4 The effects of physical restructuring on the socioeconomic status of neighborhoods: Selective migration and upgrading

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§ 4.1 Introduction

Many European and North American governments have a long tradition of urban restructuring programs to regenerate deprived neighborhoods. The combination of low-quality housing and a variety of socioeconomic problems, such as high crime rates and high unemployment rates, was thought to negatively affect the larger urban area and its residents. On the city level, concentrations of poverty were considered to be detrimental to the economic prosperity of urban regions by reducing the attractiveness of the area to businesses and higher income groups. On the individual level, neighborhood deprivation was thought to have a negative impact on the individual life chances of residents through a lack of network resources and negative role models. Urban restructuring policies therefore aimed to break up concentrations of poverty and to counteract negative neighborhood effects by changing the spatial distribution of disadvantaged residents (VROM, 1997).

In many European countries, the main tool of urban restructuring was housing diversification. Through the demolition or sales of low-quality social housing and the construction of more expensive owner-occupied or private-rented dwellings, policymakers aimed to create a socioeconomic mix of residents in deprived neighborhoods. The in-migration of middle- and high-class households in these neighborhoods was thought to lead to a process of socioeconomic upgrading (Kleinhans, 2004). It was implicitly assumed that these middle- and higher income groups would act as role models and network resources for the original residents, thereby improving their

individual life chances (Andersson & Musterd, 2005). The socioeconomic upgrading of previously deprived neighborhoods was also thought to have positive spillover effects on nearby neighborhoods, by improving the housing market position, reputation, and attractiveness of the larger geographical area (cf. Deng, 2011; Ellen & Voicu, 2006).

Many scholars have since been critical about urban restructuring. Some have criticized urban restructuring policies for being a form of state-led gentrification (Uitermark & Bosker, 2014). Similar to other processes of gentrification, state-led gentrification arguably leads to displacement as the demolition and sales of social housing forces disadvantaged residents to relocate elsewhere (Boterman & Van Gent, 2014; Uitermark & Bosker, 2014). In addition, the construction of more expensive dwellings stimulates exclusionary displacement, making it financially difficult for low-income residents to move into the neighborhood (Boterman & Van Gent, 2014; Marcuse, 1986). Others have been critical about the effectiveness of urban restructuring in actually achieving neighborhood change (e.g. Lawless, 2011; Permentier et al., 2013; Tunstall, 2016; Wilson, 2013). It has been argued that although urban restructuring has led to a physical upgrading of neighborhoods and a diversified population composition as a result of selective migration, it has failed to improve the lives of disadvantaged residents and it did not lead to significant changes in the socioeconomic status of neighborhoods (cf. Bailey & Livingston, 2008; Jivraj, 2008; Permentier et al., 2013; Tunstall, 2016; Wilson, 2013).

The present study focuses on the extent to which urban restructuring has stimulated socioeconomic neighborhood change as a result of changes in the population composition in the 31 largest Dutch cities. While many studies have extensively analyzed the effects of urban restructuring on *individual* outcomes (e.g. Bolt & Van Kempen, 2010b; Manley et al., 2012; Miltenburg, 2017), it has been much more difficult to identify the effects of urban restructuring on *area-based* outcomes (Lawless, 2011). First, urban restructuring programs were both people-based and place-based programs that entailed a number of different interventions over time that also differed between neighborhoods and cities in size and scope. This implies that it has been difficult to 'measure' urban restructuring and to identify control neighborhoods with similar socioeconomic characteristics that did not experience any urban restructuring (Lawless, 2011). The present study overcomes this limitation by focusing on the share of demolished and newly constructed dwellings as the main indicator of urban restructuring. We use propensity score matching to compare neighborhoods that experienced physical restructuring to neighborhoods with similar socioeconomic characteristics that did not, allowing us to analyze the causal effect of policy on socioeconomic neighborhood change.

Second, many studies investigating the effects of physical restructuring have focused on relatively large administrative areas, which means that the effects have to be large to

change the trajectory of the entire neighborhood. We therefore analyze neighborhood change on a relatively low spatial scale, i.e. 500 by 500 meter grids, which allows us to better capture the effects of very localized demolition and new construction.

Third, research has shown that significant changes take time to have effect (Meen et al., 2013; Tunstall, 2016; Zwiers et al., 2017; Zwiers et al., 2018a). Prior studies on urban restructuring in the Netherlands have been limited by a relatively short-time perspective, ranging from one to six years (e.g. Permentier et al., 2013; Wittebrood & Van Dijk, 2007), while it is possible that the effects of physical restructuring will only be visible over a much longer period of time. We therefore focus on neighborhood change over a 15-year period, providing insight in the effects of physical change over and beyond the course of the restructuring programs and the extent to which restructured neighborhoods have been successful in maintaining and attracting middle- and high-income groups over time.

This study focuses on neighborhood socioeconomic change in the 31 largest Dutch cities between 1999 and 2013. We compare changes in the median neighborhood income between restructured neighborhoods, control neighborhoods, adjacent neighborhoods, and all other neighborhoods. We find that restructured neighborhoods have experienced the highest increase in the median neighborhood income. We analyze to what extent these changes can be explained by a changed population composition or neighborhood change in-situ. Changes to the housing stock as a result of urban restructuring seems to attract and maintain middle- and high-income households in previously deprived neighborhoods. However, these effects are very local and do not extent to adjacent neighborhoods. These findings contribute to our understanding of long-term neighborhood change and illustrate that large-scale shocks such as physical restructuring can change the trajectory of a neighborhood.

§ 4.2 Physical restructuring and selective migration

Neighborhoods are very dynamic in their population composition as a result of residential mobility and demographic events, however, neighborhood status tends to be relatively stable over time (Tunstall, 2016; Zwiers et al., 2017; Zwiers et al., 2018a). This can be explained by the fact the housing stock tends to remain unchanged after initial construction (e.g. Meen et al., 2013; Nygaard & Meen, 2013; Zwiers et al., 2017). Next to less frequent cases of gentrification or decline, this implies that processes of residential mobility often do not lead to neighborhood change, as households with

similar socioeconomic characteristics move in and out of these neighborhoods, thereby maintaining the status quo over longer periods of time (Meen et al., 2013; Zwiers et al., 2017). Physical restructuring has however the potential to induce neighborhood change by fundamentally changing the housing stock and stimulating selective migration (Meen et al., 2013).

Over the past few decades, many Western European governments have used physical restructuring as a tool to combat processes of decline in deprived neighborhoods. Although urban restructuring often consisted of both people-based and place-based programs, most restructuring policies were strongly focused on the housing stock and aimed to create a social mix in deprived neighborhoods through housing diversification (Kleinhans, 2004). Housing diversification was achieved through the demolition, upgrading, or sales of low-quality social-rented or council housing and the construction of new upmarket owner-occupied or private-rented housing in order to attract a more affluent, middle-class population. The inflow of higher income groups as a result of these tenure changes was expected to lead to the socioeconomic upgrading of these deprived neighborhoods (Kleinhans, 2004; VROM, 1997).

However, studies evaluating area-based urban policies have been critical about the effectiveness of restructuring in generating processes of neighborhood upgrading through selective migration (e.g. Lawless, 2011; Permentier et al., 2013; Tunstall, 2016; Wilson, 2013). While some studies have found small positive effects in terms of selective migration as a result of restructuring (Bailey & Livingston, 2008; Jivraj, 2008; Permentier et al., 2013; Wittebrood & Van Dijk, 2007), others have found that selective migration can lead to increasing concentrations of poverty in restructured neighborhoods (cf. Andersson & Bråmå, 2004; Jivraj, 2008) or elsewhere (Andersson, 2006; Andersson et al., 2010; Posthumus et al., 2013).

In the current literature, it is thus unclear to what extent physical restructuring affects selective migration and how this contributes to socioeconomic neighborhood change. Researchers have argued that the effectiveness of physical restructuring in generating neighborhood change depends on the size and scope of these policies (Jivraj, 2008; Nygaard & Meen, 2013; Tunstall, 2016). Major demolition and new construction is necessary to change the trajectory of a neighborhood (Nygaard & Meen, 2013; Tunstall, 2016). In many cases, only parts of neighborhoods were targeted for restructuring, which means that the rest of the neighborhood remained unchanged (cf. Dol & Kleinhans, 2012). This could lead to a (temporary) in-flow of higher income groups in the newly constructed part of the neighborhood, however, this might not be enough to stimulate the upgrading of the entire neighborhood. At the same time, many residents from demolished dwellings have moved within the restructured neighborhood, thereby impeding neighborhood change (Kleinhans & Varady, 2011; Kleinhans & Van Ham,

2013; Posthumus et al., 2013). When a large proportion of the low-income residents moves within the restructured neighborhood, a greater share of middle- and high-income groups moving into the restructured neighborhood is needed to generate neighborhood change. Moreover, the effects of physical restructuring might only be visible over a longer period of time as neighborhood change takes long to take effect (Tunstall, 2016; Zwiers et al., 2017). The effectiveness of restructuring depends on the ability of restructured neighborhoods to maintain and attract middle- and high-income groups over time. As renovated or newly constructed dwellings age over time, continuous investments are necessary to maintain a certain housing quality (Weber et al., 2006). If unsuccessful, positive effects might be visible at first, however over time, new processes of decline might become apparent leading to the out-migration of middle- and high-income households (Musterd & Ostendorf, 2005a).

The question remains to what extent physical restructuring has effects outside those areas which were directly targeted for demolition and new construction. There are two possible opposing trends. On the one hand, several researchers have been concerned with processes of displacement. As the share of affordable housing is reduced in restructured neighborhoods, low-income households are forced to find affordable housing elsewhere (Atkinson, 2002; Posthumus et al., 2013). This process of displacement might lead to increasing concentrations of poverty in other (nearby) deprived neighborhoods (Bolt & Van Kempen, 2010b; Posthumus et al., 2013). A review of the literature on the effects of urban restructuring programs in the United States and the Netherlands has however found no evidence for such negative spillover effects (Kleinhans & Varady, 2011). On the other hand, US studies have found evidence of positive spillover effects of physical restructuring. Changes to the housing stock in deprived neighborhoods might improve the reputation and attractiveness of the entire area, leading to positive spillover effects on house prices in nearby neighborhoods (Deng, 2011; Ellen & Voicu, 2006).

The present study explores three hypotheses. First, we hypothesize that neighborhoods that have experienced large-scale demolition and new construction, resulting in a substantially different housing stock, have seen more positive change in the median neighborhood income over time than control neighborhoods with similar socioeconomic characteristics that have experienced little physical restructuring. Second, we expect that this process of neighborhood upgrading in restructured neighborhoods can be explained by a decrease in the share of low-income households and an increase in the share of middle- and high-income households. Third, it could be hypothesized that adjacent areas experienced positive spillover effects as a result of the upgrading of restructured neighborhoods. Improvements to the housing stock are likely to improve an area's reputation and lead to rising house prices. We thus might also expect a higher share of higher income households in neighborhoods surrounding restructured neighborhoods.

§ 4.3 Data and methods

This study used longitudinal register data from the System of Social statistical Datasets (SSD) from Statistics Netherlands. We have data on the full Dutch population from 1999 to 2013. Neighborhoods are operationalized using 500 by 500 meter grids. Although 500 by 500 meter grids do not correspond to the administrative boundaries of neighborhoods, they do provide the geographical most consistent spatial scale as the administrative boundaries of neighborhoods have changed drastically over time. We focused on neighborhoods in the 31 largest Dutch cities, leading to a total of 5,364 neighborhoods, and an average population of approximately 800 in 2013. To analyze neighborhood change over time, we focused on the yearly median household income adjusted for inflation in a neighborhood. The median is less affected by outliers and thus provides a robust measure of changes in neighborhood income over time. To ensure the comparability of household incomes across different household types, an equivalence factor was used. We have divided household income by the square root of household size. Conceptually, this means that a four-person household has twice the needs of a single-person household (OECD, 2013b).

We concentrated on neighborhoods that have experienced substantial restructuring, as the literature suggests that major restructuring is necessary to generate neighborhood change (Meen et al., 2013; ; Nygaard & Meen, 2013). We specifically focused on the total number of demolished and newly constructed dwellings as this has been the main tool of urban restructuring in the Netherlands (Kleinhans, 2004). Statistics Netherlands provides information on different types of demolition (partial, complete), with, or without, new construction and/or renovation. We have selected neighborhoods with more than one standard deviation above the average total number of mutated dwellings between 1999 to 2013. This means that we have selected neighborhoods with a total number of restructured dwellings ranging from 124 to 1,536. This has resulted in a total of 393 neighborhoods. As the restructuring of these neighborhoods was expected to have a positive effect on the larger urban area in terms of reputation, house prices, and overall attractiveness, we test for spillover effects in nearby neighborhoods. Potential spillover effects would be the strongest in the geographically most proximate neighborhoods, therefore, we have used queen criteria to identify adjacent neighborhoods, selecting all neighborhoods that share a boundary with the restructured neighborhoods. We have identified a total of 921 adjacent neighborhoods. Propensity score matching was used to identify control neighborhoods. Propensity score matching creates matched sets of treated and untreated subjects with similar propensity scores (Rosenbaum & Rubin, 1983). The propensity score is the probability of treatment conditional on a number of observed baseline characteristics (Austin, 2011). This study aimed to compare neighborhoods with similar socioeconomic status and used the median equivalized

household income in 1999, the share of unemployed individuals in 1999, the number of households in 1999, and the share of rented dwellings in 1999 as baseline covariates. Unemployment was defined as receiving unemployment or social assistance for a full year or longer. As we are unable to distinguish between social rented housing and private rented housing in the data, the share of rented dwellings included both, although the majority of rented housing in the Netherlands is social housing (Statistics Netherlands, 2014). The results from the propensity score model indicate that there is a significant positive causal effect of restructuring on the 2013 median neighborhood income of restructured neighborhoods (ATET = 709.93 (258.44), $p < 0.01$).

Control neighborhoods were constrained to have experienced below average physical mutations between 1999 to 2013, with the main goal of isolating the effects of physical restructuring on neighborhood change. We have used nearest neighbor matching with replacement, which means that restructured neighborhoods were matched with control neighborhoods with the closest propensity score (Rosenbaum & Rubin, 1985). Matching with replacement implies that each control neighborhood can be used as a match more than once, which is particularly useful for the present study as there are only a limited number of neighborhoods that could function as a suitable control group (Wittebrood & Van Dijk, 2007). We have identified 142 control neighborhoods with a total number of restructured dwellings ranging from 0 to 31. For comparability, these neighborhoods were selected from the 31 largest cities within the Netherlands. Control neighborhoods were not allowed to neighbor restructured neighborhoods. Maps that illustrate the distribution of the different neighborhood groups in Amsterdam and Rotterdam are presented in Figure 4.1.

To reduce selection bias it is important that the covariates are balanced between the treated and untreated subjects. We found no significant mean differences between the control neighborhoods and the restructured neighborhoods in the median household income in 1999 ($t (173) = 0.73$, $p > 0.05$), the share of unemployed individuals in 1999 ($t (156) = 0.33$, $p > 0.05$) and the share of rented dwellings in 1999 ($t (216) = -0.77$, $p > 0.05$). There was a significant mean difference in the number of households in 1999 ($t (402) = -9.17$, $p < 0.001$). Inspecting the distribution of the explanatory variables with quintiles of the propensity scores proved that the baseline covariates were balanced between the restructured and control neighborhoods (cf. Austin, 2009). The only exception here was the number of households in 1999, where we found a discrepancy in the number of households between the restructured and control neighborhoods, especially in the fourth and fifth propensity score quintile. However, excluding this variable from the propensity score model leads to severe imbalances in the other covariates (results not shown). We therefore keep the number of households in 1999 as a baseline covariate in the propensity model.

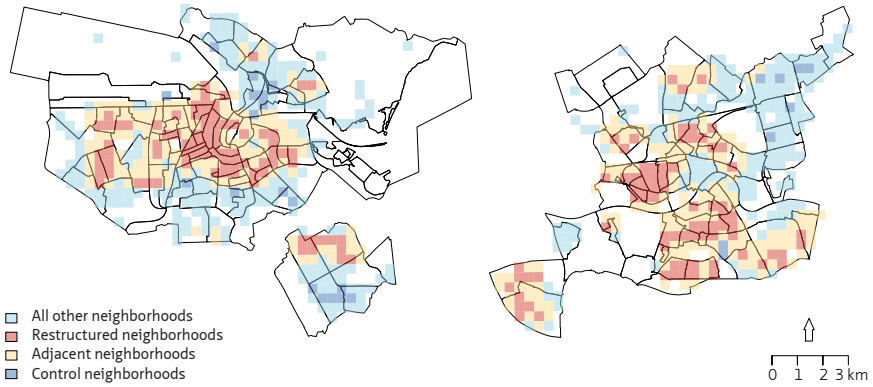

FIGURE 4.1 Distribution of neighborhood groups in Amsterdam and Rotterdam
Source: System of Social statistical Datasets (SSD)

The number of households in 1999 was associated with both our neighborhood groups and our outcome variable. As mentioned above, the number of households in 1999 was imbalanced between groups. The number of households measures the density in a neighborhood, but can also be understood as a measure of the potential for change: higher density is generally associated with less change over time. As such, this confounding variable distorted the relationship between our neighborhood groups and the change in the median neighborhood income. The inclusion of the number of households as a control variable substantially changed the regression coefficients as the differences between neighborhood groups became larger and statistically significant (results not shown). Stratification is a way of dealing with confounding by producing groups within which the confounder does not vary. We have therefore created five strata based on quintiles of the number of households in 1999, with the first stratum consisting of low-density neighborhoods and the fifth stratum of high-density neighborhoods. The distribution of neighborhoods across the five strata is presented in Table 4.1.

TABLE 4.1 Distribution of neighborhoods across the five strata based on quintiles of the number of households in 1999

	ALL OTHER NEIGHBORHOODS	RESTRUCTURED NEIGHBORHOODS	ADJACENT NEIGHBORHOODS	CONTROL NEIGHBORHOODS
Stratum 1	25.9	0.3	6.2	8.5
Stratum 2	23.7	0.8	13.4	9.2
Stratum 3	22.1	8.1	17.6	11.3
Stratum 4	18.5	18.3	26.3	24.7
Stratum 5	9.8	72.5	36.6	46.5

Source: System of Social statistical Datasets (SSD)

We conducted a stratified analysis of five OLS regression models with robust standard errors to explain changes in the median neighborhood income over time. There was some multicollinearity between the neighborhood groups in models 1 and 2 because of the small group size of the restructured neighborhoods and the control neighborhoods. For these models, these two groups have therefore been combined into one group. The residuals showed some deviations from normality. There was however no clear indication of heteroscedasticity and the results from the regression with OLS standard errors did not differ substantially from the results from the regression with robust standard errors. However, the OLS standard errors of the most important predictors were larger than the robust standard errors in the fourth and fifth strata, which suggests that the OLS standard errors were biased upward. As such, we decided to report the results from the OLS regression with robust standard errors.

To better understand the process of neighborhood change, we analysed changes in the population composition between 1999 and 2013. Based on the national household income distribution, we have created three income categories: low-income groups (the lowest 40%), middle-income groups (the middle 30%), and high-income groups (the top 30%) (see also Hochstenbach & Van Gent, 2015). We focused on changes in the share of the three income groups in the different neighborhoods. We also analyzed in-situ change by comparing changes in the median household income of non-movers between 1999 and 2013.

§ 4.4 Results

Table 4.2 presents the descriptive statistics of the restructured neighborhoods, the adjacent neighborhoods, the control neighborhoods, and the rest of the Netherlands. The median equivalized neighborhood household income in the restructured neighborhoods was 14,528 euros in 1999. The median equivalized neighborhood household income was similar in the control neighborhoods, 14,800 euros, and higher in the adjacent neighborhoods, 17,353 euros. The median equivalized neighborhood household income was much higher in the rest of the Netherlands, 20,506. The average share of unemployed individuals was 16.1% in the restructured neighborhoods, compared to 10.7% in adjacent neighborhoods and 16.6% in the control neighborhoods. These shares are far above the average share of unemployed individuals in the rest of the rest of the country; 5.9%. These descriptive figures indicate that neighborhoods that have experience large-scale demolition and new construction were among the most disadvantaged neighborhoods of the country. The average share of rented dwellings in 1999 was 80.6% in the restructured

neighborhoods, which was similar to the average share of rented dwellings in the control neighborhoods, 79.2%. The average share of rented dwellings in the rest of the country was almost half of that in the restructured neighborhoods: 40.5%. The average share of rented dwellings in the adjacent neighborhoods was 64.7%. The restructured neighborhoods were highly populated areas: the average number of households in 1999 was 1,313, compared to 775 in the control neighborhoods, 716 in the adjacent neighborhoods, and 326 in the rest of the country. In 2013, the median equivalized neighborhood household income adjusted for inflation increased to 15,180 euros in the restructured neighborhoods. This means that, after adjusting for differences in household size and inflation, the median neighborhood income has increased with 652 euros, reflecting a 4.5% increase. This increase is almost twice the increase in the control neighborhoods: the 2013 median neighborhood household income increased to 15,140, reflecting an average increase of 340 euros, or 2.3%. The median neighborhood household income in the adjacent neighborhoods increased with 216 euros to 17,568, showing a 1.2% increase. All other neighborhoods in the Netherlands experienced an average increase of 1,289 euros leading to a median neighborhood household income of 21,796, reflecting a 6.3% increase. The average share of unemployed individuals dropped in all areas. The average unemployment rate declined to 9.8% in the restructured neighborhoods, compared to 10.7% in the control neighborhoods, 7.8% in the adjacent neighborhoods, and 4.4% in the rest of the country. The average number of households remained relatively stable in all grids: in 2013, the average number of households was 1,294 in the restructured neighborhoods, 801 in the control neighborhoods, 780 in the adjacent neighborhoods, and 356 in the rest of the Netherlands.

TABLE 4.2 Descriptive statistics of the different neighborhood groups, 1999 and 2013

	ALL OTHER NEIGHBORHOODS		RESTRUCTURED NEIGHBORHOODS		ADJACENT NEIGHBORHOODS		CONTROL NEIGHBORHOODS	
	1999	2013	1999	2013	1999	2013	1999	2013
Average median neighborhood income	20,506 (5,942)	21,796 (6,723)	14,528 (2,337)	15,180 (3,416)	17,353 (4,420)	17,568 (5,536)	14,800 (4,237)	15,140 (5,661)
Average percentage unemployed	5.9 (6.3)	4.4 (4.5)	16.1 (6.7)	9.8 (5.0)	10.7 (7.8)	7.8 (5.6)	16.6 (17.6)	10.7 (6.6)
Average percentage rented dwellings	40.5 (27.7)	39.7 (23.4)	80.6 (16.0)	67.9 (14.4)	64.7 (25.2)	59.5 (21.4)	79.2 (19.2)	68.3 (20.6)
Average number of households	326 (357)	356 (377)	1,313 (809)	1,294 (825)	716 (562)	780 (595)	775 (502)	801 (523)
Average total demolished dwellings		7 (17)		292 (190)		26 (33)		6 (8)
N		**3,908**		**393**		**921**		**142**

Note: Standard deviations in parentheses
Source: System of Social statistical Datasets (SSD)

The average number of demolished dwellings between 1999 and 2013 was 292 in the restructured neighborhoods and the average share of rented dwellings decreased to 67.9% in 2013, reflecting an average reduction of almost 15%. The average number of demolished dwellings in the control neighborhoods was much lower: 6. However, the average share of rented dwellings also decreased substantially in these neighborhoods: from 79.2% to 68.3%. The average number of demolished dwellings was 26 in adjacent neighborhoods and the average share of rented dwellings decreased to 59.5%. The average number of demolished dwellings was 7 in the rest of the Netherlands, and these neighborhoods have also experienced a small decrease in the average share of rented dwellings: from 40.5% in 1999 to 39.7% in 2013. While the decrease in the share of rented dwellings in the restructured neighborhoods can most likely be ascribed to physical restructuring, the decrease in the share of rented dwellings in the other neighborhoods can be the result of other factors. As the Dutch policy of urban restructuring went hand-in-hand with the liberalization of the housing market, homeownership was increasingly stimulated and many rented dwellings were sold off to owner-occupiers (Uitermark & Bosker, 2014).

Table 4.3 presents the results from the stratified OLS regression on neighborhood income change. The results from the first stratum show no significant results between the restructured and control neighborhoods (reference group), the adjacent neighborhoods, and all other neighborhoods in the Netherlands.

TABLE 4.3 Regression coefficients from the stratified OLS regression with robust standard errors

	STRATUM 1	STRATUM 2	STRATUM 3	STRATUM 4	STRATUM 5
Control neighborhoods			-2484.89*	-1070.54**	-1393.59***
Adjacent neighborhoods	-195.00	-333.10	-2150.75**	-1121.34**	-1039.55***
All other neighborhoods (ref = restructured neighborhoods)	1813.83	138.30	-1813.64*	-912.12**	-839.87***
Median neighborhood income 1999	0.69***	0.80***	0.94***	1.00***	1.13***
Amsterdam	-3342.01***	-1459.07*	-1112.63*	-603.10	380.21*
Rotterdam	912.36	1154.56	267.89	719.56**	385.46*
The Hague	2258.03	1826.98	65.56	162.68	-685.64***
Utrecht (ref = all other cities)	1764.47	42.67	-101.17	-1593.50	-263.33
Constant	7191.73*	6014.92	3845.34***	957.92*	-1656.72***
Adjusted R^2	0.39	0.57	0.73	0.78	0.78
N	1,083	1,063	1,073	1,072	1,071

*Note: * p < .05. ** p < .01. *** p < .001.*
Source: System of Social statistical Datasets (SSD)

This suggest that in low-density areas, the change in the median neighborhood income is similar across all neighborhoods. The median equivalized neighborhood income in 1999 was included as a baseline covariate to control for floor and ceiling effects. The median equivalized neighborhood income in 1999 has a positive effect on the change in the average neighborhood income ($b = 0.69$, $p < 0.001$). To test if the changes in the average neighborhood income are not just driven by housing market dynamics in the four largest cities, dummy variables have been included. Compared to the rest the Netherlands, we find no significant differences in the neighborhood income in low-density neighborhoods in Rotterdam, The Hague, and Utrecht. Low-density neighborhoods in Amsterdam seem to have experienced a significantly lower increase in the neighborhood income than the rest of the Netherlands ($b = -3342.01$, $p < 0.001$).

The results for the second stratum show no significant differences between restructured and control neighborhoods and adjacent neighborhoods, and all other neighborhoods. For these neighborhoods, the median neighborhood income in 1999 is the most important predictor ($b = 0.80$, $p < 0.001$). There are no significant differences between Rotterdam, The Hague, Utrecht, and the rest of the country. Neighborhoods in Amsterdam show as significantly lower increase in the median neighborhood income ($b = -1459.07$, $p < 0.05$).

We find significant differences in the change in the neighborhood income between the neighborhood groups in the third, fourth, and fifth stratum. In all three strata, the restructured neighborhoods show a significantly higher increase in the median neighborhood income between 1999 and 2013. In the fifth stratum, the control neighborhoods show a significantly lower increase in the median neighborhood income compared to the restructured neighborhoods ($b = -1393.59$, $p < 0.001$). Both the adjacent neighborhoods and all other neighborhoods also show a significantly lower change in the median neighborhood income compared to the restructured grids, ($b = -1039.55$, $p < 0.001$) and ($b = -839.87$, $p < 0.001$), respectively. This finding implies that in higher density areas, the restructured grids have seen the most change in the median neighborhood income.

In high-density neighborhoods, the average neighborhood income in 1999 has a positive effect on neighborhood income change ($b = 1.00$, $p < 0.001$) and ($b = 1.13$, $p < 0.001$) in the fourth and fifth stratum, respectively. The median neighborhood income in 1999 is the strongest predictor of neighborhood change in both models ($\beta = 0.89$, and $\beta = 0.92$). The importance of the median neighborhood income in 1999 illustrates a strong degree of path-dependency (Zwiers et al., 2017). Neighborhoods with a high median income in 1999 have experienced an increase in the median neighborhood income over time: neighborhoods that did well in 1999 do better in 2013. In a similar vein, we find that Amsterdam and Rotterdam experience significantly more change

compared to all other neighborhoods in the fifth stratum (b = 380.21, p < 0.05) and (b = 385.46, p < 0.05). As many inner-city neighborhoods in Amsterdam and Rotterdam have become increasingly popular over time, both cities have experienced processeses of gentrification resulting in strong rises in house prices and neighborhood income (Hochstenbach & Van Gent, 2015). Contrarily, high-density neighborhoods in the Hague have experienced a significantly lower increase in the median neighborhood income compared to the rest of the country (b = -1656.72, p < 0.001), which indicates a processes of neighborhood decline.

Most of the change in the median neighborhood income seems to occur at the top end of the density distribution. The models for the fourth and fifth stratum both explain 78% of the variation in the change in the median neighborhood income. This seems to suggest that processes of gentrification and decline together with large-scale urban restructuring seem to have had major effects on neighborhood socioeconomic change in high-density areas.

To understand to what extent these socioeconomic changes can be explained by a changed population composition, we analyzed the changes in the share of different income groups in the four neighborhood types. Table 4.4 presents the share of low-, middle-, and high-income groups in 1999 and 2013. The share of low-income households increased in all four neighborhood groups. The control neighborhoods experienced the highest increase in the share of low-income households, 6.8%, compared to 4.7% in the adjacent neighborhoods, and 2.6% in the restructured neighborhoods. The rest of the country saw the smallest increase in low-income households, 1.7%. Despite processes of forced relocation, the restructured neighborhoods continue to be accessible to low-income households over time. The share of middle-income households increased by 0.3% in the control neighborhoods and the restructured neighborhoods, compared to 1.3% in the adjacent neighborhoods and 3.1% in the rest of the country. The share of high-income households decreased substantially in all four neighborhood groups: 3.2% in the control neighborhoods, 3.3% in the adjacent neighborhoods, and 2.3% in all other neighborhoods. The restructured neighborhoods experienced a small decline of 0.2% in the share of high-income households, suggesting that physical restructuring has had a positive effect on the ability of these neighborhoods to attract and maintain high-income households.

As urban restructuring was expected to have a positive effect on the socioeconomic situation of the sitting population, we analyzed changes in the median household income. The median household income has decreased in all four neighborhood types over the 1999-2013 period. The control and adjacent neighborhoods experienced an average decline of 959 and 985 euros in the median household income among the population in-situ, showing a 5.4% and 5.3% decrease. The decline in the median

household income in the restructured neighborhoods is similar to the decline in the rest of the country: 415 compared to 491 euros, reflecting a decline of 2.6% and 2.3%, respectively.

TABLE 4.4 Population change in the four neighborhood types, 1999 and 2013

	ALL OTHER NEIGHBORHOODS			RESTRUCTURED NEIGHBORHOODS			ADJACENT NEIGHBORHOODS			CONTROL NEIGHBORHOODS		
	1999	2013		1999	2013		1999	2013		1999	2013	
Percentage low-income households	33.6 (14.0)	35.3 (15.4)	+1.7	50.5 (8.2)	53.1 (10.7)	+2.6	42.1 (12.6)	46.8 (14.5)	+4.7	49.3 (16.9)	56.1 (17.4)	+6.8
Percentage medium-income households	27.6 (9.4)	30.7 (9.5)	+3.1	26.9 (4.8)	27.2 (6.1)	+0.3	27.0 (6.5)	28.3 (7.4)	+1.3	26.9 (8.9)	27.2 (9.8)	+0.3
Percentage high-income households	36.3 (15.9)	34.0 (16.5)	-2.3	20.0 (7.4)	19.8 (8.8)	-0.2	28.2 (12.4)	24.9 (13.5)	-3.3	19.9 (10.0)	16.7 (12.7)	-3.2
Median household income population in-situ	21,504	21,013	-491	15,910	15,495	-415	18,651	17,666	-985	17,719	16,760	-959
N		3,908			393			921			142	

Note: Standard deviations in parentheses
Source: System of Social statistical Datasets (SSD)

§ 4.5 Discussion and conclusion

This paper has analyzed the effects of large-scale demolition and new construction on neighborhood income change over time and has studied changes in the population composition. We find that restructured neighborhoods have experienced the largest increase in the median neighborhood income. Focusing on a low spatial scale, our results indicate that large-scale demolition and new construction has strong positive effects on the neighborhood income developments of deprived neighborhoods.

Restructured neighborhoods have been most successful in attracting and maintaining higher income groups compared to all other neighborhoods. The decline in the median income among the population in-situ was relatively small in the restructured

neighborhoods. Although it is difficult to assess to what extent this can be attributed to urban restructuring, it does seem to indicate that restructured neighborhoods have become more resilient to decline over time. While it is often argued that the demolition of low-cost rental housing and the construction of owner-occupied and private-rented dwellings leads to the displacement of low-income households (e.g Boterman & Van Gent, 2014), we find that restructured neighborhoods continue to be accessible to low-income households. Although some low-income households have had to relocate elsewhere as a result of restructuring, this process of displacement appears to have been temporary. However, it is unclear to what extent these neighborhoods experience exclusionary displacement (Marcuse, 1986). The decline in the share of social housing in these neighborhoods might make the neighborhood (financially) inaccessible to the most disadvantaged residents, forcing them to move to other low-income neighborhoods. This might be a possible explanation for the large increase in the share of low-income households in the adjacent and control neighborhoods.

Although it is often assumed that improvements to the housing stock lead to a better reputation of the entire area (VROM, 1997), and that increased house prices have spatial spillover effects on nearby dwellings and neighborhoods (Deng, 2011; Ellen & Voicu, 2006), we do not find evidence for positive spillover effects to adjacent neighborhoods. On the contrary, adjacent neighborhoods actually seem to suffer from urban restructuring. Adjacent neighborhoods have experienced a relatively large increase in the share of low-income households, most likely as a result of forced relocation (Posthumus et al., 2013). In addition, adjacent neighborhoods have seen the largest decrease in the share of high-income households and the largest decline in the median household income among the population in-situ. Although it is difficult to assess to what extent these developments are direct spillover effects of urban restructuring, it does indicate that the positive effects of urban restructuring do not extent beyond the restructured neighborhood. Future research should focus on the specific spillover effects of restructuring on nearby areas over time, as spillover effects might take time to take effect.

The findings from the present study shed new light on the effectiveness of urban policies. Many studies have been unable to isolate an effect of urban policies on neighborhood change, which can be explained by the relatively short-time span, the focus on large administrative units, the difficulty in measuring 'urban policies', and finding a suitable control group. The present study has therefore focused on physical restructuring on the level of 500 by 500 meter grids over a 15-year time period. The use of a measure of demolition and new construction as the main indicator of physical restructuring allowed us to identify a reliable control group. However, identifying a suitable control group is challenging in this field of research. Our control group was very similar to our treatment group in terms of socioeconomic status, but differed substantially in urban density. Because we selected control neighborhoods from different cities, we cannot

be certain that different labor markets and/or housing markets played a role in our findings. In addition, it is possible that the control neighborhoods were targeted for urban restructuring but on a different scale or with different interventions. Our control neighborhoods also experienced a decline in the share of rented housing, which can most likely be attributed to the sales of rented housing. Analyzing the effects of sales policies on neighborhood income developments was however beyond the scope of this study but would be an intriguing avenue for future research.

Despite these limitations, our findings provide enough evidence to suggest that physical restructuring has positive effects on neighborhood socioeconomic change. As neighborhoods are generally relatively stable over time, large-scale demolition seems an effective way to fundamentally change the built environment and population composition in a neighborhood within a relatively short period of time. The change in the median neighborhood income in restructured neighborhoods is significantly higher than in any of the other neighborhoods, which shows that physical restructuring functions as a shock that induces neighborhood change through selective migration (Meen et al., 2013). The question remains to what extent restructured neighborhoods will be able to maintain their improvements and continue along this trend. The present study has focused on the effects of urban restructuring on the neighborhood level, whether urban restructuring has positive effects on individual outcomes is still subjected to debate.