedure, the only missing information is the businesses with both opening and closing falling within 2001 to 2005. For those 274 addresses that have incomplete list of business that they had accommodated between 2000 and 2012, we reversely traced back the businesses name from the address.

Expanding this address list to an individual business list, we then inspected and cleaned the data set to verify their opening year, current status of whether the establishments were indeed active or closed. To obtain business duration information, we referenced the Corporation & Business Entity Database of New York Department of State, Division of Corporations, State Records & UCC, the database from Manta Media, Inc., and Yellow Page Intellectual Property, LLC, Cortera Plus TM, Bizapedia, Health Grades, Inc., Avvo, Inc., supplemented with direct phone call inquiries. For reverse look-up, we used LoopNet, Inc., DOB Search from Concert Technologies Inc.

Longitudinal sample data set is finalised with a total size of 17,054 in the study area, within which 4184 are included in West Chelsea boundaries. Full-year data are available for all other years, but data for 2012 only cover the first half of the year. The incomplete data for 2012 has a minor effect on Analysis 1 because the risk set for 2012 becomes slightly smaller than what it actually should be, hence the probability estimates of the year 2012 are greater than the actual magnitude. While this does not affect Analysis 2 at all, Analysis 3 becomes vulnerable to bias because the opening is the event of interest. Therefore, the year 2012 will be excluded from the risk set of Analysis 3, limiting the observation period to 2011.

#### Measures

The observation period is from 2000 to 2012 for the first two analyses, and 2012 is excluded in the third analysis. The time dimension differs in Analysis 1 from Analyses 2 and 3. In Analysis 1, we examine the probability of the event – closing business establishments – by age of business establishments, while in the Analyses 2 and 3, the probability of the event – closing (Analysis 2) and opening (Analysis 3) – is measured by calendar year.

Outcome variable is log-odds of timeinvariant dichotomy, h, indicating a probability a business experiences the event in interest. Odds are one way to express the probability. In this analysis, for example, odds of closing business establishment versus not doing so is explained as a ratio of the probability that a business establishment will close operation to the probability that it will not do so.

Question predictor is also dichotomy, WCh, indicating whether the business is located within West Chelsea versus the reference area in Manhattan. Analyses 2 and 3 include the interaction terms, as products of year indicators and WCh (Year\* WCh) to allow the effect of WCh vary by year. Although the location variable WCh per se is time-invariant by definition, and should be time-invariant in order not to violate the proportionality assumption (see Singer and Willett, 1993 for details), the effect of the locations may differ by year, reflecting local circumstances. Since West Chelsea underwent multiple public interventions during the observation period, making WCh act as time-variant. Therefore, in case the business closing and opening probabilities are calculated based on the calendar year in Analysis 2 and 3, the heterogeneous location effect becomes systematic and causes a violation of the proportionality assumption. Thus, the interactions were added to address this issue.

Twenty-two time-invariant industry dichotomies, Industry, are included for two purposes: to control potentially distinctive industry-specific business cycle by main effect, and to discern differential effect of West Chelsea's locations exerted on arts and cultural, as well as other industries by interactions with the question variable (Industry\*WCh). We followed the NAICS sector structure (U.S. Census, n.d.) for initial categorisation, then conducted detailed subdivision, composition and omission based on the site context.

Within the vector of *Industry*, the arts and cultural industries (*Gallery* and *Artists*) and their interactions are the primary focus. Museums, galleries within the 'Arts, Entertainment, and Recreation' and art dealers within the 'Retail Trade' sectors are combined to form a new category named *Gallery*. The *Artists* category is created to include independent artists, photographers and their agencies or promoters, separated from the 'Arts, Entertainment, and Recreation' and 'Specialised Design Service' sectors. In a wider definition, design industries are also an art-related industries (also called creative industries by, for example, Florida, 2002; Currid, 2006), therefore, we made the Design category to include architectural design and the related engineering services, industrial and graphic design. Nineteen other groups are also classified to compose a full-list industry, and measured in the subsequent analyses along with arts and cultural industries. In Appendix I, we present a full categorisation, and corresponding sample size of the industries.

#### Data-analytic plan

Analysis 1: As an actively revitalising neighbourhood, has West Chelsea been advantageous for late-arrived arts and cultural industry to sustain their businesses, compared with other neighbourhoods in Manhattan (the Reference Area)?

The event of interest is closing operation from the current location, and the duration is the number of surviving years counted from its opening. We fit the following models for the *i*th business establishment in the *k*th year, in a particular subsample of the establishments that opened their doors after 2000 (the 'late-arrivers'). We first examine the effect of the location in overall industry, without controlling *Industry*\**WCh*, then the term is added in the second analysis to discern industry-specific effect of the location. The same procedure applies to Analyses 2 and 3.

$$\ln ({}^{h_{ik}}\!/_1 - h_{ik}) = \alpha (Year) + \gamma (Industry) + \delta (Industry^*WCh_i) + \beta_1 WCh_i$$
(1)

 $\log(\frac{h_{ik}}{1-h_{ik}})$  is log-odds of the probability of a business to close its operation,  $\alpha(Year)$ is the baseline hazard function of closing operation measured by age of establishment  $(\alpha(Year) = \alpha_1 YB_1 + \alpha_2 YB_2 + \alpha_3 YB_3 + ... + \alpha_{13} YB_{13})$ . *WCh<sub>i</sub>*, the question predictor, presents the location effect of West Chelsea.  $\gamma(Industry)$  is a function of 22 industries and  $\delta(Industry^*WCh_i)$  is its interaction with the question predictor.

Analysis 2: As an actively revitalising neighbourhood, has West Chelsea been advantageous for early-arrived arts and cultural industry to sustain their businesses, compared with other neighbourhoods in Manhattan (the Reference Area)?

In this segment of analysis, the same model of Analysis 1 is used with a minor modification. As this research question focuses on establishments that opened the doors before 2000 (the 'early-arrivers'), the corresponding subsample is reversely selected from Analysis 1; members opened the businesses before the observation period, i.e. leftcensored. The event in interest is closing operation, and the duration is the number of surviving years counted from 2000 not from its opening year, while opening year of each establishment is controlled.

The logic of this analysis is that the neighbourhood revitalisation process is an external factor that disturbs the normal business lifetime cycle, which is assumed to occur from 2000 and have lasted during the observation period. Consequently, our objective in this analysis is to estimate differing hazard probability of closing operation the businesses establishments have faced from 2000 to 2012, depending on their locations. As mentioned before, we introduce **Year\****WCh*, to control heterogeneity of the location effects. Modified fitted model is below equation (2).

$$\ln {\binom{h_{ik}}{1-h_{ik}}} = \alpha (Year) + \sigma (Year^*WCh_i) + \rho Opening_Year + \gamma (Industry) + \delta (Industry^*WCh_i) + \beta_2 WCh_i$$
(2)

Analysis 3: Compared with the other neighbourhoods in the reference area within Manhattan, did West Chelsea remain a comparatively attractive location to open businesses for arts and cultural industries as active revitalisation progressed in the neighbourhood? And, what other types of industries constitute the 'late-arrivers'?

In short, this analysis is the other side of Analysis 1. Whereas Analysis 1 focused on closing businesses, this analysis focuses on the opening businesses, demonstrating the difference in probabilities of encountering a new business establishment over an old one in West Chelsea and the reference area in Manhattan. The subsample of this analysis includes business establishments that are active as of 2011 and those that newly opened and closed within the observation period, and among them newly opened establishments in each year of observation period are investigated as opposed to older ones of which their openings were prior to the observation period. As noted in Analysis 2, the baseline function concerns the calendar year (equation 3).

$$\ln (\frac{h_{ik}}{1 - h_{ik}}) = \alpha (Year) + \sigma (Year^*WCh_i) + \gamma (Industry) + \delta (Industry^*WCh_i) + \beta_3 WCh_i$$
(3)

In the three subsequent analytical results, the question variable *WCh* (the location indicator of West Chelsea) and its interactions deserve the most attention as they together depict the location effect of West Chelsea, influencing the probability of closing or opening of business establishments. Positive fitted values of the parameters associated with these predictors signify larger probability of closing operation compared with the reference location in Model 1 and 2, and larger probability of new opening in Model 3.

The series of *Year* variables capture the general hazard profile of the events for all

industries. The coefficients of *Industry* covariates display their relative deviation of probabilities to the events, from the hazard profile of omitted industries. Direct interpretation is made only on their interactions with *WCh* (*Year\*WCh* and *Industry\*WCh*), in order to keep the focus on the location effect of West Chelsea.

The *Year*\**WCh* interactions reveal the differential effect of the location in specific years made by local circumstance. Positive fitted values of parameters associated with Year\*WCh mean particularly larger probability of closing business operation in the specific years, resulting from adverse local incidents in Model 1 and 2, and larger probability of new business openings in Model 3. Likewise, positive fitted value parameters associated with Industry\*WCh presents a larger risk of closing business operation of the particular industries in West Chelsea, compared with the reference area in Model 1 and 2, and a large chance of observing new business opening in Model 3. Among the 22 tested in this study. Gallery\*WCh, Artist\*WCh and Desgin\*WCh will be discussed in more depth.

#### Results

In Table 1, we present estimates of log-odds of closing or opening businesses establishment in each subsample will experience. Model 1-a and 1-b are of Analysis 1, first without, then with the interaction term, *Industry*\**WCh*. Model 2-a and 2-b, and 3-a and 3-b explain the corresponding Analyses 2 and 3, respectively.

# Analysis 1: Fitted odds of closing operation for late-arrivers

The result of Analysis 1 suggests that latearrivers located in West Chelsea have lower probability of closing operation compared with their counterparts in the reference area. This location advantage affects industry as a whole, not particular industries (i.e. the arts, professional services).

In model 1-a in Table 1, the fitted odds that a business establishment located in West Chelsea will close its operation are 0.708 times the fitted odds of the events for their counterparts in the reference area  $(\beta = -0.346^{***}, e^{-0.346} = 0.708)$ (fitted odds calculation will be omitted for simplicity hereafter). More specifically, the ratio of the probability that a business establishment in West Chelsea will close its operation to the probability that it will not is 0.708 times of those occurring in the reference area, meaning firms in West Chelsea are less likely to close their operation compared with their counterparts (the full interpretation of oddsratio will be omitted for simplicity hereafter). In industry-specific result in Model 1-b, contrary to conventional wisdom about arts districts, at this stage in the development process, art-related industries do not exhibit better success rate despite the colocation with other similar types of industry.

In Figure 3(1), to aid interpretation, we display the fitted probability of closing operation (a) for overall industry and (b) for gallery industry, in each year of business in West Chelsea versus its counterparts in the reference area. West Chelsea pertains a lower hazard profile of closing operation in general than the reference area, as evidenced in Figure 3(1, a).

# Analysis 2: Fitted odds of closing operation for early-arrivers

In contrast to the findings of Analysis 1, West Chelsea is a disadvantageous location to sustain businesses for early-arrivers overall, suggesting that extant gentrification hypotheses hold true for West Chelsea as well. Early-arrived business establishments in West Chelsea have larger probability of closing their operations compared with those in the reference area. In the later years

Table 1. Parameter   between from 2000 tr a specific year in busi   a specific year in busi flect (Mode   location effect (Mode observation period, w   business opening prob pusi	estimates (with stand; o 2012 for three analy: ness, without <i>industry</i> * est, without (Model 2-a) and vithout (Model 2-a) and ability in a specific yea	ard errors) and goodn ses. Analysis I (Model WCh interactions to s WCh interactions to s WCh interaction bu d with industry*WCh (I ar in observation peric	ess-of-fit statistics for i 1-a and 1-b): for busir ee overall location effe sinesses opened befor Model 2-b). Analysis 3 od, without (Model 3-a	inal fitted discrete-tim lesses opened after 20 ict (Model I-a), and wi e 2000 describing busi (Model 3-a and 3-b): f6 ) and with <i>industry</i> *W(	e hazard probability mo 00 describing business f th <i>industry*WCh</i> to see ness failure probability i or business opened aftei <i>Ch</i> (Model 3-b).	dels observed ailure probability in industry-specific n a specific year in 2000 describing
	Analysis I		Analysis 2		Analysis 3	
	Model I-a	Model I-b	Model 2-a	Model 2-b	Model 3-a	Model 3-b
Variables Ist yr (yr 2000)	-6.063***	-5.884*** 	-34.211***	-34.161***	-2.474***	-2.509***
2nd yr (yr 2001)	(0.234) —4.952*** 20.430	(0.250) 4.910*** (0.1.00)	(2.603) 	(3.098) 	(0.037) 2.678*** (0.040)	(0:0:0) -2.706***
3rd yr (yr 2002)	(0.148) 4.446*** 0.020	(0.162) 4.437*** 0.52	(2.601) 	(3.098) 	(0.040) -2.622***	(0.05) -2.636***
4th yr (yr 2003)	(0.125) 3.627***	(0.135) 3.659***	(2.600) 33.931***	(3.097) 33.860***	(0.040) 2.561***	(0.055) 2.579***
5th yr (yr 2004)	(0.095) 3.398*** (0.000)	(0.105) -3.406*** (0.105)	(2.599) 34.090***	(3.097) 33.978***	(0.038) 2.592*** (0.038)	(0.055) -2.612***
6th yr (yr 2005)	(0.088) 3.212*** 0.004)	(0.100) 3.217*** (0.007)	(2.602) 34.821*** /2.202)	(3.097) 34.702*** (2.000)	(0.042) 2.530*** 0.041)	(0.057) -2.542*** 0.058)
7th yr (yr 2006)	(0.007) -3.128*** 0.084)	-3.121*** -3.0099	(2.000) -34.586*** (2.604)			-2.310*** 0.055)
8th yr (yr 2007)	-2.706*** -2.706***	-2.692*** -0.092		-34.430*** -34.430***	-2.314*** -2.314***	-2.324*** 0.057)
9th yr (yr 2008)	-2.851*** 2.851***	-2.829*** -2.829***	-34.437*** -34.437***			-2.924*** -2.924***
10th yr (yr 2009)	-2.510*** -2.510***	-2.518*** -2.518***		-33.304*** -33.304	-2.882*** -2.6653	-2.881*** -2.881***
11th yr (yr 2010)	(0.072) -2.642*** /0.107)	(0.102) -2.638*** (0.118)	(2.002) 33.596*** /7 597)	(3.076) 33.482*** (2.092)	(0.053) 2.647*** 0.049)	(0.073) -2.655*** (0.048)
12th yr (yr 2011)				-33.687*** -33.687	-3.594*** -0.072	-3.632*** -3.632
13th yr (yr 2012)	(0.170) -3.716*** (0.267)		-33.472*** (2.603)	(3.096) - 33.350*** (3.096)		(+0.1.0)
						(Continued)

	Analysis I		Analysis 2		Analysis 3	
	Model I-a	Model I-b	Model 2-a	Model 2-b	Model 3-a	Model 3-b
Yr 2000*WCh	I	Ι	-0.221	-0.185	0.079	0.177*
Yr 2001* WCh	I	Ι	(0.158)	(0.200) 0.053	(0.079) 0.062	(0.106) 0.079
				(0.193)	(0.088)	(0.117)
Yr 2002* WCh	I	I	-0.223	-0.297	-0.034	0.059
Yr 2003* WCh	I	I	(0.147) 0.184	(0.172) 0.117	(0.000)	0.060
Yr 2004* WCh	I	Ι	(0.135)	(0.178) 0.112	0.201**	(0.119) 0.264**
				(0.197)	(0.088)	(0.118)
Yr 2005* WCh	I	I	0.142	0.263	0.169* (0.089)	0.245** 0.119\
Yr 2006* WCh	I	I	0.507***	0.441**	-0.054	0.068
			(0.162)	(0.209)	(0.090)	(0.120)
Yr 2007* WCh	I	I	0.263	0.284		0.086
Yr 2008* WCh	I	I	(0.171) 0.238	(0.216) 0.147	0 401 ***	(0.124) 0.521***
			(0.171)	(0.218)	(0.105)	(0.140)
Yr 2009* WCh	I	I		-0.026	-0.060	0.005
			***/****	(0.169)	(0.122)	(0.162)
1r 2010" vvcn	I	I	0.346	(0.169)	0.203	(0.141)
Yr 2011* WCh	I	I	0.396***	0.430**	0.373**	0.606***
			(0.139)	(0.181)	(0.145)	(0.193)
Yr 2012* WCh	I	I	0.216	0.225	I	I
Gallery	-0.039	-0.434	(0.136) 0.115	(0.176) 	0.144***	-0.349***
	(0.145)	(0.286)	(0.088)	(0.248)	(0.053)	(0.112)
Artist	-0.168	-0.280	0.273***	-0.672***	-0.191***	-0.329***
	(0.156)	(0.249)	(0.080)	(0.182)	(0.057)	(0.108)
Design	-0.225*	-0.427*	-0.713***	-0.824***	-0.005	-0.244***
	(0.120)	(0.226)	(0.091)	(0.177)	(0.043)	(0.094)
						(Continued)

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Table 1. (Continued)

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	Analysis I		Analysis 2		Analysis 3	
	Model I-a	Model I-b	Model 2-a	Model 2-b	Model 3-a	Model 3-b
Const.	0.219	0.183	-0.005	-0.303**	-0.122**	-0.117
	(0.140)	(0.179)	(0.090)	(0.152)	(0.059)	(0.091)
Manuf.	0.161	0.140	0.218***	-0.048	-0.519***	-0.433***
	(0.121)	(0.148)	(0.060)	(0.094)	(0.051)	(0.077)
Auto.	I.535***	0.543	0.611***	0.816**	-0.317***	-0.017
	(0.204)	(009:0)	(0.130)	(0.319)	(0.110)	(0.314)
Whs.	0.114	0.093	0.250***	0.229***	-0.375***	-0.339***
	(0.115)	(0.143)	(0.062)	(0.086)	(0.048)	(0.073)
Retail	0.129	0.136	-0.062	-0.107	0.033	0.059
	(0.081)	(0.099)	(0.053)	(0.072)	(0.032)	(0.048)
Info.	0.003	0.025	-0.216***	-0.224**	0.040	0.038
	(0.112)	(0.135)	(0.080)	(0.111)	(0.045)	(0.068)
FIRE	$-0.280^{***}$	-0.239*	$-0.515^{***}$	-0.522***	-0.188***	-0.162***
	(0.104)	(0.124)	(0.070)	(0.098)	(0.038)	(0.058)
B.Support	-0.068	-0.039	-0.184**	-0.112	-0.184***	-0.147*
	(0.156)	(0.181)	(0.093)	(0.123)	(0900)	(0.086)
Tech.	-0.344	-0.214	0.107	0.032	-0.075	0.065
	(0.338)	(0.405)	(0.221)	(0.304)	(0.119)	(0.169)
Mng.	-0.258	-0.261	0.274	-0.231	0.667***	0.686***
I	(0.447)	(0.513)	(0.462)	(0.488)	(0.165)	(0.226)
Legal	-0.403***	-0.433***	-0.552***	-0.617***	-0.202***	-0.186***
	(0.135)	(0.156)	(0.089)	(0.115)	(0.046)	(0.065)
Admin.	0.158	0.149	0.082	-0.027	-0.320***	-0.298***
	(0.123)	(0.140)	(0.071)	(0.094)	(0.051)	(0.073)
Edu.	-0.389	-0.254	$-0.458^{***}$	-0.381*	-0.501***	-0.460***
	(0.287)	(0.329)	(0.169)	(0.217)	(0.098)	(0.148)
Health	-0.903***	-0.943***	-0.886***	-0.859***	-0.272***	-0.263***
	(0.179)	(0.220)	(0.111)	(0.147)	(0.050)	(0.075)
Etm.	0.581***	0.379	-0.447***	-0.279	-0.108	-0.363
	(0.165)	(0.395)	(0.138)	(0.297)	(0.076)	(0.221)
Lodging	-0.511	-0.385	-0.889**	-1.247**	-0.151	-0.377
	(0.516)	(0.720)	(0.352)	(0.583)	(0.140)	(0.251)

(Continued)

	Analysis I		Analysis 2		Analysis 3	
	Model I-a	Model I-b	Model 2-a	Model 2-b	Model 3-a	Model 3-b
Restr.	0.340*** (0.098)	0.262**	0.211***	0.317***	0.288***	0.356***
P.Svc.	0.100	0.102	0.050	0.013	-0.031	(500.0) -0.030 -0.030
Pb.Svc.	(0.155) -0.278 0.278	(5110) -0.227 (5250)	(0.097) -0.954*** (0.933)	(0.144) 	(0.063) -0.532***	(0.098) -0.503***
Gallery* WCh	(9.259) -	(0.289) 0.162	(0.182) -	(0.245) 1.658***	(0.088) -	(0.126) 0.553***
Artist* WCh	I	(0.355) 0.477 0.366)	I	(0.284) 1.567*** (0.227)	I	(0.143) 0.312** (0.157)
Design* WCh	I	0.540*	I	0.280	I	0.404***
Const. * WCh	I	(0.324) 0.385	I	(0.230) 0.765***	I	0.052
Manuf. * WCh	I	(0.402) 0.388 0.200)	I	(0.245) 0.764*** 0.701.00	I	(0.152) 0.363**
Auto. * WCh	I	(0.307) 1.385** 0.220)	I	(0.107) 	I	(0.10) -0.324 (0.320)
Whs. * WCh	I	(0.000) 	I	(505.0) 0.230 (101.0)	I	-0.227 -0.227
Retail* WCh	I	(0.381) 0.365 (0.251)	I	(0.191) 	I	(0.180) 
Info.* WCh	I	(10270)	I	(TC1.0) -0.016 (920.0)	I	0.100
FIRE* WCh	I	(1750) -0.118 (7750)	I	(0.200) -0.112 (0.220)	I	(001.0) -0.042
B.Support* WCh	I	(7750) -0.449 (2601)	I	(0.40E) 0.085	I	(061.0) -0.016 (195.0)
Tech. * WCh	I	(000.1)	I	(007-0) 1.375 (1111)	I	(195.0)
Mng.* WCh	I		I		I	(7)

Table 1. (Continued)

(Continued)

	Analysis I		Analysis 2		Analysis 3	
	Model I-a	Model I-b	Model 2-a	Model 2-b	Model 3-a	Model 3-b
Legal* WCh	I	1.305*	I	0.367	I	0.126
Admin * WCb	I	(0.769) 0.422	I	(0.738) 0.716***	I	(0.405) 
		0.631)		(0.251)		0.277)
Edu. * WCh	I		I	-1.213	I	-0.122
		0 517		(1.034) 		(0.350)
		(0.580)		0.534)		(0.182)
Etm. * WCh	Ι	0.497	I	-0.074	I	0.340
		(0.476)		(0.376)		(0.256)
Lodging* WCh	I	-0.106	Ι	1.142	I	0.705**
1		(1.253)		(0.936)		(0.303)
Restr. * WCh	I	0.513*	I	-0.296	I	-0.154
		(0.280)		(0.218)		(0.127)
P.Svc. * WCh	I	0.188	I	0.111	I	0.081
		(0.466)		(0.273)		(0.202)
Pb.Svc. * WCh	I		I	I.586***	I	-0.333
				(0.504)		(0.480)
Open_Year	I	I	0.016***	0.015***	I	. 1
			(0.001)	(0.002)		
WCh	$-0.346^{***}$	-0.589***	0.238***		0.110**	
	(0.070)	(0.196)	(0.073)		(0.052)	
Z	51,599	51,610	89,907	89,890	106,374	106,379
d.f.	36	54	47	69	46	69
F-test or $-2LL$	525	12,079	985	23,726	1,738	48,203
Note: Standard errors in multicollinearity.	parentheses $^{***}p < 0.0$	$1, \ ^{**}p < 0.05, \ ^{*}p < 0.1, -$	– implies variables that ha	ve not been included, an	d crossed variables are dr	opped because of

Table 1. (Continued)



**Figure 3.** (1) Fitted probability of business closure for overall industries (a) and fitted probability of business closure for galleries (b) in each year in business, for establishments opened after 2000 (latearrivers), separately plotted by locations (WCh versus the reference area), ((a) is plotted from Model 1-a; Table 1, (b) is plotted with subsamples of gallery industries). (2) Fitted probability of business closure in each year in observation, for overall establishments opened before 2000 (early-arrivers), separately plotted by locations (WCh versus the reference area), ((a) is plotted rom Model 2-a; Table 1, (b) is plotted with subsamples of gallery industries).

of the observation period as West Chelsea becomes more fully developed, this adverse location effect becomes exacerbated. Our results are specifically germane with regard to art and cultural industries. Early-arrived art-related and cultural industries experienced particularly low survival rates in West Chelsea. Within these specific industries, a disproportionately larger portion of them failed to keep the business in their current locations in each year, compared with the portion measured in the reference area in Manhattan. This confirms the prevailing expectation that early-arrived art industries in West Chelsea experienced more severe displacement than those in other parts of Manhattan when the area undergoes active revitalisation, upholding previous hypothesis on the arts and gentrification (Currid, 2007; Lloyd, 2006; Zukin, 1989, among others). Along with these, construction, manufacturing, minor business administration, public affairs, also experienced a particularly hard time.

In Model 2-a, the fitted odds of closing operation are 1.269 times larger for overall businesses in West Chelsea, compared with those in the reference area in Manhattan ( $\beta = 0.238^{***}$ ). In the years of 2006, 2010 and 2011, the positive values of the interactions **Year\*** WCh enlarge the difference of probabilities between those two locations (Model 2-b). In Figure 3(2), we visualise the fitted hazard profiles of closing operation by location; WCh versus the reference area, (a) for overall and (b) for gallery industry. West Chelsea pertains the higher hazard profile than the reference area, and in 2006, 2010 and 2011, the gap becomes even larger.

Industry-specific results in Model 2-b identify that Gallery, Artists, Construction, Manuf., Admin., Pb.Svc. had undergone disproportionately higher business closure in West Chelsea. West Chelsea imposes particularly larger hardship on Gallery, in that their survival chance is lower than their counterparts by the largest margin, evidenced by 5.249 times larger fitted odds of operation (Gallery\*WCh; closing  $\beta = 1.658^{***}$ ) at a statistically significant level of less than 5%. Artists in West Chelsea are also in a comparatively vulnerable position, exhibiting 4.792 times of the fitted odds of business closure compared with their counterparts (Artists\*WCh;  $\beta = 1.567^{***}$ ).

As discussed, one of the factors that explains the higher vulnerability of earlyarrived business establishments in West Chelsea is the upwardly shifting neighbourhood characteristics and ongoing economic development of the area, partly stimulated by aforementioned planning interventions and public projects. The announcement of rezoning in 2005 and completion of the High Line in 2009 and 2011, which may have facilitated the gentrification process, are roughly aligned with the increased hazard gap in two different locations observed in 2006, 2010 and 2011, although we cannot find a causal link in this analytical structure. This hardship is only to the early-arrived businesses of West Chelsea and the newer ones established after 2000 are not at greater risk of closing their doors than their counterparts in the reference area, as presented in the Analysis 1. It is probable that the frontier businesses might not have expected an imminent upward transformation of the West Chelsea to a new commercial/residential district and tourist attraction, when they moved in. Thus, in the current high-end commercial real estate market, the viability of those early-arrivers would be less robust than for followers, and susceptible to 'priceouts'.

# Analysis 3 : Fitted odds of opening businesses (late-arrivers)

West Chelsea accommodates comparatively higher frequency of business openings than those of the reference area in Manhattan, south of the Central Park. The probability of encountering a new business is high throughout the observation period, with greater intensity in years of 2004, 2005, 2008, 2010 and 2011. New openings of design, gallery industry and artists' enterprises are visible in West Chelsea, compared with the level observed in the reference area. This outcome can be interpreted as a sign of neighbourhood-level industrial clustering or localisation in the post-2000 period. These industrial concentrations reflect the conventional observation that West Chelsea has emerged as New York City's new arts district, and with it come the accoutrements of the 'creative class' (Currid, 2010; Molotch and Treskon, 2009). Contrary to the concerns voiced in the media that West Chelsea is losing its unique characteristics as an arts and cultural enclave, our empirical work here indicates that in reality the



**Figure 4.** (a) Fitted probability of business opening in each calendar year from 2000 to 2011, for overall establishments, separately plotted by locations (WCh versus the reference area), (plotted from Model 3-a; Table 1). (b) (c) (d) Fitted probability of business opening in each calendar year from 2000 to 2011, for *Gallery, Design* and *Lodging* establishments separately plotted by locations (WCh versus the reference area), (plotted from Model 3-b; Table 1 with subsamples of corresponding industries).

neighbourhood remains a compelling place for new gallery, design and art enterprises. Another visible influx is found in lodging industry (i.e. hotels) foreshadowing the commodification of the neighbourhood. As expected, less manufacturing enterprises choose West Chelsea for their new business location.

For the overall industries, the fitted odds of observing a new business over an old one is higher by 1.116 times ( $\beta = 0.110^{***}$ ) of the corresponding odds in the reference area (Model 3-a). By the positive values of interaction terms, *Year*<sup>\*</sup> *WCh*, the location effect

of West Chelsea deviates from the proportional trajectory in the year 2004, 2005, 2008, 2010 and 2011, displaying even stronger probability of firm openings than the one expected solely by the main effect. Figure 4(a) depicts new business opening probability profiles by location; West Chelsea exhibits the higher proportion of newly opening to existing businesses compared with the reference area in general, and the gap increases more in the later years, presented with interaction terms.

According to the industry-specific results in Model 3-b, a higher proportion of *Design*, Gallery, Artists, Lodging industries open their businesses in West Chelsea over the reference area, while new openings in manufacturing are rare in West Chelsea. The fitted odds of observing a newly opened gallery in West Chelsea during the observation years are 1.738 times greater than the fitted odds in the reference of doing so area  $(Gallery^*WCh; \beta = 0.553^{***})$ . To a lesser degree, independent art enterprises and design related industry also have higher opening tendency in West Chelsea, suggesting the neighbourhood's increasing importance as an arts district. Lodging industry also joins this trend, in that the fitted odds of observing new lodging venues over old ones in West Chelsea is 2.024 times higher than that of the reference area  $(Lodging^*WCh; \beta = 0.705^{***})$ . Figure 4(b)-(d) illustrates these statistical outcomes.

The analytical results on gallery industry and artists enterprises, together with their higher probability of closing operation revealed in the Analysis 2, suggests a fast turnover rate in West Chelsea, compared with the reference area. As of the plausible turning point of year 2000, early-arrived galleries and artists businesses in West Chelsea are more prone to business closure than those in the reference area, whereas a proportionally large number of new galleries and art-related businesses continued to open in West Chelsea after 2000, and no longer have the systematically higher tendency of closing operation, as evidenced in Analysis 1.

This outcome suggests that early pioneers, which may have been less affluent or economically successful to begin with, were pushed out, but that later galleries, perhaps lured by the neighbourhood's new reputation as an arts district, were more resilient and successful. We caution that there are many other characteristics that may explain the lesser success of the pioneers and the greater success of the late adopters. For example, the later galleries and art firms may possess greater business acumen (perhaps locating after the neighbourhood transformed is a sign of such skill). The later galleries may also have more economic resources (higher rents in the later years would suggest as much). Early galleries and art firms may have been motivated by the abandoned space and cheaper rents, as SoHo would have been the premier arts district and also more expensive. Regardless of the myriad motivations and explanations, it is clear that the arts and neighbourhood development model as put forth by Zukin (1989) and more generally discussed by other arts scholars (Currid, 2007; Lloyd, 2006) holds true.

# Limitation

One of the limitations of this study is the selection of the watershed year. Year 2000 is used to divide early-arrivers and late-arrivers in the current study, but could have been established differently. Ideally, the year 2000 should split the businesses into two distinctive groups that have contrasting economic positions. Although a series of public interventions facilitated the revitalisation process of West Chelsea from 2000 onwards, the economic restructuring takes much longer than a year. Therefore, any year within a plausible range from 2000 could be chosen for the watershed year, without harming the logic of this analytical design. In any case, the magnitudes of the estimates would be affected depending on the selection at a minor level, while the direction of the estimates would remain the same as the current study.

Another limitation may be in the establishment of the boundary of West Chelsea in our analysis. We attempted to define the site of investigation to accurately capture the full extent of the location effect of West Chelsea. In order to do this, we based our analysis on reasonable assumptions and sensitivity analysis. However, since the precise extent of the location impact of West Chelsea is not fully known, we could have delineated the boundary of West Chelsea around the core West Chelsea area alternatively, with differing assumptions. Likewise, the magnitudes of the estimates would be affected by the change, while the direction of the estimates would be the same.

### Conclusion

Our work attempts to unpack the relationship between artistic industries and economic development, based on empirical analyses on the business survival in West Chelsea between 2000 and 2012, the most active postindustrial revitalisation period for the area. Whilst we do not claim a causal link between the arts and development, we have gained a greater understanding of how the arts relate to the neighbourhood development and gentrification cycle. Our work upholds much of the previous, primarily qualitative work done in this area. We find that the early arts and cultural industries (those that arrived prior to 2000) do not fare well as the neighbourhood develops, particularly as we compare West Chelsea with our Manhattan reference area.

We find that for overall industries opened before 2000, West Chelsea is not a favourable environment for survival. Early-established firms have failed to sustain themselves in their original locations compared with those in other parts of Manhattan, as observed in the lower survival probability. Arts and cultural industries are particularly hard hit. The early-arrived museums, art galleries, artists' working spaces in West Chelsea are more susceptible to closing operation than their counterparts in the reference area, setting aside New York City's welldocumented manufacturing firm loss from the 1960s. Administrative and supportive services, non-profit and public services are in the same position.

As witnessed in SoHo, did art and cultural industries lose their position in West Chelsea? At least for the early pioneer galleries and art-related firms, the West Chelsea outcome mirrors that of SoHo. Although a causal link cannot be validated in this study, we can attribute this to the progress of revitalisation. Since Chelsea's 1999 rezoning, the observation period saw West Chelsea rezoning and the High Line completion in 2005, 2009 and 2011, respectively. Although these changes may have increased the desirability of the neighbourhood, it may have adversely affected the pre-existing businesses in their survival as the area became more appealing to a wide variety of businesses and people.

This reasoning also fits to the analytical result of the businesses that opened in the later phase of the revitalisation. We find that for overall industries opened in the more rapidly developing period (post-2000), West Chelsea is a better environment for survival for businesses. Indeed West Chelsea is an attractive neighbourhood for new business opening for particular types of industries, compared with the reference area in Manhattan. The influx of galleries and artist firms are visibly higher, corroborating extant reports in the scholarship and media detailing West Chelsea's ascent as New York City's new art district. Higher proportions of design industries also open their doors in West Chelsea, signifying West Chelsea has attracted other types of creative industries, suggesting some of the creative class dynamics put forth by Florida (2002). This analytical result fairly documents that the art/cultural industry which initiated postindustrial restructuring of West Chelsea still maintains a significant concentration in the neighbourhood, even as it diversifies.

This contrast between early-arrived and late-arrived arts and cultural industries implies that the nature of the art scene in West Chelsea may have changed during the course of the neighbourhood revitalisation (as it did in Soho). Although the characteristics of galleries in their rising and falling phases cannot be deduced from this analysis, Schuetz et al.'s (2011) study suggests that higher-tier galleries tended to survive longer than smaller or less economically robust galleries. As such, upward succession (and more high-tier galleries) may also have occurred in West Chelsea. An interview conducted by Kazakina (2013) gave a clue that mid-sized galleries were struggling from the raised rent, while the 'big players'<sup>2</sup> in the industry have expanded their presence in West Chelsea.

The cause of the continuing agglomeration of arts and cultural industries in West Chelsea cannot be fully explained through the scope of this research. However, it can be reasonably understood as 'path-dependency', whereby specialised services and knowledge-based industry cluster in an iterative fashion to share the collective social, intellectual and operational resources (Boschma and Lambooy, 1999; Currid, 2007; Scott, 2006). Arts and cultural industries in West Chelsea may benefit from the agglomeration economies. However, excessive competition between similar types of business inevitably accompanies. Amid the heated competition for space and customers, businesses with increased means can acquire space more easily than others.

We find that this spillover effect applies to overall businesses and firms, presented as low business closure probability in the analysis. Given the movement of New York City's art district to West Chelsea, the neighbourhood gained more visits from customers which undoubtedly supported the economic viability of in situ businesses. The fastgrowing hotel industry in West Chelsea evidenced in this study, and widely reported retail expansion including higher-end restaurants and fashion boutique shops (Moss, 2012a; PHA, 2005), and the increase in amenities – the High Line, the Hudson River Park – have made West Chelsea one of the popular spots in New York (PHA, 2005). Residential development has increased dramatically (Gregor, 2010; Russell, 2011), and developers have sought zoning variances to acquire even more FAR to survive under intensified property development competition (Berman, 2013). This suggests that localisation economies are at play within the gallery and arts industries and urbanisation economies are beneficial more broadly.

As this research and extant literature argues, the arts and cultural industries, in general, are critical in the early stage of the neighbourhood revitalisation process. They have also emerged as significant players in the wider economic dynamics within cities and regions (Currid, 2006; Scott, 2000, 2005; Stolarick and Currid-Halkett, 2013, among others). This is not limited to US cities, but observed ubiquitously in world cities (Economic Survey of Singapore, 2003; Fujita and Child Hill, 2004; Yusuf and Nabeshima, 2005).

In order to maintain the specific characteristics of the place and maximise the synergic effect of the agglomeration of creative, arts and cultural industries, balanced policy intervention is necessary (Mommaas, 2004). As this research suggests, the double goals of West Chelsea rezoning to boost the development momentum and to preserve the original nature of the art scene is inevitably selfconflicting, and requires greater effort to find the balance between those two. The current analysis supports the partial success of the policy on the second count, in that West Chelsea maintains an advantage in artsrelated industries and galleries. However, these policies and rezoning efforts could not prevent the 'price-out' of the earlier pioneers.

Recall however that SoHo's movement from nascent arts community to commercial takeover spanned over 25 years. Whilst the DCP rezoning for artists' live-work space in 1971, and the galleries moved in through the 1970s and 1980s, it was only in the 1990s when Soho's galleries started closing or moving out (Currid, 2010; Zukin, 1989). Thus, the West Chelsea arts story continues to unfold. Although a longer time must pass before we conclude on the success of the planning intervention, already our research would indicate that a more aggressive and comprehensive regulatory framework could have been instrumental in promoting such industries in this context.

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#### Notes

- 1. Unlike SoHo, West Chelsea began to attract art dealers first and artists later. Even before the art dealers made their way, however, there has been a unique art scene created by photographers and performing artists (Bruni, 2008; Pincus, 1997). We do not claim that there is a strong connection between the art works created and consumed in West Chelsea.
- 2. For example, David Zwirner, Hauser and Wirth, Larry Gagosian, Pace and Barbara Gladstone expanded their galleries or opened another branch in West Chelsea (Kazakina, 2013).

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List (Variable name)	NAICS codes	Description	Number in the p	opulation data	Number in the	e sample
			Study area	WCh	Study area	WCh
Gallery/Museum (Gallery)	712110~712190 453920	Museums, Historic Sites and Similar institution, Arr Dealer Gallerv	2093	628	408	540
Artists (Artist)	711110~711190 711310~711510 541921	Performing Arts and Related Industries, Independent Artists and Associas Phytrosronbers	4469	327	511	274
Architectural design and related service, graphic design (Design)	541310~541380		I 6,356	302	855	225
Construction	236115~238990		6249	173	554	128
Manufacturing (Manuf.)	3     ~339999		13,948	429	1049	277
Automotive Services (Auto.)	81111~811198	Originally from "Services" sector	766	221	297	167
Wholesale Trade (Whs.) Retail Trade (Retail)	423110~425120 441110~453910 453920	Subsector "Art Dealer" (453920) is moved to Gallery/Museum	12,154 42,846	219 994	1002 2154	173 686
Information (Info.) Finance, Insurance, Real Estate, Rental Leasing (FIRE)	511110~519190 521110~533110		16,268 21,831	322 342	787 1415	135 242
Accunting, Consulting, Tax Preparation, Advertising, Public Relation (Business Support)	541211~541219 541611~541690 541810~541890		12,434	229	650	171
						(Continued)

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Appendix I

Appendix I. (Continued)						
List (Variable name)	NAICS codes	Description	Number in the po	opulation data	Number in the	sample
			Study area	WCh	Study area	WCh
Computer system design,	541511~541519		5471	1002	286	75
scientific research (Tech.)	541711~541720					
Management (Mng.)	551111~551114		4438	8	232	62
Legal Services (Legal)	541110~541199		15,036	22	879	13
Administrative,	561110~561990		15,801	151	816	64
Support Services (Admin.)						
Educational Services	611110~611710		2939	43	276	27
Health Care and Social	621111~624410		11,758	124	729	89
Assistance						
(Health)						
Entertainment	713110~713990	Amusement, Gambling	1008	175	335	172
(Etm.)		and Recreational Industries				
Lodgings	721110~721310		871	22	160	8
(Louging) Restaurants	722110~722410		11,875	371	939	257
(Restr.)						
Personal Services	812111~812990		6536	137	472	87
Non-profit, Public	813110~928120	Religious, Grant-making,	5063	57	359	22
Services (Ph. Svc.)		Civic Professionals, Public Administration				
Others Total			35,440 265,650	583 6054	1889 17,054	282 4186